RELATIONSHIP BETWEEN LEAN MANUFACTURING PRACTICES AND SUSTAINABILITY IN MANUFACTURING ORGANISATIONS: MEDIATING EFFECT OF MANUFACTURING PERFORMANCE AND MODERATING EFFECT OF ETHICAL CLIMATES

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ABSTRACT

Lean manufacturing practices (LMP) is considered as a manufacturing philosophy that can lead to global manufacturing performance by adopting and carefully implemented in the organisations. In fact, it gives the manufacturers a competitive advantage by enhancing the economic, environmental and social. In line with that, this study was aimed to examine the relationship between LMP and sustainability among Malaysia's manufacturing organisations. Specifically, it aimed at investigating both the mediating role of manufacturing performance (MP) on the relationship between LMP on sustainability, and the moderating role of ethical climate (EC) on the relationship between LMP on manufacturing performance. The motivation for this study was motivated by the sustainability issue of previous research that needs to be more investigated for the good of the organisations. In addition, further exploration is also needed on the impact of lean manufacturing on long-term sustainability. In this case, sustainability in production is seen as the leading feasible solution that needs to be explored. Furthermore, studies in examining the influence of EC on MP where the effect of possible mediating and moderating variables that had been proposed to explain the inconclusiveness, were limited. Consequently, this study integrated theories Resource Based View (RBV) and the Stakeholder Theory to map and position the possible relationships between the variables in the conceptual framework. Since the quantitative method was applied, the questionnaires were developed through extensive literature review. The population size for this study was 2368 based on Malaysia Federation of Manufacturing in Malaysia (FMM). In this study, the unit of analysis was the companies embodied from middle up to the top management. The survey questionnaires were randomly distributed to 335 manufacturing organisations in Malaysia as the sample with a 30.4 percent response rate. The data collected were analysed by performing the PLS-SEM technique. The results indicated that i) the positive relationship between LMP and SUS, ii) the positive relationship between LMP and MP, iii) the positive relationship between MP and SUS, iv) the positive relationship between EC and MP, v) mediating role of MP between LMP on SUS were established, vi) EC as a moderator did not support the relationship between LMP on MP. Generally, LMP and MP positively improved sustainability, showing that these are the important elements that should be seriously considered by practitioners. Therefore, this study could broaden the boundary of the existing literature, and contributes to the body of knowledge related to lean manufacturing practices, sustainability, manufacturing performance and ethical climate theoretically, practically, and methodologically.

Keywords: lean manufacturing practices, sustainability, manufacturing performance, ethical climate, manufacturing organizations

ABSTRAK

Amalan Pembuatan *Lean* (LMP) dianggap sebagai falsafah pembuatan yang dapat membawa kepada prestasi pembuatan global dengan menerapkan dan dilaksanakan dengan teliti dalam organisasi. Malah, ia memberikan kelebihan daya saing kepada pengeluar dengan meningkatkan ekonomi, persekitaran dan sosial. Sejajar dengan itu, kajian ini bertujuan untuk mengkaji hubungan antara LMP dan kemampanan dalam kalangan organisasi pembuatan Malaysia. Secara khusus, ini bertujuan untuk mengkaji peranan pengantara prestasi pembuatan (MP) mengenai hubungan antara LMP dan kemampanan, dan peranan moderator iklim etika (EC) pada hubungan antara LMP pada MP. Motivasi untuk kajian ini didorong oleh isu kemampanan berdasarkan penyelidikan lepas yang perlu lebih banyak diselidiki untuk kebaikan organisasi. Di samping itu, kajian lebih lanjut juga diperlukan mengenai kesan LMP pada kemampanan jangka panjang. Dalam kes ini, kesinambungan dalam pengeluaran dilihat sebagai jalan penyelesaian terbaik yang perlu diterokai. Tambahan pula, kajian pengaruh EC terhadap MP di mana pengaruh kemungkinan pemboleh ubah pengantara dan moderator yang telah dicadangkan untuk menjelaskan kes tersebut adalah terhad. Oleh yang demikian, kajian ini mengintegrasikan teori *Resource Based View* (RBV) dan *Stakeholder Theory* untuk memetakan dan meletakkan kemungkinan hubungan antara pemboleh ubah dalam kerangka konsep. Sejak kaedah kuantitatif diterapkan, soal selidik dikembangkan melalui tinjauan literatur yang luas. Saiz populasi untuk kajian ini adalah 2368 berdasarkan *Malaysia Federation of Manufacturing* (FMM) di Malaysia. Dalam kajian ini, unit analisis adalah organisasi yang terdiri dari pengurusan menengah ke atas. Soal selidik tinjauan diedarkan secara rawak kepada 335 organisasi pembuatan di Malaysia sebagai sampel dengan kadar balas 30.4 peratus. Data yang dikumpulkan dianalisis dengan melakukan teknik PLS-SEM. Hasil kajian menunjukkan bahawa i) hubungan positif antara LMP dan SUS, ii) hubungan positif antara LMP dan MP, iii) hubungan positif antara MP dan SUS, iv) hubungan positif antara EC dan MP, v) peranan pengantara MP antara LMP pada SUS diperkenalkan, vi) EC sebagai moderator tidak menyokong hubungan antara LMP pada MP. Secara amnya, LMP dan MP meningkatkan kemampanan secara positif, menunjukkan bahawa ini adalah elemen penting yang harus dipertimbangkan secara serius oleh pengamal. Oleh itu, kajian ini dapat memperluas batas literatur yang ada, dan menyumbang pada pengetahuan yang berkaitan dengan praktik amalan pembuatan *lean*, kemampanan, prestasi pembuatan dan iklim etika secara teori, praktikal, dan metodologi.

Kata kunci: amalan pembuatan *lean,* kemampanan, prestasi pembuatan, iklim etika, organisasi pembuatan

LIST OF PUBLICATIONS

Hasan, M.Z., Mohd Asaad, M.N., & Iteng, R. (2020). *Discover Lean Manufacturing Practices and Manufacturing Performance: Leads to Sustainability*. International Multidisciplinary Conference. Universiti Malaysia Perlis.

Hasan, M.Z., Mohd Asaad, M.N., & Iteng, R. (2019). *Ethical Climates as a moderator on the Relationship between Lean Manufacturing Practices and manufacturing Performance using PLS SEM*. International Research Journal of Engineering and Technology, 6(5), 6740-6750.

Hasan, M.Z., Mohd Asaad, M.N., & Iteng, R. (2018). *The Mediating Role of Manufacturing performance on the Relationship between LMP and Sustainability.* Journal of Information System and Technology Management, 3(7), 45-54.

Hasan, M.Z., Mohd Asaad, M.N., & Iteng, R. (2017). *Does Manufacturing Performance mediate on Lean Manufacturing Practices and Sustainability*. Journal of Humanities, Language, Culture and Business, 1(2), 40-49.

Hasan, M.Z., Mohd Asaad, M.N., & Iteng, R. (2017). *Lean Manufacturing Practices and Manufacturing Performances: The moderating effect of Ethical Climate*.Journal of Global Business and Social Entrepreneurship, 3(5), 189–200.

Hasan, M.Z., Mohd Asaad, M.N., & Iteng, R. (2017). *Mediating effect of Manufacturing Performance on Lean Manufacturing Practices and Sustainability: A proposed theoretical framework.* Proceeding: International Conference on Humanities, Language, Culture and Business (2nd ICoHLCB). ISBN: 978-967-14835-1-0

Hasan, M.Z., Mohd Asaad, M.N., & Iteng, R. (2017). *Moderating role of Ethical Climate on Lean Manufacturing Practices and Manufacturing Performance: A proposed conceptual model.* Proceeding: International Conference on Humanities, Language, Culture and Business (2nd ICoHLCB). ISBN: 978-967-14835-1-0

Hasan, M.Z., Mohd Asaad, M.N., & Iteng, R. (2017). *Lean Manufacturing Practices and Sustainability: Mediates by manufacturing Performance.* Proceeding: International Conference on Social Sciences, Humanities and Technology (ICSHT 2017). ISBN: 978-967-14841-3-5

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LIST OF ABBREVIATION

CSR	Corporate Social Responsibility
CVR	Content validity ratio
EC	Ethical Climate
GDP	Gross Domestic Product
NKEA	National Key Economic Area
MPC	Malaysia Productivity Corporation
MP	Manufacturing Performance
VSM	Value stream mapping
TPS	Toyota Production System
HRM	Human Resource Management
JIT	Just in time
LMP	Lean Manufacturing Practices
TBL	Triple bottom line
TQM	Total Quality Management
TPM	Total Preventive Maintenance
PLS-SEM	Partial Least Square-Structural Equation Modelling
SME_S	Subject Matter Expert
SME	Small Medium Enterprise
SUS	Sustainability
5S	Sorting, set in order, shine, standardize and sustain

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The rapidly growing global population and the raising demand for consumer products are placing tremendous pressure on our country's manufacturing industries. According to Department of Statistics Malaysia (2020), Malaysia’s Manufacturing sales in November 2019 grew by 2.3 per cent to RM73.5 billion as compared to RM71.8 billion reported a year ago as shown in figure 1. The sales value dropped by 1.6 percent (RM1.2 billion) in month-on-month growth, while the sales value grew by 0.5 percent in seasonally adjusted terms.

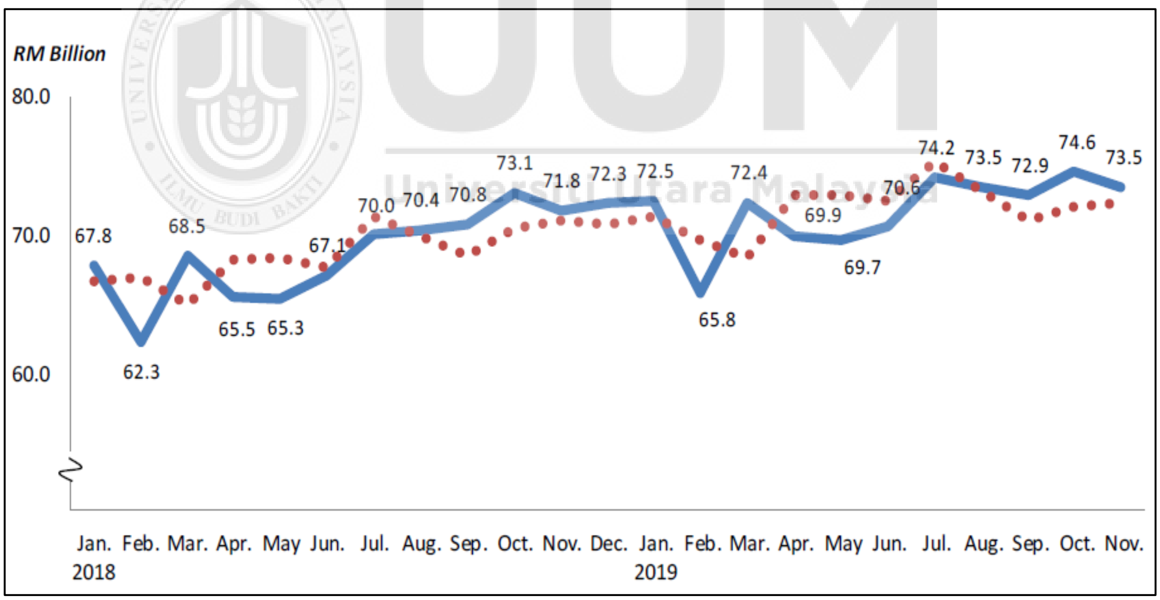


Figure 1. 1
Sales Value of the Manufacturing Sector
(Source: Department of Statistics Malaysia, 2020)

As a consequence, new sectors have been developed and more imported goods are added to the markets to fill the gaps. However, manufacturing operations use a huge volume of energy, natural resources and have produced more air and land pollution, thus having major effects for both society and the economy (Linke, Corman, Dornfeld, & Tönissen, 2013). The manufacturing operations also have a massive effect on the eco-system and living beings (Ahmad & Wong, 2018).

As mentioned by Swarnakar, Tiwari and Singh (2020), in the global dynamic market, manufacturing companies play a leading role. Therefore, to ensure the growth of the economy, the manufacturing sector should play a more important role. Individual organisations should strengthen their efficiency in order to stay relevant, competitive and profitable in an exceedingly complex, unreliable and vibrant sector.

The manufacturing industry has been one of the strategic industries in the Malaysian manufacturing sector due to its importance (Mohd Fuzi, Habidin, Janudin, & Ong, 2019). Referring to the statistics of 10th Malaysian Plan (2011-2015), socioeconomic development was achieved to sustain Malaysian economy. The statistics shows the manufacturing sector contributed 23% to GDP. In 2015, the total exports of manufactured goods have increased to 81% and share in total employment was 18% (Khan, Saufi, & Rasli, 2019) .

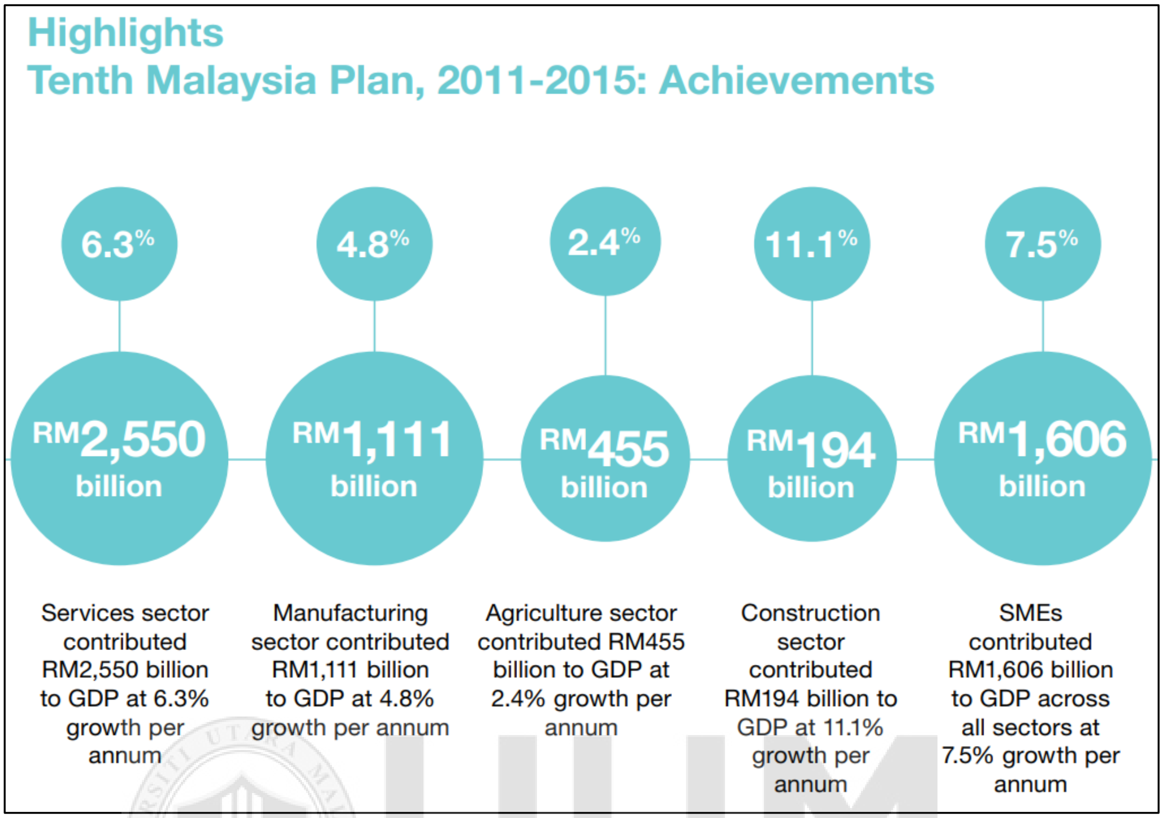


Figure 1. 2
Highlight Tenth Malaysia Plan
(Source: Economic Planning Unit, 2015)

Figure 1.2 shows the highlight from the Tenth Malaysia Plan which indicated that the manufacturing sector is the second largest contributor to the economy in this country. It shows that the manufacturing sector has contributed about RM1, 111 billion to GDP at 4.8% growth per annum. The manufacturing sector will generally move towards a more high-value, varied and complex commodity in the Malaysian 11th Plan, led by three catalytic subsectors, namely chemicals, electrical & electronics (E&E), machinery & equipment (M&E), as well as high-potential growth industries such as medical devices and aerospace (Economic Planning Unit, 2015).

Major indicators of the manufacturing sector, 2010-2020

Item	2010	2015	2020	Tenth Plan Achieved	Eleventh Plan Target
Contribution of manufacturing sector to GDP (RM billion in 2010 prices)	192.5	243.9	312.5	1,110.9	1,417.3
Annual growth rate (%)	12.1	4.7	4.4	4.8	5.1
Share to GDP (%)	23.4	23.0	22.1	23.1	22.5
Total exports of manufactured goods (RM billion in 2010 prices)	489.6	636.7	812.8	2,801.3	3,677.9
Share to total exports (%)	76.6	81.8	83.4	76.4	82.8
				Average annual growth rate (%)	
Share to total employment (%)	17.0	18.0	18.2	3.9	2.5

Note: 2015 numbers are estimated; 2020 numbers are forecasted
Source: Economic Planning Unit and Department of Statistics Malaysia

Table 1. 1
Major indicators of the manufacturing sector
(Source: Economic Planning Unit, 2015)

Table 1.1 shows the major indicators of the manufacturing sector from 2010 to 2020. Here, it shows that the total exports of manufacturing goods were gradually increased every year. The 11th Malaysian Plan seeks overall exports of manufactured goods at RM 812.8 billion in 2020. In addition, the manufacturing industry is estimated to expand at 5.1% annually, leading to 22.1% of GDP and 18.2% of net employment in 2020 (Economic Planning Unit, 2015). Based on report of Malaysian 11th Plan, this transition will be underpinned by enhanced R&D, more sustainable manufacturing practices, greater compliance with global standards, and collaboration between stakeholders.

Sustainability is a gradually more vital component of most company strategies in organisations. Nonetheless, previous studies has received less attention in the literature (Iranmanesh, Zailani, Hyun, Ali, & Kim, 2019). Up till now, sustainability has become the most important strategy of the new millennium in manufacturing organisations. Elkington

(1997) addressed the term sustainability as a “triple bottom line” which is consist of social, environmental and economic. In a same vein, Aminpour, Steven, Richardson, Singer, Diaz, Schaefer, Ramlan and Chikowore (2020) mentioned that sustainability is a broad and dynamic concept whereby a common understanding of sustainability focuses more on the interdependence of the social, environmental and economic aspects of sustainability.

According to Pham and Thomas (2012), sustainability is very broad and has not only existed to retain existing operating standards and break into new markets, but it can go deeper by achieving growth and development such that a firm survives in business, thrives in the future and helps to maintain the company's strategic advantages. Hence, the important existence of sustainability was realized by most of the companies to enhance their competitive advantage, and as a consequence, they adopt sustainability as the organisational imperative elements. Subsequently, Stoughton and Ludema (2012) found out that, based on previous literature, there is a mechanism by which sustainability is adopted by companies to improve business growth.

In general, economic sustainability is characterised as having the capacity to generate at any time with sufficient cash flow to ensure liquidity and to provide a long-term return that satisfies the economic needs of the business and its stakeholders, while environmental sustainability is accomplished if the organisation uses natural resources at a rate below the natural regeneration rate (Vachon & Mao, 2008). From a manufacturing point of view, social sustainability reveals the mindset of companies towards their workers, consumers and society as a whole, which contributes to an evaluation of the negative and positive social effects of operations and industries (Ahmad, Wong, & Rajoo, 2019).

A study by Longoni and Cagliano (2015) disclosed the effect of cross-functional executive involvement on the invention of lean manufacturing associated with environmental and social sustainability. As a result, employee involvement significantly influenced the actual employment of lean manufacturing associated with environmental and social sustainability.

Manufacturing industries were carried out the manufacturing activities that bring a substantial amount of sustainability-related burdens and risks due to their intensive resource consumption (Ahmad et al., 2019). Report by Central Bank Malaysia, (2017) reveals that many companies bankrupt every year. Meanwhile, the Department of Statistics Malaysia (2017) reported that issues on sustainability in the manufacturing organisation in Malaysia lead to bankruptcies as depicted in figure 1.3.

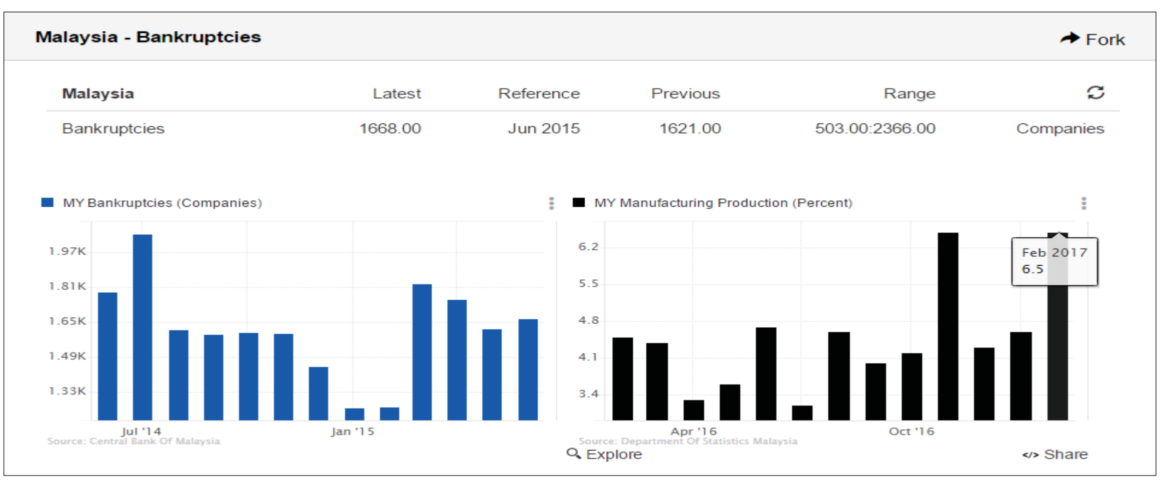


Figure 1. 3
Bankruptcies in Malaysia manufacturing sector
(Source: Central Bank of Malaysia)

The manufacturing sector will need to further improve its competitiveness and capability and position itself to take the opportunities and challenges emerging from global and regional transitions in trade and investment (Economic Planning Unit, 2015).

According to the reports by the Malaysia Investment Development Authority, manufacturing organisations fail to sustain, thus the number of projects are gradually decreasing from 2010 until 2015. Likewise, reports by Bank Negara Malaysia and the Department of Statistics Malaysia as shown in figure 1.4 also reveal that the growth rate for manufacturing production is declined from the previous year and cannot sustain in terms of export oriented manufacturing or domestic oriented manufacturing (Economic Planning Unit, 2016).

Selected Industries	2012		2013		2014		2015	
	Index	% p.a.	Index	% p.a.	Index	% p.a.	Index	% p.a.
3.5 **Industrial Production Index** [1/]								
(2010=100)	**106.7**	***4.2***	**110.3**	***3.4***	**116.0**	***5.1***	**121.2**	***4.5***
Manufacturing [2/]	**111.3**	***5.2***	**116.0**	***4.2***	**123.0**	***6.1***	**128.9**	***4.8***
Export-Oriented Industries	**110.4**	***6.5***	**114.5**	***3.7***	**120.8**	***5.6***	**126.7**	***4.8***
Electronics and electrical products	106.7	*8.1*	117.3	*9.9*	131.1	*11.8*	143.1	*9.2*
Chemicals and chemical products	121.9	*10.8*	121.1	*-0.7*	125.4	*3.6*	131.2	*4.6*
Petroleum products [3/]	108.3	*4.7*	108.6	*0.2*	109.2	*0.6*	110.5	*1.2*
Textiles, wearing apparel and footwear	105.2	*-7.1*	102.4	*-2.6*	113.5	*10.8*	122.0	*7.5*
Wood and wood products	103.1	*8.7*	99.9	*-3.1*	107.7	*7.8*	115.3	*7.1*
Rubber products	124.3	*3.0*	134.5	*8.2*	132.8	*-1.3*	139.5	*5.1*
Off-estate processing	104.6	*-0.8*	111.5	*6.6*	117.2	*5.1*	113.1	*-3.5*
Paper products	112.9	*3.1*	115.5	*2.3*	114.2	*-1.1*	117.7	*3.0*
Domestic-Oriented Industries	**114.4**	***1.7***	**121.2**	***5.9***	**130.6**	***7.7***	**136.7**	***4.7***
Non-metallic mineral products	115.4	*2.9*	115.0	*-0.4*	122.9	*6.9*	131.3	*6.8*
Fabricated metal products	138.6	*13.8*	155.6	*12.2*	159.9	*2.8*	167.3	*4.6*
Basic iron and steel and non-ferrous metal	95.4	*-6.6*	98.6	*3.4*	101.4	*2.8*	102.9	*1.6*
Transport equipment	115.8	*3.4*	131.8	*13.8*	150.7	*14.4*	158.6	*5.2*
Food products	112.5	*-2.8*	116.7	*3.8*	123.0	*5.4*	126.1	*2.5*
Construction-related products	105.6	*-1.5*	106.9	*1.3*	112.3	*5.1*	117.4	*4.5*
Beverages	105.6	*-3.2*	103.3	*-2.1*	121.6	*17.7*	135.8	*11.7*
Tobacco products	123.6	*10.6*	101.3	*-18.0*	106.2	*4.8*	115.9	*9.1*
Others	117.5	*2.3*	105.5	*-10.2*	116.6	*10.6*	108.8	*-6.7*

Note : [1/] This index covers mining, manufacturing and electricity sectors as defined under the Malaysian Standard Industrial Classification (MSIC) 2008
[2/] The index covers 102 out of the 194 manufacturing industries, which accounted for 89.7% of the value of total manufacturing gross output and 86.1% of the value-add in the 2005 Economic Census
[3/] Includes natural gas

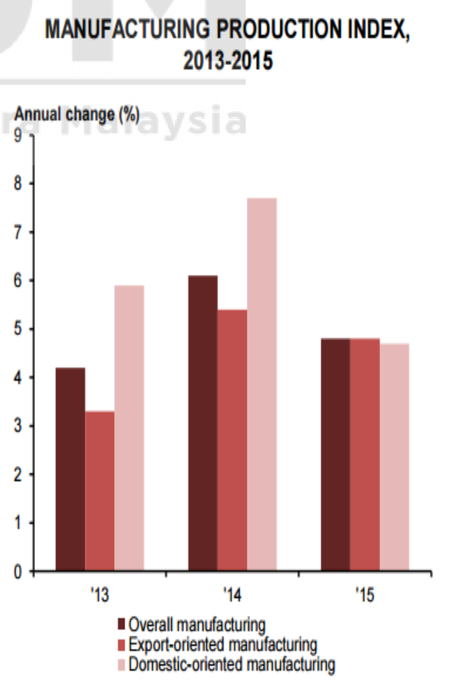


Figure 1. 4
Manufacturing production index
(Source: Malaysian Investment Development Authority)

Stoughton and Ludema (2012) mentioned that organisations are commencement to adopt sustainability increasingly as an organizational imperative and also revealed that based on previous literature on the process through which organisations go to embrace sustainability so that can increase the growth of the business. There were 97% of CEOs saw sustainability as essential to their potential success, while 78% saw sustainability as an incentive for growth and innovation (United Nations Global Compact, 2013).

Consequently, one of the initiatives that appear to have a link to sustainability is lean manufacturing (Nawanir, Lim, Lee, Okfalisa, Moshood & Ahmad, 2020). In addition, lean manufacturing will be a compatible tool and practice in order to help manufacturing organisations to survive in the market (Bhamu & Sangwan, 2014). Singh and Singh (2020) revealed that lean manufacturing is well-established management concept in many manufacturing organisations. In addition, Singh, Kumar and Gupta (2014) found out that lean manufacturing is a concept that applies to the Toyota Development System and other Japanese management methods that aim to reduce excess and excessive company operation.

Currently, the utilisation of lean manufacturing is still relevant especially in manufacturing organisations. According to Begam, Swamynathan and Sikkizhar (2013), lean manufacturing implementation is still in the shriving phase and accepted by the organisations that try to increase the performance of the firms. In fact, the lean manufacturing system is an essential paradigm for existing product in organisations (Jabbour, Junior, & Jabbour, 2014). Henceforth, the manufacturing industries world-wide are being affected by the development of present technologies resulting in a significant rise in competition either locally or internationally. For that reason, the performance of an organisation in manufacturing industries can be enhanced by the employment of lean manufacturing (Jabbour et al., 2014). However, there is an extent to which particular organisation can sustain it performance. Despite lean programmes took initiative and strategy in the form of policy deployment, this has generally been weakly implemented and hardly sustained (Hines, Howeg, & Rich, 2004).

Langenwalter (2006) also firmly mentioned that lean implementation leads the organisations towards sustainability that facilitate to cater to the wastes problem. In the meantime, González and Guillén (2002) claimed that companies ought to pay certain attention to ethics in order to ensure the consistency of their work. The companies therefore ought to follow the code of ethics, particularly the code of ethics in the Lean Principles. Furthermore, according to Maguad and Krone (2009), ethical excellence should be incorporated into a continual phase of change in order to ensure the consistency of implementation.

Likewise, lean is valuable for the organisations' growth and there is no special single correct way to apply lean. Besides, in order to ensure lean is successfully applied in a particular organisation, they need to select, adapt, apply and evaluate their selected approaches in a correct way (Ljungblom, 2014). The code of ethics is one of the essential frameworks that companies need to completely follow and enforce as extracted by the chief. Hence, it is about developing the ethical climate that creates the involvement of everyone.

Due to this, many prior researchers have tried to examine the antecedents and consequences of an ethical climate as an important element for the organisational competitiveness advantage (Simha & Cullen, 2012). The ethical climate had been defined by Martin and Cullen (2006) ; Victor and Cullen (1988) as the prevalent views of practices and processes in the organisation that comprised of ethics matters. As a result, an ethical climate refers to employees' mutual view of how ethical their organisations are, and whether it provides the employees with enough information on right or wrong on ethics and behaviours within the organisation (Barnett & Vaicys, 2000; Martin & Cullen, 2006).

Even though some researchers have studied the connection between an ethical climate and performance at the organisational level, there are limitations in those studies as it was more focused on the ethical factors of social performance rather than the ethical climate (Koo et al., 2014). Therefore, the ethical climate will be a moderator in this study to examine the effect on the manufacturing performance.

The purpose of this study is to examine the relationship between lean manufacturing practices and sustainability with moderating effect of ethical climate and mediating effect of manufacturing performance. Specifically, it focuses on the role played by the organisational model employed to formulate and implement a company's sustainability goals in an operations setting that is characterised by lean manufacturing adoption.

This research resolves several issues such as how to fully defining lean manufacturing, the manufacturing performance, and how to identify a broad range of sustainability and linking these sustainability outcomes back to lean manufacturing practices, the mediate effect of manufacturing performance, and as well as moderating effect of ethical climate.

1.2 Problem Statement

In the face of rising societal and environmental problems around the world, organisations are under increasing demand from stakeholders to manage and contribute to the triple bottom line (TBL) of social, environmental and economic sustainability (Juettner, Windler, Podleisek, Gander, & Meldau, 2020). At present, manufacturing companies are under pressure from governments, non-governmental organisations and consumers to perform in a sustainable manner (Iranmanesh, Zailani, Hyun, Ali, & Kim, 2019).

Subsequently, a great deal of attention has been given to the notion of sustainability due to some controversial issues such as increasing scarcity of natural resources, rapid global environmental degradation, and human beings pursuing higher life quality (Hami, Muhamad, & Ebrahim, 2016). However, according to Abdul-Rashid, Sakundarini, Raja Ghazilla and Thurasamy (2017), the manufacturers need to take proactive steps by incorporating sustainability concepts into their company's strategy and actions.

Sustainability has been controversial due to the increasingly essential elements of most company plans, nonetheless, the invention and employment of operations strategies that embrace sustainability remain concerns (Longoni & Cagliano, 2015). The alignment of the operation system in traditional lean manufacturing with environmental and social sustainability aims and practices might be complicated and difficult to align together (King & Lenox, 2001; Hasle et al., 2012).

Ferro, Padin, Svensson, Carlos, Varela, Wagner and Hogevold (2017) mentioned that the impact of companies' activities on the physical environment, society and economy is inarguable. It is said that most companies are driven by the profit objective rather than the concern on the sustainability holistically (three pillar model). Undeniably, the majority of the past studies were concentrating on only some of the aspects of sustainability. Fewer studies have presented a simultaneous approach that takes into account on the economic, environmental and social aspects of sustainability (Abdul-Rashid et al., 2017) and the implications of lean manufacturing on long-term sustainability (in terms of the three pillars of 3BL) still needs further exploration (Nawanir et al., 2020).

According to Longoni and Cagliano (2015), companies were facing problems and struggling to recognize how to deploy their sustainability purposes and practices for their business routes in the right approach. According to Ahmad and Wong (2018), the majority of the preceding sustainability assessment-related review articles were based on environmental analysis and evaluation in manufacturing industries. There is a must review recent sustainability assessment studies in the manufacturing sector that display the current status of sustainability assessment from the Triple Bottom Line (TBL) perspective (Ahmad & Wong, 2018).

According to Ahmad and Wong (2018), the environmental assessment is comparatively matured in the manufacturing industries. However, there was only the cost of analysis and workers' safety that were, considered in most of the studies from the economic and social standpoint. Therefore, it is recommended for manufacturers to integrate the three pillars of sustainability (economy, environment, and social) into their operational and business activities (Hami et al., 2016).

Subsequently, a question emerges whether continued economic growth and the expansion of manufacturing activities in the current practices would be sustainable in the long term or otherwise (Hami et al., 2016). Meanwhile, Singh, Singh and Kumar (2020) pointed out that lean practices could impact the whole organisational sustainability. Thus, several organisations are implementing the principles and ideas of lean manufacturing (Singh & Singh, 2020).

However, this positive view of lean manufacturing practices has recently been argued by many researchers even though its potential of it providing environmental, social, and economical benefits to firms their effect on sustainable performance is ambiguous (Iranmanesh et al., 2019). Many researchers questioned the potential of lean manufacturing whether it could leave a negative impact on the environment and social sustainability (King & Lenox, 2001; Hasle et al., 2012; Longoni et al., 2013). On the other hand, according to Sahoo and Yadav (2018), successful lean manufacturing practices implementation will generate better sustainability in the organization.

According to King and Lenox (2001); Hasle et al. (2012); Longoni, Pagell, Johnston and Veltri (2013) the relationship between lean manufacturing and sustainability is still under discussion and need to be further investigated. The understanding of lean manufacturing deployment among companies are very important in pursuing sustainability (Nawanir et al., 2020). Besides, the companies need to comprehend the way to align these efforts to evade contradictory impact.

On top of that, one of the aims of lean operations is to use fewer resources to generate the same result. King and Lenox (2001) mentioned that we could use less material, reduce rework, use scrap, reduce power/water consumption in production, and remain environmentally friendly during the quality boost processes. However, numerous sustainability studies have taken a narrow view of lean as only an operational level of waste reduction, Piercy and Rich (2015).

In addition, Ahmad et al. (2019) mentioned that manufacturing activities carry a substantial amount of sustainability-related burdens and risks due to intensive resource consumption. In this situation, sustainability in manufacturing is seen as the leading viable approach that need to be concerned. Therefore, the needs to study the influence of lean manufacturing practices on sustainability which includes social, economic and environmental.

Meanwhile, according to Shah and Ward (2003), academics and managers altogether agree that the implementation of lean manufacturing was able to enhance the performance in the organisations. Lean manufacturing embodied a great and impacted tool that can influence the performance whereby able to increase operational and economic performance. Additionally, a study by Zhu & Lin (2017) found that there were all positive and significant outcome in their research after implementing lean manufacturing and the magnitudes of positive effect are increasing.

A study conducted by Sahoo (2019) revealed that lean manufacturing practices are positively related to business performance. Whilst Fullerton and Wempe (2009) and Yang et al. (2011) concluded in their study that Lean practices present a positive relationship with both financial and market performance. Meanwhile, a study conducted by Hofer, Eroglu and Rossiter Hofer (2012) found inconsistent result between lean practices and performance. Hence, the conclusion regarding the relationship between lean practices and performance were inconsistent (Valente, Sousa, & Moreira, 2019).

Negrão, Filho and Marodin (2017) mentioned that some studies point out negative outcomes between lean and performance in their review of 83 articles on the degree of lean adoption and the link between lean and performance. In today's world, the industrial scene has faced higher challenges because of the rise in international competition; lean manufacturing has been taking part in a crucial role to boost companies' performance, not solely performance at the operations levels however additionally at the business level (Singh & Singh, 2020). Besides, according to Hofer et al. (2012) the exact mechanism which lean practices affects performance remain under researched. Thus, in attempting to fill this gap, the present study investigates the relationship between lean manufacturing practices and manufacturing performance in the manufacturing organisations.

Langenwalter (2006) stated that lean practices can lead organisations towards sustainability and allowing waste issues to be potentially resolved. Furthermore, several companies have achieved financial performance by refining cost reduction in their organisations (Langenwalter, 2006). Besides, a study by Bodhanwala and Bodhanwala (2018) found that sustainability can impact the firms' profitability. Therefore, researchers mentioned that by embracing policies that incorporate social, environmental, and economic sustainability will lead to profitability in the organisations. According to Longoni and Cagliano (2015), the environmental and social impacts due to the implementation of lean manufacturing had been discussed but there still lack of research.

Given the above results, manufacturing organisations may be led to sustainability, as per demonstrated by several companies that have achieved financial performance by refining cost reduction in their organisations, such as Baxter International (Langenwalter, 2006) and Clorox Company (Galpin, Whitttington, & Bell, 2015). However, it can be seen that the lack of studies that examine the significant relationship between manufacturing performance and sustainability statistically or in short, more studies need to be done related to these relationships. Therefore, to bridge the gap, there is a necessity to examine these relationships.

A research executed by Long and Driscoll (2008) indicated that an ethical climate was able to increase organisational performance. Therefore, the positive effect of an ethical climate, prior studies have emphasized on the interrelation between an ethical climate and organisational performance, and yet investigation of the mechanisms by which an ethical climate improves performance has been slightly ignored (Koo et al., 2014). Suggestively, there is still a need for a study on ethical climate that affected sustainability.

Based on Koo et al. (2014), it was expected for an ethical climate to be a significant predictor. In other respect, there is another factor that accomplishing lean manufacturing. Indisputably, the organisations need to fully adopt and implement the company's code of ethics to succeed in lean implementation (González & Guillén, 2002; Maguad & Krone, 2009; Sneider & Carries, 2008).

Lean and ethics need to integrate and walk "side by side" to gain the best results and involve co-workers who can acknowledge the ethical codes in their task with their customers and carrying out regular work. In fact, according to Ljungblom (2014), it is essential to compare the values lean stood for with the ethical codes used in the industry to identify potential interactions and misalignment. Hence, ethical climate will be hypothesized to see does it improve the manufacturing performance in the manufacturing organisations.

The variables must be mediated and moderated better to reduce the contradictions among the results of the studies. This is to ensure that the relationship between lean manufacturing practices and sustainability will be better examined. In this regard, to increase sustainability, manufacturing performance will be considered as a mediating effect. The terms of manufacturing performance have been used in the manufacturing company for a long time. However, the term operational performances also been used in the previous research, yet remain the same definition. Therefore, operational performance and manufacturing performance using the same metrics to monitor and measure the performance and efficiency in a particular organization (Tan & Wong, 2015; Hon, 2005).

The linkage of these variables derived in the previous study from the manufacturing sector shows that the manufacturing performance is partially mediated between lean practices and business performance (Nawanir, Teong & Othman, 2013), while Fullerton and Wempe (2009) found the operational performance being mediated between lean practices and financial performance. However, less empirical research has found a direct relationship between lean manufacturing practices with manufacturing performance and sustainability.

Hence, manufacturing performance will be hypothesized to act as the mechanism, to see whether lean manufacturing practices continuously improve sustainability components in the manufacturing organisations or otherwise. Thereby, this study will investigate the effect of manufacturing performance as the intervening variable between lean manufacturing practices with sustainability.

As the importance of lean manufacturing practices with sustainability been extensively explored, so does the importance of manufacturing performance and sustainability. As such, Arulrajah (2015) highlighted that it is the main concern of all bodies neither professionals nor disciplines to discover all potential ways of creating ethical behavior and activities within the business organizations. Besides, the ethical climate can affect both decisions making and performances in the organizations. (Martin & Cullen, 2006). Stare and Klun (2017) mentioned that ethical climate is representing the organization's policies, procedures and practices on ethical issues. Hence, the ethical climate has been essential issues in the organisations that contributed to the company's performances. It is a part of the larger organisation culture (Fournier, 2010; Appelbaum, Deguire, & Lay, 2005) but Martin and Cullen (2006) conceptually classified the ethical climate as a type of organisational work climate.

Ethical climate needs to perform as a moderator as suggested by Sabiu, Mei and Raihan Joarder (2016) to enhance the relationship between practices and performance. Hence, this study will explore ethical climate as a moderating effect as to observe the relationship between lean manufacturing practices with manufacturing performance among Malaysia's manufacturing organisations. This is to ensure that this study clearly highlight the relationship between lean manufacturing practices, ethical climate, and manufacturing performance.

Besides, the positive relationship between ethical climate and financial performance had been backed up with theoretical background by stakeholder theory. Also, as stated in stakeholder theory, stakeholders, such as investors and governments, consider an organisation's social responsibility as one of the important determinants affecting their investment decisions (Orlitzky, Schmidt, & Rynes, 2003). Moreover, if the organisations do not act ethically, stakeholders may enforce financial and/or non-financial authorizations or even terminate their relationships with such organisations (Choi, Moon, & Ko, 2013).

Stakeholders' pressure to accomplish social responsibilities and engage in ethical business practices may take a substantial toll on organisational performance (Luo & Bhattacharya, 2006; Orlitzky et al., 2003). Furthermore, stakeholders' resource allocation decisions are based on an overall evaluation of the organisations' behaviour (Neville, Bell, & Mengüç, 2005; Orlitzky et al., 2003), hence organisations' ethical behaviour can influence the stakeholders' favourable evaluation of the organisations.

As a result, ethical organisations are expected to develop more support from stakeholders. In short, organisations with a high ethical climate can improve performance while maintaining organisational legitimacy in society by acquiring stakeholder's support (Long & Driscoll, 2008).

This study aims to deepen the understanding of the role of an organisation's ethical climate as moderating influences for sustainability. Therefore, a study on the sustainability of lean manufacturing practices implementation in manufacturing organisation will fill the gaps in explaining the impact of sustainability.

1.3 Research Questions

This study aims to examine the relationship between lean manufacturing practices, manufacturing performance, ethical climate and sustainability are based on the research background and as highlighted in the research problem. Therefore, this research was guided by six (6) major research questions:

i. Is there any relationship between lean manufacturing practices and sustainability in the manufacturing organisation?

ii. Is there any relationship between manufacturing performance and lean manufacturing practices?

iii. Is there any relationship between sustainability and manufacturing performance?

iv. Is there any relationship between ethical climate and manufacturing performance?

v. Does the manufacturing performance mediate the relationship between lean manufacturing practices and sustainability?

vi. Does the ethical climate moderate the relationship between lean manufacturing practices and manufacturing performance?

1.4 Research Objectives

To answer these research questions, the following six (6) main research objectives have been developed accordingly:

i. To examine the relationship between lean manufacturing practices and sustainability in the manufacturing organisation.

ii. To examine the relationship between lean manufacturing practices and manufacturing performance.

iii. To examine the relationship between manufacturing performance and sustainability.

iv. To determine the relationship between ethical climate and manufacturing performance.

v. To examine the mediating effect of manufacturing performance in between lean manufacturing practices on sustainability.

vi. To examine the moderating effect of ethical climate of lean manufacturing practices on manufacturing performance.

1.5 Scope of Research

This research is carried out in Malaysia manufacturing organisations including Sabah and Sarawak which is narrowed down to investigate the relationship between lean manufacturing practices and manufacturing performance that have an effect on sustainability. In this study, the researcher is interested in analysing the mediating effect of manufacturing performance in between lean manufacturing practices, sustainability and the moderating effect of ethical climate in between lean manufacturing practices and manufacturing performance. The participating respondents in this research are the Malaysian manufacturing organisations that are listed in the Federation of Malaysia Manufactures (FMM) due to the contribution of manufacturing sector itself in economic growth.

The duration of the study is 6 months to collect and analyse the data. Resource base view theory and stake holder theory will be use as underpinning theory on this study. Furthermore, this study will also utilize structural equation modelling (SEM) for analysing the data since it is the most fully developed that capable to describe variance of endogenous constructs (Henseler, Hubona, & Ash, 2016). Besides, the ability of PLS-SEM in handling problematic modeling issues has received much attention among scholars, mainly in the social sciences and there are three prominent reasons which are non-normal data, small sample sizes and formatively measured constructs (Hair, Hult, Ringle, & Sarstedt, 2014).

Subsequently, this study also will present quantitative data which provide information with sufficient generalisability on the topic. This study will be carried out uses cross-sectional studies or sometimes some scholars called as one-shot time horizon (Sekaran & Bougie, 2013). The reason using this design is to allow the researcher collects the data sufficiently at one point in time and of course the findings will help to answer the research questions. Further information will be explained in chapter four.

1.6 Significance of Research

A review of lean manufacturing practices is reflected in sustainability. This study is not only limited to focus on lean manufacturing implementation in the organisation, but to also prove the impact of lean manufacturing practices implementation in the organisations towards sustainability specifically economic, environmental and social. Therefore, this research is useful both theoretically and practically. Thus, the significance of the study is discussed in two perspectives; theoretical significance and practical significance.

1.6.1 Theoretical Significance

The first contribution of a theory is to contribute to the body of literature within expanse of lean manufacturing practices, sustainability particularly in Malaysia manufacturing organisations. The second contribution of a theory is to examine the mediating effect of manufacturing performance. This study also provides a systematic explanation of the moderating effect of the ethical climate. A new moderating variable; ethical climate, is added as this critical factor has an influence on manufacturing performance.

The third contribution of a theory in this study is to introduce a new theoretical framework suggestion, whereby the new model combines 4 variables into one study: lean manufacturing practices, manufacturing performance, ethical climate and sustainability. Thus, this study will comprehensively enrich the readers in regards to integration of variables. The fourth contribution of theory contributes to the body of knowledge and academic literature which relates to the extension of the manufacturing performance and ethical climate literature that play a role as a mediating and moderating variable respectively. Indeed, there has been a lack of research on ethics in lean manufacturing literature.

1.6.2 Practical Significance

This study may help practitioners, engineers as well as the top management in the manufacturing organisations on the relationship between lean manufacturing practices and sustainability. In addition, lean manufacturing practices are able to help organisations to measure sustainability. Other than that, organisations also can look the way to improve the performance in the facet of ethical climate which is directly involved with human behaviour and ethics which is not deeply investigated prior to this. Subsequently, the top management in the manufacturing organisation can plan a strategy in order to improve and enhance productivity so that it is reflected in the increase of the company performance. Additionally, the findings also can be used to apply in other sectors that are looking into researching about sustainability in academic institution. For instance, to educate the institution's management to ensure the organisational performance is sustainable.

1.7 Definitions of Key Terms

This section clarifies briefly the main important key terms of this research. The key terms designate the operational definitions of each variable and it helps to generate a comprehensive understanding within the area of this research. Further, the elaboration of each definition will be embraced in chapter 2.

1.7.1 Lean Manufacturing Practices

Lean manufacturing practices refer to an incorporated system that includes pertaining fundamentals and varied organisation practices whereby it's goals are to upsurge productivity, diminish lead time and cost and as well as increase quality (Abdelhadi, 2016; Nawanir, Teong, & Othman, 2013)

1.7.2 Manufacturing Performance

Manufacturing performance refer to the strength of the firm is ascertained based on the capability or output provided (Narkhede, 2017; Al-Jawazneh, 2012).

1.7.3 Ethical Climate

Ethical climate refers to the view of employee pertaining what constitutes ethically right or wrong behaviour and through which ethical issues are managed, will become a psychological mechanism in an organisation and affects decision making and performances in the particular organisation (Cullen & Victor, 1993; Martin & Cullen, 2006; Sabiu, Mei, & Raihan Joarder, 2016).

1.7.4 Sustainability

Sustainability is viewed as a triple bottom line which will be measured by the three pillars model which is the economic, social and environment (Hami et al., 2016; Barron & Chou, 2017).

1.8 Summary

This research focuses on the relationship between lean manufacturing practices with sustainability through mediating and moderating effect on manufacturing performance and ethical climate respectively. Furthermore, this study investigates the causal connection between lean manufacturing practices and sustainability at the same time to boost up lean manufacturing sustainability by drawing attention to manufacturing performance and ethical climate. The result of this research will finally shows the increment of sustainability effect in the manufacturing organisation in the long run.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss an overview of variables in this research such as lean manufacturing practices, sustainability, manufacturing performance and ethical climate. Several topics are covered in this chapter in order to explain further details about the variables. Section 2.1 discusses the definition of lean, followed by 2.2 explained about the history of lean manufacturing. Section 2.3 covers the researches pertaining to lean practices and section 2.4 discussed sustainability. Next, manufacturing performance and ethical climate are discussed in section 2.5 and section 2.6 respectively. Section 2.7 will be discussing the underpinning theory of the governing factor in this study. Then, section 2.8 will explain on the measurement and the summary of this chapter.

2.2 Definition of Lean

Lean is a term invented by Krafcik (1988) who was the chief researcher in the International Motor Vehicle Program (IMVP) study which was executed at the Massachusetts Institute of Technology (MIT). In his landmark paper Krafcik introduced the term "Lean" in order to portray a production system that uses fewer resources of the whole thing compared to mass production. Nonetheless, many researchers define lean differently. Some companies choose to implement the full array of lean tools while others choose a piecemeal approach in which showed only several tools deemed appropriate to their operation (Doolen & Hacker, 2005). Nonetheless, the principles of lean still remain constant, which are the elimination of waste by specifying the value, identifying value stream, flow, pull, and perfection (Womack & Jones, 1996).

Consequently, Bhamu and Sangwan (2014) has reviewed on the lean studies and summarised the term that had been used to define lean. The result from the review shows that lean had been define as a way; a process; a set of principles; a set of tools and techniques; an approach; a concept; a philosophy; a practice; a system; a program; a manufacturing paradigm; a model.

Even though there are many definition of lean but there was one aim which is to eliminate waste (Shah & Ward, 2007). In fact, the frequently cited list of lean principles found in the literature was suggested by Womack and Jones (1996). However, Liker (2004) extended the principles created by Womack and Jones (1996) by highlighting the 'matters of people' in his principles. Liker (2004) mentioned that a particular organisation will consider a lean organisation when it develops and deploy lean principles properly. Table 2.1 illustrate the various definitions from different authors.

Table 2. 1
Definitions of lean

No	Authors	Lean manufacturing definition
1	Ohno (1988)	The basis of TPS is the absolute elimination of waste. The two pillars needed to support the TPS are JIT and autonomation. The operations should progress smoothly without any disruption by seven types of waste.

Table 2. 1 (Continued)

No	Authors	Lean manufacturing definition
2	Krafcik (1988)	Compared to mass production it uses fewer of everything-partial the human effort in the factory, partial the manufacturing space, partial the investment in tools, partial the engineering hours to create a new product in partial the time. Also it needs keeping far fewer than partial the desirable inventory on site, results in a lot of fewer flaws, and produces a better and ever rising diversity of products.
3	Womack, Jones and Roos (1990)	Lean is a dynamic process of change leads by an organized set of principles and best practices intended at continuous improvement. Lean manufacturing blends the best features of both mass and craft production.
4	Womack and Jones (1996)	The term lean refers to a system that employs fewer, in terms of all inputs, to produce the same outputs, like those formed by a traditional mass production system while contributing increased varieties for the end customer.
5	Shah and Ward (2003)	Lean manufacturing can be best defined as an approach to deliver the utmost value to the customer by eliminating waste through the process and human design elements. Lean manufacturing has become an integrated system composed of highly inter-related elements and a wide variety of management practices, including JIT, quality systems, work teams, cellular manufacturing, etc.
6	Doolen and Hacker (2005)	The principles of lean are relatively constant, there are many different practices that can and have been implemented in the quest for value creation in the manufacture of products for instance JIT production systems, total productive maintenance, cellular manufacturing, single-minute exchange of die, mixed model production, and mistake-proofing are just a few of the many examples of practices that are associated with a lean production system

Table 2. 1 (Continued)

No	Authors	Lean manufacturing definition
7	Shah and Ward (2007)	Lean manufacturing is a socio-technical system whose key purpose is to eradicate waste by decreasing or lessening supplier, customer, and internal variability.
8	Taj and Morosan (2011)	A multi-dimensional approach that contains of production with least amount of waste (JIT), continuous and uninterrupted flow (Cellular Layout), well-maintained equipment (TPM), well- established quality system (TQM), well-trained and empowered work force (HRM) that has positive impact on operations/competitive performance (quality, cost, fast response, and flexibility)
9	Demeter and Matyusz (2011)	Which consists of several manufacturing practices, including process focus, pull production, quality development, total productive maintenance, continuous improvement, worker empowerment, supplier development, and so on. The main objective of LP is to satisfy customer needs on the highest possible level through the elimination of waste.
10	Chauhan and Singh (2012)	Lean emphasizes teamwork, continuous training and learning, production to demand, mass customization and batch-size reduction, cellular flow, quick changeover, total productive maintenance, and so on.
11	Karim and Arif-Uz-Zaman (2013)	A series of activities or solutions to diminish waste and non-value added (NVA) operations, and increase the value added (VA) process. This VA and NVA concept was derived from the Japanese style production, especially the TPS.
12	Meybodi (2013)	Lean manufacturing as a process that employs these five principles to eradicate waste and the needs optimise the value added production activities by eliminating unnecessary wastes.

Table 2. 1 (Continued)

No	Authors	Lean manufacturing definition
13	Nawanir, Teong and Othman (2013)	When Lean manufacturing practices are implemented integrally, higher performance can be achieved.
14	Thanki and Thakkar (2014)	Lean manufacturing is a philosophy for organising, operating, controlling, managing and continuously improving industrial production systems. It provides a way to do more with fewer human effort, less equipment, less time, and less space while coming closer to providing customers with exactly what they want.
15	Wiengarten, Gimenez, Fynes and Ferdows (2015)	Lean manufacturing can be defined as a multi-dimensional approach to manufacturing that comprises a wide range of management practices such as, JIT, quality systems, work team, cellular manufacturing, supplier collaboration and TPM. These practices are synergistically incorporated to produce a continuous, streamlined and high-quality system to diminish or eradicate waste.
16	Abdelhadi (2016)	Lean manufacturing has become an integrated system that includes highly interconnected features and extensive management practices, including just-in-time, quality systems, work teams, cellular manufacturing, etc. It aims to increase productivity, reduce lead time and cost and improve quality; in other words, lean production is more than just tools and techniques.
17	Jasti (2016)	The definition of Lean manufacturing is “use fewer of everything – partial the human effort in the factory, partial the manufacturing space, partial the investment in tools, partial the engineering working hours to develop a new product in partial the time.

Table 2. 1 (Continued)

No	Authors	Lean manufacturing definition
18	Zhu and Lin (2017)	The central theme of lean manufacturing is to have the right items of the right quality and quantity in the right place and at the right time suggesting that waste would be extremely eliminated.
19	Sahoo and Yadav (2018)	Lean implementation practices can be categorized as a roadmap, conceptual/implementation framework, descriptive and assessment checklist initiatives by the manufacturing firms to pursue operational excellence and gain a competitive advantage over their competitors
20	Allaraj and Bakri (2019)	Lean Manufacturing is the backbone of efficient manufacturing and is significant to the achievement of manufacturing firm by turning the waste into profit.
21	Singh and Singh (2020)	Lean manufacturing is encompassed with various techniques to attain leanness within the manufacturing organisation and it is a waste elimination method which is created through unevenness of workload.

Nevertheless, Carlborg, Kindström and Kowalkowski (2013) asserted that no common definition of lean exists and the lean term that usually used comprises; lean, lean manufacturing, lean production, lean thinking, lean management, lean approach and lean concept carry the same principles or philosophy which to reduce non-value added activities (Wang, 2011). Likewise, even though many researchers and practitioners have attempted to identify the main lean manufacturing practices, but there was no single agreement among them regarding the relative importance of the practices (Nawanir et al., 2013). Overall, this shows that lean can be formulated as a concept to eliminate waste while increasing productivity in an organization that suit to be employed in various type of industries.

2.3 History of Lean

The aggressive competition forced by mass production systems during and after the World War II led the Toyota Motor Company (TMC) to a thorough study of the production system of the American automobile industry in particular Ford (the Ford Production System) (Papadopoulou & Ozbayrak, 2005). Ohno (1988) mentioned that the solution offered by Toyota led to a complete reconstruction of the company and soon gave way to the introduction of an alternative production system indicated to as the Toyota Production System (TPS) which aimed at directly attacking any form of waste in the production process. Besides, the JIT philosophy was refined in the framework of this new production system and developed exactly out of the need of the Japanese industry to endure in the post-war global market (Papadopoulou & Ozbayrak, 2005).

Lean manufacturing is considered a manufacturing philosophy that can lead to global manufacturing excellence by adopting and carefully implementing in the organisations (Papadopoulou & Ozbayrak, 2005). Besides, to prosper in today's economic environment, any manufacturing firm must be dedicated to never-ending improvement, and more efficient ways to obtain products or services that consistently meet customer's need (Sahoo & Yadav, 2018). Subsequently, lean manufacturing gives the manufacturers a competitive advantage by enhanced the productivity and quality and as well as reducing the cost (Bhamu & Sangwan, 2014). This is one point where both researchers and practitioners can agree upon.

However, the term origin of lean manufacturing has been making people confused. The originality of the term and its relation to the production system first introduced by Toyota. One possible way for this issue to be clarified is to explain how the term “Lean” was introduced to describe either “Lean Manufacturing” or the “Lean Production” paradigm (Papadopoulou & Ozbayrak, 2005).

Generally, it was believed that lean is a term that was invented by Krafcik (1988) who was the chief researcher in the International Motor Vehicle Program (IMVP) study which was performed at the Massachusetts Institute of Technology (MIT). In his landmark paper, Krafcik introduced the term “Lean” to depict a production system that uses less resources of everything compared to mass production.

Also, the origins of lean manufacturing coincide with primary automobile manufacturing. The master craftsmen that leading constructed individual cars with a wide range of skills and abilities, but with little efficiency and at much cost (Worley & Dolen, 2006). Lean manufacturing drives back as far as 1978 when Ohno wrote his book on the Toyota Production System (TPS) in Japanese. The idea of lean manufacturing was founded by a Japanese automotive company, Toyota, during the 1950s which was well known as Toyota Production System (TPS) (Noraini Nordin, Md Deros, & Wahab, 2010). It could be said that the ‘lean’ principles caused from the broader community outside Japan, as a reaction to the mass-production system that was practised in most American and European companies after the Second World War (Herzog & Tonchia, 2014). The main goal of TPS was to decrease the cost and to increase productivity by eradicating wastes or non-value added activities. During the 1980s there was a penetrating interest in lean manufacturing implementation among the western manufacturers because of rising Japanese imports (Noraini Nordin et al., 2010).

For a long time, lean manufacturing was equated with JIT and thus it is difficult to make a clear distinction between lean and JIT. Similarly to its origin JIT lean aims to meet demand instantaneously, with perfect quality and no waste (Herzog & Tonchia, 2014). In fact, lean manufacturing has many definitions associated with it. Some researchers provide definitions specific to manufacturing processes while others employ a more general definition that could be applied to a variety of industries (Worley & Dolen, 2006). Nevertheless, the idea of lean can be summarised in a simple and short definition which is "doing more with less." Even though the definition is an obvious oversimplification, it conveys the crucial aim of the overall idea of lean which is more effective utilisation of available resources.

The main goal of lean manufacturing is to enable organisations to provide their customers with the product or service they need whenever they need it. Simultaneously, any potential sources of waste are identified and eliminated in order to achieve and maintain high quality and low manufacturing costs (Shah & Ward, 2003). Many manufacturing companies have engaged in a lean manufacturing system as a best practice of management tool and most of them have embraced lean techniques in numerous forms and names. Lean manufacturing is a manufacturing strategy that meant to attain smooth production flow by eradicating waste and by adding the activities value (Noraini Nordin et al., 2010). In this sense, the lean manufacturing system is an important paradigm for current production (Jabbour et al., 2014).

Besides, lean manufacturing contains a big number of tools and practices. Shah and Ward (2003) recognized twenty two lean manufacturing practices that are often revealed in literatures and characterized them into four bundles. They are JIT, total quality management, total productive management and human resource. Lean manufacturing aims to consume fewer human effort, lesser inventory, lesser time to develop products, and smaller space to turn into greatly responsive to customer demand, while at the same time producing quality products in the utmost capable and economical way (Motwani, 2003).

According to Chauhan and Singh (2012) and Melton (2005), the waste was explicitly referred to any activity that use resources but then makes no value. It was a result of the Toyota Production System (TPS) and its purpose is to improve value-added work by eradicating seven basic types of waste:

1. Over-production
2. Motion (of operator, material or machine)
3. Waiting of operator, material or machine
4. Conveyance
5. Processing
6. Inventory
7. Corrections (rework and scrap)

Table 2.2 shows the description of seven wastes adopted by Melton (2005) where the detail descriptions and examples of each of the waste types are properly indicated. The types of wastes that had been considered in the industry are basically closely related to the cost and quality. According to Chauhan and Singh (2012), the method is often measured from the reductions of time between customers' order and shipment, and this was meant to improve profitability, customer satisfaction, throughput time, and employee motivation. Also, Puvanasvaran, Megat, Tang, Muhamad and Hamouda, (2008) asserted the profits of lean manufacturing usually are lesser costs, greater quality with smaller lead times.

Table 2. 2
The seven types of waste
(source: Melton, 2005)

Types of waste	Description	Within the process industry	Example symptom
Over production	• Product made for no specific customer • Development of a product, a process or a manufacturing facility for no additional value	Large campaign – large batch–scale manufacturing processes Development of alternative process routes which are not used or the development of processes which do not support the bottleneck Redesign of parts of the manufacturing facility which are 'standard', e.g., reactors	The extend of warehouse space needed and used Development and production organisation imbalance An ever changing process (tweaked) Large engineering costs/time associated with facility modifications
Waiting	• As people, equipment or product waits to be processed it is not adding any value to the customer	Storage tanks acting as product buffers in the manufacturing process – waiting to be processed by the next step An intermediate product which cannot leave the site until lab tests and paperwork is complete.	The large amount of work in progress' held up in the manufacturing process- often seen on the balance sheet and as 'piles of inventory' around the site.

Table 2. 2 (Continued)

Types of waste	Description	Within the process industry	Example symptom
Transport	Moving the product to several locations Whilst the product is in motion it is not being processed and therefore not adding value to the customer	Raw materials are made in several locations and transported to one site where a bulk intermediate is made. This is then transported to another site for final product processing Packaging for customer use may be at a separate site	Movement of pallets of intermediate product around a site or between sites Large warehousing and continual movement of intermediate material on and off site rather than the final product.
Inventory	Storage of products, intermediates, raw materials, and so on, all costs money	Economically large batches of raw material are purchased for large campaigns and sit in the warehouse for extended periods. Queued batches of intermediates material may require specific warehousing or segregation especially if the lab analysis is yet to be completed or confirmed .	Large buffer stocks within a manufacturing facility and also large warehousing on the site; financially seen as a huge of working capital.
Over processing	When a particular process step does not add value to the product	A cautious approach to the design of unit operations can extend processing times and can include steps, such as hold or testing, which add no value. The duplication of any steps related to the supply chain process, e.g., sampling, checking.	The reaction stage is typically complete within minutes yet we continue to process for hours or days We have in process controls which never show a failure The delay of documents to accompany the finished product.
Motion	The excessive movement of the people who operate the manufacturing facility is wasteful. Whilst they are in motion they cannot support the processing of the product	People transporting samples or documentations People required to move work in progress to and from the warehouse People required to meet with the other people to confirm key decisions in the supply chain process	Large teams of operators moving to and from the manufacturing unit but less activity actually within the unit Data entry is seen as a problem within MRP system

Table 2. 2 (Continued)

Types of waste	Description	Within the process industry	Example symptom
	excessive movement of data, decisions and information	people entering key data into MRP system.	
Defects	Errors during the process- either requiring re-work or additional work.	The material out of specifications, batch documentation incomplete. Data and data entry errors General miscommunication	Missed or late orders Excessive overtime. Increased operating costs.

Therefore, the existence of lean manufacturing practices is the answer to get liberates all the waste in order to improve the profitability, customer satisfaction, throughput time, and employee motivation as mention by Chauhan and Singh (2012) in their study. Therefore, to ensure this objective will be achieved, the implementation of lean manufacturing practices among practitioners in the manufacturing organisations are crucial (Hines, Holweg, & Rich, 2004). Thus, to counter this matter, the implementation of lean manufacturing practices are required to support waste elimination that lead improve value added.

2.4 Lean Manufacturing Practices

The previous section had discussed about lean history which has shown that some of the past study had mentioned that the source of the term lean was introduced by Krafcik (1988). Regardless, Hallgren and Olhager (2009) stated in their study that before lean is introduced, just-in-time (JIT) system or Toyota Production System was the precursor of lean manufacturing with the effort and combination attempt from Taiichi Ohno, Shigeo Shingo and Yasuhiro Monden as notable of the rise of JIT/TPS/lean in the 1980s.

According to Hallgren and Olhager (2009); Schonberger (2007) the ideas and methods under the lean label were the same as those of JIT that came before. Womack and Jones (1996) have deliberated lean to be the five important lean principles as follows:

i. Identify what does add value to the customer and what does not generate value as well.
ii. Highlight non-value adding waste across the entire value stream process.
iii. Do actions that add value flow without interruption.
iv. Do services which are only pulled by the customer.
v. Attempt for perfection by removing consecutive layers of waste as they are uncovered.

These principles have been referred to as a guideline for waste elimination. Lean practices have several tools at its disposal based on these principles. The implementation of lean relies on two main pillars, namely JIT and *jidoka* (Jekiel, 2011). JIT is a technique of providing the right quantity at the right time and the right location whereas *jidoka* is the Japanese word for autonomation which is roughly translated to quality at the source. It is human intervention in an automated process to avoid the production of unacceptable quality. The *jidoka* production mindset can be extended to the maintenance function when the quality at source thinking has become a part of the workforce culture (Aikens, 2011). In addition, the implementation of lean manufacturing practices leads to improvement of the performance in the industry (Melton, 2005).

However, according to Doolen and Hacker (2005), the portability of lean practices both within and between different manufacturing sectors has been explored. As a result, there is evidence that factors such as changing economic conditions, high levels of demand uncertainty, high-mix, low-volume product portfolios, and rigid organizational structures may limit the applicability of lean manufacturing practices or may prevent manufacturers from realizing the full benefits of these practices.

Besides, lean manufacturing consists of a large number of tools, techniques and practices. Despite the fact that previous researchers and practitioners have attempted to identify the main lean manufacturing practices, there was no single agreement among them regarding the relative importance of the practices (Nawanir, Teong, & Othman, 2013; Ahmad, Schroeder, & Sinha, 2003). Normally author's backgrounds reflect to the types of practices. However, the concept remain the same although have different sets of practices. Shah and Ward (2003) recognized twenty two lean manufacturing practices that are regularly pointed out in literature and considered them into four bundles associated with JIT.

The most regularly used practices suggested by several past studies are selected into six groups because of the overall consensus that is still lacking. Based on the philosophical approach, some of the principles that have been discuss are the purpose to eradicate waste or non-value added to the operational level of the organisation. Several researchers categorised the lean tools and lean practices in several groups according to the purpose of the measurement. For example, Shah and Ward (2003) had characterized lean manufacturing into four bundles that each bundles. Each bundle includes principles and tools such as human resource management (HRM), total quality management (TQM), just in time (JIT) and total preventive maintenance (TPM). Each of bundle has their types of lean tools and practices. For instance, human resource management (HRM) consists of training and cross functional teams, meanwhile total quality management (TQM) consists of quality management, continuous improvement and statistical process control.

On the other hand, JIT comprised of set up time reduction, small lot size reduction, cellular manufacturing, continuous improvement and *kanban* whereas total preventive maintenance (TPM) included practices primarily designed to maximize equipment effectiveness through planned predictive and preventive maintenance of the equipment and using maintenance optimization techniques.

Meanwhile, according to Hines, Holweg and Rich (2004), their study have defined lean at two levels which are comprised of the strategic and operational levels. The level of strategy is based on the principles of lean thinking that are accessible by Womack and Jones whereas the level of operation has been focused on the shop floor, which comprise of the strategic aspects such as the value creation and the understanding of customer value.

Moreover, a study by Olsen (2004) had defined lean practices as a supportive practices that categorised lean into four wide areas such as JIT, TQM, TPM, and infrastructure. The study was measured seven lean manufacturing practices on small medium sized companies in order to examine the relationship with the firm level financial performance.

Additionally, according to Worley and Doolen (2006), the management support and communication have been proposed to support lean manufacturing practices, as well as to drive the implementation of lean in order to see the great impact of organisational performance. Basically, the research was executed to see the impact area on the manufacturing equipment & process, shop floor management, new product development, supplier relationships, customer relationship and workforce management area.

Concurrently, a study by Steinlicht (2010), had characterized lean tools into 3 groups which are continuous improvement tools and techniques, process tools and techniques and support system tools and techniques. The reason of combining all these groups is to enhance the productivity in mature organisations compared to younger organisations.

Similarly, grounded by the Socio-Technical System Theory (STS), Iteng, Ariffin and Abdul Rahim (2015) had grouped the lean practices into two groups namely (1) socially oriented lean production (SLEAN) which comprises of supplier focus, employee focus, continuous improvement and customer focus and (2) technically oriented lean production (TLEAN) that encompasses quality at source, JIT, flow system and technology and innovation. These groups' practices had been proposed by considering the recommendation from Shah and Ward where it was suggested that to eliminate waste, they need to group lean production practices into two dimensions based on STS as aforementioned.

A study by McLachlin (1997) indicated that the number of management initiatives is necessary for the implementation of JIT manufacturing. Through a case-based research methodology, 6 plants that claimed to be implementing JIT manufacturing were tested. This study had considered a several JIT elements such as JIT setup reduction, equipment layout, small lot size, uniform plant load, daily schedule adherence, pull system, JIT delivery, supplier quality, zero defects, statistical process control. According to Hallgren and Olhager (2009); Schonberger (2007) the concepts and techniques under the lean label were the same as those of JIT elements, JIT practices or lean practices. Thus, in order to avoid ambiguity, this study will use term lean manufacturing practices in order to represent JIT elements or JIT practices.

The method used in the aforementioned study by McLachlin (1997) also considered as lean practices. Whereas, Karlsson and Ahlstrom (1996) have been using several other practices in their study such as the elimination of waste, continuous improvement, zero defect, JIT, pull, multifunctional teams, decentralised responsibility, integrated function as well as vertical information system. That study aims to create an operationalised model which can be used to assess the changes that take place to introduce lean production. As a result, the development of a model that summarised the importance of the principles contained within lean production was produced. Finally, the resulting model was tried-out in an experimental field study. The ultimate model has affects neither research nor practice. In terms of the research, to operationalise lean production can be as a model that can study change processes properly. On the other hand, for the practice, the model can be used as a tool to assess the development taking place to turn it into lean.

On top of that, a study by Sohal (1996) describe the experiences of one Australian company which has successfully adopted lean production concepts. The company called Trico Australia was able to not only sustain a competitive advantage but also to grow throughout the 1984-1994 period. A period during which foreign competition (particularly from Japan) intensified their protection from tariffs and continued to reduce. The major recession has seriously affected the Australian economy. That company had applied several lean practices such as customer focus, flexible resources and zero defect that resulted in a good performance to the company.

Simultaneously, the studies by Lee and Paek, (1995); Ramarapu et al., (1995); Sakakibara et al., (1993);Voss and Robinson (1987) shows the successful result of implementing lean practices at the organisations. They were using different lean practices but with the same aim to improve the performance. For example, Lee and Paek (1995) had used statistical process control techniques, autonomous, defect control system, quality-oriented visual displays, total quality control, TQM, QC circles, k*anban* system and many more in order to present the concept and specific practices of the enlarged JIT and to determine its impact on JIT implementation and system performance.

This study found that enlarged JIT requires changes in the way customers do business and as well as the customers are the ones who buy products. Therefore, enlarged JIT could be a tough concept to implement. Nonetheless, by seeing the potential advantage, enlarged JIT is absolutely a valuable concept for implementation within JIT plants. While JIT has emerge as a crucial tool to improve manufacturing competitiveness, Sakakibara et al.,

(1993) came out with the research that proposes a framework of JIT and came out with a valid and reliable instruments that capture vital features of JIT useful in assessing its impact in the manufacturing environment.

As a result, there are four JIT practices that were recognised as the main donating reasons to performance of JIT which are the equipment layout, pull system support, supplier quality and *kanban.* Meanwhile study by Voss and Robinson (1987) reports the results of a survey of UK industry designed to develop knowledge of JIT application. In this research, a broad-based view of JIT is taken, encompassing JIT in manufacturing, purchasing and supply. This research also determines the extent of knowledge of the JIT concept in the manufacturing industries in the United Kingdom, together with the level of application of various JIT techniques. Therefore, there were17 lean practices that had been used in this research such as flexible resources, WIP reduction, set up time reduction, continuous improvement and many more. Thus, this study has found that reduction in WIP and increased flexibility were consistently perceived as the aspects of JIT from which most benefits were derived.

In addition, study by Doolen and Hacker (2005) reveal the development of a survey instrument to assess the implementation of lean practices within an organization. Results of a literature review, which was used to identify lean manufacturing practices and existing lean assessment tools, are presented.The findings of this review were synthesized to develop an instrument to assess both the number and the level of implementation of a broad range of lean practices in an organization.

On top of that, study by Chauhan and Singh (2012) determine the approaches of lean manufacturing in order to identify and measure the intimately associated parameters of lean manufacturing and also examines the weight of their contribution to overall lean manufacturing. The study found that that most of the responding firms are in transition towards the realization of lean manufacturing. On the other hand, study by Nawanir et al., (2013) has been investigated the relationship between lean practices, operations performance (OP), and business performance (BP) in Indonesian manufacturing companies. As a result, this study provided evidence that lean practices should be implemented holistically. Lean practices has proven that have a positive and significant impact on both OP and BP. Additionally, OP partially mediates the relationship between lean practices and BP.

In addition, table 2.3 shows the summarise of lean manufacturing practices in research from the year 2000 to 2009. The table shows a few authors that used lean practices in their studies. For example, Hallgren and Olhager (2009) investigated factors of internal and external that lead to the choice of lean and agile operations competences and their corresponding influence on operational performance. The outcomes showed that lean and agile manufacturing varies in terms of drivers and outcomes. The choice of a cost-leadership strategy wholly mediates the impact of the competitive intensity of industry as a key point of lean manufacturing, whereas agile manufacturing is straight impacted by both internal and external drivers, i.e. a difference strategy as well as the competitive strength of the industry.

Agile manufacturing is found to be negatively related to a cost-leadership strategy, highlighting the dissimilarity between lean and agile manufacturing. The main variances in the performance results are connected to cost and flexibility.

Table 2. 3
Summarizes of Lean Manufacturing Practices/Tools in Research 2000-2009

Lean Manufacturing Practices	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Cellular manufacturing/group technology	x	x		x						x	x	x	x	
Continuous improvement/*kaizen*			x				x							
JIT			x	x	x	x		x		x	x	x	x	x
Pull system/*kanban*	x				x	x	x		x		x	x	x	
Quick changeover techniques		x	x	x	x	x	x	x	x		x	x	x	
Total quality management			x					x				x	x	x
Statistical process control					x			x		x	x			
Total productive maintenance			x	x	x			x		x	x	x	x	
Employee involvement					x					x				
Supplier communication/supplier feedback/supplier focus				x	x			x		x	x			
Customer involvement/customer focus	x				x	x		x		x	x		x	
5s							x		x					
Poka Yoke									x					
Multifunctional workforce											x	x	x	
VSM						x	x		x					
Root cause analysis														
Small lot production			x	x	x	x		x			x	x	x	x
Visual control									x					
Continuous flow	x													

Authors: (1) Hallgren & Olhager (2009) (2) Fullerton and Wempe (2009) (3) Dal Pont et al. (2008) (4) Jayaram, Vickery & Dröge (2008) (5) Shah and Ward (2007) (6) Matsui (2007) (7) Worley & Doolen (2006) (8) Kannan and Tan (2005) (9) Melton (2005) (10) Olsen, 2004 (11) Ahmad et al. (2003) (12) Fullerton, McWatters, and Fawson (2003) (13) Fullerton and McWatters (2001) (14) Callen et al. (2000)

According to Monden (1983) *kanban* or pull system is a critical component of lean practice. Same goes to Alaskari, Ahmad, and Pinedo-Cuenca (2016); Zahraee (2016); Nawanir, Teong and Othman (2015); Krishnan and Parveen (2013); Nawanir et al.,(2013); Chauhan (2016); Taj and Morosan (2011); Furlan, Vinelli and Dal Point (2011); Andrea Furlan, Dal and Vinelli, (2011); Rahman,i Aosirihongthong and Sohal (2010); Mackelprang and Nair (2010); Hallgren and Olhager, (2009); Shah and Ward (2007); Matsui (2007); Worley and Dolen (2006); Melton, (2005); Ahmad et al., (2003); Fullerton, Mcwatters and Fawson (2003); Fullerton and Mcwatters (2001); McLachlin (1997); Karlsson and Ahlstrom (1996); Lee and Paek, (1995); Sakakibara et al. (1993); Voss and Robinson (1987) also using *kanban* in their study.

Correspondingly, it shows that *kanban i*s an important practice in an organisation whereas cellular manufacturing is the systemised whole process for a specific product or associated products into a set or cell that includes all the necessary equipment, machines and operators (Zahraee, 2016). Many research such as Alaskari et al. (2016); Nawanir et al. (2013); Taj and Morosan (2011); Furlan et al. (2011a); Furlan et al., (2011b); Steinlicht (2010); Mackelprang and Nair (2010); Hallgren and Olhager (2009); Fullerton and Wempe (2009); Jayaram, Vickery and Droge (2008); Olsen (2004); Ahmad et al.(2003); Fullerton et al. (2003); Fullerton and Mcwatters (2001); Lee and and Paek (1995); Ramarapu et al. (1995); Sakakibara et al.(1993); Voss and Robinson (1987) considered cellular manufacturing or group technology as a good practice in organisation in order to increase the performance as indicate in the table 2.3.

Furthermore, in lean perspective according to Womack & Jones (1996), continuous improvement or 'Kaizen' is defined as a step of upgrading activities lead within current processes by people in the organisation. The aim of continuous improvement activities in lean environment is to upsurge the possibility of improving the work process. People in the firm are a great source of ideas for continuous improvement activities and should work together as a team or work group. Meanwhile according to Iteng et al. (2015) continuous improvement can be comprehended through the combination of employees' thoughts and participation to support the achievement of the targeted goal.

There are several studies involves the continuous improvement or *kaizen* such as Belekoukias, Garza-Reyes and Kumar (2014); Krishnan and Parveen (2013); Chauhan and Singh (2012); Steinlicht (2010); Worley and Dolen (2006); Karlsson and Ahlstrom(1996); Voss and Robinson (1987). Table 2.4 shows JIT, Pull system/*kanban*, quick changeover and small production are the most common practices that had been used in the studies and research. However, most of the studies combined several practices in JIT such as lot size reduction, cycle time reduction, quick changeover techniques and production process reengineering (Pont, Furlan, & Vinelli, 2008), reducing batches, setup time *kanban* system, cellular layout (Yang, Hong, & Modi, 2011) whereas Furlan, Dal, et al. (2011) using several practices such as *kanban*, set up times, small lot sizes, pull system in as combination practices in JIT system. Therefore, this research prefers to use a single practice instead of combination practices. Thus, the JIT system is not considered in this study because the single practice will be considered.

Another lean practice that had been used widely is *kanban*. According to Zahraee (2016) *kanban* is the marking system for developing JIT production, whereby a visual signal helps flow by 'pulling' products through the process as required by the customer. Many researchers are using *kanban* in their studies because they believe that *kanban* is a pull system in managing the material movement comprising a mechanism which activates the drive of material from one operation through to the next as written by Krishnan and Parveen (2013); Chauhan and Singh (2012); Taj and Morosan (2011); Furlan et al. (2011a); Furlan et al., (2011b); Rahman et al. (2010); Mackelprang and Nair (2010); Hallgren and Olhager (2009); Shah and Ward (2007); Matsui (2007); Worley and Dolen (2006); Melton (2005); Ahmad et al.(2003); Fullerton et al. (2003); Fullerton and Mcwatters (2001); McLachlin (1997); Karlsson and Ahlstrom (1996); Lee and Paek (1995); Ramarapu et al. (1995); Sakakibara et al.(1993); Voss & Robinson(1987).

Table 2.4 shows lean manufacturing practices had been used by different scholar in different researches such as cellular manufacturing/group technology, continuous improvement/*kaizen*, JIT, pull system/*kanban*, quick changeover techniques, total quality management, statistical process control, total productive maintenance, employee involvement, supplier communication/supplier feedback/supplier focus, customer involvement/customer focus, 5s, *poka yoke*, multifunctional workforce, employee evaluation/employee focus, VSM, root cause analysis, quality at source/ autonomation/ *jidoka*, load levelling, one piece flow, point of use storage, flexible resources, small lot production, uniform production level, elimination of waste ,zero defects, decentralization, vertical information system, visual control, flow system, technology & innovation, sig sigma, job reengineering, work teams, benchmarking, organisational restructuring, business process reengineering, integration of functions, continuous flow and many more. Meanwhile, according to Nawanir et al., (2013) there is no single argument from the previous research that can choose the best practice. Therefore, the impact of lean manufacturing practice can be seen through the implementation and the consistency application of lean manufacturing practices at particular organisations. In fact, the correct deployment of lean manufacturing practice and also the understanding of lean practice especially lean principle will help the particular organisation to give a positive impact to the organisation especially in terms of the performance. In addition, lean manufacturing practices must be implemented in a holistic manner in order to influence performance (Nawanir, Lim, Othman, & Adeleke, 2018). There are many recent studies using lean manufacturing practices and tools as seen in table 2.4 below.

Table 2. 4
Summarizes of Lean Manufacturing Practices/Tools in current studies

Lean Manufacturing Practices	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Cellular manufacturing/group technology	x		x	x				x		x		x	x		x		x
Continuous improvement/*kaizen*					x	x	x		x						x		
JIT			x		x	x	x		x	x	x	x	x	x	x	x	x
Pull system/ *kanban*	x	x	x	x			x	x	x	x		x	x			x	x
Quick changeover techniques	x	x	x	x				x		x		x	x	x	x	x	x
Total quality management			x				x				x					x	x
Statistical process control							x			x							
Total productive maintenance			x	x	x	x	x	x						x	x		x
Employee involvement											x						

Table 2. 4 (Continued)

Lean Manufacturing Practices	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Multifunctional workforce									x					x			
Employee evaluation/ employee focus					x												
VSM						x									x		
Root cause analysis															x		
Quality at source/ Autonomation/*jidoka*	x			x	x			x									
Load leveling														x	x		
One piece flow															x	x	
Point of use storage															x		
Flexible resources	x			x				x									
Small lot production	x			x				x		x		x	x	x		x	
Uniform production level	x			x				x									
Elimination of waste									x							x	
Zero defects									x			x	x		x		
Decentralization									x								
Vertical information system									x								
Visual control			x														
Flow system					x												
Technology & innovation					x												
Six sigma							x										
Job reengineering							x										
Work teams							x										
Benchmarking							x										
Organisational restructuring							x										
Business process reengineering							x										
Integration of functions									x								
Continuous flow		x															
Supplier communication/supplier feedback/supplier focus				x	x			x				x	x			x	
Customer involvement/customer focus			x														
5s		x	x											x	x		
Poka yoke		x	x												x	x	

Authors: (1) Nawanir et al (2018) (2) Alaskari et al (2016) (3) Zahraee (2016) (4) Nawanir et al (2015) (5) Iteng et al (2015) (6) Belekoukias et al. (2014) (7) Krishnan & Parveen (2013) (8) Nawanir et al (2013) (9) Chauha et al (2012) (10) Taj and Morosan (2011) (11) Yang, Hong, and Modi (2011) (12) Furlan et al. (2011a) (13) Furlan et al. (2011b) (14) Chen and Tan (2011) (15) Steinlicth (2010) (16) Rahman, Laosirihongthong, and Sohal (2010) (17) Mackelprang and Nair (2010)

Table 2.4 shows the mapping summaries of lean manufacturing practices in previous study that had been used in their research. As a result of the mapping summaries, this research comes out with six lean manufacturing practices that commonly used from the previous study. Those practices are cellular manufacturing or known as group technology (Monden, 1983), *kanban* or pull system, quick changeover technique, total quality management, total productive maintenance, and small lot production.

Zahraee (2016) defined the cellular manufacturing as the entire process is systemized for a particular product or related products into a set or cell that includes all the necessary equipment, machines and operators. It was indicated and valuated the implementation of lean manufacturing practices and tools in selected production companies in Iran. As a result, this study showed the importance of the lean manufacturing implementation condition in the selected automotive production industry in Iran that works in identifying effective lean manufacturing factors in the Iranian automotive industry. In line with what is being said by Doolen and Hacker (2005) which is the decision to engage in lean practices is often part of an organization's manufacturing strategy. Besides, cellular layouts had a strong effect upon the competitive position of manufacturing plants (Matsui, 2007).

Furthermore, *Kanban* is the Japanese word for a card and it is refers to the work signaling system to trigger actions (Chen & Tan, 2011). The basic idea of a pull system is to produce only when requested move to where it is needed just as it is needed finished products are pulled by customer demand (Shah & Ward, 2007). There is no production and material movement if there is no demand. The production and material movement are performed just as needed, in the right quality, right quantity, right time, and precisely where required in the pull system/ *kanban* (Nawanir, 2016).

Meanwhile, quick changeover which is also known as quick setup (Shah & Ward, 2003) was defined as a technique of eliminating times it takes to setup or changeover a process from running one specific product to another (Chen & Tan, 2011). According to Pont et al. (2008) and Matsui (2007), training for quick changeover is essential to ensure the setup process can be performed appropriately. In addition, TQM, TPM, Small lot of production

Womack et al. (1990); Doolen and Hacker (2005) stated that the importance of total quality management (TQM) in the context of manufacturing processes. TQM has been an approach to management characterized by some guiding principles orcore concepts that embody the way the organization is expected to operate, which, when effectively linked together, will lead to high performance (Anvari, Ismail, & Hojjati, 2011). Furthermore according to Pont et al. (2008) TQM practices also increase the overall efficiency of plant operations.

Subsequently, there is a strong consensus that preventive maintenance programs were critical to lean manufacturing success (Chen & Tan, 2011; Matsui, 2007; Taj & Morosan, 2011). This is because losing any machines or equipment due to unexpected downtime will stop the production line (Nawanir, 2016).

Hereinafter, small lot production has been categorized as a key practice of lean manufacturing (Chen & Tan, 2011; Yang et al., 2011). Traditional paradigm always suggested operating in large lot size as an effort to maximize utilization of machines (Nawanir, 2016). Besides, the ability of suppliers to deliver the products in small lot size is essential in lean manufacturing ystem.

Consequently, due to the many advantages and importance of lean manufacturing practices as abovementioned, this study has taken an approach to use these six lean manufacturing practices in this study as shown in table 2.5.

Table 2. 5

Lean practices that commonly used

Lean Manufacturing Practices	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cellular manufacturing/group technology		x	x				x		x		x	x		x		x	x	x		x
Pull system/k*anban*	x	x	x			x	x	x	x		x	x			x	x				
Quick changeover techniques	x	x	x				x		x		x	x	x	x	x	x	x	x	x	x
Total quality management		x				x				x					x				x	
Total productive maintenance		x	x	x	x	x	x						x	x		x			x	x
Small lot production			x				x		x		x	x	x		x			x	x	x

Authors: (1) Alaskari et al. (2016) (2) Zahraee (2016) (3) Nawanir et al. (2015) (4) (Rosman Iteng et al. (2015) (5) (Belekoukias, Garza-Reyes, et al. (2014) (6) Krishnan & Parveen (2013) (7) Nawanir et al. (2013) (8) Chauhan & Singh (2012) (9) Taj & Morosan (2011a) (10) Yang et al. (2011) (11) Furlan, Vinelli, et al. (2011a) (12) Furlan, Dal, et al. (2011b) (13) Chen & Tan (2011) (14) Steinlicht (2010) (15) Rahman et al. (2010) (16) Mackelprang & Nair (2010) (17) Hallgren & Olhager (2009)(18) Fullerton & Wempe (2009) (19) Pont et al. (2008) (20) Jayaram, Vickery, & Droge (2008)

Table 2. 5 (Continued)

Lean Manufacturing Practices	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Cellular manufacturing/group technology						x	x	x	x				x	x	x	x
Pull system/Kanban	x	x	x		x		x	x	x		x	x	x		x	x
Quick changeover techniques	x	x	x	x	x		x	x	x		x		x		x	x
Total quality management				x				x	x	x			x	x	x	
Total productive maintenance	x			x		x	x	x	x				x		x	x
Small lot production	x	x		x			x	x	x	x	x		x	x	x	

Authors: (21) Shah & Ward (2007) (22) Matsui (2007) (23) Worley & Dolen (2006) (24) Kannan & Choon (2005) (25) Melton (2005) (26) Olsen (2004) (27) Sohel Ahmad et al. (2003) (28) Fullerton et al. (2003) (29) Fullerton & Mcwatters (2001) (30) Callen, Fader, & Krinsky (2000) (31) McLachlin (1997) (32) Karlsson & Ahlstrom (1996)c(33) Lee & Paek (1995) (34) Ramarapu et al. (1995) (35) Sakakibara et al. (1993) (36) Voss & Robinson (1987)

Lean practices that were commonly used in previous studies are shown in Table 2.5. Based on this perspective, because of the establishment and common use of practises, six components are used to measure lean manufacturing. The six components used to define lean manufacturing practices are cellular layout, pull system/ *kanban*, quick changeover technique, total quality management, total productive maintenance and small lot production. The breakdown of these six elements is as follows:

2.4.1 Cellular manufacturing

Cellular manufacturing is a process where tools and workplaces are organized in a structure that supports a smooth movement of materials and components through the process with the lowest conveyance or delay (Suzaki, 1985). Meanwhile, Zahraee (2016) defined cellular manufacturing as the entire process that systemized for a particular product or related products into a set or cell that includes all the necessary equipment, machines and operators. In fact, cellular manufacturing can help to eradicate the waste resulting from conveyance and unnecessary motion, the '3M' comprises of men, machinery and material. According to Stemhanou and Spiegl (1992), the possibility of making changes and at the same time maintaining competitive price structure makes the application of cellular manufacturing whereas Fullerton et al., (2003) had defined cellular manufacturing as a gathering and forming common concepts, principles, problems, and tasks.

Besides, it evades needless duplication through standardization. It contains sequencing similar parts through the same machine and creating manufacturing cells for processing. Study by Nawanir et al. (2015); Taj and Morosan (2011); Furlan et al. (2011a); Furlan et al., (2011b); Steinlicht (2010); Mackelprang and Nair (2010); Hallgren and Olhager (2009); Fullerton and Wempe (2009); Jayaram, Vickery and Droge (2008); Olsen (2004); Ahmad et al.(2003); Fullerton et al. (2003); Fullerton and Mcwatters (2001); Lee and Paek (1995); Ramarapu et al. (1995); Sakakibara et al.(1993); Voss and Robinson(1987) agree with Stemhanou and Spiegl (1992), the used of cellular manufacturing in their study and the result shows the positive impact of implementation. Subsequently, Nawanir et al. (2020) asserted that cellular manufacturing with close proximity between the facilities and changeable layouts diminish conveyance, material handling, inventory, and spacewill leads to less energy consumption.

2.4.2 Pull system/*Kanban*

Kanban is the marking system for emerging JIT production which is a visual signal that helps flow by ‘pulling’ products through the process as required by the customer. According to Ohno (1988), the operating method of the Toyota production system is *kanban*. There are several functions of *kanban* such as arrangement for pick-up or conveyance information, provides production information, averts overproduction and extreme conveyance, serves as a work order attached to goods, avoids flawed products by recognizing the process making the defectives and discloses existing problems and sustains inventory control. Previous study by Alaskari et al. (2016); Zahraee (2016); Nawanir et al. (2015; Krishnan and Parveen (2013); Nawanir et al. (2013); Chauhan and Singh (2012); Taj and Morosan (2011); Furlan et al. (2011a); Furlan et al., (2011b); Rahman et al. (2010); Mackelprang and Nair (2010); Jayaram, Vickery and Droge (2008); Shah and Ward (2007); Matsui (2007); Worley and Dolen (2006); Melton (2005); Olsen (2004); Ahmad et al.(2003); Fullerton et al. (2003); Fullerton & Mcwatters (2001); McLachlin (1997); Karlsson and Ahlstrom (1996); Lee and Paek (1995); Sakakibara et al.(1993); Voss and Robinson(1987) using *kanban* in their study and shows that *kanban* can improve the performance. Besides, according to Nawanir et al. (2020) the application of the pull system that will produce when requested by customers can result in less work and more efficient usage of machines. In addition, the main advantage of the pull system is the reduced inventory and therefore the associated cost of inventory reduction (Herzog & Tonchia, 2014).

2.4.3 Quick changeover

Shah and Ward (2007) defined quick changeover or set-up time as the time that passes in the middle of when the last good piece comes off the current run and when the first good piece comes off the next run, while running at the optimal rate. In fact, Shah and Ward also mentioned that by reducing the set-up time it can helps to reduce the time between product changeovers. Furthermore, Monden (1983) stated that lowering set-up time will help promote greater flexibility, especially for multiple products in the same production line.

All these reductions could ensure that customer's lead time such as set-up time, moving time, processing time, waiting time, and queuing time will enable a company to respond quickly to customer needs. Previous study by Alaskari et al. (2016); Zahraee (2016); Nawanir et al. (2015); Nawanir et al. (2013); Taj and Morosan (2011); Furlan et al. (2011a); Furlan et al., (2011b); Chen and Tan (2011); Steinlicht (2010); Rahman et al. (2010); Mackelprang and Nair (2010); Hallgren and Olhager (2009); Fullerton and Wempe (2009);

Pont, Furlan and Vinelli (2008); Jayaram, Vickery and Droge (2008); Shah and Ward (2007); Matsui (2007); Worley and Dolen (2006); Kannan and Choon (2005); Melton (2005); Ahmad et al.(2003); Fullerton et al. (2003); Fullerton and Mcwatters (2001); McLachlin (1997); Lee and Paek (1995); Sakakibara et al.(1993); Voss and Robinson (1987) also take consideration into quick changeover by aiming the set-up times reduction which is to enable batch sizes to be reduced (Voss & Robinson, 1987).

Other that that, quick changeover can help to make setup process efficient and effective. Hence, it requires fewer resources and energy (Nawanir et al., 2020). On the other hand Fullerton et al., (2003) stated that saving some of the time and costs in changing tooling and other aspects requisite in moving from making one product to one more is well-defined as quick changeover. As a result, it will diminish lot sizes and the must for buffer inventories.

2.4.4 Total Quality Management

According to Zahraee (2016), total quality management (TQM) is a method of non-stop development using participative management to address the core requests of consumers based on the supposition that the incompetency is not formed by people but rather, by systems. The key elements are used for participation and preparation, problem solving, arithmetical methods, long-term aims and detection. TQM is one of the lean practice that is applied widely in the manufacturing industry (Krishnan & Parveen, 2013).

Previous studies from Zahraee (2016); Krishnan and Parveen (2013); Yang, Hong and Modi (2011); Rahman et al. (2010); Pont, Furlan, & Vinelli (2008); Kannan & Choon (2005); Fullerton et al. (2003); Fullerton and Mcwatters (2001); Callen, Fader and Krinsky (2000); Lee and Paek (1995); Ramarapu et al. (1995); Sakakibara et al.(1993) also considered TQM. In their studies since TQM is perceived to be the most frequently used practice when seeing both manufacturing firms and service sector, this can be described by the high levels of quality that both sectors struggle towards.

TQM is practices into the operations strategy, the possibility exists to enlarge value and to improve the position for oneself to react to competitive forces. At an operational level TQM practices can be organized together to create value. The extent to which many practices associated with each other and with performance is proof that while the three may have distinct characteristics and goals, there are elements of each that are common and which can be successfully reinforced by each other (Kannan & Choon, 2005).

2.4.5 Total Productive Maintenance (TPM)

Total productive maintenance or also known as TPM has been defined by Shah and Ward (2003) as by using maintenance techniques, utilize of equipment effectiveness through scheduled and preventive maintenance that should be focused to. TPM is enables waste reduction by reducing the chances of idle down time during operation because it is one of the lean manufacturing pillars. Furthermore, TPM is a maintenance system that administers the whole life of the equipment in every section such as planning, manufacturing, maintenance, and others in order to increase the overall performance of this equipment.

According to Zahraee (2016), the aim of TPM is to be able to identify, modify and repair faults in operations to avoid crashes. Therefore, employees perform arranged tool protection to identify any irregularities. In this case, the operators were included in the protection and control activities to prevent and warn of breakdowns as they are nearby the machines.

In addition, TPM also focuses on maximizing equipment effectiveness through planned and preventive maintenance, as well as using maintenance optimization techniques (Shah & Ward, 2003). In addition, it is one of the lean manufacturing pillars in which it enables waste reduction by reducing the chances of idle down time during operation. Besides, there is a sturdy agreement that preventive maintenance programs were critical to lean manufacturing triumph (Matsui, 2007; Taj & Morosan, 2011; Cua, Mckone, & Schroeder, 2001). This is because losing any machines or equipment due to unanticipated downtime will break the production line (Nawanir, 2016).

Surprising results were also obtained in concerning to the no impact of TPM on performance (Belekoukias, Garza-Reyes, et al., 2014). Several authors such as Zahraee (2016); Nawanir et al. (2015); Iteng et al.(2015); Belekoukias, Garza-Reyes and Kumar (2014); Krishnan and Parveen (2013); Nawanir et al. (2013); Chen and Tan (2011); Steinlicht (2010); Fullerton and Wempe (2009); Pont, Furlan and Vinelli (2008); Jayaram, Vickery and Droge (2008); Shah and Ward (2007); Kannan and Choon (2005); Olsen (2004); Ahmad et al.(2003); Fullerton et al. (2003); Fullerton and Mcwatters (2001); Lee and Paek (1995); Sakakibara et al.(1993); Voss and Robinson(1987) also use TQM as one of the practice that to measure lean manufacturing. In the same vein, TPM also ensures machines, tools, and equipment are in a high state of readiness at all the time while preventing breakdowns from occurring that leads the plants rigorously clean workstations to make unusual incidences visible (Nawanir et al., 2020). For that reason, immediate actions can be taken to avert worse incidents.

2.4.6 Small Lot of Production

The key to Ford's mass production system ia making large lots of single part that is punching out a large number of parts without a die change (Taiichi Ohno, 1988). Furthermore, batches are made as small as possible in contrast to traditional mass production, where bigger volume is considered better in production levelling. According to Chen and Tan (2011), small lot size is a typical practice in the JIT system. Reduce lot size enables JIT systems to operate effectively so that it benefits from less work-in-process (WIP) inventories, less space required and increased flexibility.

Many researchers have examined this element in their research such as Nawanir et al. (2015); Nawanir et al. (2013); Taj and Morosan (2011); Yang, Hong, & Modi (2011); Furlan et al. (2011a); Furlan et al., (2011b); Chen & Tan (2011); Rahman et al. (2010); Fullerton and Wempe (2009); Pont, Furlan and Vinelli (2008); Jayaram, Vickery and Droge (2008); Shah and Ward (2007); Matsui (2007); Kannan and Choon (2005); Ahmad et al.(2003); Fullerton et al. (2003); Fullerton and Mcwatters (2001); Callen, Fader and Krinsky (2000); McLachlin (1997); Lee and Paek (1995); Ramarapu et al. (1995);

Sakakibara et al.(1993). Besides, complete elimination of waste is the fundamental of Toyota Production System. Thus, production levelling is strictly practiced and fluctuation is flattened or smoothed. Then, lot sizes are made smaller and the continuous flow of one item in large quantity is avoided (Taiichi Ohno, 1988). In addition, Nawanir et al. (2020) revealed that small lot production can increase quality because quality issues can be detected easily, and operators have a low tendency to let defects pass and also minimizes the inventory level because it depends on the quantity produced in a batch. As a result, it saves energy and resources for handling inventory and defective products.

2.5 Lean Manufacturing Developments

In today's world the industrial scene has faced higher challenges because of the rise in international competition, therefore lean manufacturing (LM) has been taking part in a crucial role to boost organizations' performance (Jagmeet Singh & Singh, 2020). In fact, the adoption of lean manufacturing has been discussed globally for decades. As per the growing interest, federal government through Malaysia Productivity Corporation (MPC) also have set interest and demonstrated commitment on Lean Management since 2011 which is initiated as part of improving the operations of the small and medium enterprises (SMEs) in Malaysia. (Osman, Othman, & Abdul Rahim, 2020).

In addition, lean manufacturing has been proven that can be a systematic method for identifying and eradicating waste in operations with continuous improvement in doing everything more efficiently, reducing the operating cost of the system and fulfilling the customers' desire for maximum value at the lowest price (Chauhan & Chauhan, 2019).

Therefore, the importance and effectiveness of lean manufacturing remains relevant for use up until now. Literally, the development of lean manufacturing has been noticed to the entire world as it succed to boost the organisational performance (Khalfallah & Lakhal, 2020; Novais, Marín, & Moyano-Fuentes, 2020; Sahoo, 2019; Valente et al., 2019; Nawanir et al., 2013; Hofer et al., 2012).

Lean has undergone the process of evolution in three different stages; scientific management, engagement and integration. In the period of scientific management (1890-1940) which in the era of efficiency and productivity, Frederick Taylor, Frank and Lillian Gilbreth, Henry Ford and others managed to initiate division of labor, simplified work and standardized manufacturing methods (Bell & Orzen, 2011). In the age of engagement (1940-1995) after World War II, Taiichi Ohno and Shigeo Shingo and other in Japan, embraced the ideas of quality and continuous improvement and developed the Toyota Production System (TPS) after visited the Ford plant at River Rouge that considered the most advanced car manufacturing system in the world (Liker & Morgan, 2006). Then TPS move ahead to make a great improvement by adopting lean production (Hasle et al., 2012).

The development of lean manufacturing shows that it is successfully disseminated to all types of organizations. It has been started in 1988, Krafcik in his article Triumph of The Lean Production System coins the term lean to describe manufacturing system used by Toyota that emphasized on how to use fewer resources compared to mass production (Papadopoulou & Özbayrak, 2005). Finally in the era of integration (1996-present) non-manufacturing companies such as healthcare (Anuar, 2018; Anuar, Saad and Yusoff, 2017) and higher institution (Nawanir, Binalialhajj, Teong Lim, & Hanafiah Ahmad, 2019) started to discover lean manufacturing concept through out the organisations.

Then, in 1996, lean thinking was published that accentuate integration of improvement across value streams across all functions of the business and in all industries (Bell & Orzen, 2011). Lean thinking was presented by Womack and Jones based on five key principles; specific value, value streams, value flow, pull value and pursue perfection (Hines, Howeg, et al., 2004).

Furthermore, a study by Doolen and Hacker (2005) has contribute the body of knowledge pertaining the development and validation of a survey to measure both the number and level of adoption of lean practices by an organization. A review of 12 different surveys and assessment tools was completed along with a review of related literature on the potential limitations of a lean manufacturing strategy. Meanwhile study by Chauhan and Singh (2012) has dentified and measured the intimately associated parameters of lean manufacturing and also examines the weight of their contribution to overall lean manufacturing. The study also revealed that Indian manufacturing industries were still overlooking the elimination of waste, the most important parameter of lean manufacturing.

Subsequently, lean manufacturing has been used to effectively improve organisation performance in the long term (Negrão, Filho & Marodin, 2017). Despite being an intensively researched and covered topic, there were many authors who agreed that there was a lack of common and widely accepted definition of Lean (Valente, Saosa and Moreira, 2019; Bhamu and Singh Sangwan, 2014; Hines et al., 2004; Karlsson and Ahlström, 1996;

Shah and Ward, 2007). Nonetheless, the lean principles no longer can be used if the lean techniques and practices unable to apply wisely. Thus, there were previous scholar had thought explicitly to define lean by combining set of principles and practices or tools that allows philosophical to eliminate waste (Anuar, 2018). In the meantime, there were several studies that grouped and categorised lean tool/practice in order to measure a particular purpose of research. The most commonly used practices proposed by several past studies are compiled by regrouping various activities due to the overall consensus that is still lacking (Nawanir et al., 2013). Table 2.6 below shows several authors that had grouped and categorized several lean tools/practices.

Table 2. 6
Categorize lean tools/practices

No	Scholars	Lean groups/ Categorized
1	Shah and Ward (2003)	Categorized LM into 4 bundles HRM- training & cross functional team TQM- Quality management, continuous improvement, SPC JIT- Setup time, small size reduction, cellular manufacturing, Kanban TPM- includes practices primarily designed to maximize equipment effectiveness through planned predictive and preventive maintenance of the equipment and using maintenance optimization techniques
2.	Hines, Howeg, et al. (2004)	Lean exists at two levels: strategic and operational. The customer-centred strategic thinking applies everywhere, the shop-floor tools do not. This has led frequently to confusion, or led to misunderstanding as to where to apply lean
3	Olsen (2004)	Define lean practices as a supportive practices: JIT TQM TPM Infrastructure
4	Worley and Doolen (2006)	To well drive in lean implementation, the authors proposed: Management support Communication

Table 2.6 (Continued)

No	Scholars	Lean groups/ Categorized
5.	Steinlicht (2010)	Categorised lean tools in the diverse group: Quality/continuous improvement tools & technique process tools & technique support system tools & technique The quality category contains *Kaizen*, TQM, TPM, and autonomation. Cellular manufacturing, small-lot production, production smoothing, JIT, and line balancing fall in the production process category. The third category, methods, includes 5S, value stream mapping, visual systems, work standardization, setup reduction, and single minute exchange of die (SMED)
6.	Iteng et al. (2015)	This study proposes the practices should be grouped together into two main dimensions Socially-oriented Lean Production (SLEAN) customer focus supplier focus employee focus continuous improvement Technically- oriented Lean Production (TLEAN) Just-in time flow system quality at source technology
7.	Zahraee (2016)	Internally oriented lean practices: processes and equipment manufacturing planning and control human resources supplier relationship Externally oriented lean practices: customer relationship

Based on the philosophical approach, some principles that have been discussed on the purpose to eliminate waste or non-value added in the operational level of the organisation. Several researchers that categorised the lean tools and lean practices in several groups according to the purpose of the measurement. For example, Shah and Ward (2003) had categorized lean manufacturing into four bundles and each bundle comprises of the principles and tools such as human resource management (HRM), total quality management (TQM), just in time (JIT) and total preventive maintenance (TPM).

Each bundle has its own type of lean tools and practices. For human resource management (HRM) consists of training and cross functional teams, meanwhile total quality management (TQM) consists of quality management, continuous improvement and statistical process control and on the other hand, JIT comprised of set up time reduction, small lot size reduction, cellular manufacturing, continuous improvement and *kanban* whereas total preventive maintenance (TPM) is a preventive maintenance that includes practices primarily designed to maximise equipment effectiveness through planned predictive and preventive maintenance of the equipment and using maintenance optimisation techniques. The results also indicate that lean bundles contribute substantially to the operating performance of plants, and explain about 23% of the variation in operational performance after accounting for the effects of industry and contextual factors.

Besides, Hines, Holweg and Rich (2004) had reviewed lean thinking and its evolution over time. Their study has defined lean at two levels which comprised strategic levels and operational levels. The level of strategic is based on the principles of lean thinking that accessible by Womack and Jones whereas the level of operational have been focused on the shop floor, which comprise strategic aspects like value creation and understanding customer value.

Additionally, a study by Olsen (2004) had defined lean practices as a supportive practices that categorised lean into four wide areas such as JIT, TQM, TPM, and infrastructure. The study was measured by seven lean manufacturing practices on small medium sized companies to examine the relationship with the firm level financial performance. The results demonstrated that lean practices act as a synergistic, mutually supportive set rather than linearly additive individual practices in affecting operations financial performance.

Meanwhile, according to Worley and Doolen (2006), management support and communication have been proposed to support lean manufacturing practices, as well to drive the implementation of lean to see the great impact of organisational performance. The research was executed to see the impact area on manufacturing equipment & process, shop floor management, new product development, supplier relationships, customer relationship and workforce management area. The result shows that to support the supposition that management support does play a role in driving a lean manufacturing implementation. Management support impacted the lean manufacturing implementation both negatively and positively. The research also found moderate support for improved communication in the organization attributable to the lean implementation.

Furthermore a study by Steinlicht (2010), had characterised lean tools into 3 groups that are continuous improvement tools and techniques, process tools and techniques and support system tools and techniques. The reason for combining all these groups is to enhance the productivity in mature organisations compared to young organisations.

There were two groups namely (1) socially oriented lean production (SLEAN) which comprises supplier focus, employee focus, continuous improvement and customer focus and (2) technically oriented lean production (TLEAN) encompasses quality at source, JIT, flow system and technology and innovation that grounded by STS theory (Iteng et al., 2015). This groups practices had been proposed by considering the recommendation from Shah and Ward in order to eliminate waste, they need to group lean production practices into two dimensions based on STS theory.

Meanwhile, a study by Zahraee (2016) aimed to investigating and evaluating the implementation of lean manufacturing practices and tools in selected production companies in Iran due to the lack of information on lean practices by some manufacturing industries. The lean tools and techniques were categorized according to the area of implementation, such as internally and externally oriented lean practices. The study has found that the importance of the lean manufacturing implementation condition in the selected automotive production industry in Iran which is support that the manufacturing industry should develop lean thinking and approaches in order to sustain in a competitive environment.

According to Womack, Jones and Roos, (1990); Liker (2004), although the Japanese automobile industry has been developed this production philosophy, but the practices and principles still can be practice to all other industries and service around the world. Therefore, the researcher summarises lean manufacturing practices or tools in Table 2.7 that commonly used in the manufacturing firms.

Table 2. 7
Summarizes of Lean Manufacturing Practices/Tools in Research 2011-2016

Lean Manufacturing Practices	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cellular manufacturing		x				x		x	x	x	x	
Continuous improvement/kaizen			x	x	x		x					
JIT/continuous flow production		x	x	x	x		x	x		x	x	x
Pull system/kanban	x	x				x	x					
Quick changeover techniques								x	x	x	x	x
Total quality management		x			x					x	x	x
Statistical process control					x							
Total productive maintenance		x	x		x	x		x		x	x	x
Supplier communication/supplier feedback/supplier focus			x			x						
Customer involvement/customer focus		x										
5s	x	x										
Kanban	x				x							
SMED	x	x				x						
Poka Yoke	x	x										
Multifunctional workforce							x					
Employee evaluation/employee focus			x									
Quality at source/ quality control			x			x		x	x	x	x	

Authors: (1)
Alaskari et al (2016) (2) Zahraee(2016) (3) Iteng et al (2015) (4) Belekoukias et al. (2014) (5) Krishnan & Parveen (2013) (6) Nawanir et al(2013) (7) Gulshan (2012) (8) Taj and Morosan (2011) (9) Yang, Hong, and Modi (2011) (10) Furlan et al. (2011a) (11) Furlan et al. (2011b) (12) Chen and Tan (2011)

Table 2.7 (Continued)

Lean Manufacturing Practices	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Flexible resources					x		x	x		x	x
Small lot production					x		x	x	x	x	x
Uniform production level					x		x	x	x	x	x
Elimination of waste						x					
Zero defects						x					
Decentralization						x					
Vertical information system						x					
Visual control	x										
Flow system		x									
Technology & innovation		x									
Automation			x								
Sig sigma				x							
Job reengineering				x							
Work teams				x							
Benchmarking				x							
Organisational restructuring				x							
Business process reengineering				x							
Integration of functions						x					

Authors: (1) Alaskari et al (2016) (2) Zahraee(2016) (3) Iteng et al (2015) (4) Belekoukias et al. (2014) (5) Krishnan & Parveen (2013) (6) Nawanir et al(2013) (7) Gulshan (2012) (8) Taj and Morosan (2011) (9) Yang, Hong, and Modi (2011) (10) Furlan et al. (2011a) (11) Furlan et al. (2011b) (12) Chen and Tan (2011)

Lean manufacturing tools that commonly used in previous studies are shown in Table 2.7. Despite the fact previous researchers and practitioners have attempted to classify the main lean manufacturing practices, nevertheless Nawanir et al. (2013); Ahmad et al. (2003) stated that there was no consensus among them regarding the relative prominence of the practices. In addition, Zhu and Lin (2017) mentioned that firm value is influenced by several factors and it is difficult to claim that lean manufacturing alone is the main cause of any improvements in firm value. In other words, it is impossible to identify the real effects of lean manufacturing on firm value without controlling for the effects of other possible factors that might capture firm heterogeneity.

Frequently, the author's backgrounds reflect on the types of practices. However, the concept remains the same although have different sets of practices (Hasan, Asaad, & Iteng, 2017). Due to the overall consensus that is still lacking, the most commonly used practices proposed by several past studies are compiled by regrouping various activities into six practices. This study has classified cellular layout, pull system/ *kanban*, quick changeover technique, total quality management, total productive maintenance and small lot of production as lean manufacturing practices.

The studies in lean manufacturing have been around for a long time since the lean era was introduced until now. However, past studies have been made from various aspects such as in terms of culture, process, principles, and sustainability and so on. This study has taken the approach to study the relationship between lean manufacturing practices and sustainability in manufacturing organization in Malaysia.

2.6 Sustainability

In the current industrial unpredictable situation with serious resource crises, business players are inspired to apply approaches to sustain their businesses while targeting competitive advantage (Nawanir et al., 2020). The concept of sustainability was formally defined in 1987 after the World Commission on Environmental and Development (WCED) published the Brundtland Report titled "Our Common Future" (Shokouhyar, Seddigh, &

Panahifar, 2020). In this report, the commission introduced sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987).

Years later, Elkington (1994) reshaped the three dimensions, defining them as “People, Planet and Profits”. Thereupon, the original term of sustainability was coined by Elkington (1994) which considers environmental, social and economic aspects (Abdul-Rashid et al., 2017). While the most accepted definitions of sustainability offer accessible dimensions, such as the triple bottom line, the application domains of human activity are subject to interpretation. As a result, professions differ in their conceptualisation and application of sustainability depending on how they approach the question of what is sustained.

Besides, a major motive for divergence is found in the different levels of analysis. For example, management thinkers are focussed on variables that deal with sustaining organisational systems, sociologists on individuals or groups, and political scientists on even broader populations, defined around geopolitical borders. At the same time, it is telling that the environmental movement was initiated in close connection with the sciences, specifically, biology, also the study of life (Ratiu & Anderson, 2015).

Sustainability has turned into the strategic vital of the twenty-first century. While most of the organisations have set their strategic course to lead to sustainable, the successful employment of these strategies requires making an infrastructure that reflects and reinforces these initiatives. Subsequently, the idea of sustainability in the manufacturing context recognizes the vital interactions between the economic growth, environmental problems and social issues (Muhamad, Ebrahim, & Hami, 2014). Besides, increasing interest in sustainability reflects a growing concern about a range of major challenges and problems facing societies, environments and economies (Jones, Hillier, & Comfort, 2016). Without a doubt, sustainability has been given attention by organizations in increasing sustainability performance.

Sustainability is considered long-term aim that should be planned in nature. Various companies only contemplate sustainable business practices to improve their worth over a shorter term. The long-term perspective that sustainability should be approach from must be much considered (Ferro et al., 2017). Meanwhile, according to Nawanir et al. (2020), the incresing in resource consumption, climate change, biodiversity, water scarcity, and demographic changes and instability triggered the society to consider sustainability issues by taking the triple bottom line dimensions into organizational activities. In addition, Barron and Chou (2017) mentioned that the triple bottom line can be viewed as a measurement tool that concurrently accounts for a firm's economic, ecological and social performance.

Consequently, Ahmad et al. (2019) reviewed the indicators of the triple-bottom line which are environment, economy and society for manufacturing sectors. The study intended to document the sustainability indicators for manufacturing sectors; perform an analysis of the indicators to show the evolutional progress and maturity in terms of their consistent, repeated and standardized usage. The study found that in immature aspect of wastle handling in the environmental category whereas economic assessment was most of the time limited to cost-based indicators. Meanwhile, from a social perspective, most of the reviewed studies were based on workers and local community and society related indicators. Besides, studies for metal manufacturing industries were more focused on all three dimensions of sustainability; economic, environment and social.

As a result, researcher found that sustainability play a crucial role in order to determine the stability of an organization. According to the past studies, nowadays most of the organizations take into consideration the element of sustainability so that able to strengthen the placement and be competitiveness among the industry.

2.6.1 The Concept of Sustainability: Triple Bottom Line

Sustainability aims at meeting the resource needs of the current and the future generations without hampering the environment and it consists of three dimensions; economic, social and environmental (Sharma, Jabbour, & Jabbour, 2020). Besides, sustainability also can refers to triple bottom line (TBL), which means being competitive through a low cost and creating value (economically), generating wellbeing (socially) and without compromising the environment (environmentally)(Karman & Savanevičienė, 2020). Correspondingly, Elkington (1997) mentioned that the triple bottom line concept also known as the three pillars (profit, planet and people). Yet, the triple bottom line (TBL) concept of sustainability requires manufacturing industries to consider all three aspects of sustainability comprehensively (Ahmad et al., 2019).

According to Dhanda and Shrotryia (2020), the perspective for sustainability concept was a result of three drivers: first, the increased awareness and expectations of the stakeholders; second, the increased transparency which brings organizational performance under scrutiny and third, the declining resources and environmental degradation. In this view, the economic, social and ecological domains are constantly being integrated by companies to create shared value for all their stakeholders.

In addition, sustainability provides an overview for companies in selecting and implementing general strategies to improve and maintain the company (Sinaga, Suharyono, Musadieq, & Iqbal, 2020). Subsequently, the social and environmental goals have been considered subordinate to the prime goal of creating economic value (Dhanda & Shrotryia, 2020). Furthermore, the economic facet of sustainability is about the impacts on the economic welfare of the stakeholders, and local and national economic systems that covers all economic interactions (Ahmad et al., 2019). Meanwhile, according to Eriksson and Svensson (2016), the concepts of sustainability was considered interchangeable by both scholars and practitioners.

Based on those definitions, sustainability is concluded as a strategy to create a condition which allows a company to win over the competition with other companies engaged in the same field or market, where the company has a distinguishing value from other companies (Sinaga et al., 2020).

The organizations are incorporating sustainability dimensions in their business strategies for their growth (Gupta & Singh, 2020). Irrefutably, Ratiu and Anderson, (2015) asserted that sustainability has become global attention that drives governments to take appropriate action to achieve it. Therefore, the triple bottom line principle of sustainability has been a reference since it was first introduced by Elkington (1994). According to figure 2. 2 , it was underlying strategy and principles to balance economic, environmental and social interests have been established on every continent in the world (Elkington, 1994).

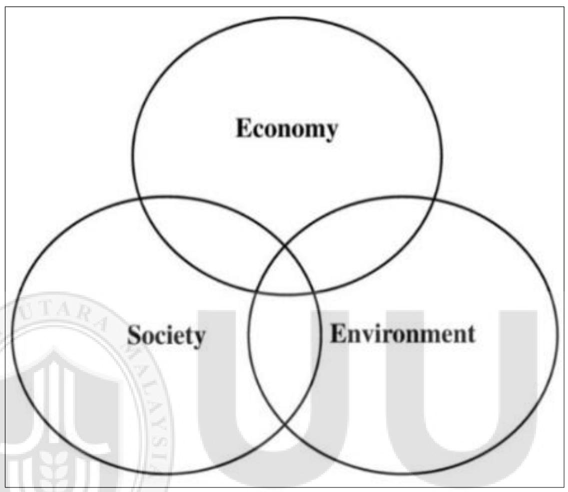


Figure 2. 1
Triple bottom line principle of sustainability (Elkington, 1994)

2.6.2 Sustainability in the Organizations

In response to the growing sustainability concerns, manufacturing companies have to formulate measures to aiming at integration of sustainability aspects that generally was evaluated by environment, social, and economic; known as the three pillars of sustainability (Nawanir et al., 2020). Das, Rangarajan and Dutta (2020) reviewed the current status of corporate sustainability practices, issues and challenges in small and medium enterprises (SMEs). The result revealed that social and environmental practices were totally abandoned in SMEs more specifically in emerging markets. Besides, the collaborative mode of operation, government policy and facilitation, supporting organisation culture can positively influence SME's sustainability performance and also improve their financial performance. A model that can improve and strategically manage their sustainability practices in the emerging market context of Asia has been suggested based on literature. Undoubtedly, it was proven that sustainability plays a crutial role in an organisation.

In addition to this, Iranmanesh et al. (2019) were examined the effect of lean manufacturing practices on environmental performance by considering lean culture as a moderator in the organisations. The result found that there was a positive and significance effect between lean practices on sustainability performance. These results have essential implications for improving the sustainable performance of manufacturing organizations through lean manufacturing practices. Likewise, it was also remarkable to observe that lean culture positively moderated on sustainable performance. Therefore, the author has assumed that lean will have a positive impact on a relationship as the most of results of previous studies. Apart from this, Miidom and Sholokwu (2017) discovered the relationship between operations management activities and organizational sustainability in manufacturing firms. The results exposed a positive connexion between operations management activities and organizational sustainability and recommended that management should make effective use of the models of facilities layout and facilities location in decision making process. A proper inventory control mechanism should be developed in order to reduce costs and wastage of materials by avoiding overloading or poor handling of materials and human resources which may cost the firm and damage the environment and the society thereby reduce the level profitability of the firm.

Furthermore, Hami et al. (2016) investigated the impact of sustainable manufacturing practices on sustainability performance among manufacturing firms in Malaysia. The three pillars of sustainability encompassing economic, environmental, and social sustainability advocated in measuring firm performance. The results revealed that sustainable manufacturing practices have positive and significant impact on environmental and social sustainability. Therefore, the study was beneficial for practitioners in understanding the diverse aspects of sustainable manufacturing practices and sustainability performance, identifies the strengths and weaknesses of their current sustainable manufacturing practices, and provides a guideline in improving their performance.

Additionally, Jones, Hiller and Comfort (2016) has conducted a study in order to investigate the reflections on sustainability within the hospitality industry. For the most part, there were three sets of issues that the authors make a number of suggestions. First that definitions of sustainability within the hospitality industry can be interpreted as being constructed around business imperatives rather than an ongoing commitment to sustainability. Second that materiality and external assurance are not treated comprehensively within the industry, which undermines the credibility of the sustainability reporting process. Third that the concept of sustainable consumption and any critique of the industry's commitment to economic growth were noticeable by their lack in the both of the research literature on sustainability and in sustainability reporting within the industry. It should be noted that sustainability was very essential in an economic development, especially in an organization.

Furthermore, Jorsfeldt, Hvolby and Nguyen (2016) has been conducted a study that aimed to develop the comprehensive understanding in sustainability of operational coordination. As a result, the study provides rich insights into managing the implementation of environmental sustainability in supply chain operations. Meanwhile, study by Adebanjo, Teh and Ahmed (2016) has investigated the direct effect of external pressure on environmental sustainability and manufacturing performance.The result found that there was a significant relationship between variables. Hence, researcher sees that the understanding of the sustainability contexts able to bring the organisations towards sustainable economic growth. The relationship between sustainability and each variable also will lead to the positive development of the organisations.

Moreover, Bjorklund, Forslund and Isaksson (2016) found that a social contribution with its input on sustainability and especially environmental issues in their study. The classification models developed can be an important mean for managers and also consumers to judge the environmental sustainability. On the other hand, study by Graubner, Pelzeter and Pohl (2016) has presented the development of an action and assessment framework to make sustainability in German facility management. The outcome of the study that consists of environmental, economic, sociocultural and quality was initially only a measurement and assessment framework. Notwithstanding, researcher believes that the assessment framework can be a guide to developing the sustainability in the organisations.

Likewise, Ratiu and Anderson (2015) were tracked the conceptualizations and measurements of sustainable development in the areas of government, business, education, and the trades in a contexts of social and environment sustainability. The findings of the study were recognized the need for professions to develop their own understanding of sustainability and to strategically prioritize the actions to be undertaken. While study by Thomas, Byard, Francis, Fisher and White (2016) aimed to identify the tools, methods and models that UK manufacturing companies adopt and apply in order to achieve resiliency and economic sustainability. As a result, it was found that companies who seem to struggle in achieving economic sustainability or lack the ability to bounce back from various setbacks either do not employ such models or at best apply tools and techniques in an ad hoc manner. The results of the study provide important information on the sustainability landscape of UK manufacturing companies. Nonetheless, the results of that study was also beneficial for others to achive resilency of sustainability.

Besides, study by Marshall, McCarthy, McGrath and Claudy (2015) was examined the adoption that drives social, environmental and cultural sustainability supply chain practices. The results show a strong positive relationship between a firm's sustainability culture and the adoption of social sustainability supply chain practice. This means that companies with a social sustainability culture and mindset were more likely to engage in social sustainability practices, which was good for the company and good for the people inside and outside of the supply chain. Even so, researcher believes that this scenario not only happen in supply chain industry, but could be occurred in all industries.

Meantime, Galpin, Whitttington and Bell (2015) has presented a multidisciplinary model that can be used as both a road map for practicing managers to create a sustainability focused culture within their own organizations. The result found that development of an organizational infrastructure that cultivates a culture of sustainability results in positive employee and organizational level sustainability performance. On top of that, a study by Liboni and Cezarino (2014) suggested that the application of systemic methodologies in order to develop sustainability strategies and solve problems involving the sustainability of organizations and their operations. Sustainable development requires a broad new development strategy that encompassed political, economic, social, technological and environmental dimensions. This study advanced the understanding of how the systemic approach can aid the development of corporate sustainability strategies. Researcher also agreed that the development strategy that embraced political, economic, social, technological and environment can lead to sustainability enlargement. Despite most of the past studies was focus on economic, social and environmental, nevertheless another sustainability context such as technological and political may also contribute in the sustainability development.

Furthermore, Agyekum-Mensah, Knight and Coffey (2012) was conducted a research that explored the role and function of project management in the achievement of sustainability in the built environment by developing a 4Es (Economic, Effectiveness, Efficiency and Ethics) and 4 Poles (Economic, Social, Environmental and Technology) model of sustainability. As a result, research established the importance of technology in the sustainable development agenda that proposed a 4Es (project management model) and 4 Poles (poles or factors of sustainability) model as a holistic approach to achieving sustainable construction.

Moreover, Fernando (2012) had proposed a conceptual to embed sustainability in corporate strategy. The objective was to motivate business and national leaders to do so with sustainability mindsets and strategic leadership in terms of social, economic and environment. On the other hand, realizing the importance of sustainability in industry, Amrina and Yusof (2011) was proposed a set of initial key performance indicators (KPIs) for sustainable manufacturing evaluation in automotive companies due to struggling to reduce environmental impacts of their products and operations. Hence, the authors suggested that they should try to aim at a balance amongst economic development, environmental protection and social equity. It is a big challenge for the automotive companies, particularly in Malaysia to give serious attention on sustainability. Contrariwise, it is not impossible to put serious attention on sustainability since there were studies has proved that sustainability successful applied in manufacturing Industries in Malaysia.

Other than that, Paulraj (2011) was empirically evaluated the effect of firm-specific resources and capabilities on sustainable supply management and sustainability performance. As a result, from a practical viewpoint, the study shows that, in addition to external stakeholder pressures, firm-specific capabilities can also have a significant influence on the environmental, social and economic performance of firm. Meanwhile, Bansal (2005) was conducted a study that operationalized corporate sustainable development and examined its organizational determinants. Discussions were also combined around the three principles that ground sustainable development: environmental integrity, economic prosperity, and social equity. The result found that both resource-based and institutional factors influenced corporate sustainable development.

In addition, Wagner and Schaltegger (2004) discussed on relationship between environmental and economic performance and the influenced of corporate environmental strategy. The result found that the firms should therefore actively seek to integrate their economic goals with the environmental and social goals of society at large. Contrariwise, Brent and Labuschagne (2004) has been proposed methodologies to assess the sustainability of such operational initiatives in industry and discussed an assessment procedure, with associated sustainable development indicators especially in the context of environmental and social sustainability. Also, Zhu and Sarkis (2004) had examined the relationships between green supply chain management practice and environmental and economic performance. Besides, this study provided additional insight into the growing field of the relationships between envi- ronmental and operational practices and performance.

There was lot of research regarding sustainability and the articles in the literature have been maturing for the past two decades and very rapidly in the past decade (John & Narayanamurthy, 2015). However, there seems to be very little literature available which identifies manufacturing industry's engagement in the application and implementation of manufacturing resiliency and sustainability models, tools and techniques (Thomas, Byard, Francis, Fisher, & White, 2016). Moreover, Singh et al. (2020) investigated the impact of lean practices on organizational sustainability among the industrial professionals and academicians of northern India region. The study discovered that lean practices has positive impact on organizational sustainability of the Indian industries. The results conclude that effective implementation of lean practices were became as contributing factor for realization of organizational sustainability improvement.

Additionally, referring to Nawanir et al. (2020), the triple bottom line dimensions that encompassed economic, social and social should be taken into account in order to be sustainable. However, sustainability components may be applied with different levels of complexity and boundary (Ahmad et al., 2019). Therefore, table 2.8 shows the summarise of sustainability's components in the previous research.

Table 2. 8

Components of Sustainability in Past Studies

Sustainability	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Social	x	x		x	x	x	x	x	x	x	x	x	x	x				x		x	x	x	x
Economics	x	x	x	x	x	x	x	x	x	x	x			x	x	x		x		x	x	x	x
Environment	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x
Culture												x											
Technology								x	x														
Politic									x					x									
Ethics																							
Sociocultural																x							
Optional Quality																x							
Facilities Management																							

Authors: (1) Zhu & Sarkis (2004) (2) Brent & Labuschagne (2004) (3) Wagner & Schaltegger (2004) (4) Bansal (2005) (5) Paulraj (2011) (6) Amrina & Yusof (2011) (7) Fernando (2012) (8) Agyekum-Mensah, Knight, & Coffey (2012) (9) Liboni & Cezarino (2014) (10) Galpin, Whitttington, & Bell (2015) (11) Hami at al. (2016) (12) Marshall, McCarthy, McGrath, & Claudy (2015) (13) Ratiu & Anderson (2015) (14) John & Narayanamurthy (2015) (15) Thomas, Byard, Francis, Fisher, & White (2016) (16) Graubner et al. (2016)(17) Björklund, Forslund, & Persdotter Isaksson (2016) (18) Adebanjo, Teh, & Ahmed (2016) (19) Jorsfeldt, Hvolby, & Nguyen (2016)(20) Jones, Hillier, & Comfort (2016)(21) Miidom & Sholokwu (2017) (22) Iranmanesh et al. (2019) (23) Das, Rangarajan, & Dutta (2020)

2.7 Manufacturing Performance

In the manufacturing sector, it is vital for companies to ascertain, evaluate and improve their manufacturing performance, which is mainly related to their production and operational performance (Tan & Wong, 2015). Nevertheless, manufacturing performance measurement remains an unstable subject due to its diverse and multi-dimensional manufacturing properties (Hon, 2005). However, to stay competitive, companies facing today's levels of unprecedented global competition must design and offer better products and services and improve their manufacturing operations (Taj & Morosan, 2011).

Manufacturing performance usually discussed in multi facet base on particular research. Operational performance and manufacturing performance using the same metrics to monitor and measure the performance and efficiency in a particular organisation (Tan & Wong, 2015; Hon, 2005). Furthermore, Voss, Ahlstrom and Blackmon (1997) also using the term manufacturing performance to describe the operational performance. They discuss manufacturing performance in three dimensions comprises of quality, productivity and cycle time.

Subsequently, manufacturing performance has been an important measure of the companies' success (Adebanjo et al., 2016). In fact, the achievements in manufacturing performance enhanced a firm's manufacturing competitive capabilities (Jabbour et al., 2014; Wickramasinghe & Wickramasinghe, 2017). Notwithstanding, Hasan, Mohd Assad and Iteng (2017) stated that manufacturing performance usually discussed in multi facet base on specific research.

Likewise, Voss, Ahlstrom and Blackmon (1997) has been proposed benchmarking promotes performance directly through identification of practices and performance goals. Researchers also using the term manufacturing performance in order to describe the operational performance. They discuss manufacturing performance in three dimensions comprised of quality, productivity and cycle time. Most likely the previous studies mentioned that manufacturing performance conventionally discussed from the aspect of priorities of quality, delivery, flexibility, time and cost.

Improving quality, sustaining on-time delivery, decreasing production costs, and reducing inventory levels were among the highest-ranked manufacturing competencies in manufacturing performance (Taj & Morosan, 2011). Furthermore, the important issue in the development of contemporary strategies such as quality, flexibility, reliability and low cost is the extent to which management performance measures enhanced the potential for improving manufacturing performance (Chenhall, 1996). Yet, the process of choosing appropriate manufacturing performance measures was quite difficult due to the complexity and the suitability to the operations of the organization (Montoya-Torres, 2006) that can leads to competitiveness (Leachman, Pegels, & Shin, 2005). Besides, a complete manufacturing performance measurement system needs to be comprehensive and cover the most critical critical performance dimensions of the organization (El Mola & Parsaei, 2010).

Furthermore, according to Randhawa and Ahuja (2018), manufacturing performance and organizational sustainability can be improved through deployment of lean manufacturing. Likewise, Alaskari et al., (2016) asserted that most of the manufacturing company implemented lean manufacturing to boost performance. Therefore, a set of lean tools used to improve manufacturing performance thereby it is responding to the market demands in various dimensions, such as enhanced product quality, faster delivery and lower cost (Alaskari et al., 2016). On the other hand, Melton (2005) highlighted the key tools and techniques within the lean system for example *kanban*, 5s, *poka-yoke*, single-minute exchange of dies (SMED), visual control and many more that lead to improving the manufacturing performance. Meanwhile, Bhuiyan, Baghel and Wilson (2006) stated that lean production was one of the oldest improvement methodologies, providing high value to the customer via the use of best practices such as 5S, mistake proofing and *kanban*.

A study by Karim and Arif-Uz-Zaman (2013) defines and evaluates the manufacturing performance indicators based on production quality, processing time and cost. The indicators that had been used were able to measure performance of the company. Meanwhile, Narkhede (2017) revealed that the capabilities of manufacturing performance can be improved by reducing manufacturing outputs such as the cost, quality, delivery time and delivery time reliability, flexibility and innovativeness. In a meantime, Corbett (1998) had considered the manufacturing performance indicators in the five main constructs cost, quality, flexibility and delivery, as well as inventory.

Therefore, researcher believes that manufacturing performance has various indicators in measuring it. In order to measure manufacturing performance, the indicators need to be encompassed. In response to this study, there were several indicators that involved such as quality, delivery, flexibility, time and cost that will further discuss in the next section.

2.7.1 Manufacturing Performance Construct and Dimensions

The terms of manufacturing performance has been used in the manufacturing company for a long time. However, the term operational performances also been used in the previous research, yet still remain the same definition. Therefore, operational performance and manufacturing performance using the same metrics in order to monitor and measure the performance and efficiency in a particular organisation (Tan & Wong, 2015; Hon, 2005).

Forty studies relating to manufacturing performance measures were reviewed to identify the most commonly used performance indicators in the manufacturing sector (Alaskari et al., 2016). Based on these studies, the performance indicators most frequently mentioned in literature and used in manufacturing performance measures were identified, namely, quality, delivery, flexibility, time and cost.

Tan and Wong (2015) examined the effect of knowledge management on manufacturing performance. Data were collected among 700 manufacturing companies in Malaysia. The results obtained would help managers to better understand the linkage between knowledge management and manufacturing performance. They could use the results to manipulate their knowledge management practices to improve their manufacturing performance. The manufacturing performance's metrics that has been used in that study namely quality, time and delivery, cost, flexibility and customer satisfaction.

Likewise, Belekoukias, Garza-Reyes, et al. (2014) had investigated the impact of five essential lean methods such as JIT, autonomation, kaizen, TPM, and VSM on the operation performance that consist of cost, speed, dependability, quality and flexibility. That study provided further evidence regarding the effects of lean practices on the performance of organisations. As a result, the research had offered companies, and their managers, a better understanding of the relationship between the lean strategy and the performance of their operations.

Meanwhile, study by Nawanir, Teong and Othman, (2013) had investigated the relationship between lean practices, operations performance, and business performance. For the operation performance, the researcher has been used quality, inventory, delivery, cost reduction and productivity. Whereas profitability, sales and customer satisfaction has been used to measure business performance. The results provided evidence that lean practices should be implemented holistically and have a positive and significant impact on both operation performance and business performance. Understanding of that relationships will help practitioners in making better decisions in manufacturing organizations.

Karim & Arif-Uz-Zaman (2013) has developed an effective methodology for implementing lean manufacturing strategies and a leanness evaluation metric using continuous performance measurement. This study evaluates the manufacturing performance indicators based on production quality, processing time and cost. As a result, this study had proposed methodology that able to systematically identify manufacturing wastes, selected appropriate lean tools, identified relevant performance indicators, achieved significant performance improvement and established lean culture in the organization.

Also, Al-Jawazneh (2012) had explores the effect of manufacturing flexibility on the operational performance of Pharmaceutical manufacturing firms in Jordan. Some variables such as of machine, volume, material handling, mix, and routing flexibilities were selected to represent the manufacturing flexibility dimension. On the other hand, operational performance has been measured through quality, cost, speed and reliability. The result revealed that the level of operational performance was considerably very good, a high rating was given to the reliability, speed, cost and quality.

Furthermore, Taj and Morosan (2011) had investigated the impact of lean operations practice and design on the Chinese manufacturing performance, using lean assessment data from 65 plants in various industries. Manufacturing performances has been measured by inventory turnover, on-time delivery, lead time and cycle time. The result revealed that lean performance factors are strongly related to operations practice and production system design. These results also supported other findings of the positive impact of lean operations on the performance of the Chinese manufacturing sector.

Besides, Furlan, Vinelli, et al. (2011) has tested and validated the complementarity effects on operational performance of two of the main lean manufacturing bundles, just-in-time (JIT) and total quality management (TQM). Other than that, this study also explored the role played by the human resource management bundle as an enhancer of the complementarity between JIT and TQM. The researchers using 5 items to measure performance namely quality, dependability, delivery, flexibility and cost. As a result, the study proved the existence of complementarity between JIT and TQM and shows the enabling role of human resource management on such complementarity. Also, the study also indicated that only those plants characterized by a significant implementation of HRM practices enjoy the complementarity effects of TQM and JIT on operational performance.

Likewise, Furlan, Dal, et al. (2011) also using the same indicators of measuring performance in their study except speed. This study was tested the existence of complementarity among internal and external just-in-time bundles. Consequently, the findings of this study found that the importance of managing the interdependencies both in designing and implementing upstream and downstream JIT was crucial in order to maximize operational. Therefore, this was aligned with the previous study that most of literature has proved that the implementation of internal and external JIT practices improves the overall performance of the firm and its competitive advantage.

Chen and Tan (2011) had investigated the perceived impact of just-in-time (JIT) implementation on operations performance. This study adopted four measures for production operations performance namely quality, delivery, cost and inventory. The result revealed that the implementation of an aggregate bundle of JIT elements improved production operations performance. Accordingly, the findings of this study can benefit firms in improving implementation of JIT in practice, particularly for those firms in developing countries.

Moreover, the impact of lean strategy on operational performance has been studied by Rahman, Laosirihongthong and Sohal (2010). The purpose of this study was to examine the extent to which lean management practices are adopted by manufacturing organizations in Thailand and their impact on firms' operational performance. Delivery, cost, productivity and customer satisfaction has been used to measure the performance in this study. The result indicated that all three lean constructs were significantly related to operational performance. Foreign-owned companies shown a higher level of significance on operational performance for both waste management and flow management than Thai and joint venture companies.

Additionally, Cedergren, Wall and Norström (2010) has developed two conceptual tools to support the evaluation of performance in product development. The Performance Measurement Evaluation Matrix (PMEX) helped managers evaluate performance measurement systems they currently use, in order to identify areas requiring improvement. Results from using the PMEX indicated that it was common to associate performance measurements with the efficiency aspects of time, cost, and quality. Also, the Product Development Organizational Performance Model (PDOPM) assisted in developing the perception of performance by relating uncertainty, efficiency, and effectiveness at three generic activity levels within the product development function. The use of the tools developed provided an improved perception of performance and its measurement, thus enabling improvements to the evaluation of performance.

Meanwhile, El Mola and Parsaei (2010) had identified the critical dimensions of performance and identified a set of measures that reflects the performance. Reseachers also had proposed a framework to select the appropriate measures. The study used seven performance criteria: quality, delivery, flexibility, time and cost in order to measure performance, finance and customer satisfaction. Those seven dimensions can be seen to cover all aspects of business: the financial results, the operating, and the way the company is perceived externally. This study also revealed that quality, flexibility, time, delivery, and cost were commonly cited as the main operational dimensions which should be measured. The proposed framework for selecting performance measures can be used to select the appropriate measures based on the critical characteristics of the performance measures.

Moreover, Chakrabarty and Tan (2007) had reviewed six sigma application in services towards the performance which is measured through quality, delivery, flexibility, time and cost. The result found that the major benefit of six sigma was in the form of considerable improvement in the bottom line result for both manufacturing as well as service organizations. Besides, Hallgren and Olhager (2009) investigated internal and external factors that drive the choice of lean and agile operations capabilities and their respective impact on operational performance. Quality, delivery, cost, and flexibility indicators has been used to measure performance. The results indicated that lean and agile manufacturing differ in terms of drivers and outcomes. The major differences in performance outcomes were related to cost and flexibility, such that lean manufacturing has a significant impact on cost performance.

Besides, Cordero, Walsh and Kirchhoff (2009) had explored the extent to which firms staffing with competent workers, in addition to adopting organization technologies and advanced manufacturing technologies change manufacturing performance. To measure manufacturing performance, researchers were measure on productivity, product quality, speed to complete manufacturing orders, customer satisfaction, flexibility to manufacture new products, and diversity of product line. Meanwhile, Ahmad, Dhafr, Benson, and Burgess (2005) has introduced a model that focuses on the issues at the shop floor of specialty chemicals manufacturing. Lean manufacturing techniques has been used to see the impact on performance that measured through quality, delivery, cost and time. The result indicated that the performance measurement and benchmarking of bottom line processes on the shop floor of the plant has been proved to be as usefulas a tool for lean manufacturing in the organisation.

Furthermore, Gibson, Zellmer-Bruhn, and Schwab (2003) argued that a common measure of team effectiveness and performance with demonstrated equivalence across contexts expands current theoretical developments and addresses team implementation needs. Therefore, the research outlines the processes, strategies and findings obtained in creating a systematic team productivity survey and performance across six multinational organisations. However, from a diagnostic point of view, it will be advised that teams work more efficiently across a variety of performance facets. There are five measures that used to measure effectiveness of outcome namely goals, customers, time, quality and prodctivity.

Additionally, Chenhall (1996) was examined the role of manufacturing performance measures to evaluate managers' performance for firms pursuing strategies of manufacturing flexibility. The manufacturing performance measures has been devided to two groups which is internal performance measures and external performance measures. Both of the groups were consists of indicators such as quality, delivery, flexibility, time and cost. The result found that both survey and case evidence indicated that a significantly large proportion of high performing divisions achieving high levels of manufacturing flexibility were using manufacturing performance measures as part of their formal man agerial evaluation systems. Likewise, Kaplan and Norton (1996) has emphasized the indicators of manufacturing performance that consists of quality, delivery, flexibility, time and cost and their book that titled Focusing Your Organization on Strategy with the Balanced Scorecard.

Meanwhile, Sakakibara, Flynn, Schroeder and Morris (1997) had proposed a theoretical framework for the study of JIT and presented a set of reliable and valid scales for measuring JIT practice. This study identified four JIT practices as the major driving forces to improve the manufacturing performance variables (lead time, cycle time, and inventory turns). In addition, Corbett (1998) has executed the benchmarking of manufacturing performance in Australia and New Zealand. It was considered the distributions of attainment on a number of key performance indicators for some of the main constructs in manufacturing strategy. Corbett (1998) considered the key performance indicators in the five main constructs of manufacturing strategy namely cost, quality, flexibility and delivery, as well as inventory. On the basis of the country comparisons, the study found that Australian and New Zealand manufacturers still have room for improvement in a number of areas, particularly quality, inventory and delivery performance.

Moreover, Lee and Paek (1995) had explored the concept and practices ofen larged JIT, which involves customers in the JIT plan. Through a descriptive field study, it investigated the impact of enlarged JIT on JIT implementation and production system performance. The findings showed that extended JIT can lead to a greater extent to the adoption of JIT practises and thus companies using the concept of broad JIT have achieved a much greater improvement in the quality, cost, delivery, and flexibility.

On the other hand, Kaplan (1983) asserted that competition between companies would be based on quality, minimization of costs and productivity. Product quality is emerging as perhaps the most critical performance field of development. Then, volatility in the availability of goods or in final demand generates a demand for greater inventories in more complicated stock situations. In addition, the most obvious choice for characterising efficiency in a production setting is a measure of productivity, the ratio of the outputs produced to the physical inputs consumed.

Therefore, manufacturing performance can be described as the organization's ability to make an improvement in several aspects for the purpose of this analysis. There were variety performance measures that had been used to examine the manufacturing performance as can be referenced in previous studies. There are still no specific measuring tools to measure manufacturing performance.

Subsequently, Table 2.9 shows the commonly used of manufacturing performance measure based on previous studies whereas Table 2.10 summarize the performance measure that will be used in this study namely, quality, delivery, flexibility, time and cost.

Table 2. 9

Summarize of manufacturing performance's components in past studies

Manufacturing Performance	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Quality	x	x	x		x	x	x	x	x	x	x	x	x			x			x	x	x	x	x	x	x
Delivery		x	x	x	x	x	x			x	x	x	x	x	x	x	x	x				x		x	x
Flexibility		x	x		x	x			x	x	x	x	x			x	x	x	x	x			x	x	x
Time				x	x	x	x	x	x		x	x	x			x				x	x		x	x	
Cost		x	x		x	x	x			x	x	x	x	x	x	x	x	x		x	x	x	x	x	
Inventory	x		x	x											x							x			
Productivity	x							x	x					x								x			
Customer satisfaction									x			x		x										x	
Diversity									x																
weighted performance Flow																			x						
Dependability (Product specification)																	x	x					x		
Reliability																				x					

(1) Kaplan (1983) (2) Lee (1995) (3) Corbet (1998) (4) Sakakibara et al. (1997) (5) Kaplan & Norton (1996) (6) Chenhall (2005) (7) Ahmad & Benson (2005) (8) Gibson et al. (2003) (9) Cordero et al. (2009) (10) Hallgren et al (2009) (11) Chakrabarty & Tan (2007) (12) El Mola & Parsaei (2010) (13) Cedergren at al. (2010) (14) Rahman et al (2010) (15) Chen et al (2011) (16) Amrina & Yusof (2011) (17) Furlan (2011a) (18) Furlan (2011b) (19) Taj & Morosan (2011) (20) Al-Jawazneh (2012) (21) Karim & Arif (2013) (22) Nawanir et al. (2013) (23) Belekoukias et al (2014) (2013) (24) Tan & Wong (2015) (25) Alaskari (2016)

Table 2.9 show the summaries of manufacturing performance's components to measure in the previous research. Based on previous study, most of the researcher adopt five (5) main elements in measuring manufacturing performance or operational performance in the manufacturing industry which covers quality, delivery, flexibility, time and cost as study by Kaplan (1983); Lee (1995); Corbet (1998); Sakakibara et al. (1997); Kaplan& Norton (1996); Chenhall (2005); Ahmad & Benson (2005) ; Cordero et al (2009); Hallgren et al (2009); Chakrabarty & Tan (2007); El Mola & Parsaei (2010); Cedergren at all (2010); Rahman et al (2010); Amrina & Yusof (2011); Chen et al (2011); Furlan et al (a)(2011); Furlan et al (b) (2011); Taj & Morosan (2011); Karim & Arif (2013); Belekoukias et al (2014); Tan & Wong (2015); Alaskari (2016) in previous research.

2.7.1.1 Quality

In the rapid growth of global business, it has become very tough for companies to survive unless they advocate highly relevant concept which is good quality in their business (Kebede Adem & Virdi, 2020). Quality is the competency of a product or service to come across customer's request and fulfillment which can contribute to the highest impact on the performance (Belekoukias, Garza-reyes, & Kumar, 2014). In assessing manufacturing performance, quality was argued in the form of product performance, product durability and product's acceptance within the limit of design qualifications. Several studies at the organisational level have postulated that lean manufacturing has become a strong approach to increasing quality in the context of operational performance (Nawanir et al., 2013).

Besides, integrating product quality in the production measures imitates to the overall highlighting on quality and increases the comprehensiveness of performance evaluation (Leachman, Pegels, & Shin, 2005). Likewise, Al-Jawazneh (2012) stated that the context of quality could be determine the performance of particular organisations. Additionally, operating output is affected by operating conditions and reflects performance at each level of production resources (Nawanir et al., 2013). In this study, it is important to assess the quality of product conformance both in the house (defects occurring in the plant, in terms of defect/reject, scrap, rework) and in the field (defects occurring after sale but within the warranty period, in terms of customer complaints and warranty claims) as suggested by Chong, White, & Prybutok (2001).

2.7.1.2 Delivery

In terms of on-time delivery and speed of delivery, delivery efficiency has always been highly rated over the years as a significant competitive target in the global manufacturing industries (Corbett, 1998). Product delivery refers to the time occupied for a product to be conveyed to the customer (Christiansen, Berry, Bruun, & Ward, 2003). Lessening of the lead time, faster delivery than the competitors and on time product delivery to the customer had been used to measure manufacturing performance in the manufacturing industry. Subsequently, quick delivery is a good manufacturing performance that can be attained devoid of extra employment of practices (Christiansen et al., 2003).

Additionally, production time, yield, capacity usage, raw materials and energy consumption are among the operational problems that can affect the delivery performance of the production plant (Ahmad et al., 2005). Companies are expected to enhance their performance in today's dynamic world to adapt to consumer demands in different dimensions, such as increased product consistency, quicker delivery and lower costs (Alaskari et al., 2016). Besides, at the level of operations, numerous studies asserted that lean manufacturing has become a strong strategy in terms of delivery to improve operational efficiency (Nawanir et al., 2013). Hence, in this study, delivery will be taken into account as one of the manufacturing peformance's measure.

2.7.1.3 Flexibility

Flexibility is defined as an ability to respond to change (Stevenson, 2012). Change was related to product, volume, routing, equipment, labor and supply and it may also reflect firm's agility, adaptability, and responsiveness. Meanwhile, Narkhede (2017) stated that flexibility can refer to the ability of a company to react with penalty in term of time, cost and customer's value. Besides, that flexibility also can be categorised based on its fundamental features of 'range' and 'mobility' which entails the capability to alter production while range suggests the ability to manage product and/or process diversity (Narkhede, 2017).

In addition, flexibility is the organization's ability to meet an increasing variety of customer expectations and increasing the range of products available, improving a firm's ability to respond quickly, and achieving good performance over this wide range of products (Zhang, Vonderembse, & Lim, 2003). As the way of adopting flexibility concept in the manufacturing area may be different from one to another, therefore there were several types of flexibility such as Market Flexibility, Volume Flexibility, Material Handling Flexibility and Mix Flexibility (Al-Jawazneh, 2012). However, Mix Flexibility will be used in this study because it reflect to output performance and requires both process flexibility and product flexibility (Al-Jawazneh , 2012; Salvador, Rungtusanatham, Forza, & Trentin, 2007). Besides, according to Zhang et al. (2003), Mix Flexibility also can rapidly change the mix of items being delivered to the market while maintaining cost-effectiveness. Therefore, with the value of this Mix Flexibility, it is appropriate for use in this study.

Furthermore, Al-Jawazneh (2012) also pointed out that via set-up time reduction, cellular production layouts, preventive maintenance, process improvement efforts and initiatives, and reliable suppliers, manufacturing flexibility enables businesses to manufacture the right amount of high-quality goods rapidly and efficiently. Moreover, the ability to improve manufacturing flexibility leads to improve manufacturing performance (Narkhede, 2017). Furthermore, it permits the organisations to produce the right quantity of high quality products quickly and competently (Al-Jawazneh, 2012). In addition, one of the critical focus areas of lean manufacturing implementation is achieving greater manufacturing flexibility at the level of operations. Nevertheless, it seems like there was no consensus on the aspect of manufacturing flexibility that the lean manufacturing implementation sought to achieve. Furlan et al. (2011) measured the efficiency of flexibility in terms of flexibility to adjust the mix of goods and flexibility to change volume. Moreover, the global superiority in cost, quality, productivity, and flexibility has been complementary in an organisation (Nawanir et al., 2013). In addition, flexibility is not only a trend or a road to super performance for any organization, but it is a necessity for those companies that need them to do so because of their nature of production and marketing (Al-Jawazneh, 2012). Therefore, the measure of flexibility will take into consideration in this study.

2.7.1.4 Time

The aspect of time in this is refers to average batch processing time, average lead time, changeover time, cycle time, machine downtime, mean flow time, on-time delivery, setup time, takt time, throughput time in the production process (Hon, 2005). The cycle time, also called manufacturing lead-time, flow time (FT), sojourn time, delay time, throughput time, turnaround time (TAT).

The cycle time is the time taken to produce the final product. It embraces value-added and non-value-added activities. In the ideal situation, the cycle time is equal to the Takt time which includes the time spent processing, as well as transport time and time spent waiting in queue for both processing and transportation (Abdelhadi, 2016). Besides, study conducted by Balok (2012) has been identified the lean manufacturing positively impacts performance but can be influenced by team effectiveness and design. Eventually, the study concluded by proposed areas for future studies in lean manufacturing practises that may lead to operational performance breakthroughs in other diverse manufacturing environments. Balok (2012) has been use the instruments from Gibson, Zellmer-Bruhn and

Schwab (2003) to measure performance. This study also adapted the instruments from Gibson et al. (2003) to measure time.

2.7.1.5 Cost

Cost is about the required payment to produce the product. A success in worldwide marketplaces entails products of high quality at low cost, and first class customer services (Abdel-maksoud, Dugdale, & Luther, 2005). The cost pertaining the workers' productivity, production and reduction in inventory are used in measuring the manufacturing performance in the manufacturing industry. The lesser the labor cost used to produce an output, the greater the workers' productivity. Extensive literature review shows that cost efficiency has been regularly measured in terms of unit cost of production (Chen & Tan, 2011; Pont et al., 2008; Matsui, 2007). According to Corbett (1998), the drive to continue to reduce costs is always with managers, and it appears some manufacturers in all countries are struggling to do so. Besides, manufacturing time, yield, power usage, raw materials, and energy consumption are part of the operating challenges that which affect cost (Ahmad et al., 2005).

Subsequently, the major differences in performance outcomes are related to cost and flexibility, such that lean manufacturing has a significant impact on cost performance (Hallgren & Olhager, 2009). In response to that, Nawanir et al. (2013) conducted a study on impact of lean practices towards operations performance that consider cost as one of the performance measure. Additionly, Meredith (1992) claimed that, relevant to the consensus, cost savings can be accomplished effectively in a variety of ways, such as decreasing inventory, delivering better product content, having less space, and reducing labour hours. Then, Huson and Nanda (1995) supported this claim, arguing that optimal usage of resources will influence cost efficiency because it does not allow any waste to occur within a production system.

In conclusion, after referring to previous studies, researcher has selected the five most commonly cited measures of manufacturing performance namely cost, delivery, flexibility, time and cost. Each measure chosen has its own importance which is able to help the organization to improve performance while driving towards sustainability.

2.8 Ethical Climate

The occurrence of unethical behaviours within business organisations has been widely discussed and increasing concern. Therefore, it is the main concern of all bodies neither professionals nor disciplines to discover all potential ways of creating ethical behaviour and activities within the business organisations (Arulrajah, 2015). Ethical climate is a perceptions of ethical either doing correct or wrong that should be handle in all organisations in order to ensure the productivity of organisations can be maintain in the good performance whereby it can be also seen as policies in the organisations, procedures, and ethical conduct that guides an individual to behave with maximum level of ethics that leads to organisational success (Victor & Cullen, 1987).

Besides, ethical climate can affects both decision making and performances in the organisations (Martin & Cullen, 2006). Stare and Klun (2017) mentioned that ethical climate is representing the organisation's policies, procedures and practices on ethical issues. As a result, it can be as a reference for employee behaviour as it can influence employees' attitudes and behaviour. Hence, it is a part of the larger organisation culture (Fournier, 2010; Appelbaum, Deguire, & Lay, 2005) but Martin and Cullen (2006) conceptually classified ethical climate as a type of organisational work climate.

Anaza, Rutherford, Rollins and Nickell (2015) defined ethical climate as the steady, emotionally meaningful views members of organisations hold regarding ethical processes and policies present in their organisations and organisational subunits. The ethical issues are essentials in the organisations and always being a part of performance contribution because the organisational values are dealing with ethical issues. Consequently, those that determine what is deliberated ethically right make up the ethical climate of an organisation (Appelbaum et al., 2005).

Besides, ethical climate also has been defined as the common views of what ethically right behaviour is and how ethical issues should be controlled (Arulrajah, 2015). Definitely, an ethical climate can be definite as the employees' view of what creates ethically right or wrong behaviour; hence, it becomes an emotional mechanism through which ethical issues are managed in an organisation (Choi et al., 2013).

2.8.1 The Role of Ethical Climate in Organisations

Ethical climate has been essential issues in the organisations that contribute to the company's performance. As a result, the study from previous scholars had found ethical climate as a good predictor on organisational performance (Sabiu, Mei, & Raihan Joarder, 2016). Furthermore, based on previous study, resource based view (RBV) asserted that human capital asset makes competitive advantage and develop performance through employee's behaviour.

Subsequently, swapping the unethical behaviour of members in an organisation through the help of ethical climate may have important impact on organisational performance and entire system (Arulrajah, 2015). As a result, an ethical climate has an influence on the degree to which an organisation meets real ethical issues. Yet again, Martin and Cullen (2006) deliberated ethical climate as associated to recognized normative system of an organisation. The previous studies conclude that fluctuating the unethical conduct with the help of ethical climate may have a critical impact on organisation performance and its reputation.

Study by Anaza et al., (2015) was examine the connection between ethical climate and features of job satisfaction amid organisational buyers. The important result was that buyer's organisational policy mediates the connection between buyers' perception of ethical climate and buyers' satisfaction with salary and promotion as well as satisfaction with co-workers and supervisors. The results also show that work satisfaction can be reached at dissimilar levels based on particular components related to the work atmosphere.

Meanwhile, study by Appelbaum et al., (2005) was accomplished a literature review of the current body of empirically-based studies connecting to the causes and consequences of in what way the ethical climate of a company eventually affects the occurrence of workplace abnormality. Consequently, obviously, unethical and unexpected behaviour problems are of great anxiety to organisations, which must take steps to resolve them, at the same time as development strong positive ethical cultures. Therefore, further studies related to ethical climate are needed using more definitive and qualitative measurements to learn more about these behaviours.

On the other hand, Arulrajah (2015) created a paper reviews the present literature on making and sustaining ethical culture and climate through human resource management (HRM) by deliberating main issue and aim of dealing ethical culture and climate and examining the state of human resource management in the same context. This review designates dissimilar forms of ethical issues that still extensively are real in the organisations and also discloses limited literature that studies how ethical culture and climate can be managed in organisations through effective HRM. The results of this review show the contribution of functional dimensions of HRM in creating and sustaining ethical culture and climate at all levels in the organisations. This review also deliberates the inferences for practice and advance research in relative to producing HRM- based ethical climate in organisations.

Conversely, study by Barnett and Vaicys (2000) look at the direct and indirect effects of individuals' perceptions of work climate on their ethical judgments and behavioural intents pertaining an ethical dilemma. A national sample of marketers was surveyed in a scenario-based research study. The results specified that, even though observed climate dimensions did not have a direct effect on behavioural intentions, there were significant moderating effects. Climate discern as highlighting social responsibility and rules/codes moderated the individual ethical judgment-behavioural intentions connection such that individuals were less likely to say that they would involve in a questionable selling practice even when they themselves did not believe the practice to be unethical.

Apart from that, Belak and Mulej (2009) proposed that enterprise consciousness of importance of ethical climate can be of vital meaning for its long-term success. The study found that there are some variances in enterprise ethical climate for enterprise life cycle stages and shows a significant existence of the "rule", "law and code" and "instrumental" ethical climate. Movement in the direction of a more bureaucratic method of enterprise functioning, as an enterprise moves from the pioneer stage towards the stage of turn-over, was also found.

Subsequently, according to Cemberci, Civelek and Gunel (2016) a cognitive model was created to test the relationship between organisational commitment, and ethical leadership and ethical climate. With the hierarchical regression method, mediator role was analysed in a relation between organisational climate, and ethical leadership and organisational leadership. As a conclusion, this relation is found statistically significant. Ethical climate implies that business and applications are done by taking account of ethical values in organisation and there are several decisive factors play role on creating ethical climate. These factors are norm, culture, ethical standards and applications.

Understanding, adopting, and applying the ethical values by the employees is a sign for that ethical value is accepted by the climate which adopted by employees. The determinants of the ethical climate are quality of the organisation and personal behaviours. The correct evaluation of the ethical perception by the employees of the organisation affects them to search for the resolution of the problem. Individuals understanding the operational processes in the workplace and feeling the ethical climate is a result of the climate. Nowadays, the healthy and sustainable life of an organisation is contingent on its harmony with ethical codes. The concept of ethics should become a part of organisation culture and it is needed to internalize by all employees. Therefore, ethical climate could be created in the organisation (Cemberci et al., 2016).

On top of that, Choi, Moon and Ko (2013) has conducted a research in order study how an organisation's ethical climate positively connects to its financial performance by considering an organisation's innovation, a support for innovation and performance evaluation. The results indicate that an organisation's ethical climate is positively related to financial performance, and its positive relationship is mediated by an organisation's innovation. The result also shows that a support for innovation has the moderating effect, such that the positive influence of an organisation's ethical climate on its innovation increases when a support for innovation is high.

In particular, much attention has been paid on ethical climate in organisational ethics literatures, because ethical climate is a critical factor influencing the employees' perception of how their organisation emphasizes the ethical aspect of business and encourages employees' ethical work behaviours. As the attention on ethical climate increases, previous studies have examined how the employees' perception of ethical climate affects their attitudes toward the organisation and their behaviours. For instance, researchers have found that employees' perception of ethical climate was positively related to job satisfaction (Babin, Boles, & Robin, 2000; Martin & Cullen, 2006), trust in the organisation (Mulki, Jaramillo, & Locander, 2006), organisational commitment (Cullen, Parboteeah, & Victor, 2003; Koh & Boo, 2004; Trevino, Butterfield, & McCabe, 1998), ethical decision-making (Valentine & Barnett, 2007), and organisational performance (Berrone, Surroca, & Tribó, 2007; Gonzalez-Padron, Hult, & Calantone, 2008).

While previous studies make contributions by demonstrating the relationships between ethical climate and its consequences, there are still some limitations in organisational performance. In conjunction to that, ethical climate questionnaire was formed to get respondents' views of how the fellows of an organisation naturally make decisions regarding numerous "events, practices, and procedures" requiring ethical criteria (Victor & Cullen, 1987).

2.8.2 Elements of Ethical Climate

Victor and Cullen (1987) stated that ethical climate comprises of three main dimensions which are egoistic or instrumental, benevolence or utilitarianism and principle or deontology in terms of theories or ethical criterion. Besides, for every single dimension, they also acknowledged another three dimensions in terms of locus of analysis (levels of analysis). They are individual level, local level (organisation itself) and cosmopolitan level (community or society at large).

Basically, an egoistic or instrumental criterion is refer to the moral philosophy of egoism, which indicates that a deliberation of what is in the person's best attention will govern the ethical reasoning process (Barnett & Vaicys, 2000). On the other hand, Barnett and Vaicys (2000) also stated that the benevolence or utilitarian criterion is grounded largely on utilitarian principles of moral philosophy, which propose that persons make ethical choices by seeing the positive or negative significances of engagements on referent others (Barnett & Vaicys, 2000). Likewise, the principled or deontological criterion is referring to large part on deontological principles of moral philosophy, which postulate that individuals make ethical decisions after allowing for actions in respect to universal and rigid principles of right and wrong.

In addition, Victor and Cullen (1988) suggested nine types of ethical climate by three main classes of philosophy (egoism, benevolence, and principles), and three loci of analysis (individual, local, and cosmopolitan). Meanwhile, every each of nine ethical climate types is complemented by a normative expectation (Cullen & Victor, 1993). There are differences between egoistic individual climate and egoistic local climate. Self-interest is the normative expectation in the egoistic-individual climate whereas in the egoistic-local climate, company attention leads to ethical decisions. For the meantime, efficiency is the normative criterion in the egoistic-cosmopolitan climate.

On the other hand, in the benevolent-individual, local, and cosmopolitan climate, the welfare of individuals, groups inside the organisation, and those external to the organisation (respectively) guides decisions. Besides, personal morals monitor decisions in the principled-individual climate. In the meantime, organisational procedures and regulations are the normative criterion in the principled-local climate. Moreover, external laws and codes lead ethical decisions in the principled-cosmopolitan climate. Nonetheless, the outcomes propose that ethical climate and ethical culture are not substitute ways of conceptualizing the ethical perspective.

Relatively, both are essential due to some dimensions are more powerfully connected with manners and others are more strongly related with commitment (Dienhart, Moberg, & Duska, 2001). Other than that, Kohlberg (1981) defined three major types of ethical climate namely, self-interest, caring, and principle which are also reflect to three main classes of ethical climate, i.e., egoism, benevolence, and principles..

Furthermore, study by Fein, Tziner, Lusky and Palachy (2013) found that there was a significant positive connection between ethical climate and Leader-member exchange (LMX) due to ethical climate represents norms and patterns of typical interaction and may influence essential organisational outcome. Furthermore, ethical climate reflects shared views about what is permitted and what is forbidden in respect to ethical matters in the organisation. Likewise, Victor and Cullen (1988) propose that ethical climate may also be considered as a component of organisational culture. In specific, they assertion that ethical climate associates exactly to organisational norms that have a straight effect on organisational practices with sturdy ethical inferences (Fein et al., 2013).

As a whole, the full components (egoism, benevolence, and principled) elucidated the construct ethical climate which is invented from Victor and Cullen (1987). Nonetheless, some previous studies measured the construct as multi-dimension (Choi, Moon, & Ko, 2013; Martin & Cullen, 2006). This study used the construct as uni-dimension as considered by previous scholars (Arulrajah, 2015; Cullen, Parboteeah, & Victor, 2003; Cullen & Victor, 1993; Zehir, Müceldili, & Zehir, 2012) nevertheless, considering all the dimensions and treated the construct as reflective and formative model and indeed the construct were measured as uni-dimension by Victor and Cullen (1987) who was the inventor of the construct and instrument. Besides, 26 items developed and used for measuring the construct as all the items explained the whole components of the construct.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In this section, details of the methodology will be discussed. According to Saunders, Lewis and Thornhill (2016), the theory of how a research should be commenced together with the theoretical and philosophical assumptions upon which research is based should be include in the research methodology. Meanwhile, the forms of data collection and techniques of data analysis that researchers propose in a study also should include in research metholodogy (Creswell, 2014). Take into account, this chapter presents the framework of this study with relevant theories as the foundation of constructs in the propose research framework. The research framework is further described through operational definitions of each construct. Thereafter, adopted research designs that justify targeted population, sampling frame, sampling techniques and unit of analysis involved also will be discussed. Then, instrument development, data collection procedures, and selection of data analysis techniques are also will be further discuss in this chapter.

3.2 Underpinning Theories

A good research model should be based on a sound theory (Sekaran & Bougie, 2016). A theory attempts to elucidate the logical linkage between the constructs in the research model, to guide the researcher to understand regarding the linkage between the constructs and how they affect with one another (Zikmund, Babin, Carr, & Griffin, 2009). Therefore, this study presents underpinning theories into a separate section that provides a complete clarification of the theory section, its application, and how it relates to the study as recommend by (Creswell, 2014). Henceforward, it can be clearly identify the theory from other components. Neuman (2014) has defined a theory as an explanation of a specific social phenomenon that describes a set of causally relevant factors. Meanwhile, Zikmund, Babin, Carr, & Griffin (2009) mentioned that a theory logically establish a connection between two or more variables through a set of general propositions. Therefore, this study has been used resources based view theory and stakeholder theory as underpinning theories.

3.2.1 Resource Based View Theory

The resource based view (RBV) is an underpinning theory on this study. RBV of a firm has been used for long time ago and source can be followed back to before query about the originators Barney and Penrose. Furthermore. RBV is one of the most important currents of thought in the area of business strategy, as it highlights the role of business resources in building a sustainable competitive advantage and improving economic performance (Silva, Gohr, & Santos, 2019). RBV advocates that organisations are able to develop certain resources and competencies that can be used to improve their level of performance and competitiveness (Adebanjo et al., 2016).

Referring to RBV, the resources and competencies to be leveraged can be deliberated to be valuable, rare, inimitable and non-substitutable and the ability to effectively leverage these resources is what leads to competitive advantage (Barney & Griffin, 1992). In conjunction to the context of sustainability, RBV theory is a relevant theory with respect to gaining competitive advantage (Shang, Lu, & Li, 2010). Furthermore, Shang et al. (2010) asserted that applicability of RBV is suitable in understanding the organisational performance.

In addition, RBV occurred somewhere around 1983, 1984 and the mid-1990's (Barney, 1991). The RBV debated that organisations have funds, a subset of which authorizes them to achieve competitive advantage, and a subsection of those that quick predominant long haul performance. Yet again, RBV highlighted that human capital asset creates competitive advantage and improve organisational performance through employees behaviour.

Consequently, workers can perform over effective operation of internal resources base on human resource practices. In RBV viewpoint, ethical climate has been related to add value to manufacturing performance in terms of playing an important role to achieve organisational triumph. In addition, ethical climate highlights on taking strategic value for organisation and how human resource systems may support that value to reach the goals (Sabiu, Mei, & Raihan Joarder, 2016). On the whole, based on the stated disagreement, the current study plans to use RBV in order to explain the research framework.

Fundamentally, RBV is represented as a direction and application of relational lean practices to support organisation to reached competitive advantages towards manufacturing performance and at the same time as the short run competitive advantage into sustainability in terms of social, economic and environmental. In a short sentence, lean manufacturing practices adoptions which are cellular manufacturing pull system/ *kanban*, quick changeover, TQM, TPM and small lot of production would be the resources and capabilities that used to improve the manufacturing performance and sustainability in Malaysian manufacturing industry. In conjunction, that view is consistent with the resource-based view (RBV), a theory from strategy management that considers organisations as a bundle of resources that allow the development of competitive differentials (Silva et al., 2019). Besides, the RBV theory also mentioned that transformation is the key to improved performance (Ramon-Jeronimo, Florez-Lopez, & Araujo-Pinzon, 2019).

Like other theory, it draws on prior theoretical work in developing predictions and prescriptions. Resource based theory comes from at least four sources which are the traditional study of distinctive competencies, Ricardo's analysis of land rent, Penrose (1995) and the study of the antitrust implications on economics (Barney & Clark, 2007). Moreover, RBV can lead to sustain competitive advantage by their unique resource position and by the production of superior products of lower costs, higher quality, or superior performance (Ali, Hussain, & Jamal, 2011).

Different capabilities are those attributes of a firm that enable it to pursue a strategy more efficiently and effectively than other firms. Firms can vary in the resources and capabilities that they possess. However, even when operating in the same industry, manufacturers make different choices in strategy, technology, geographic locations and others. In addition, these differences can exist for various explanations that might include personal preferences of firms, financial constraint and uncertainty in the competitive environment facing the firms (Barney & Clark, 2007).

Aforementioned, RBV highlighted the potential for processes as source of competitive advantage (Shang et al., 2010; Dutta, Zbaracki, & Bergen,2003), and it analyzes and interprets resources of the organisations to understand how organisations achieve sustainable competitive advantage (Madhani, 2010). In addition, RBV theory suggested that valuable strategies that are created and implemented using resource that are widely held or easy to imitate however, could not be a source of sustained competitive advantage (Barney, 2002).

According to study by Silva et al., (2019) found that RBV's theoretical presented significant results concerning value of lean practices and sustainability. Therefore, the theory of RBV is suitable to use in this study. Align with previous scholar Barney (1991) and Madhani (2010), an organisation can be considered as a collection of physical resources, human resources and organisational resources that are valuable and being as a main source of sustainable competitive advantage for sustained superior performance.

3.2.2 Stake Holder Theory

The stakeholder theory has been in use since 1984 and is one of the most crucial theories in discussing value creation and trade in the business world (Nie, Ibrahim, Mustapha, Mokhtar, & Shah, 2019). This Stakeholder theory is managerial in that it helps and directs how managers operate instead of primarily addressing management theorists and economists (Freeman, Wicks, & Parmar, 2004). In addition, Freeman (1984) is generally attributed as the founding father of the Stakeholder Theory, a theory that had evolved over the years to be one of the most crucial theories in discussing value creation and trade in the business world (Ibrahim, Mustapha, Mokhtar, Shah, & Nie, 2019).

The Previous research frequently used the word "from Friedman to Freeman" in order to show the shift in the discussion on the role of business in society. Meanwhile, prior studies also shows that the evolutionary stakeholder theory does provide ethical and action guiding rules for balancing stakeholder interests (Kline & McDermott, 2019). Its origins and early development were clearly aimed at making business policy and strategy more effective (Freeman, Phillips, & Sisodia, 2018).

The proponents of a "stakeholder model" is explain that businesses are accountable to everyone who has a stake in their activity (Kakabadse & Rozuel, 2006). Fundamentally, stakeholders' ultimate objective is for corporations to meet their needs, whether environmental or social, in addition to profit making (How, Lee, & Brown, 2019). Furthermore, most of the previous studies asserted that the stakeholder theory emphasizes on value creation and the symbiosis relationship between organisations and the public. Besides, the main premise of the theory is that by creating value for all stakeholders without compromising business would benefit organisations in the long run (Nie et al., 2019). Hence, according to Ibrahim et al., (2019), Stake holder theory is always concentrated on corporate social responsibility, ethics in business as well as creating shared values and business sustainability.

Meanwhile, study by Mainardes, Alves and Raposo (2011) mentioned that the roots of stakeholder theory attract on four main academic fields for example sociology, economics, politics and ethics. Stakeholder theory draw the literature on corporate planning, systems theory, corporate social responsibility and organisational theory (Mainardes et al., 2011). The book entitled Strategic Management: a Stakeholder Approach by Freeman (1984) commonly recognized as launching the stakeholder theory concepts it also describes how stakeholders with alike interests or rights form a group. He was seeking to describe the association between the company and its external environment and its behaviour within this environment.

Yet, the author set out his model as if a chart in which the company is located at the centre and is involved with stakeholders associated with the company. The conception of stakeholder management was developed so that organisations could identify, evaluate and examine the characteristics of individuals or groups influencing or being influenced by organisational behaviour (Mainardes et al., 2011).

The main query related to this study is the connection between organisation and stakeholder interests, especially regarding sustainability, and in what way this connection affects the way company conducts business. For the common of stakeholders (clients, suppliers, governments, employees, etc.), the drive for sustainability continues to be tough to reconcile with their interests, and this places a burden on the company to reconcile them all (Bulgacov, Ometto, & May, 2015). This was supported by Freeman et al. (2004), which is stated that many firms such as J&J, eBay, Google, Lincoln Electric, AES, and the companies featured in Built to Last and Good to Great have developed and run their businesses in terms highly consistent with stakeholder theory was provided compelling examples of how managers understand the core insights of stakeholder theory and use them to create outstanding businesses. Therefore, in conjunction to this study that related to performance and sustainability it leads to suitability of stakeholder theory to apply.

3.3 Theoretical Framework

A theoretical framework refers to a network of associations among variables in a research study that is logically developed, described, explained and explicate the relationship between variables in this study (Sekaran & Bougie, 2016). This framework was developed based on the literature review deliberated in Chapter Two and it has been identified, an independent variables, one mediating variable, one moderating variable and one dependent variable. Lean manufacturing practices is an independent variable, sustainability is a dependent variable, ethical climate is a moderating variable whereas manufacturing performance is a mediating variable. This section establishes the theoretical rationale for the research model. Furthermore, from the theoretical framework, testable hypothesis has been developed in order to examine theoretical validity (Sekaran, 2003). Table 3.1 illustrates the relationship constructs in this study.

Table 3. 1
Research Variables

Independent Variables (IV)	**Moderating Variable**	**Dependent Variable**
Lean Manufacturing Practices	Ethical climate	Sustainability
	Mediating Variable Manufacturing Performance	

Subsequently, lean manufacturing practices or tools widely used among the researchers. Lots of researchers used lean practices or tools in order to measure the particular objectives regarding lean manufacturing either with single dimension or by grouping or categorizing the dimensions. Moreover, according to Shah and Ward (2003). Lean manufacturing represents a many-sided concept that may be grouped together as distinct bundles of organisational bundles. For instance, lean manufacturing had been categorized into four bundles by Shah and Ward (2003). Each bundle encompasses principles and tools such as human resource management (HRM), total quality management (TQM), just in time (JIT) and total preventive maintenance (TPM). Respective bundles have their own varieties of lean tools and practices. They test the effects of the bundles towards operational performance. The result specified that lean bundles donated to the operating performance of the organisation.

Further, lean had been defined by Hines, Holweg and Rich (2004) whereby it consists of at two levels. It was encompassing strategic level and operational levels. The level of strategic is based on the principles of lean thinking that reachable by Womack and Jones while the level of operational have been focused on the shop floor, which encompass strategic aspects like value creation and understanding customer value.

Likewise, in another study, Olsen (2004) had classified lean into four wide areas such as JIT, TQM, TPM, and infrastructure. The study was dignified seven lean manufacturing practices on small medium sized companies in order to examine the relationship with the firm level financial performance. Conversely, Steinlicht (2010) had described lean tools into 3 groups that is continuous improvement tools and techniques, process tools and techniques and support system tools and techniques. Researcher had been grouped the tools in order to boost the productivity in in the organisations.

Similarly, Iteng et al. (2015) was gathered the lean practices into two groups namely (1) socially oriented lean production (SLEAN) which comprises supplier focus, employee focus, continuous improvement and customer focus and (2) technically oriented lean production (TLEAN) encompasses quality at source, JIT, flow system and technology and innovation. This groups practices had been proposed by considering the recommendation by Shah and Ward whereby in order to eliminate waste, they need to group lean production practices into two dimensions based on socio-technical system theory (STS) as aforementioned.

However, this study has proposed a group of lean manufacturing practices that comprises of six dimensions. Table 3.1 shows the proposed theoretical framework in this research whereby indicate the relationship between lean manufacturing practices, ethical climate, manufacturing performance and sustainability. Lean manufacturing practices will be an independent variable. Meanwhile dependent variable is sustainability, whereas ethical climate is moderating and manufacturing performance is mediating.

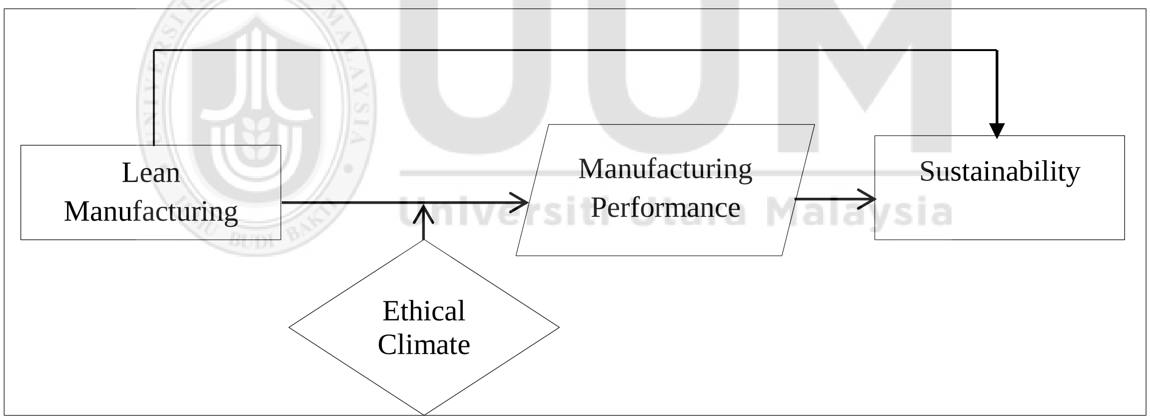


Figure 3. 1
Theoretical Framework

The above of the theoretical framework as illustrated in figure 3.1 was underpinned by two theories; containing RBV theory and Stakeholder Theory. Consequently, this study empirically examines the relationship among lean manufacturing practices, manufacturing performance, ethical climate and sustainability. There are four relationships have been pointed out which are listed as follows:

i. The relationship between lean manufacturing practices and sustainability in the manufacturing organisation.

ii. The relationship between manufacturing performance and lean manufacturing practices.

iii. The relationship between sustainability and manufacturing performance.

iv. The relationship between ethical climate and manufacturing performance.

From the discussion in Chapter Two, previous studies showed that sustainability is influenced by lean manufacturing practices (Iranmanesh et al., 2019). It is also can be seen, manufacturing performance was influenced by lean manufacturing practices (Alaskari et al., 2016).

The mediating variable surfaces has been proposed by Sekaran and Bougie (2013) and Baron and Kenny (1986) as a function to conceptualize and describe the influence of the independent variable on the dependent variable. The nature of mediator variables that introduced by Baron and Kenny (1986) has shown in Figure 3.2 which they have formulated the steps and conditions to ascertain whether full or partial mediating effects are present in a model. Correspondingly, Hair, Hult, Ringle and Sarstedt (2014) also mentioned that mediating variable performed as intervening between two other related variables.

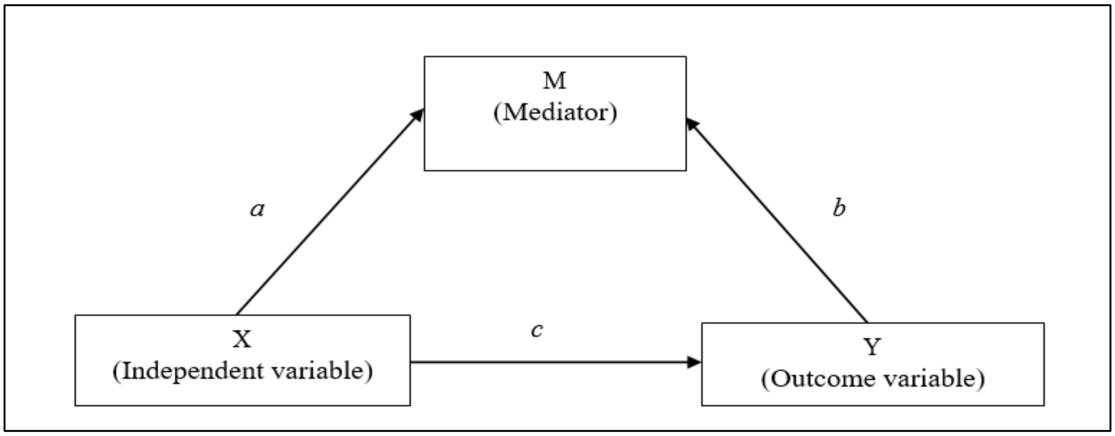


Figure 3. 2
Nature of Mediator Variables
Source: Baron and Kenny (1986)

Nevertheless, Hayes (2009) had debated that it is not advisable to depend on statistical significance criteria for the individual paths in a mediation model in order to assess whether M functions as a mediator. It is counselled to predict the indirect effect rather than to see the output is significance or insignificance. In addition, Hayes (2009) endures contended the issue of mediation such in term of full or complete and partial has no longer relevant for 21st century mediation analysis and it should be escaped. Consequently, it is recommended to apply bootstrapping to test mediating effects that has been recognized as one of the more rigorous and powerful methods for testing the mediating effect as mentioned by Zhao, Lynch and Chen (2010); Hayes (2009) in their studies. Meanwhile, studies by Hair, Ringle & Sarstedt (2013); Preacher & Hayes (2008) mentioned that the non-parametric resampling procedure completely matched for PLS-SEM since it can be applied to small sample sizes and it makes no assumption about the shape of the variables' distribution.

Therefore, this study proposes manufacturing performance as mediating variable that helps to hypothesize and comprehend the relationship of lean manufacturing practices that bring about sustainability. This linkage of these variables derived from the preceding results in the manufacturing sector that shows, manufacturing performance has partially mediated between lean practices and business performance. However, less empirical research has found a direct relationship between lean manufacturing practices with manufacturing performance with sustainability.

In addition, the nature of moderator variables that introduced by Baron and Kenny (1986) has shown in Figure 3.3. Specifically within a correlational analysis framework, a moderator is a third variable that affects the zero-order correla- tion between two other variables (Baron & Kenny, 1986).

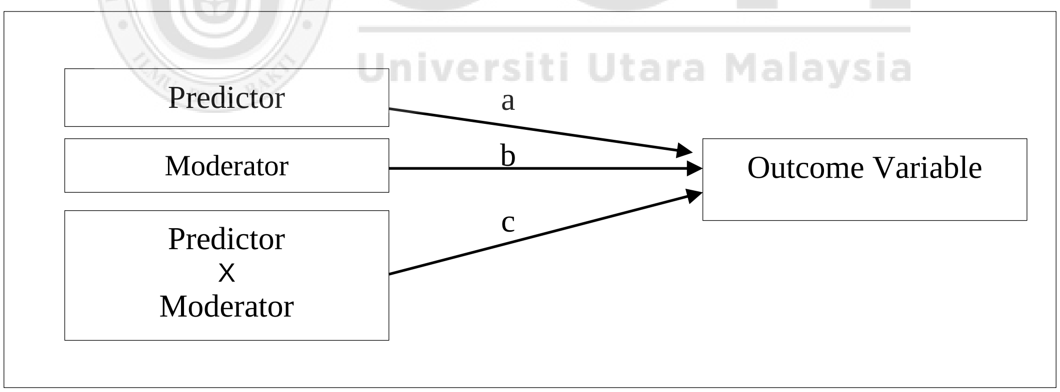


Figure 3. 3
Nature of Moderator Variables
Source: Baron and Kenny (1986)

Further, ethical climate has taken into account that acts as a moderating variable which feasibly will moderate the relationship between lean manufacturing practices and manufacturing performance. Moderating variable will exist, whenever the relationship between the independent variable and the dependent variable becomes contingent on another variable (Sekaran & Bougie, 2013). Another variable refers to moderating variable that modifies the original relationship between these two variables. While Baron and Kenny (1986) defined moderator as qualitative or quantitative variable that affects the relation between two variables; independent (predictor) variable and dependent (criterion) variable. In addition, moderator variables are typically introduced when there is an unexpectedly weak or inconsistent relation between a predictor and a criterion variable (Baron & Kenny, 1986). Thus, this study suggests ethical climate as a moderating variable has a contingent effect on the relationship between lean manufacturing practices with manufacturing performance.

Ethical climate has posited as moderator due to variations in result was found whereby some of the positive result and negative result of ethical climate appeared in the manufacturing context such as a study conducted by Sabiu, Mei and Joarder (2016) found that ethical climate was not statistically significant on the relationship between training development and operational performance. Likewise, a study by Tanner, Tanner and Wakefield (2015) mentioned that if ethical climate only serves to minimize unethical behaviour, then creating a highly ethical climate would be worthwhile.

There were several approaches to test mediation effect or indirect relationship which are including; i) Baron and Kenny's causal procedure method, ii) Sobel Test, and iii) bootstrapping the indirect effect (Ramayah, Cheah, Chuah, Ting, & Memon, 2018). This study has decided to employ the bootstrapping the indirect effect approach as advocated by Preacher and Hayes (2004) and Preacher and Hayes (2008) due to several reasons as follow:

i) Baron and Kenny's causal procedure method has been criticised as having very low statistical power and the multiple steps involved are causing false conclusion that there was mediation effect when actually there was no mediation effect (Rungtusanatham, Miller, & Boyer, 2014).

ii) Sobel test was not appropriate to be used because the distributional assumptions do not hold for the indirect effect that will yield lower statistical power than other alternatives especially in a study with small sample sizes. Whereas, this study can be considered as having small samples (i.e. 101).

In response to this decision, there was no need to explain full or partial mediation of complementary and competitive concepts to conclude the mediation result. Such concepts are rooted in the Baron and Kenny's causal procedure method (Baron & Kenny, 1986; Ramayah et al., 2018). Instead, researchers are advised to calculate variance accounted for (VAF) to conclude the mediation effect (Hair Jr et al., 2017). The same approaches (i.e. indirect effect bootstrapping and VAF calculation) were also conducted by a precedent researcher in the same context of study (i.e. lean manufacturing) (Mohamed Ismail, 2014).

3.3.1 Operational Definition

This section explains the operational definitions of this research. Operational definitions are definitions for variables that is specific to testing criteria, specifying what must be gathered, measured or computed from the researcher's perspective (Cooper & Schindler, 2008). The key terms designate the operational definitions of each variable and it helps to generate a comprehensive understanding within the area of this research.

3.3.1 Lean Manufacturing Practices

Lean manufacturing practices refer to an incorporated system that includes pertaining fundamentals and varied organisation practices whereby it's goals are to upsurge productivity, diminish lead time and cost and as well as increase quality (Abdelhadi, 2016; Nawanir et al., 2013). For this study, lean manufacturing practices comprises of up to six (6) components which are cellular layout, pull system/ *kanban*, quick setup, total quality management (TQM), total productive maintenance (TPM), small lot of production which are backed by a holistic philosophy and principle throughout the organisations (Losonci, Kása, Demeter, Heidrich, & Jenei, 2017). Most of the organisations have amended the lean concepts to increase the efficiency of their business performance (Kundu & Manohar, 2016).

3.3.2 Manufacturing Performance

Manufacturing performance refer to the strength of the firm is ascertained based on the capability or output provided such as cost, quality, delivery time and delivery time reliability, performance, flexibility and innovativeness to satisfy the customer (Narkhede, 2017; Al-Jawazneh, 2012). Meanwhile according to Hon (2005), manufacturing performances are commonly used to observe and manage operational efficiency, reflect the current state of manufacturing conditions, lead to upgrading programmes and engage in the effectiveness of manufacturing decisions. Therefore, this study utilized quality, flexibility, time, delivery and cost reduction to measure manufacturing performance. This research would like to examine manufacturing performance of Malaysia manufacturing organisations by taking several aspects to measure lean manufacturing practices with sustainability.

3.3.3 Ethical Climate

Ethical climate refers to the view of employee pertaining what constitutes ethically right or wrong behaviour and through which ethical issues are managed, will become a psychological mechanism in an organisation and affects decision making and performances in the particular organisation (Cullen & Victor, 1993; Martin & Cullen, 2006; Sabiu, Mei, & Raihan Joarder, 2016). It can affects the way of making business decisions and solving ethical dilemmas in business (Stamenkovic, Ratkovic Njegovan, & Vukadinovic, 2018).

3.3.4 Sustainability

Sustainability is considered an enduring or long-term objective that should be strategic (Ferro et al., 2017). Meanwhile Barron and Chou (2017) and Hami et al. (2016) viewed sustainability as a triple bottom line which will be measured by the three pillars model which is the economic, social and environment. A common understanding of sustainability focuses more on the interdependence of the social, environmental and economic aspects of sustainability (Aminpour et al., 2020). Thus, this study place emphasis on lean manufacturing practices with manufacturing performance which affect sustainability.

3.4 Hypothesis Development

Based on the conceptual framework, hypothesis will be developed in order to show the relationship among variables. This study is using alternative hypothesis (h_a) which is statistically important relationship between two variables. Previous literature shows the relationship between the variables.

Lean is the most important practice in an organisation. It is important driving force for conserving the environment and sustainability (Ho, 2010). Furthermore, according to King and Lenox, (2001); Rothenberg, Pil and Maxwell, (2001), lean practices are managerial actions that reduce or remove wastes in all forms. Hence, lean practices are supportive for particular organisation to eliminate pollutant and dangerous emissions by means of decrease in logistic and as a result reduce non-value added activities.

In addition, lean practices also play the role in order to sustain the environmental performance (King & Lenox, 2001; Shah & Ward, 2003). Consequently, Langenwalter (2006) mentioned that lean leads in the direction of sustainability initiatives. Lean tools apply to any kind of problem, including environmental ones. Meanwhile, lean manufacturing can also have an impact on environmental and social sustainability practices (Longoni & Cagliano, 2015). In addition, sustainability is about not only concerning about to sustain current operational levels and penetrating new markets in order to replace lost ones, likewise attempt to achieving development so that organisation can be well growth. Hence, the organisation must be able to support the manufacturing operations by lean implementation. Therefore, the hypothesis (H1) is develop as below:

H_1: There is a relationship between lean manufacturing practices and sustainability in the manufacturing organisation.

According to Fullerton and Wempe (2009), the findings from their study indicated that utilization of manufacturing performance measure mediates the relationship between lean manufacturing and financial performance. Besides, study by Taj and Morosan (2011) found that lean manufacturing practices have significant effect on manufacturing performance. They measure manufacturing performance through three components namely flow, flexibility and quality.

However, quality is not indicated positive relationship with lean practice. This means that to improve the quality of their products consider about supply management and labour factor as well. In addition, research done by Chong, White, and Prybutok (2001) found that lean practices that had been used able to help company to increase the manufacturing performance. The implementation of lean manufacturing practices able to reduce variability and enhance productivity as well as can minimize cost and improve delivery. As a result it can improve manufacturing performance (Cua et al., 2001). Likewise, research by Shah and Ward (2003) shows that the findings provide explicit evidence that the effect of lean practices influenced the manufacturing performance to be improved. Therefore, the hypothesis 2 was developed as below:

H_2: There is a relationship between lean manufacturing practices and manufacturing performance.

The implementation of manufacturing practices comprises of lean operational practices and business practices associated to sustainability (Piercy & Rich, 2015). In addition, their study also indicated that lean operations meet a wide range of sustainability outcomes. Furthermore, study conducted by Stubblefield Loucks, Marten and Cho (2010) found that the particular company do certainly need thoughtfulness when it comes to business strategies to achieve sustainability and in fact, the tools that are developed to support sustainability need to recognize.

In addition the findings from Pham and Thomas (2012) shows that in order to achieves economic and environmental sustainability, the companies need to produce products using less resource with a key concentration on waste reduction. Likewise, research conducted by from Thomas et al., (2016) agreed with that suggestion and proposed that a dual strategic approach that came from manufacturing strategy needs to be engaged so that a company can be achieved sustainability.

Moreover, researchers also mentioned that the company must achieved limited manufacturing performance improvement and suggest that a multi-strategy approach in order to achieve manufacturing resiliency and sustainability. According to Thomas et al., (2016), there is a relationship that exists between the sustainability technique and application of tools, models and the resulting levels of manufacturing performance.

Other than that, according to Langenwalter (2006), a company which embraces sustainability no need to worry about stern regulations because by the time sustainability can mean the difference between receiving building permits and not receiving them. Besides, the sustainable companies which are positioned to favour tighter environmental and social regulations that can easily compete the challengers. For example, the manufacturing performance leads to financial stability at Oki Semiconductor Manufacturing in Portland, Baxter International and The Collins Companies. In sum, it saved an estimated $1 million in the first year of implementing. Therefore, the hypothesis 3 was developed as below:

H_3: There is a relationship between manufacturing performance and sustainability.

Arulrajah (2015) mentioned that ethical climate should be emphasize in the organisation in order to lead to the success in the business operation (Arulrajah, 2015). Alluding to Victor and Cullen (1987), ethical climate is play a role to ensure the productivity of organisations can be maintain in the good performance whereby it can be also seen as policies in the organisations, procedures, and ethical conduct that guides an individual to behave with maximum level of ethics that leads to organisational success. Notwithstanding, Martin and Cullen (2006) asserted that ethical climate can affects both decision making and performances in the organisations. Aforementioned, Stare and Klun (2017) also agreed that ethical climate can representing the organisation's policies, procedures and practices on ethical issues that can be as a guidelines for employee behaviour as it can influences employees' attitudes and behaviour at once can boost the manufacturing performance.

Undeniably, an ethical climate can be defined as the employees' view of what creates ethically right or wrong behaviour. Henceforward, it becomes an emotional mechanism through which ethical issues are managed in an organisation at the same time can lead to the organisation performance (Choi et al., 2013). Likewise, a study from Sabiu, Mei and Raihan Joarder (2016) found that ethical climate was play a role as a good predictor on organisational performance. Subsequently, transaction of unethical behaviour of members in an organisation through the help of ethical climate may have vital influence on organisational performance and entire system (Arulrajah, 2015). Similarly, Martin and

Cullen (2006) deliberated that ethical climate as associated to recognized normative system of an organisation. The previous studies conclude that fluctuating the unethical conduct with the help of ethical climate may have a critical impact on organisation performance. Therefore, the hypothesis 4 was developed as below:

H_4: There is a significant relationship between ethical climate and manufacturing performance.

It is common to adopt third variable such as moderator perspective or mediator perspective when hypothesizing the effect of one variable on another variable is contingent on a third variable (Xu, Cavusgil, & White, 2006). Study conducted by Nawanir, Teong and Othman (2013) in the manufacturing organisation found that there is positive relationship between lean practices, operational performance and business performance. Likewise, it indicated that operational performance was partially mediated the relationship between lean practices and business performance.

Furthermore, study lead by Fullerton & Wempe (2009) initiated that utilization of manufacturing performance measures mediates the relationship between lean manufacturing and financial performance. In addition, the mediation finding may give a clear view on the consistent result of prior studies that examine the associations between financial performance and lean practices. Consequently, on the part of manufacturing executives, tends to strengthen the relationships between the selected model of business, targeted competitive strategy and the manufacturing performance need to sustain the competitive market (Gomes, Yasin, & Lisboa, 2011). Hence, it shows that manufacturing performance plays the important role as a mediating effect. Likewise, Leachman, Pegels and Shin (2005), mentioned that the greater manufacturing performance leads to competitive advantage. Moreover, in order to sustain manufacturing strength, the particular companies need to understand the critical manufacturing practices. Therefore, the hypothesis 5 was developed as below:

H_5: Manufacturing performance is mediate variable that influence of lean manufacturing practices on sustainability.

Ethical climate act as important mechanism in improving manufacturing performance (Sabiu, Mei, Hasanur, & Joarder, 2015). Study by Peng Lin, Lang Tang and Hsiao (2005) shows that ethical climate has been tested as a role of moderating effect. However, that study was executed in the behavioural intentions. Moreover, there were studies demonstrated ethical climate significantly influence the formation of intentions.

On top of that, study conducted by Sabiu, Mei and Raihan Joarder (2016), proposed that ethical climate as a potential moderator on the relationship between HRM practices and organisational performance. In the same vein, study by Hasan, Mohd Asaad, & Iteng (2017) also proposed ethical climate as a moderator in relationship between lean manufacturing practices and manufacturing performance. Furthermore, the changing of unethical attitude of team members in a particular organisation through the support of ethical climate may have crucial influence on organisational performance and the whole system of organisation (Arulrajah, 2015). Therefore, the hypothesis 6 was developed as below:

H_6: Ethical climate is moderate influencing lean manufacturing practices on manufacturing performance.

3.4.1 Summary of Hypothesis Development

Table 3.1 illustrated the summary of hypothesis that develops based on the past literature. This is summary from hypothesis H1-H6.

Table 3. 2
Summary of Research Hypothesis

Hypothesis	Statements of Hypothesis
H_1	There is a relationship between lean manufacturing practices and sustainability in the manufacturing organisation.
H_2	There is a relationship between lean manufacturing practices and manufacturing performance.
H_3	There is a relationship between manufacturing performance and sustainability.
H_4	There is a relationship between ethical climate and manufacturing performance.
H_5	Manufacturing performance is mediate variable that influence of lean manufacturing practices on sustainability.
H_6	Ethical climate is moderate influencing lean manufacturing practices on manufacturing performance.

3.4.2 Summary of Relationship between RQ, RO and Hypothesis

Next, the hypothesis that developed in this study is summarised as in table 3.3 in order to show the relationship between research questions and research objectives.

Table 3. 3
Summary of relationship between RQ, RO and Hypothesis

Research Question	Research Objective	Research Hypothesis
Is there any relationship between lean manufacturing practices and sustainability in the manufacturing organisation?	To examine the relationship between lean manufacturing practices and sustainability in the manufacturing organisation.	There is a relationship between lean manufacturing practices and sustainability in the manufacturing organisation.
Is there any relationship between manufacturing performance and lean manufacturing practices?	To examine the relationship between lean manufacturing practices and manufacturing performance.	There is a relationship between lean manufacturing practices and manufacturing performance?
Is there any relationship between sustainability and manufacturing performance?	To examine the relationship between manufacturing performance and sustainability.	There is a relationship between manufacturing performance and sustainability.
Is there any relationship between ethical climate and manufacturing performance?	To determine the relationship between ethical climate and manufacturing performance	There is a significant relationship between ethical climate and manufacturing performance.
Does the manufacturing performance mediate the relationship between lean manufacturing practices and sustainability?	To examine the mediating effect of manufacturing performance in between lean manufacturing practices on sustainability.	Manufacturing performance is mediate variable that influence of lean manufacturing practices on sustainability.
Does the ethical climate moderates the relationship between lean manufacturing practices and manufacturing performance?	To examine the moderating effect of ethical climate of lean manufacturing practices on manufacturing performance.	Ethical climate is moderate influencing lean manufacturing practices on manufacturing performance.

3.5 Research Design

Research design works as a framework and a blueprint for the purpose of measuring, analyzing, and collecting the data to meet the research questions and research objectives of the study (Sekaran & Bougie, 2013; Saunders et al., 2016). An appropriate research design will be choosing to answer the research questions. There are three approaches used in researches i) exploratory research, ii) descriptive research, and iii) causal research. Exploratory research is defined as a research used to investigate a problem which is not clearly defined (Creswell, 2014). It is conducted to have a better understanding of the existing problem, but will not provide conclusive results. Flexibility is important in exploratory research and it is bound to result in new ideas, revelations and insights. In addition, exploratory research is carried out when a topic needs to be understood in depth, especially if it hasn't been done before. The goal of such a research is to explore the problem and around it and not actually derive a conclusion from it.

Meanwhile, descriptive research is defined as a research method that describes the characteristics of the population or phenomenon studied. According to Creswell (2014); Dawson (2007), the term descriptive research then refers to research questions, design of the study, and data analysis conducted on that topic. Also, a descriptive research method can be used in multiple ways and for various reasons. Before getting into any survey, though, the survey goals and survey design are crucial (Sekaran, 2003). Compared to exploratory research, descriptive research follows a very rigid approach. The data collection methods are highly rigid as compared to the unstructured and flexible approach used in exploratory research.

On the other hand, casual research is effective in terms of identifying covariation between variables. Causal research, also known as explanatory research is conducted in order to identify the extent and nature of cause-and-effect relationships. Besides, causal research helps identify if there is a causal relationship between two or more variables. It is highly structured like descriptive research and is also known for use of control procedures used during experimental designs related to tests of causal relationships. In most of such cases the researcher is concerned with knowing the impact the independent variable has on the dependent variable. Causal studies focus on an analysis of a situation or a specific problem to explain the patterns of relationships between variables. Experiments are the most popular primary data collection methods in studies with causal research design (Cooper & Schindler, 2014).

The major objective of exploratory research design is to discover ideas and insights where as in descriptive research design involves describing market aspects and functions. Nevertheless, causal research design tries to determine the cause-effect relationships in the research one is conducting. Thus, this study employs quantitative approach. Then, specifically, a descriptive approach will be employed for identifying specific characteristics of the organisation or the members especially the demographical features of the research population (Sekaran, 2003). Meanwhile, the associations among variables of this study will be examine based on the hypothesis of the research framework which is correlational study would be the best method to describe the relationship (Cooper & Schindler, 2014).

A quantitative approach will be employed in order to obtain the objectives of this research which is to examine the influence of lean manufacturing practices towards sustainability in manufacturing organisations. This research also aimed to test the hypotheses of the research framework by using a quantitative approach because of several relevant point of view of quantitative method. According to Creswell (2014); Dawson (2007) and Sekaran (2003), a large number of respondents able to reaches in a short time by quantitative approach. Time matters is important for the process of this study because in manufacturing organisations, it is essential to find the suitable tools for collecting complete data without wasting their time and obstructing their work.

Furthermore, in order to test the developed hypotheses and measuring the relationship between the different variables, quantitative approach is applicable by using several statistical tools and techniques. On top of that, according to Polit and Beck (2010), generalizability is considered a major criterion for evaluating the quality of a study which is can be done by using qualitative method. Nonetheless, the data collected through quantitative methods also are often believed to produce more objective and precise information because they are collected using standardized methods and can be replicated (Frechting, 2002).

Therefore, for data analysis, this study relies on quantitative. The main purpose of quantitative research is to study facts, test hypotheses and identify relationships using statistical methods. The used of large-scale survey research that using methods such as questionnaires or structured interviews generated statistic by quantitative research where it reaches quickly to a large sample of respondents (Dawson, 2007).

Conversely, Saunders et al., (2016) asserted that prior to selecting the appropriate data sources, collection methods and analysis techniques to answer the research questions, researchers should make clarifications on other research inquiries such as philosophical stance, adopted approach to theory development, and methodological choice through the research "Onion" as shown in figure 3.4.

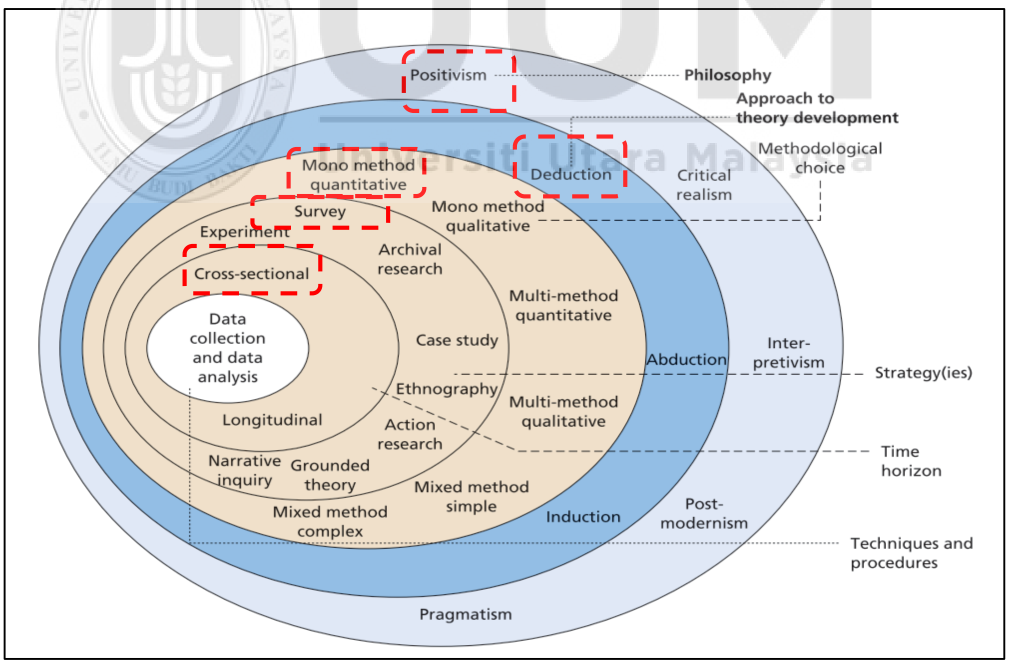


Figure 3. 4
Research Onion
Source: Adapted from Saunders et al. (2016)

3.5.1 Research Philosophy

Research philosophy refers to a system of beliefs and assumptions about the development of knowledge and the nature of that knowledge in relation to research (Mark Saunders et al., 2016). Figure 3.4 illustrates five types of research philosophies which include; i) positivism, ii) critical realism, iii) interpretivism, iv) post-modernism, and v) pragmatism. This study adopts positivism as the philosophical stance in conducting the research on Lean Manufacturing Practices towards Sustainability.

Positivism philosophy advocates the application of the deductive rule and quantitative methods to the study of social reality and beyond (Sekaran & Bougie, 2016). Besides, according to Ikeda (2009), the objectivity and externality of the universe can be explored and overcome by positivists. Therefore, in ensuring the objectivity, while observing the subjects they should (researchers) remained independent, and to draw a conclusion to examine the proposed relationships they should develop hypotheses.

In addition, since the use of natural science methods is promoted by positivists to explain social reality and beyond (Bryman, 2012), they followed the quantitative approach and studies to evaluate abstract deductive generalisations (Guo & Sheffield, 2008). Moreover, Baker (2001) highlighted the importance of the proper procedure for data collection, description, and behavioural pattern research. Meanwhile, Straub and Gefen (2004) stressed that it relies on the positivist paradigm when generalising the findings derived from a study of a certain population. Subsequently, in management and behavioural science studies, the application of positivism is commonly accepted where positivists apply the quantitative research approach and methods that are survey and experiment that aim to create causal relationships (Brown, Squire, & Blackmon, 2007).

A conceptual research model and its fundamental hypotheses are planned to be tested by focusing on a survey-based quantitative research approach, because the positivism method is more fitting for the achievement of the research goals for this study.

3.5.2 Methodological Justification

Three approaches to the development of philosophy exist: i) abduction, ii) deduction, and iii) induction (Mark Saunders et al., 2016) (Saunders et al., 2016). This study chose to follow the deduction approach. Truthfully, a study appears to lead to deductive reasoning from a positivist perspective (Holden & Lynch, 2004). According to (Mark Saunders et al., 2016) Deduction reasoning is clearly characterised as applying a general principle to a particular situation.

Also, this study is designed according to hypothetico-deductive method. According Saunders et al., (2016), hypothetico-deductive method involves seven steps research process including; i) identifying a broad problem area, ii) defining the problem statement, iii) hypotheses development, iv) determining measures, v) data collection, vi) data analysis, and vii) data interpretation. In this study, all these procedures are definitely included.

Furthermore, methodological choices has been categorised into three major options namely; i) mono method, ii) multiple method and iii) mixed method (Saunders, Lewis, & Thornhill, 2009). Saunders et al. (2016) classified each option into quantitative and qualitative mono methods, quantitative and qualitative multiple methods, as well as simple and complex mixed methods as shown in figure 3.5. In the sense of this study, a mono method quantitative is considered suitable to address the research questions formulated and fulfil the research objectives proposed. Basically, Saunders et al. (2016) stated that mono method means using a single data collection technique and corresponding analysis procedures. In particular, this research uses quantitative data collection entirely.

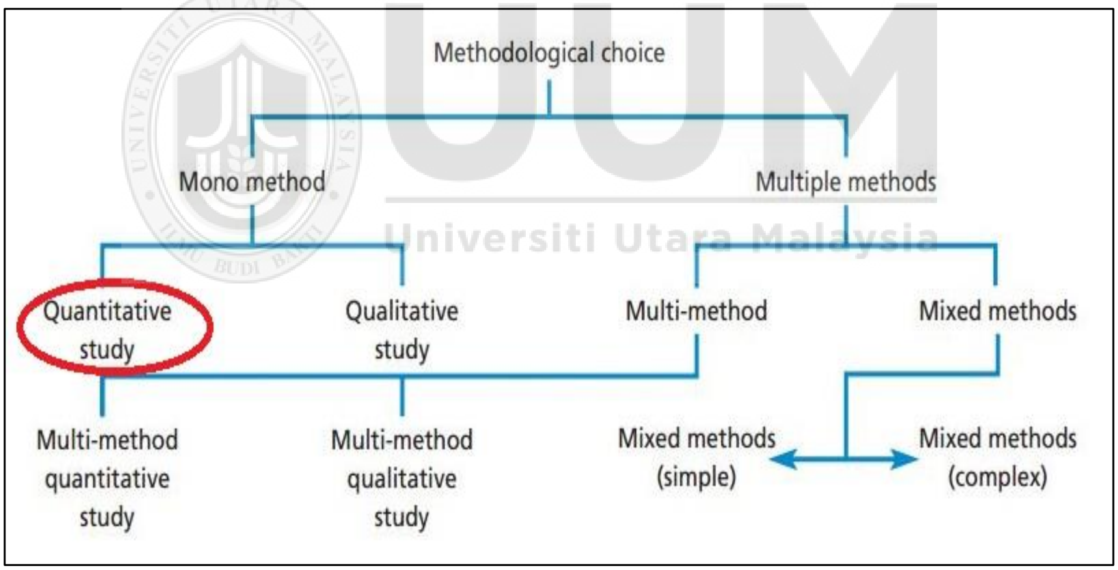


Figure 3. 5
Methodological Choices
Source: Adapted from Saunders et al. (2016)

3.5.3 Research Design Strategy

The data of this study gathered using survey method. This study involves collecting the perceptions of respondents within manufacturing organisations. According to Zikmund (2003), the survey method is able to designate the phenomena or to learn the reason for any specific activity. Furthermore, Duane (1996) mentioned that this kind of method also a versatile method that had been used in many research.

This study involves with empirical data from the manufacturing organisations which implemented lean manufacturing practices in the production through questionnaires. The structured questionnaires were developed to get the data needed in order to analyse the variables as depicted in the research framework. Then, pre-testing the questionnaires will be done in order to test the validity of that particular questionnaire so that it clear, complete and able to understand by the respondents.

Therefore, this study was a survey study which is the respondents must be involved by those who involved directly in lean practices management and implementation from middle management up to top management. Hence, these questionnaires focus those who involved with lean manufacturing practices and decision making in the manufacturing organisations. The advantages and disadvantages of such method was summarised in Table 3.4.

Table 3. 4

The Advantages and Disadvantages of Survey

Advantages	**Disadvantages**
Good for gathering descriptive data	Self-report may lead to biased reporting
Can cover a wide range of topics	Data may provide a general picture but lack depth
Are relatively inexpensive to use	May not provide adequate information on context
Can be analyzed using a variety of existing software	Self-report may lead to biased reporting
Good for gathering descriptive data	Data may provide a general picture but lack depth

Source: (Frechting, 2002)

3.5.4 Time Dimension of the Study

According to Sekaran (2003), the research time horizon can be cross sectional or longitudinal study which is can be distinguished by period of gathering the data of the study. It is known as cross sectional study when the study is conducted at one point in time and just once to answer some research questions. On the other hand, longitudinal study is the study conducted at different points of time. Therefore, this study is a cross-sectional study as it is carried out once and represents the issue in the specific time. Cross-sectional design is quiet simple, less expensive and permitted the data to be obtained in a short period of time relative to longitudinal design (Papaioannou & Wilson, 2010 ;Sekaran & Bougie, 2016).

3.6 Sampling Process

According to Sekaran and Bougie (2016), sampling is the process of choosing applicable number of the representative samples from a population. Meanwhile, Martínez-Mesa, González-Chica, Duquia, Bonamigo and Bastos (2016) defined sampling as the process through which individuals or sampling units are selected from the sample frame. In fact, this process is imperative to make sure the selected samples are precisely representing the characteristics of the population (Cooper & Schindler, 2014). Without a rigorous sampling plan the estimates derived from the study may be biased (Martínez-Mesa et al., 2016).

Consequently, Sekaran and Bougie (2016) had listed five appropriate orders in performing the sampling process. The orders were as follows; i) defining the population, ii) determining the sample frame, iii) deciding the sampling technique, iv) estimating the appropriate sample size, and v) executing the sampling process. Therefore, this section is presented following these orders.

3.6.1 Population and Sample Frame

The identification of the population is the starting point of sampling process. According to Sekaran and Bougie (2016), a population in research studies refers to the whole group of people, events, or things that the researcher desires to study (Sekaran & Bougie, 2016). In the meantime, Taherdoost (2016) has defined population as commonly related to the number of people living in a particular country. In the context of this study, the population under study is manufacturing organisations in Malaysia, including Sabah and Sarawak.

Meanwhile, the sampling frame must be representative of the population (Taherdoost, 2016). Attaining a sampling frame is a necessity if researchers anticipate to use probability sampling (Cooper & Schindler, 2014; Saunders et al., 2016). According to Sekaran and Bougie (2016), a sampling frame is a full list of all the cases in the target population from which the samples are taken. Devoid of a sampling frame, researchers unable to properly draw samples from the target population as the chance or probability of every case being selected is unknown and might be zero (Cooper & Schindler, 2014; Saunders et al., 2016).

Subsequently, the target sample frame was selected from the sources of Malaysia Federation of Manufacturing in Malaysia (47th edition). The population size for this study is 2368. However, the sample size required is 335 based on the table produced by Krejcie and Morgan (1970). Thus, 335 respondents were randomly selected from the list to take part in this study.

These 355 manufacturing organisations including Sabah and Sarawak were from 11 different industries namely; i) Electrical and Electronics (E&E), ii) Machinery, Appliances and Parts iii) Transport Equipment, iv) Food, Beverages and Tobacco, v) Other Manufacturing Goods, vi) Chemical and Plastics, vii) Rubber, viii) Iron, Steel and Metal, ix) Wood-based, x) Non-Metallic Mineral, xi) Petroleum-based.

3.6.2 Unit of Analysis

Unit of analysis is referring to the subject is being analysed and describe the units themselves in this study. According to Sekaran (2003), the unit of analysis can be individual, dyads, groups or organisation. The aim of this study is investigate the relationship of lean manufacturing practices and sustainability in manufacturing organisations. Based on the research questions, organization was considered as the unit of analysis in this study. The element of the unit of analysis was determined based on the responsibility in the organization and the person knows the ropes of lean manufacturing practices and manufacturing performance. In connection with that, the middle and top management in production such as director, head of department, manager, and other positions, which were familiar with manufacturing activities and manufacturing performance. Hence, the unit of analysis in this study will be the organisations who involved with the lean manufacturing practices starting from middle management up to the top management.

According to Lee & Teece (2013), middle management has been defined as those who are supervise supervisors and are supervised by others. In addition, middle managements are administering the technical work of the organisation, serve as a bridge between top management and lower levels of the organisation. It also can impact organisations in a various way by performing different roles (Rezvani, 2017). Consequently, executive level and above are eligible to be a part of respondent for this research. The combination between both top and middle management will leads to competitiveness and sustainability thereupon to organisational performance (Lee & Teece, 2013). The respondents will be asked to answer the survey items with respect to the lean practices in the respective manufacturing organisation.

3.6.3 Sampling Technique

Sampling techniques was divided to two groups namely probability and non- probability sampling (Creswell, 2014). Every subject in a population has an equal chance to be selected as a sample of the study by using probability sampling whereas non- probability technique does not give such a chance (Mark Saunders et al., 2016). Besides, probability sampling relies on random selection processes. Random selection was defined as a selection process deprived of any pattern (Cooper & Schindler, 2014; Neuman, 2014). In addition, random sampling yields samples most likely to truly represent the whole population (Neuman, 2014).

Furthermore, Creswell (2014) stated that drawing cases or units randomly is the utmost rigorous sampling since randomisation offers generalisation upon the target population. Saunders et al. (2016) mentioned that the larger the sample's size the lower the possible error in generalising to the target population. In addition, Dawson (2007) suggested several techniques to execute probability or random sampling such as i) simple random, ii) systematic random, iii) cluster sampling, and iv) stratified sampling. Consequently, this study applied the simple random technique as the simple random technique was the purest form of probability sampling and easy to implement (Cooper & Schindler, 2014).

Moreover, Sekaran and Bougie (2016) has the least bias and offers the most generalisability compared to other probability sampling techniques. Yet, the participants will have an equal chance of being selected when using random sampling as stated by Saunders et al. (2016), thus, all the manufacturing organisation in Malaysia will have equivalent chance to be selected.

Then, research randomizer software that available at web application http://randomizer.org was performed to generate random numbers of this study as shown in figure 3.6. Through this software, it has randomized 335 the total of sample size out of 2368 manufacturing organisations in Malaysia.

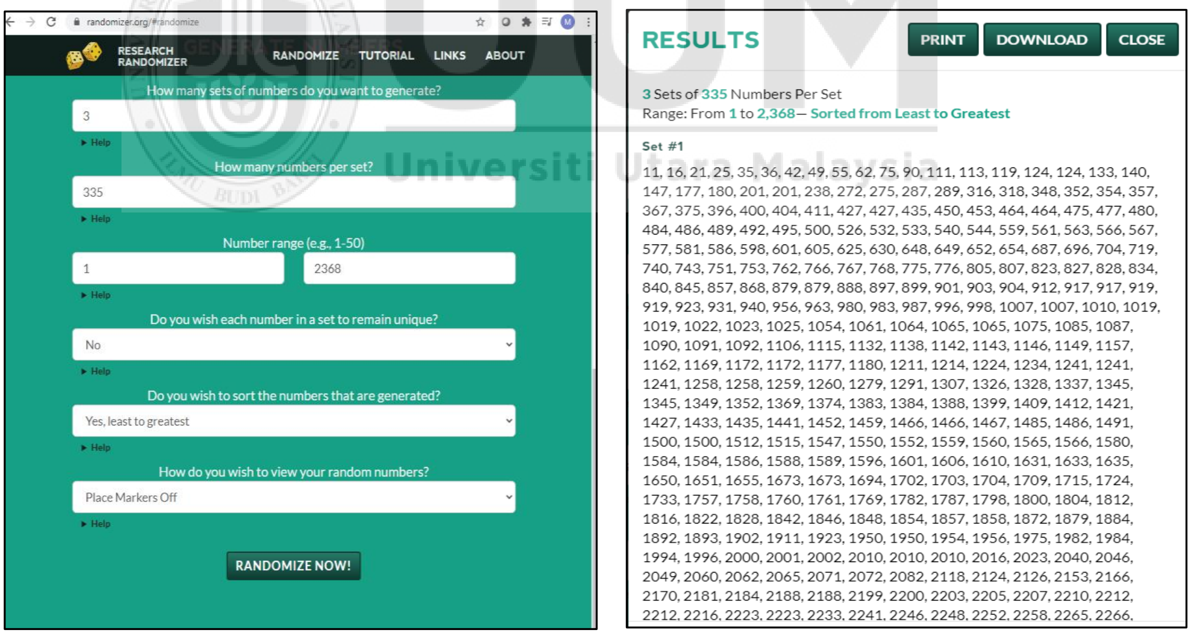


Figure 3. 6
Randomizer Software

Due to the fact that the response rate for unit analysis of an organisation was low, which has demonstrated in the past studies (Daud & Zailani, 2011; Iteng, 2013;Mohamed Ismail, 2014; Nordin et al., 2010; Wong, Wong, & Ali, 2009), the researcher decided to use PLS-SEM with the recommendations of sample size ranging from 30 to 100, compared to CB-SEM which generally ranged from 200 to 800 (Sarstedt, Ringle, & Hair, 2014).

Therefore, statistical analysis techniques has been performed using SPSS version 25 software for data examining procedures, while SmartPLS version 3.2.8 has been used to perform measurement and structural model assessments.

3.6.4 Sample Size

Sekaran and Bougie (2016) had defined sample size as the actual number of subjects selected as a sample to denote the population characteristics, with subject means a single member of the sample. Optimal sample size estimation depends on several deliberations such as; i) population characteristics, ii) the degree of confidence in sample accuracy needed for research purposes, and iii) types of data analysis to be employed (Creswell, 2014; Neuman, 2014; Saunders et al., 2016). Therefore, this study attempts to determine optimal sample size following these considerations.

Sekaran and Bougie (2016) suggested to the embrace the “rules of thumb” for assessing optimal sample size requires in quantitative studies. Neuman (2014) mentioned that rules of thumb are often used as the alternative when researchers do not have the information required by the statistical estimation method (e.g. population mean, population dispersion, margin of error, etc.). Correspondingly, these rules provide sample sizes adjacent to those of the statistical method. Common rules of thumb have deliberated the minimum confidence level anticipated in a quantitative research (Mark Saunders et al., 2016).

Subsequently, rule of thumb by Roscoe (1975) stated that a sample size larger than 30 and less than 500 is appropriate for most researches. Nevertheless according to Sekaran (2003), the minimum sample size is 10 times as large as the number of variables in the study in multivariate analysis. Since this research had four main variables, the minimum sample size is 4(10) = 40. Meanwhile, according to conventional rules of thumb introduced by Krejcie and Morgan (1970), the optimal sample size is 335 from the population of 2368.

3.7 Data Collection Approach

The survey strategy was very common, in fact popular in business research because it allows the researcher to collect quantitative data on many types of research questions (Sekaran & Bougie, 2016). In addition, Frechting (2002) also mentioned that surveys were very popular form of data collection from large groups. Surveys also were quite flexible and when appropriately administered, offers extremely valuable insights to the business managers (Zikmund et al., 2009).

Besides, surveys were generally preferred for exploratory and descriptive research to collect data about people, events, or situations (Saunders et al., 2016; Sekaran & Bougie, 2016). An exploratory research denotes to a study where very slight knowledge or information is available on the subject under investigation (Sekaran & Bougie, 2016). It is also described as a research that purposes to find new insights into phenomena and to assess the phenomena in a new light (Saunders et al., 2016). Therefore, this study employed survey strategy because it is well suited to answer research questions regarding ‘what’, ‘how much’ and ‘how many’ by providing certain types of factual and descriptive information which ultimately serve as the hard evidence (Saunders et al., 2016). These types of research questions are utilised in this study.

Furthermore, according to Sekaran (2003) there were several ways of administering survey questionnaires through the study for example self- administered, postal, telephone, internet, electronic questionnaires, personal or face-to-face interviews, telephone interview or fax.

Yet the personal administrated questionnaire was considered as the best instrument to be used in the research as it provides high respondent rate and a direct contact with the respondents (Frazer & Lawley, 2000). Alternatively, electronic questionnaire and telephone has been applied in this study since the time constraints in order to get the data for the whole Malaysia. This is because online survey-based questionnaires are practical for a large sample (Mohd Fuzi et al., 2019; Ponto, 2015). More importantly, Abdul-Rashid et al. (2017) asserted that majority of the previous studies in the manufacturing industry have also used the online survey to collect data.

As mentioned by Sekaran (2003), questionnaires are an effective data collection mechanism when the researchers do it in the right way. In this regard, a thoroughly well-designed questionnaire has been distributed using mail to the manufacturing organisations in Malaysia. Aforementioned, this method was used as to ensure the questionnaire form is given to the right person which is from middle management up to top management who can understand better and answer appropriately. In order to have a good questionnaire, Sekaran (2003) emphasized three main points; first refers to the wording of the questions; secondly relates to the issues of how the variables will be coded, categorized and scaled as well as to determine the reliability and validity; the third area focuses to the general appearance of the questionnaire.

Subsequently, for this study, the questionnaire was prepared in bilingual which is English language and Malay as to ensure the potential respondents understand the questions without any misunderstanding because Robbin (2009) wrote in his research method book, “writing the questions should make sense to the target respondents, but not make sense to the researcher”. Therefore, the potential respondents in this study are the middle management up to top management level that involved in implementing the whole operational process of the organisation, especially related to lean manufacturing practices.

3.8 Instrument Development

The development of the instruments is purposely to measure the relevant construct. Henceforth, the instruments constructing in this study ascends from the conceptual framework resultant from a review of existing literature on the subject of lean practice and sustainability as described in previous chapter. The instruments used to gather the data is in the form of questionnaires. Therefore, the questionnaires divided to 5 sections as follows:

Section A:	Companies background information
Section B:	Questions to measure independent variable (lean manufacturing practices) in the manufacturing organisation.
Section C:	Questions to measure dependent variable (sustainability) in manufacturing organisation.
Section D:	Questions regarding moderating effect of ethical climate in the manufacturing organisation.
Section E:	Questions regarding mediating effect of manufacturing performance in the Manufacturing Organisation

The preparation and development of the questionnaire design, scale-item development and wording is prepared based on suggestion Kaplan and Saccuzzo (2009), which is stated that in order to ensure the reliability and validity of the questionnaire, a few things need to concern when developing questionnaires mainly must avoid the ambiguous wording, double barrelled questions, double negative words, jargon and technical terms. Therefore, close-ended questions was design as suggestion by Sekaran (2003) whereby it is good for research because it can ensure the respondents easily capture the purpose of the questions and the data more precise.

Furthermore, a pre-testing of developed questionnaire was executed in order to ensure the validity, relevant, readable, complete and clear. Therefore, the response from academician and manager from several manufacturing organisation is considered in developing the questionnaires. Any feedback and comments is use to enhanced the questionnaires.

The likert scale is used in this study since the scale is a practical and familiar survey format has been used in this study. The Likert scale from 1 to 5 which indicates the low to high or from disagrees to agree. Development of each dimensions were begin from searching for past literature pertaining lean manufacturing practices as depicted in the flow chart 4.1. Suitable questions and dimension will be gathered accordingly. There a few questions that directly adopt from past researchers and also a few questions adapt base on situations. The questionnaires have been attached with a cover letter in order to ensure the respondents understand about the purpose of the questionnaire given.

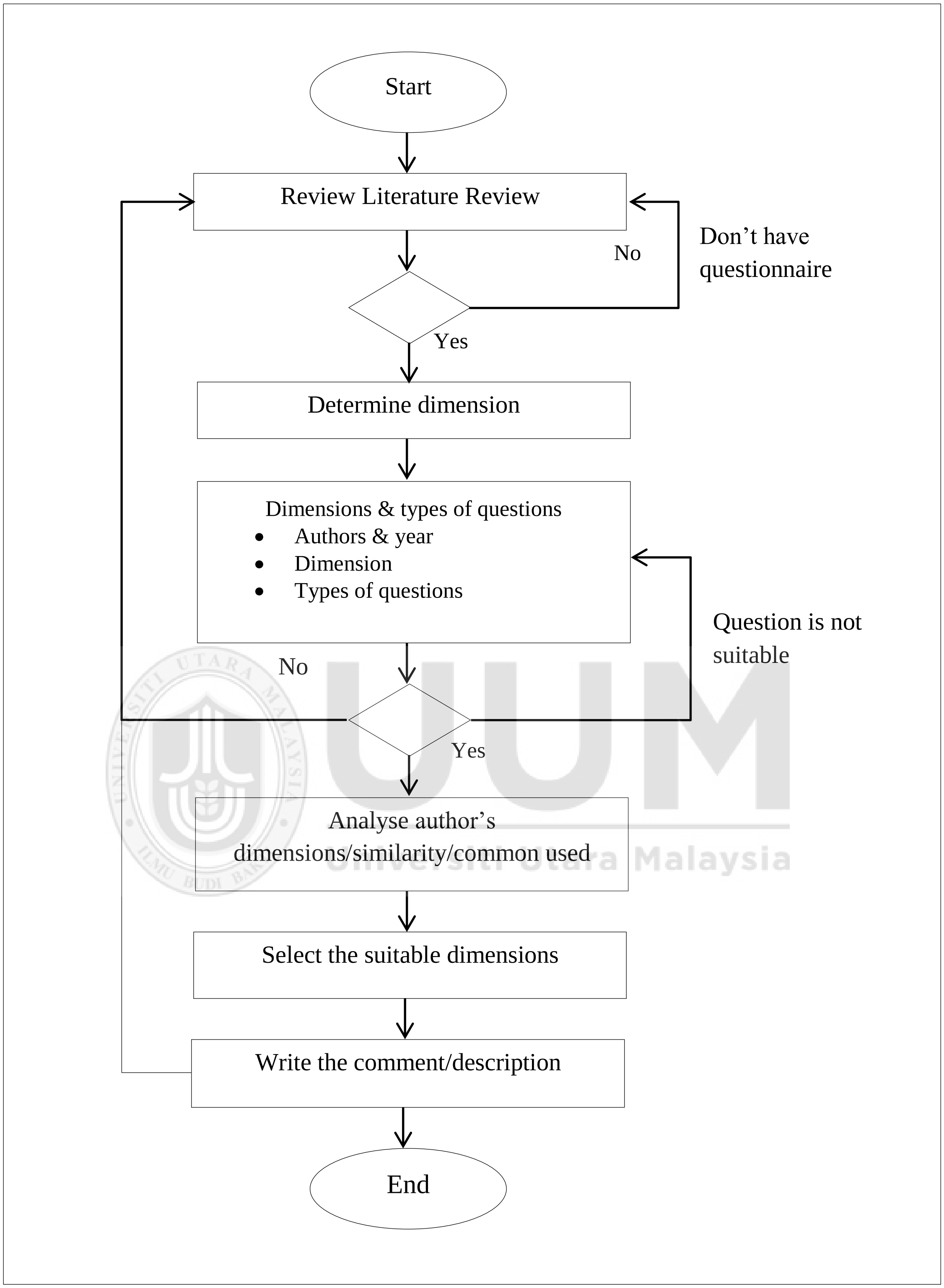


Figure 4. 1
Flow Chart of Instrument Development

3.8.1 Lean Manufacturing Practices Construct and Dimensions

The dimensions and items for independent variables which is lean manufacturing practices were adopt from the past scholarly literature review as shown in table 3.5. These dimensions include cellular layout; pull system/*kanban*; quick changeover technique; total quality management; total productive maintenance; and small lot of production was operationalised using 35 items from Nawanir et al (2013); Doolen & Hacker (2005); Sakakibara et al. (1993). Aforementioned, lean manufacturing practices will be measured by six dimensions. In total, there are 35 items has been used to measure lean manufacturing practices that adapted and adopted from several previous researchers as abovementioned. The items were anchored on a five Likert scale: (1) strongly agree; (2) disagree; (3) neutral; (4) agree; and (5) strongly agree. The appropriate answer is requested to respondents that related with their organisation. The details of each construct are discussed as follows.

3.8.1.1 Lean Manufacturing Practices

a) Cellular layout

b) Pull system/*kanban*

c) Quick changeover technique

d) Total quality management (TQM)

e) Total productive maintenance (TPM)

f) Small lot of production

Table 3. 5

Measurement of Lean Manufacturing Practices

Dimensions/Items	Related sources	Method
Cellular Layout		
1. We group dissimilar machines into work centres (called cells) based on product families (product families can be determined based on shapes/design similarity, processing requirement similarity, or routing requirement similarity).	Nawanir et al. (2013);	Adopt
2. Our processes are located close together, so that material handling and part storage are minimized.	Nawanir et al. (2013);	Adopt
3. The design of the cells/workstations is easily changed depending on the product being manufactured.	Nawanir et al. (2013);	Adopt
4. We have laid out the shop-floor so that processes and machines are in close proximity to each other.	Nawanir et al. (2013);	Adopt
5. The cells/work centers/machines are arranged in relation to each other so that material movement, material handling, and transit times are minimized.	Nawanir et al. (2013);	Adopt
6. Our processes physically move closer together and transportation between stations runs simply.	Nawanir et al. (2013);	Adopt
Pull System/*Kanban*		
1. We use a production system in which items are produced only when called for by the users of those items.	Nawanir et al. (2013);	Adopt
2. Production is performed based on the shipment of goods from previous workstation.	Nawanir et al. (2013);	Adopt
3. We use a production system in which items are produced only in necessary quantities, no more and no less.	Nawanir et al. (2013);	Adopt
4. We use *kanban* to authorize the production or withdrawal the goods.	Nawanir et al. (2013);	Adopt
5. To authorize the order, we use a supplier *kanban* that rotates between factory and suppliers.	Nawanir et al. (2013);	Adopt
6. Production at a workstation is performed based on the current demand of the subsequent workstation.	Nawanir et al. (2013);	Adopt
Quick Changeover		
1. Our shop-floor employees perform their own setups to reduce the time required.	Nawanir et al. (2013);	Adopt
2. Our plant emphasizes the importance of good housekeeping, with tools in their normal storage location.	Nawanir et al. (2013);	Adopt
3. We are aggressively working to lower machine setup times in our plant.	Nawanir et al. (2013);	Adopt
4. We have converted most of our machine setups to external setups that can be performed while the machine is running.	Nawanir et al. (2013);	Adopt
5. We have low machine setup times in our plant.	Nawanir et al. (2013);	Adopt

Table 3.5 (Continued)
Measurement of Lean Manufacturing Practices

	Dimensions/Items	Related sources	Method
a)	**Total Quality Management (TQM)**		
1.	We are always train employees on the usage of statistical tools.	Doolen & Hacker (2005)	Adapt
2.	We are always use statistical tools like control charts.	Doolen & Hacker (2005)	Adapt
3.	We are always measure process capability for key processing steps.	Doolen & Hacker (2005)	Adapt
4.	We are always use continuous process improvement (CPI) tools.	Doolen & Hacker (2005)	Adapt
5.	We are always use experimental design methods to improve operations.	Doolen & Hacker (2005)	Adapt
6.	We are always using Failure Modes and Effects Analysis (FMEA) to identify and control risk or failures.	Doolen & Hacker (2005)	Adapt
7.	We are always seek quality certifications such as ISO.	Doolen & Hacker (2005)	Adapt
8.	We are always apply for quality awards.	Doolen & Hacker (2005)	Adapt
b)	**Total Productive Maintenance (TPM)**		
1.	Our equipment is in a high state of readiness for production at all times.	Sakakibara, et al. (1993)	Adopt
2.	We kept the records of routine maintenance.	Nawanir et al. (2013)	Adapt
3.	We scrupulously clean equipment, tools, workspaces, and machines to make unusual occurrences more noticeable.	Nawanir et al. (2013)	Adopt
4.	We dedicate a periodic inspection and maintenance system to keep machines in operation.	Nawanir et al. (2013)	Adopt
5.	We dedicate a system of daily maintenance, periodic inspection, and preventive repairs designed to reduce the probability of machine breakdown.	Nawanir et al. (2013)	Adopt
c)	**Small Lot of Production**		
1.	We emphasize producing large quantity of items together in a batch.	Nawanir et al. (2013)	Adapt
2.	We are aggressively working to lower lot sizes in our plant.	Sakakibara, et al. (1993	Adopt
3.	We emphasize small lot sizes to increase manufacturing flexibility.	Nawanir et al. (2013)	Adopt
4.	We reduce the average level of inventory by producing in more frequent but smaller lot size.	Nawanir et al. (2013)	Adopt
5.	We tend to have small lot-sizes in our master schedule	Sakakibara, et al. (1993	Adapt

3.8.2 Sustainability Construct and Dimensions

The dimensions and items for dependent variables which is sustainability were derived from the past scholarly literature review as shown in table 3.6. These dimensions include economic sustainability; environment sustainability; and social sustainability was operationalised using 25 items adopted from Hami, Muhamad, & Ebrahim (2016).

Table 3. 6
Construct of Sustainability

Dimensions/Items	Related sources	Method
Economic sustainability		
1. Reduced cost		
2. Improved product quality		
3. Reduced lead times (i.e. time between when customer order is made and when the order is completely satisfied)		
4. Improved customer service.		
5. Increased productivity		
6. Increase revenues		
7. Increased market share		
8. Improved reputation		
9. Better new market opportunities		
Environment Sustainability		
1. Reduced water usage		
2. Reduced energy consumption		
3. Reduced non-renewable resources usage	Hami et al. (2016)	Adopt
4. Reduced hazardous inputs usage		
5. Reduced solid waste		
6. Reduced waste water emissions		
7. Reduced emission of polluting gases		
Social sustainability		
1. Increased employee satisfaction		
2. Better recruitment and staff retention		
3. Increased occupational health and safety		
4. Improved employee education and skill		
5. Improved supplier commitment		
6. Increased certified suppliers		
7. Increased customer satisfaction		
8. Increased public health and safety		
9. Reduced local community complaint		

3.8.3 Manufacturing Performance Construct and Dimensions

The questions were adopted from Nawanir et al., (2013); Al-Jawazneh (2012); and adapted from Gibson et al. (2003). Table 3.7 shows the details of dimensions and construct of the questionnaires that comprises of 24 questions.

Table 3. 7
Construct of Manufacturing Performance

Dimensions/Items	Related sources	Method
Quality		
1. Products that do not meet the quality specifications have reduced.	Nawanir et al. (2013)	Adopt
2. We have superior quality of products compared to our competitors'.	Nawanir et al. (2013)	Adopt
3. Activities in fixing defective products to conform to the quality specifications (reworks) have reduced.	Nawanir et al. (2013)	Adopt
4. Poor quality products that must be discarded (scraps) have reduced.	Nawanir et al. (2013)	Adopt
5. The percentage of product that passes final inspection the first time (first-pass quality yield) has increased.	Nawanir et al. (2013)	Adopt
6. We have superior quality of service compared to our competitors'.	Nawanir et al. (2013)	Adopt
7. We can produce consistent products with low defects rate.	Al-Jawazneh (2012)	Adopt
Delivery		
1. Our ability to deliver products to the market quickly has increased.	Nawanir et al. (2013)	Adopt
2. Our ability to deliver products to the customer as promised has increased.	Nawanir et al. (2013)	Adopt
3. We are capable of delivering products to the market faster than our competitors.	Nawanir et al. (2013)	Adopt
Flexibility		
1. We can vary product combinations from one period to the next.	Al-Jawazneh (2012)	Adopt
2. We can produce a wide variety of products in our plants.	Al-Jawazneh (2012)	Adopt
3. We can produce different product types without major changeover.	Al-Jawazneh (2012)	Adopt
4. We can changeover quickly from one product to another.	Al-Jawazneh (2012)	Adopt

Table 3.7 (Continued)

	Dimensions/Items	Related sources	Method
	Time		
1.	Our team able to meets deadlines of customer's order.	Gibson et al. (2003)	Adapt
2.	Our team is not wastes time.	Gibson et al. (2003)	Adapt
3.	Our team provides deliverables (e.g. products, or services) on time.	Gibson et al. (2003)	Adapt
4.	Our team is work aggressively.	Gibson et al. (2003)	Adapt
5.	Our team adheres to its schedule.	Gibson et al. (2003)	Adapt
6.	Our team takes a reasonable amount of time to complete its work.	Gibson et al. (2003)	Adapt
	Cost		
1.	Unit manufacturing cost has reduced.	Nawanir et al. (2013)	Adopt
2.	Our unit manufacturing cost is lower than our competitors.	Nawanir et al. (2013)	Adopt
3.	Internal failure costs (i.e., defect, scrap, rework, process failure, price reduction, and downtime) have reduced.	Nawanir et al. (2013)	Adopt
4.	External failure costs (i.e., complaints, returns, warranty claims, liability, and lost.	Nawanir et al. (2013)	Adopt

3.8.4 Ethical Climate Construct and Dimensions (Moderating Variable)

The moderating variable in this study refers to ethical climate. The original instruments to measure ethical climate were from Victor and Cullen (1987). The researcher took 26 items after validation has been made by the experts to suit for this study. Table 3.8 shows the details of dimensions and construct of the questionnaires that comprises of 26 questions.

Table 3. 8
Construct of Ethical Climate

Dimensions/Items	Related sources	Method
1. Efficient is the major responsibility for employees in this company.	Victor & Cullen (1987)	Adapt
2. Employees are expected to do anything to further the company's interests.	Victor & Cullen (1987)	Adapt
3. It is very important to follow strictly the company's rules and procedures here.	Victor & Cullen (1987)	Adopt
4. Work is considered substandard when it affects the interests of the company.	Victor & Cullen (1987)	Adapt
5. Company only concern all the good deed in the company.	Victor & Cullen (1987)	Adapt
6. The first consideration is whether a decision violates any law.	Victor & Cullen (1987)	Adapt
7. Employees in this company are expected to comply with the law and professional standards and on other considerations.	Victor & Cullen (1987)	Adapt
8. Everyone is expected to stick by company rules and procedures.	Victor & Cullen (1987)	Adapt
9. Employee in this organisation are actively concerned about the customer's and the public's interest.	Victor & Cullen (1987)	Adapt
10. Successful employee in this company go by standard operation procedure (S.O.P).	Victor & Cullen (1987)	Adapt
11. The most efficient way is always the right way, in this company.	Victor & Cullen (1987)	Adopt
12. In this company, employee are expected to strictly follow legal or professional standards.	Victor & Cullen (1987)	Adapt
13. Our major consideration is what is best for everyone in the company.	Victor & Cullen (1987)	Adopt
14. Successful employee in this company strictly obey the company policies.	Victor & Cullen (1987)	Adapt
15. In this company, the law or ethical code of theft profession is the major consideration.	Victor & Cullen (1987)	Adopt
16. In this company, each person is expected, above all, to work efficiently.	Victor & Cullen (1987)	Adopt
17. In this company employees are mostly going out to settle both, work matters and personal matters during working hour.	Victor & Cullen (1987)	Adapt
18. In this company, employees are expected to follow their own personal and moral beliefs.	Victor & Cullen (1987)	Adapt
19. In this company, employees look out for each other's good.	Victor & Cullen (1987)	Adapt

Table 3.8 (Continued)

Dimensions/Items	Related sources	Method
20. There is no room for one's own personal morals or ethics in this company.	Victor & Cullen (1987)	Adapt
21. Each employee in this company decides for their self what is right and wrong.	Victor & Cullen (1987)	Adapt
22. In this company, employees protect their own interest.	Victor & Cullen (1987)	Adapt
23. The most important consideration in this company is each person's sense of right and wrong.	Victor & Cullen (1987)	Adapt
24. In this company, our major concern is always what is best for the other person.	Victor & Cullen (1987)	Adapt
25. In this company, employees are guided by their own personal ethics.	Victor & Cullen (1987)	Adapt
26. It is expected that company will always do what is right for the customer and public.	Victor & Cullen (1987)	Adopt

3.9 Analysis of Instrument Validity

There are three major criteria for assessing a measurement tool mainly validity, reliability and practicality (Cooper & Schindler, 2008). The internal validity means the ability of the particular instrument which has been developed to measure the things that need to be measure whereas reliability is referred to evaluating the output consistency of an assessment test over time. The most important thing while developing the instruments is the practicality in terms of convenience and interpretability. Subsequently, this study has taken the questions from the previous study so that the validity of the questions can be ensured. Nonetheless, there a few questions are refined specifically for this study. According to Sekaran (2003), content validity is crucial in order to ensure the suitability of the questions on the particular study. Therefore, this study performed pre-test which is involved the expert panel from industries and academician to seek their expert opinion.

3.9.1 Pre- Test

Once the initial questionnaire for this study has been developed, some types of test are performed to ensure the goodness of the measure. Face and content validity testing is first established to verify that the measure adequately represents the domain of the concept being measured (Sekaran, 2006).

Face validity has been used to modify the measurement items by interviewing the experts such as operation management of manufacturing organisations at the selected firms, together with four academicians from the educational institutions. These experts have been chosen based on their extensive knowledge, vast experience and motivation to assess the items of each construct and approve it after the judgment has made. From the abundant interview and discussions with the experts, numbers of items were adjusted and revised as to see the suitability of each relationship for the purpose of this study. Alluding to Hardesty and Bearden (2004), validity is needed in order to ensure the assessment instruments are reflecting what is proposed to measure in the study at once can meet the objective.

3.9.2 Content Validity

Kumar, Talib and Ramayah (2013) has defined content validity as the level of which the instrument fully measures the construct of interest. Consequently, the researcher decided to assign and select eight (8) Subject Matter Experts (SMEs) in manufacturing organisations and in academic field as showed in table 3.9 and table 3.10 before distribute the questionnaires to the respondents. Content validity is very important because to ensure the questions is clear and the respondents could understand the questions the way they are planned and projected as suggested by Sekaran (2003) in previous study. In connection with that, there were at least two experts from academic institutions has been involved to check a several criteria as suggested by Kumar et al., (2013) for instance wording for each instruments, the language and understanding of the questions, the arrangement of the questions and the vibrant instructions to all the respondents.

In conjunction to that, manufacturing industry has been represented by four (4) experts from different organisation that has been asked their wise opinion related to the selected variables and the suitable content as well as to govern the acceptance or removals of the question. Meanwhile another four (4) experts from academic filed has been chosen to validate the questionnaires. The experts have been validated, examined, and counselled regarding the questions from the set of instruments and at once to make it easy understanding among the potential respondents based on the expert's review form as shown in appendix 7.

The feedback, comments and recommendations from the experts were considered to improve the quality of the measure. Some of the comments are presented in table 3.9 based on the inputs gathered from the experts, minor modifications are made to the questionnaires.

Table 3. 9

SMEs among Practitioners

No	Backgrounds and Qualifications
1.	Assistant Manager *Panasonic AVC Networks Johor Malaysia Sdn. Bhd.*
2.	Senior Manager *Denso (M) Sdn Bhd*
3.	Quality Control Manager *Sony EMCS (Malaysia) Sdn Bhd*
4.	Manager of Industrial Engineering Department *Kawasaki Motors (Malaysia) Sdn Bhd*

Table 3. 10

SMEs among Academicians

No	Backgrounds and Qualifications
1.	Senior Lecturer, *PhD. Maintenance Engineering, Universiti Sains Malaysia, Penang*
2.	Lecturer, *PhD. Manufacturing Engineering, UniMAP*
3.	Senior Lecturer, *Master in Manufacturing Engineering, UniMAP*
4.	Senior Lecturer, *Master in Mechanical Engineering, UTHM*

3.9.3 Summary of Reviewers' comment

The comments from reviewers or subject matter experts (SMEs) was very important in order to ensure that questionnaires that will be used are valid. Therefore, the process after completion of validity procedures has been summarize as depicted in table 3.11. Based on the inputs gathered from the experts, minor modifications are made to the questionnaires.

Table 3. 11

Summary of Reviewers' Comments

Subject Matter Experts (SMEs)	Comments	Action
Academician	It is advisable the name of the organisation in the section A should not be included in the report. Revise the item of “151 and more” in question 3 section A Change the sentence of “process failure modes and effects analysis (PFMEA)” in question no 23 section B Change the sentence of “less than 1 year and more than 3 years” in question 5 section A The questions of “how long have you been with the company” is asking about individual unit of analysis but this study is using organisation as a unit of analysis Some of the sentences should be written short and clear.	The name of organisations is not include in the report The item of “151 and more” was revised to “151 and above” The sentence of the sentence of “process failure modes and effects analysis (PFMEA) was changed to “failure modes and effects analysis (FMEA) The sentence of “less than 1 year and more than 3 years” was changed to “<1 year and >3 years” The questions of “how long have you been with the company” was deleted.
Industry professional	Need to add Government Linked Company (GLC) and others in type of company in section A.	Government Linked Company (GLC) was added in the type of company in section A
	The sentence in section E (ethical climate) should be revised eg: People	The sentence in section E (ethical climate) was revised. The usage of term “people” was changed to “employee”.
	Revise the item of “successful people in this company go by the book” in question no 10.	The item of “successful people in this company go by the book” was revised to be “successful employee in this company go by the standard operation procedure (SOP) as advised by SMEs.
	Considering the unit of analysis for this study is organisation, need to revise the item of “it is expected that you will always do what is right for the customer and public” in question no 26.	The item of “it is expected that you will always do what is right for the customer and public” was revised to “it is expected that company will always do what is right for the customer and public” is suggested from SMEs

3.9.4 Pilot Test

Having confirmed the content validity of the measure, a pilot test is performed to test and refine the measure (i.e questionnaire) before the actual survey takes place. Using the different respondents from the population to be studied, the indicator variables are screened for appropriateness. The testing was important to ensure that the indicators were understood by the respondents and there were no problems with the wording of the measure (Sekaran, 2006). It was particularly important as indicators designed in the current study were applied in specific context (Hair, Tatham, Anderson, & Black, 2006).

A set of questionnaire has been sent by mail and using electronic questionnaire to manufacturing firms located in Malaysia. In total, 50 copies of questionnaires were sent out, with 30 copies received back. The collected data was analyzed to ascertain the reliability of the measure. The reliability of a measure was an indication of stability and consistency with which the indicator variables measure the concept (i.e respective constructs) and help to assess the goodness of the measure (Sekaran, 2006).

Cronbach's coefficient alpha has been employed to test the interim consistency reliability, which is related to the consistency of respondents; answers to all the indicators in a measure. Using the IBM SPSS scale-reliability analysis procedure, an internal consistency analysis is performed for ach set of indicator variables, separately. The result of the test is shown in table 3.12.

As presented in table 3.12, the value of Cronbach's alpha (α) ranging from 0.74 to 0.96 demonstrate the high internal consistency reliability of the constructs as recommended threshold value of 0.70 (Nunnally, 1978), thus proving the reliability of these constructs.

Table 3. 12
The Analysis of Interim Consistency Reliability

Construct	Number of items	Cronbach's alpha (α)
Lean manufacturing practices	35	0.96
Cellular manufacturing	6	0.83
Pull System	6	0.86
Quick changeover	5	0.81
TQM	8	0.91
TPM	5	0.81
SLP	5	0.86
Sustainability	25	0.94
Economic	9	0.91
Environment	7	0.90
Social	9	0.89
Manufacturing Performance	24	0.96
Quality	7	0.91
Delivery	3	0.84
Flexibility	4	0.81
Time	6	0.90
Cost	4	0.74
Ethical Climate	26	0.96
Egoism	9	0.89
Benevolence	5	0.87
Principle	12	0.91

3.10 Method of Data Analysis

Data analysis will be used to analyze statistically from the data collected in order to see if the hypothesis development based on the previous literature has been supported (Sekaran & Bougie, 2016). Therefore, the researcher employed SPSS software for descriptive statistics and SmartPLS was used for inferential statistics.

Generally, analysis of data has been lead through different stages. First, initial analysis was conducted at early stage which was data screening and cleaning in order to check any abnormalities through SPSS. Correspondingly, it indicated any missing or outlier data. Then, descriptive analysis also has been conducted using SPSS software for the determination of the demographical features of the sample of the study such as percentage of firms involved etc. Second, the researcher employed SmartPLS for inferential statistics. Thus, Table 3.13 exhibited the summary of research objectives, research hypothesis and types of data analysis.

Table 3. 13
Research Objectives, Research Hypothesis and Types of Data Analysis

No	Research Objectives	Research Hypothesis/ testable statement	Data Analysis
RO1	To examine the relationship between lean manufacturing practices and sustainability in the manufacturing organisation	H1:There is a relationship between lean manufacturing practices and sustainability in the manufacturing organisation.	Structural model of PLS-SEM using Smart PLS 3
RO2	To examine the relationship between lean manufacturing practices and manufacturing performance.	H2:There is a relationship between lean manufacturing practices and manufacturing performance?	Structural model of PLS-SEM using Smart PLS 3
RO3	To examine the relationship between manufacturing performance and sustainability.	H3:There is a relationship between manufacturing performance and sustainability.	Structural model of PLS-SEM using Smart PLS 3
RO4	To determine the relationship between ethical climate and manufacturing performance	H4:There is a relationship between ethical climate and manufacturing performance	Structural model of PLS-SEM using Smart PLS 3
RO5	To examine the mediating effect of manufacturing performance in between lean manufacturing practices on sustainability.	H5:Manufacturing performance is mediate variable that influence of lean manufacturing practices on sustainability.	Structural model of PLS-SEM using Smart PLS 3
RO6	To examine the moderating effect of ethical climate of lean manufacturing practice on manufacturing performance.	H6:Ethical climate is moderate influencing lean manufacturing practices on manufacturing performance.	Structural model of PLS-SEM using Smart PLS 3

3.10.1 Data Entry Errors

Page and Meyer (2000) stated that when inserted the data into the SPSS, the data entry error was the most common source of errors and generally it occurred. Therefore, in order to identify any errors before continuing with the analysis of descriptive and inferential statistics, the data checking has been treated seriously because it deals with analysis data that resultant from primary data.

Data entry errors have been identified using SPSS through descriptive statistics and check all variables so that there is no error output for minimum and minimum values. Basically, incorrect keyin of value usually occurs if the researcher enters manually. However, this study uses an online survey of the goole form, so the chances of misplacing it were low. As a result, this study did not face data entry problems.

3.10.2 Missing Value

In line with data entry error, Page and Meyer (2000) also indicated that missing value or data was existed that initiated by the data errors. Hair, Hult, Ringle and Sarstedt (2014) revealed that it is most often problem in a social science research. Therefore, Page and Meyer (2000) and Hair et al., (2014) have delineated some causes of missing value which includes answer not required, had trouble to answer, answer uncertain, reluctant to answer and finally answer unknown or respondent have no idea. In conjunction to that, Kumar (2013) asserted that treatment of handling missing data is very crucial. Consequently, Hair et al., (2014) mentioned that there are two techniques are being suggested to handle the missing data which is mean replacement and casewise deletion. Contrariwise, there are another three approaches that comprise listwise deletion, pairwise deletion and replacing the missing value as proposed by Kumar (2013).

Subsequently, the missing value has been checked using SPSS through descriptive statistics and check all the variables so that there was no missing value. As mentioned above, this study uses an online survey of goole forms, so the chances of missing key in data were zero as respondents were required to fill in all questions before submitting. As a result, fortunately this study did not face any missing value problems.

3.10.3 Treatment of Outliers

In subsequent step, the existence of outlier need to be scrutinized. According to Hair et al., (2014) and Kumar et al., (2013) stated that outlier is there are the case extreme scores to a certain question which contribute the higher outcome or extreme scores or responses to all questions. For that reason, Kumar et al., (2013) commended that the data set should be checked for both univariate and multivariate outliers in order to overcome any biased result. Nevertheless, whether to exclude or include outliers from a data analysis, it depends on the causes. Contrariwise, Hair et al., (2014) proposed to directly remove the outliers once it is detected in a data.

Outlier refers to an extreme response to a particular or all questions in a survey questionnaire (Hair et al., 2017). For this study, detection of outliers was performed using box plot diagrams and Mahalanobis distance (D2) in SPSS software. As suggested by Pallant (2016), box plot diagrams were used to detect outlier cases (responses) in univariate situations. On the other hand, Mahalanobis distances were used to detect outliers in multivariate situations as recommended by Hair Jr et al. (2010) and (Byrne, 2016).

Additionally, SPSS defines points of outliers in a boxplot diagram if the items exceeded beyond 1.5 box-lengths from the edge of the box and were considered extreme when beyond 3 box-lengths (Pallant, 2016). Meanwhile, Hair Jr et al. (2010) suggested that Mahalanobis distance value divided by the number of variables involved (i.e. D2/df) for every case (response) which exceeded 2.5 can be considered as potential outlier.

3.10.4 Test of Multicollinearity

Multicollinearity is the final step of data screening and cleaning. Multicollinearity is defined as statistical phenomenon when two or more independent variables in a multiple regression model are highly correlated (Kumar et al., (2013); Sekaran and Bougie (2013). Find the correlation matrix for the independent variables is the easiest method to discover multicollinearity. It is considered the first sign of sizeable multicollineraity if the correlations value is 0.70. Moreover, measuring tolerance value and the variance inflation factor (VIF) also can be used to identify multicollinearity which will be elucidated in the subsequent section.

3.11 Descriptive Statistics and Inferential Statistics

There were two prior reasons in order to analyze the data which contains descriptive statistics and inferential statistics (Kumar et al., 2013). Meanwhile, Sekaran and Bougie (2013) defined descriptive analysis was derived from maximum, minimum, means, standard deviations and variance of each variable. In a nutshell, according to Kumar et al. (2013) the purpose of descriptive statistics and inferential statistics to organize and summarize the data. Previous scholars such as Sekaran and Bougie (2013) and Kumar et al. (2013) agreed that inferential statistics refer to establish the relationships among variables using various tests of significance, such as univariate analysis or bivariate analysis.

In response to this study, descriptive analysis was performed for the purpose of this study in evaluating the basis statistical description of constructs used. The calculation of statistical values such as means and standard deviation were conducted for all constructs such as independent, mediating, moderating, and dependent. Meanwhile, for the inferential statistic, this study employed SmartPLS which is need to analyze two models namely: measurement model and structural model that will be explained in the subsequent section. Aforementioned, after obtaining the result it intends to test hypothesis and then an assumption could be concluded. Furthermore, Kumar et al. (2013) stated that descriptive statistics will deal with frequency distribution and also to describe the respondent's profile. On the other hand, inferential analysis was highlighted with the process of by considering at testing statistical hypotheses and the association between sample statistics and population parameter.

3.11.1 Partial Least Square (PLS)

Structural Equation Modeling (SEM) has been widely used in business and social sciences in order to solve the statistical techniques (Hair, Hult, Ringle, & Sarstedt, 2017). Structural equation modeling (SEM) also uses numerous types of models to portray relationships among observed variables, with the same basic goal of providing a quantitative test of a theoretical model hypothesized by the researcher (Schumacker & Lomax, 2004). Shah and Goldstein (2006) mentioned that recently the application of SEM has better acceptation and increased especially in publishing articles in Operation Management journals and empirical research. In conjunction to that, this study has been conducted using SmartPLS software application to analyses the data.

Wong (2013) stated that this useful software that has been developed by Ringgle, Wende and Will which had launched since 2005 was widely used among researchers due to user friendly for the interface, systematic in reporting and the most important thing is freely access. Furthermore, PLS has been the most fully developed that proficient to describe variance of endogenous constructs compared to other variance-based SEM methods (Henseler et al., 2016).

Consequently, Hair et al. (2014) revealed that most of the scholars interested and widely used PLS-SEM especially in the social sciences due to the capability in handling problematic modeling issues. Nonetheless, several justifications have been established to rationalize the PLS-SEM application as to cultivate trust of acceptance among scholars. According to Hair et al. (2014), there are three noteworthy reasons which are small sample sizes, non-normal data, and formatively measured constructs. On the other hand, another reasons in using PLS approach have been justified by Roy, Tarafdar, Ragu-Nathan and Marsillac (2012) in their study which are formative latent variable can be tested by scholars independently; sample size can be compromising, expectations about the normality of the data or residual distributions; and the latest software in accordance with the PLS approach has been facilitated such as SPADPLS, Visual PLS, SmartPLS and PLS Graph.

Nonetheless, the prior reason of choosing PLS analysis for this study as stated by Hair et al. (2014) is due to the capability of PLS in assessing a complex model set-ups or multiple measurement items which includes many variables such as mediating, moderating or hierarchical component models. Besides, there were three reasons of choosing PLS-SEM as an appropriate approach for statistical analysis tool by Hadid, Mansouri and Gallear (2016). It encompasses (1) PLS-SEM proficient to measure both formative and reflective latent (unobservable) variables, (2) PLS-SEM decreases the assumption of multivariate normality and; (3) PLS-SEM permit to capture small sample sizes. According to Hair et al. (2017), the result of the statistical method are still robust and the model is generalizable even though the minimum sample size has been used. In response to this study, since the researcher had found all the indicators reflected to the constructs in the research framework, it is important to meet the criteria of evaluation reflective measurement models.

Accordingly, there were two sub models in a PLS path model namely outer model and inner model. For the outer model were also known as measurement models which exhibited the relationships between the constructs and the indicator variables. Notwithstanding, the second model denotes to the inner model or structural model shows the relationships (paths) between the constructs (Hair et al., 2017; Wong, 2013). The explanation of both models has been elucidated in the subsequent section. Figure 3.14 shows a simple path of measurement models.

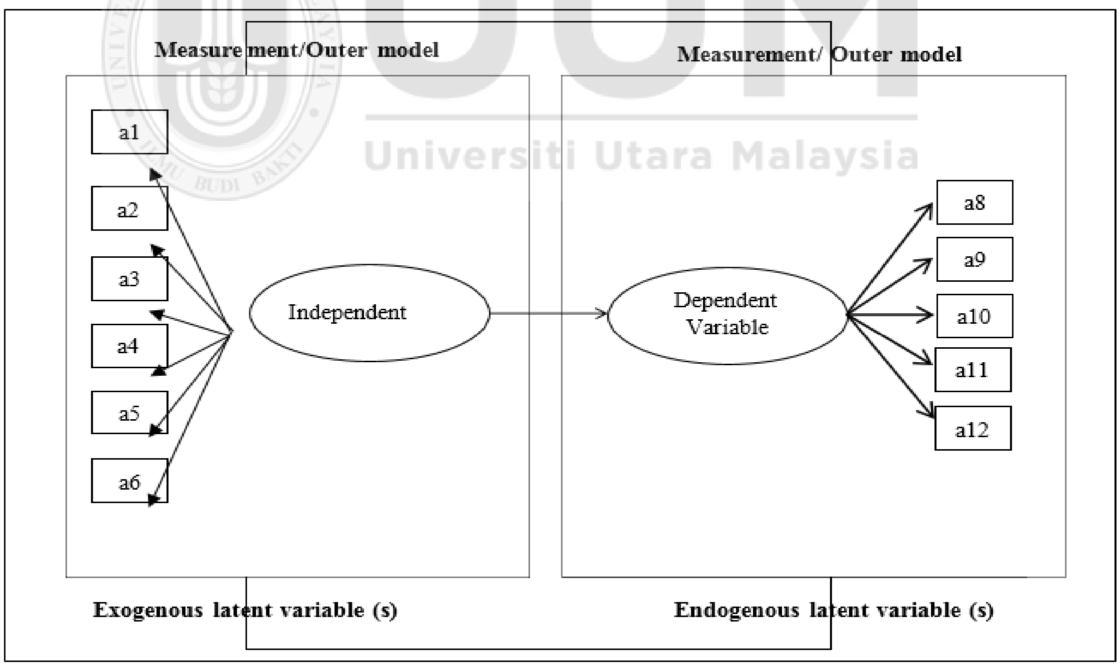


Table 3. 14
A Simple Path Model
Source: Hair et al. (2017) and Wong (2013)
SEM terminology - That CB-SEM and PLS-SEM is normally used when developing latent

variables in SEM which have their own specific term to differentiate each variable. Fundamentally, independent variable (IV) entitled as exogenous, dependent variable (DV) denoted as endogenous variables, while mediator represented by intervening variable whereas moderator stands as moderator. According to Hair et al. (2017) the summarization of SEM terminology has been used in the context of PLS-SEM as one of the approaches in estimating the relationships which presented in Table 3.7 below.

Figure 3. 7
SEM Terminology for Studied Variables

Variable	**Variable measured**
DV Endogenous	Sustainability
IV Exogenous	Lean Manufacturing Practices
MV Mediator/intervening	Manufacturing Performance
MV Moderator	Ethical Climate

3.11.1.1 Measurement Model

The first step of PLS analysis is the evaluation of the measurement model. This part is crucial because it reveals to fulfill the certain criteria of reliability and validity. According to Rigdon, Ringle and Sarstedt (2015), it necessity to be linked with reflective and formative outer models. In the same way, measurement model specifically associated with reflective and formative measurement model which analyzing the measures of reliability and validity that stated by Henseler et al. (2016). Consequently, reflective and formative model is crucial to be differentiated. Aforementioned, a reflective measurement model has connections from the latent variable to its indicators (J. F. Hair et al., 2014). On the other hand, formative measurement models have relationships from the indicators to the latent variable.

In addition, measurement model was an element of a path model that contains the indicators and their relationships with the constructs. It was also called the outer model in PLS-SEM (Hair Jr et al., 2017). In this study, measurement model analysis was performed using PLS Algorithm function in SmartPLS 3.2.8 software (Ringle, Wende, & Becker, 2015) to assess construct reliability and validity.

Measurement model analysis includes the assessment of; i) i) Cronbach's alpha (α) and composite reliability (ρc) to indicate internal consistency, ii) outer loadings to specify individual indicator reliability, iii) average variance extracted (AVE) to accomplish convergent validity, and iv) discriminant validity through cross-loadings, Fornell-Larcker criterion, and Hetereotrait-Monotrait (HTMT) ratio (Hair et al., 2017).

Furthermore, this study applied second order measurement model since construct under studies (i.e. lean manufacturing practices, ethical climate, manufacturing performance, and sustainability) were regarded as multi-dimensional variables, consistent with previous studies (Habidin, 2012; Iteng, 2013; Nawanir, 2015; Todorova, 2013). Conventionally, second order measurement model assessment in PLS-SEM was conducted through "repeated indicator" approach (Becker, Klein, & Wetzels, 2012). However, the correct AVE will not appear in the result output, hence researchers need to do the appropriate calculation manually (Marko Sarstedt, Hair, Cheah, Becker, & Ringle, 2019). Due to this limitation, this study employs another technique called "two-stage approach" as suggested by Ringle, Sarstedt, & Straub, (2012). Likewise, this approach is also recommended by Sarstedt, Hair, Cheah, Becker and Ringle (2019) as it minimise parameter bias in the structural model relationships testing. This technique is called "two-stage approach" because:

i) Stage One: Researchers need to apply repeated indicator approach (Becker et al., 2012) to obtain latent variable scores of the first order constructs.

ii) Stage Two: Previously obtained latent variable scores were used as the manifest variables to establish second order constructs.

Then, measurement model was further assessed by verifying the discriminant validity. Three (3) types of test were involved in assessing the discriminant validity namely; i) cross-loadings comparison, ii) Fornell and Larcker (1981) criterion, and iii) HTMT ratio. Cross-loadings refer to an indicator's (i.e. item's) correlations with other constructs in the model. In order to establish the discriminant validity, indicator's (i.e. item's) outer loading on the associated construct must be greater that any of its cross-loadings on other construct (Hair Jr et al., 2014, 2017).

Next, the second approach to specify discriminant validity was the Fornell-Larcker criterion (Fornell & Larcker, 1981). Fornell-Larcker criterion was a measure of discriminant validity that compares the square root of each construct's AVE with its correlations with all other constructs in the model. In particular, the square root of each construct's AVE must be greater than its highest correlation with any other construct. It means a construct must share more variance with its associated indicators (i.e. items) than with any other construct (Fornell & Larcker, 1981; Hair Jr et al., 2014).

Recent criticism on the cross-loadings approach and Fornell-Larcker criterion to examine a lack of discriminant validity under several circumstances have led to the suggestion of using HTMT ratio to assess discriminant validity (Hair Jr et al., 2017; Henseler, Ringle, & Sarstedt, 2015). HTMT is the ratio of the between-trait correlations to the within-trait correlations. HTMT is the mean of all correlations of indicators across constructs measuring different constructs relative to the mean of the average correlations of indicators measuring the same construct (Henseler et al., 2015). As such, this study also tests discriminant validity using this newly proposed method. In addition, HTMT value that was greater than .85 (R. B. Kline, 2011) or .90 (Gold, Arvind, & Segars, 2001), indicates a problem of discriminant validity.

3.11.1.2 Structural Model

In subsequent, the structural model need to be evaluated. Basically, according to Sang, Lee and Lee (2010), the purposed of structural model or inner model is to specifies the causal relationships between the constructs which concern an estimation of the path coefficients (the strength of the relationship between independent and dependent variables is referred). Once measurement models are done, then followed by structural model that need to be conducted in order to analyze the standardized path coefficients between variables because the combination of measurement models and structural model are vital to make the structural equation model more comprehensive as stated by Urbach & Ahleman (2010).

Besides, structural model analysis or also known as the significance testing was the process of testing whether a certain result likely has occurred by chance. It involved testing whether a path coefficient was truly different from zero in the population. Assuming a specified significance level, the null hypothesis of no effect (i.e., the path coefficient is zero in the population) is rejected if the empirical t-value (as provided by the data) is larger than the critical t-value. Empirical t value is the test statistic value obtained from the data set at hand, while critical t-value is the cut-off or criterion on which the significance of a coefficient is determined (Hair et al., 2017).

Moreover, analysing the structural model involves assessing basic measures such as coefficient of determination (R2), path coefficient (β) and the empirical t-values (t-statistics) (Hair Jr et al., 2014, 2017). Nevertheless, several additional measures such as confidence interval (Hahn & Ang, 2016), effect sizes (f2) and predictive relevance (Q2) (Soto-Acosta, Popa, & Palacios-Marqués, 2016; Soto-Acosta et al., 2016), were also recommended for a more comprehensive reporting.

3.12 Data Collection Procedures

Data collection has the procedures that need to be followed in order to get the reliable result of data analysis. There were four (4) stages involved in collecting the data which will be elucidated as follows:

3.12.1 First Stage

The preliminary step was concentrated on the setting up thoroughly of instruments (questionnaires) that previous literature in chapter two (2) as reference and guided. Subsequently, content validity has been done among selected SMEs which involved four (4) industry professional and four (4) academicians. Afterwards, based on response from SMEs, the questionnaire has been refined and adjusted accordingly.

3.12.2 Second Stage

Next, for the second stage has been distributed the questionnaire through online survey among the top management that consist of managerial level and middle level of manufacturing organisations in Malaysia such as General Manager, Operational Manager, Head of Department, Engineers or any managerial level. The formal address of the office, contact number and email addressed were attained through the directory of Federation of Malaysian Manufactures (FMM) 2017. All the particulars were very essential to make sure the process of collecting the data are running smoothly.

3.12.3 Third Stage

The following step was preparation for uncertainty for instance the prediction of non-responses for not answering the questions. Previous study in manufacturing organisations indicated low response rate. Consequently, it was an appropriate to follow-up the respondents through phone call or emails in order to give gentle reminder to them. This action might be able to give positive feedback to increase the number of response rate.

3.12.4 Fourth Stage

The stage for data collection was to analyze the data with the target to examine the influence of lean manufacturing practices towards sustainability in the Malaysia's manufacturing organisations. In line with that, SPSS version 25 and SmartPLS 3.2.8 has been used to analyses the data. Yet, descriptive statistics has been analyzed using SPSS version 25 whereas data analysis has been conducted using SmartPLS3.2.8 for inferential statistics.

3.13 Summary of the Chapter

This chapter presented and explained the details of theoretical framework along with in-depth discussion about resource based view theory (RBV) and stake holder theory to provide logical explanation on connections between Lean manufacturing Practices with Sustaianbility and moderating effect of ethical climates and mediating effect of manufacturing performance. The research framework is further described by defining each proposed variable to suit the context of this study. In addition, this study adopts positivism philosophical stance and deductive reasoning as the approach to theory development.

Besides, this chapter also deliberates the route of designing the research methodology for this study. Research was conducted in quantitative study by engaging descriptive study and to examine the relationship between variables as discuss in chapter two (2). The organisation has been as the unit of analysis which includes middle level of management up to top management in Malaysia's manufacturing organisation. In order to generalize the result, the simple random technique has been choosing as representative of the target population. The design of the instruments was organized, and has been validated by the Subject Matter Experts (SMEs) through content validity in order to confirm the item of each section is reliable and can be established to use for the data collection. Finally, SPSS version 25 and SmartPLS 3.2.8 has been used for the purpose of descriptive statistics and inferential statistics respectively.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Introduction

This chapter presents the results of data analyses and hypothesis testing to answer the research questions and fulfil the research objectives. This chapter consists of four important parts which involve; i) data examining procedures to ensure the dataset is error free, ii) testing of biases to confirm the dataset is valid and reliable, iii) measurement model assessment to test the validity and reliability of constructs under study, and iv) structural model assessment to the test the hypothesised relationships between the constructs. Statistical analysis techniques were performed using SPSS version 25 software for data examining procedures, while SmartPLS version 3.2.8 was used to perform measurement and structural model assessments.

4.2 Response Rate

As discussed in Chapter Four, a total of 2,368 manufacturing companies in Malaysia including Sabah and Sarawak was listed as population of the study. In the data collection stage, the total of 355 eligible respondents to represent 335 manufacturing organisations were derived from the directory of the Federation of Malaysian Manufacturers (FMM) were distributed through online survey via mail to the targeted respondents since the end of December 2017. The sample companies were expected to return completed questionnaires within 14 to 30 days after the receipt. Starting from 20 days after the distribution date, the non-response companies were reminded through telephone and e-mail in attempting to maximize response rate. After six months, 102 online survey were completed and returned.

As a result, this study has achieved 30.5% response rate, hence met the acceptable requirement. Sekaran and Bougie (2016) stated that a 30% response rate was considered acceptable for online or web survey in many cases. In fact, this study has acquired larger response rate compare to previous studies in the same research context, which commonly not more than 25% (Daud & Zailani (2011); Iteng (2013); Mohamed Ismail (2014); Nordin, Md Deros, & Abd Wahab (2010); (Wong, Wong, & Ali (2009). Hence, a test for checking the non-response error or bias was conducted and discussed in section 5.4.

4.3 Data Examination

The data examination stage is very important in all types of research but is particularly important when a researcher intends to use Structural Equation Modelling (SEM) (Hair Jr, Anderson, Babin, & Black (2010); Hair et al. (2014)). Meanwhile, Hair et al. (2017) denote that the primary dataset issues that need to be examined are including; i) missing data, ii) suspicious response patterns (e.g. straight lining answers, inconsistent responses, etc.), iii) outliers and iv) normality of data distribution. Hence, this study has addressed these issues according to the following procedures (see Table 4.1).

Table 4. 1
Data Examination Procedures

Dataset Issues	Procedures
Missing data	Online survey and frequency analysis
Suspicious response patterns	Standard deviation values
Outliers	Boxplot diagrams and Mahalanobis distance
Normality of data distribution	Skewness and kurtosis z-scores

4.3.1 Missing Data

Missing data is a common problem in social science research since many studies seek and obtain the required data through survey approach (Hair et al., 2017). In response to this problem, this study has employed online survey approach to collect the data. This approach can prevent respondents from skipping questions. Respondents cannot move on to the next question if they do not fill or answer a particular question. As the result, there was no missing data in the collected dataset for this study. This was also confirmed with Frequency Analysis running on SPSS software.

4.3.2 Suspicious Response

This study observes standard deviation of each response cases using MS Excel to detect suspicious response as suggested by (Gaskin, 2016). Standard deviation value equals to zero indicates that there was no variation in every response (answer) of a particular case (respondent). No variation means the response given for all questions by a particular respondent were the same (i.e. straight lining answers). As the result, case No.20 was removed from the dataset and the remaining 101 cases (respondents) were carried forward to next data examination procedure.

4.3.3 Outliers Detection and Removal

Detection of outliers was performed using box plot diagrams and Mahalanobis distance (D2) in SPSS software. **B**ox plot diagrams also were used to detect outlier cases (responses) in univariate situations. On the other hand, Mahalanobis distances were used to detect outliers in multivariate situations. Table 4.2 summarised the output of both univariate and multivariate outliers' detection procedures.

Table 4. 2
Summary of Outliers' Detections

No	Case ID	Univariate Outliers Frequency		D^2/df
		Total Cases	Extreme Cases	
1	67	15	-	2.078
2	57	11	-	1.128
3	42	9	-	1.611
4	48	8	-	1.455

Note. *Sorted based on frequency of univariate outliers

Based on outliers' detection result in Table 4.2, four cases (i.e. case No. 42, 48, 57, and 67) were detected to have the most number of outlier responses at univariate level. Nevertheless, there was no extreme case has been detected. This was also confirmed with the values of D^2/df which were not exceeding 2.5 to indicate the dataset as free of multivariate outliers. Hence, no case (respondent) was removed from the dataset and all remaining 101 respondents are carried forward for the next analysis procedure.

4.3.4 Normality of Data Distribution

Normality of data distribution was the benchmark for statistical methods. Data distribution was regarded as normal when its shape for an individual metric variable was correspondent to the normal distribution (Hair Jr et al., 2010). SEM advocates strongly advised researchers to check normality of data distribution for both univariate and multivariate conditions (Byrne, 2016; Kline (2011); Tabachnick & Fidell (2014); Hair Jr et al. (2010). In this study, normality of data distribution was checked using WebPower (Z. Zhang & Yuan, 2018), an online and free access statistical power analysis web application available at https://webpower.psychstat.org. This web application provides both univariate and Mardia's multivariate skewness and kurtosis values and have been recommended in the recent literatures (Cain, Zhang, & Yuan, 2017; Ramayah, Yeap, Ahmad, Abdul Halim, & Abidur Rahman, 2017). Table 4.3 exhibits the results of data normality test.

Table 4. 3
Data Normality Results

Constructs	Skewness		Kurtosis	
	Statistics	z-score	Statistics	z-score
Cellular Layout (CELL)	-0.406	-1.699	-0.720	-1.519
Pull System (PULL)	-0.569	-2.380	-0.597	-1.259
Quick Setup (QUICK)	-0.671	-2.807	-0.197	-0.416
Total Quality Management (TQM)	-0.563	-2.355	-0.143	-0.302
Total Productive Maintenance (TPM)	-0.184	-0.769	-0.719	-1.517
Small Lot Production (SLP)	-0.584	-2.443	-0.448	-0.945
Economy (ECO)	-0.319	-1.334	-0.907	-1.914
Environment (ENV)	-0.304	-1.271	-0.854	-1.802
Social (SOC)	-0.547	-2.288	-0.074	-0.156
Quality (QUAL)	-0.446	-1.866	-0.477	-1.006
Delivery (DELI)	-0.192	-0.803	-0.552	-1.165
Flexibility (FLEX)	-0.252	-1.054	-0.771	-1.627
Time (TIME)	-0.509	-2.1297	-0.541	-1.141
Cost (COST)	-0.342	-1.430	-0.591	-1.247
Egoism (EGO)	-0.168	-0.702	-0.678	-1.430
Benevolence (BVL)	-0.115	-0.481	-0.672	-1.418
Principle (PCP)	-0.139	-0.581	-0.733	-1.546
Mardia's Multivariate Normality	78.970	1342.495	352.278	5.817

According to Kline (2011) data distribution was within acceptable range when the z-score of univariate skewness were not exceeding ±3 and univariate kurtosis were not beyond ±7. Meanwhile, Cain et al. (2017) and Mardia (1970) asserted that z-score of multivariate skewness ranging from -3 to +3 and multivariate kurtosis ranging from -20 to +20 indicates the data as normally distributed. Results in Table 5.3 shows that all values for univariate skewness and kurtosis were within the acceptable range. However, the results of Mardia's multivariate skewness and kurtosis data distribution are non-normal. Even so, PLS-SEM is a non-parametric statistical method that does not require the data to be normally distributed (Hair Jr et al., 2014, 2017). Since this study has been used SmartPLS 3 software to test the hypothesised relationships, researcher can still proceed to hypotheses testing stage.

4.4 Bias Tests

As denoted by numerous business, management and social research scholars, survey studies are subjected to the probability of having non-response bias and common method bias (De Vaus, 2002; Hulland et al., 2018; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Sekaran & Bougie, 2016; Zikmund et al., 2009). Non-response bias or non-response error refers to bias that appears within a sample by people who either refuse to participate in the study or to answer particular questions being systematically different from those who do respond (De Vaus, 2002). If a difference exists, it doubts the generalizability of the findings for a research (Hulland et al., 2018).

Meanwhile, common method bias (CMB) or common method variance (CMV) was variance that is attributable to the measurement method rather than to the construct of interest (Podsakoff et al., 2003). The term method represents the form of measurement at different levels of abstraction, such as the content of specific items, type of scale, response format, and the general context. According to MacKenzie and Podsakoff, (2012) and Podsakoff, MacKenzie and Podsakoff (2012) CMB or CMV was a problem because it was one of the main sources of measurement error. Measurement error threatens the validity of the conclusions about the relationships between measures (Bagozzi, Yi, & Phillips, 1991; Nunnally, 1978). These biases also have been addressed in previous studies within the same research field (i.e. Lean Manufacturing) (Habidin, 2012; Iteng, 2013; Nawanir, 2015). Hence, this study employs extrapolation technique and full collinearity test to check these biases.

Extrapolation technique to evaluate non-response bias was first introduce by (Armstrong & Overton, 1977). This technique involves comparing early respondents against late respondents, with the key assumption being that later respondents more likely similar to the non-respondents. This study utilised a natural breakpoint at approximately halfway through the data collection process to classify the early and late respondents. The first half respondents were regarded as early respondents, while the second half respondents were considered as late respondents. An independent sample t-test was then performed using SPSS software to test for significant differences between the two groups. The result is presented in Table 4.4.

Table 4. 4
Non-Response Bias Results

Construct	Responses	N	Mean	Std. Dev	Sig.
Cellular Layout (CELL)	early	50	4.2167	.54216	.572
	late	51	4.1569	.57098	
Pull System (PULL)	early	50	4.2600	.57554	.414
	late	51	4.1699	.57590	
Quick Setup (QUICK)	early	50	4.3000	.60643	.947
	late	51	4.2118	.58297	
Total Quality Management (TQM)	early	50	4.2700	.54243	.991
	late	51	4.1838	.54277	
Total Productive Maintenance (TPM)	early	50	4.1120	.58993	.998
	late	51	4.0392	.61712	
Small Lot Production (SLP)	early	50	4.4720	.50590	.658
	late	51	4.3765	.49903	
Economy (ECO)	early	50	4.3200	.58950	.847
	late	51	4.1329	.58753	
Environment (ENV)	early	50	4.3686	.51636	.070
	late	51	4.0560	.65719	
Social (SOC)	early	50	4.3600	.45429	.090
	late	51	4.1874	.59108	
Quality (QUAL)	early	50	4.2943	.53328	.860
	late	51	4.2269	.54449	
Delivery (DELI)	early	50	4.2933	.52442	.947
	late	51	4.2418	.50367	
Flexibility (FLEX)	early	50	4.2800	.51912	.042
	late	51	4.2010	.61648	
Time (TIME)	early	50	4.2200	.57384	.056
	late	51	4.0719	.69543	
Cost (COST)	early	50	4.1250	.50571	.285
	late	51	4.2206	.56490	
Egoism (EGO)	early	50	4.1356	.50109	.239
	late	51	4.0828	.57728	
Benevolence (BVL)	early	50	4.1143	.48831	.253
	late	51	4.1050	.56140	
Principle (PCP)	early	50	4.1500	.48152	.309
	late	51	4.2092	.52211	

Table 4.4 reveals that there were no statistically significant differences between early and late respondents and suggesting that the dataset was free of non-response biases. Further, full collinearity test was performed to check CMB as introduce by Kock and Lynn (2012). Full collinearity test provides a comprehensive procedure for the simultaneous assessment of both vertical and lateral collinearity (Kock, 2015; Kock & Gaskins, 2014). Vertical collinearity was collinearity issue of predictor-predictor phenomenon, while lateral collinearity refers to collinearity issue of predictor-criterion phenomenon in multiple regression models (Kock, 2015). Collinearity issue was implying that predictor variable measures the same underlying construct, or a facet of such construct, as a variable to which it points in a regression model (Hair Jr et al., 2017; Kock, 2015). Following Gaskin (2017), full collinearity test in this study was employed by observing values of variance inflation factors (VIFs) that have been generated for all latent variables in the research model using SmartPLS 3 software. Table 4.5 shows the VIFs obtained for all the latent variables in this study research model, based on a full collinearity test.

Table 4. 5
Full Collinearity Test Results

Latent Variables	EC	LMP	MP	SUS
EC		1.560	1.461	1.610
LMP	1.951		2.014	1.670
MP	2.604	2.836		1.922
SUS	3.114	2.568	2.102	

The values of VIF greater than 3.3 was proposed as an indication that a model may be contaminated by CMB (Kock, 2015). All VIF values reveal in Table 4.5 were below than 3.3, hence this model can be considered free of CMB.

4.5 Demographic Information

This study utilises 101 valid samples, representing 101 manufacturing organisations in Malaysia for data analysis. The organisations include in this study were selected by research randomizer software. Every selected organisation was represented by personnel with the most qualified position in the organisation to fill up the survey form. Demographic section in the survey form has requested the respondents to provide information on their; i) designated positions, ii) assigned department, iii) lean implementation duration, iv) enterprise's size, v) enterprise's ownership, and vi) categories of product produced. Table 4.6 summarised the requested information.

Table 4. 6
Background of the Respondents

Information	Frequency	Percentage	Cumulative Percent
Positions			
Manager	39	38.6	38.6
Engineer	36	35.6	74.2
Executive	16	15.8	90.0
CEO/ General Manager	10	9.9	100
Total	101	100	
Department			
Production	39	38.6	38.6
Engineering	30	29.7	68.3
Quality	26	25.7	94.0
Others	6	6.0	100
Total	101	100	
Lean implementation duration			
More than 3 years	86	85.1	85.1
1 to 3 years	11	10.9	96.0
Less than 1 year	4	4.0	100
Total	101	100	
Enterprise's size			
Large (more than 200 employees)	75	74.3	74.3
Medium (75 to 200 employees)	22	21.8	96.1
Small (less than 75 employees)	4	4.0	100
Total	101	100	

Table 4. 6 (Continued)

Information	Frequency	Percentage	Cumulative Percent
Enterprise's ownership			
Multi-national corporation	65	64.4	64.4
Locally owned	25	24.8	89.2
Joint ventures	6	5.9	95.1
Others	5	5.0	100
Total	101	100	
Product Categories			
Electronics and electrical	32	31.7	31.7
Machinery, appliances and parts	18	17.8	49.5
Transport equipment	12	11.9	61.4
Food, beverages and tobacco	11	10.9	72.3
Other manufacturing goods	9	8.9	81.2
Chemical and plastics	6	5.9	87.1
Rubber	5	5.0	92.1
Iron, steel and metal	4	4.0	96.1
Wood-based	2	2.0	98.1
Non-metallic mineral	1	1.0	99.1
Petroleum-based	1	1.0	100
Total	101	100	

Table 4.6 displays that the majority of the respondents were among managers (38.6%) and followed by the engineers (35.6%). CEO/ general managers were the minority among the respondents with only 9.9%. Meanwhile, majority of the respondents were attached to production department (38.6%), followed by the department of Engineering (29.7%) and Quality (25.7%). On the other hand, there were few respondents which belong to other departments such as maintenance and supply chain. Nevertheless, all these acquired respondents were considered as qualified to participate in this survey based on the rational justified in Chapter 3.

Meanwhile, majority of respondents' companies (85.1%) have been implementing lean manufacturing practices (LMP) for more than three years. There were also 10.9% from the total respondents' companies with one to three years' LMP implementation experience, while the rest (4%) were just implementing LMP for less than a year.

Therefore, this information confirms that all respondents' companies were among lean practitioners. Although not all respondents have reached the maturity phase in their implementation, they were at least familiar with LMP. Maturity of LMP implementation was not a major concern in this study. Hence, all acquired respondents are considered as the qualified and eligible samples for this study.

According to SME Corp Malaysia, size of a manufacturing enterprise can be categorised as "small" when it has less than 75 employees. Meanwhile, manufacturing enterprise which possess 75 to 200 employees are categorised as "medium-sized" (SME Corporation Malaysia, 2015). Thus, manufacturing enterprise with more than 200 employees can be regarded as "large" enterprise. Therefore, this study has been obtained majority of respondents' companies from large-sized category (74.3%), followed by medium-sized (21.8%), and with only small percentage of small-sized (4.0%). It was deemed true that large-sized enterprises were more likely to implement LMP as denoted in previous studies (Nordin et al., 2010; Rahman, Laosirihongthong, & Sohal, 2010; Shah & Ward, 2003).

Moreover, regarding enterprise's ownership, most of the respondents were multi-national corporations (MNCs) which was 64.4% from total respondents. There were also 24.8% of locally owned enterprises, 5.9% joint-venture (JV) enterprises with the remaining 5% were categorised as "others". This proportion of responses was similar to Mohamed Ismail (2014) which also have reported MNCs as the majority of lean practitioners, followed by local enterprises and JV enterprises.

Lastly, this study has captured the diversity of manufacturing industry in Malaysia by successfully obtained respondent companies that were producing different product categories. Overall, respondent companies can be classified into 11 product categories as shown in Table 5.6 with the majority were producing electronics and electrical (E&E) products (31.7%). Besides E&E products, other major respondents were among machinery, appliances and parts manufacturers (17.8%), transport equipment manufacturers (11.9%), and food, beverages and tobacco manufacturers (10.9%). On the other hand, the minority are non-metallic mineral manufacturer and petroleum-based products manufacturer with only one company for each category. In comparison with other LMP studies in Malaysia which only involved single product category like E&E (Wong et al., 2009), automotive (Nordin et al., 2010), machinery (Salimi, Hadjali, & Sorooshian, 2012) and food and beverages (F&B) (Khusaini, Ismail, & Rashid, 2016), this study has proved that lean practitioners were not limited to these product categories only.

4.6 Descriptive Statistics

Descriptive analysis was performed for the purpose of this study in evaluating the basis statistical description of constructs used. The calculation of statistical values such as means and standard deviation were conducted for all constructs such as independent, mediating, moderating, and dependent. Thus, the results of the statistical values can be seen in Table 4.7 measured through a five-point scale.

Table 4. 7
Descriptive Statistics of Each Construct

Constructs	Mean	Std. Dev
Cellular Layout (CELL)	4.187	.555
Pull System (PULL)	4.215	.575
Quick Setup (QUICK)	4.255	.594
Total Quality Management (TQM)	4.227	.542
Total Productive Maintenance (TPM)	4.075	.602
Small Lot Production (SLP)	4.423	.502
Economy (ECO)	4.226	.593
Environment (ENV)	4.211	.609
Social (SOC)	4.273	.532
Quality (QUAL)	4.260	.537
Delivery (DELI)	4.267	.512
Flexibility (FLEX)	4.240	.569
Time (TIME)	4.145	.639
Cost (COST)	4.173	.536
Egoism (EGO)	4.109	.539
Benevolence (BVL)	4.110	.524
Principle (PCP)	4.180	.501
Sustainability (SUS)	4.356	.535
Lean Manufacturing Practices (LMP)	4.228	.496
Manufacturing Performance (MP)	4.215	.485
Ethical climate (EC)	4.142	.501

Viewing to Table 4.7 above, the results have disclosed that the mean value of sustainability is 4.356, while the mean value for lean manufacturing practices is 4.228. Next, the mean value of manufacturing performance is 4.215 whereas ethical climate is 4.142.

Sustainability which has reached the highest mean among other constructs shows that the manufacturing organisations have placed a major concerned on the organisations' sustainability in the context of economic, social and environmental in order to ensure it can compete others and also to endure in the industry. The second highest mean score was lean manufacturing practices indicated that respondents were agreed with the implementation of lean practices in the organisations. Subsequently, the third highest mean was achieved in manufacturing performance, signifying that the components in fostering performance in organisations were important which most of the respondents were responded to agree level. Finally, ethical climate variable generated as the lowest mean values.

4.7 Measurement Model

As mentioned in chapter three, this study employed “two-stage approach” as suggested by Ringle, Sarstedt, & Straub, (2012). Figure 4.2 illustrated Stage One of the measurement model assessment, while Figure 4.3 illustrated the Stage Two assessment.

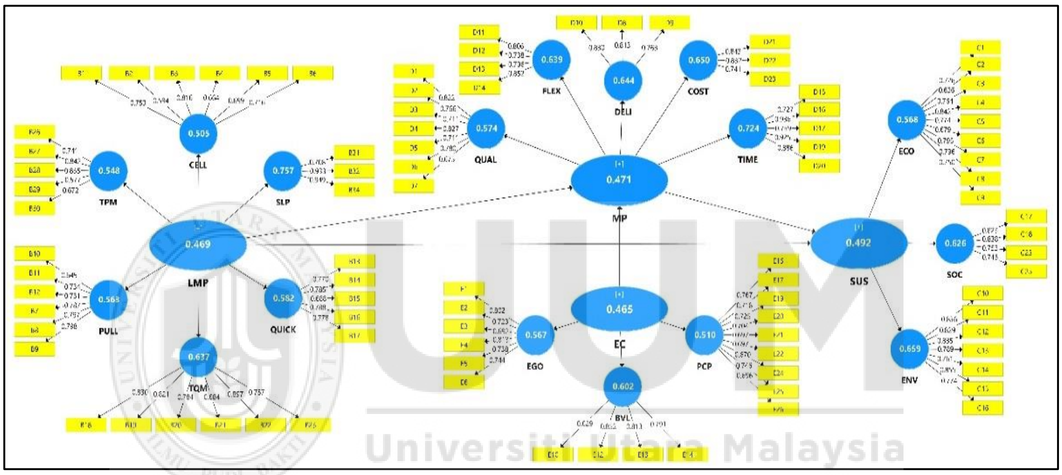


Figure 4. 2

Measurement Model (stage one)
Note. For better visual, see Appendix 3

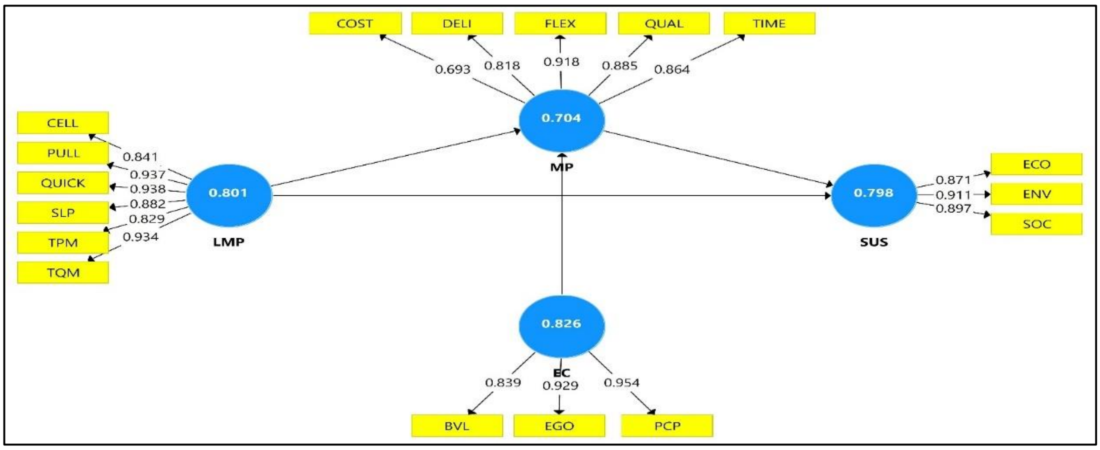


Figure 4. 3
Measurement Model (stage two)
Note. For better visual, see Appendix 4

Figure 4.2 illustrated the first stage of measurement model assessment, whereby there are 21 latent variables (i.e. 17 first order constructs; CELL, PULL, QUCIK, SLP, TPM, TQM, BVL, EGO, PCP, COST, DELI, FLEX, QUAL, TIME, ECO, ENV and SOC with four second order constructs; LMP, EC, MP and SUS). First order constructs represent the dimensions of second order constructs. Meanwhile, Figure 4.3 illustrated the second stage of measurement model assessment, whereby there were only four latent variables (i.e. LMP, EC, MP and SUS). In this stage, the dimensions of LMP, EC, MP and SUS have been transformed into manifest variables (indicators). In both figures, numbers noted on the arrows represented the outer loading (factor loading) values while numbers appeared inside the constructs indicated the AVE values. Table 4.10 presents these values in detailed.

Table 4. 8
Internal Consistency Reliability and Convergent Validity Results

Constructs		Items	Loadings	α	ρ_c	AVE
1st Order	2nd Order					
Economy (ECO)		C1	.726	.904	.922	.568
		C2	.636			
		C3	.764			
		C4	.842			
		C5	.774			
		C6	.679			
		C7	.795			
		C8	.796			
		C9	.750			
Environment (ENV)		C10	.836	.914	.931	.659
		C11	.829			
		C12	.835			
		C13	.789			
		C14	.761			
		C15	.855			
		C16	.774			
Social (SOC)		C17	.823	.801	.870	.626
		C18	.838			
		C23	.753			
		C25	.745			
	Sustainability (SUS)	ECO	.871	.873	.922	.798
		ENV	.911			
		SOC	.897			

Table 4.8 (Continued)

Constructs: 1st Order	Constructs: 2nd Order	Items	Loadings	α	ρ_c	AVE
Cellular Layout (CELL)		B1	.753	.803	.858	.505
		B2	.594			
		B3	.816			
		B4	.664			
		B5	.699			
		B6	.716			
Pull System (PULL)		B7	.787	.845	.885	.563
		B8	.797			
		B9	.798			
		B10	.645			
		B11	.734			
		B12	.731			
Quick Setup (QUICK)		B13	.770	.820	.874	.582
		B14	.785			
		B15	.688			
		B16	.788			
		B17	.778			
Total Quality Management (TQM)		B18	.830	.885	.913	.637
		B19	.821			
		B20	.784			
		B21	.684			
		B22	.897			
		B23	.757			
Total Productive Maintenance (TPM)		B26	.741	.785	.856	.548
		B27	.842			
		B28	.835			
		B29	.577			
		B30	.672			
Small Lot Production (SLP)		B31	.708	.833	.902	.757
		B32	.933			
		B34	.949			
	Lean Manufacturing Practices (LMP)	CELL	.841	.952	.960	.801
		PULL	.937			
		QUICK	.938			
		TQM	.934			
		TPM	.829			
		SLP	.882			

Table 4.8 (Continued)

Constructs		Items	Loadings	α	ρ_c	AVE
1st Order	2nd Order					
Egoism (EGO)		E1	.787	.849	.886	.528
		E2	.718			
		E3	.682			
		E4	.818			
		E5	.721			
		E6	.721			
Benevolence (BVL)		E10	.594	.775	.849	.533
		E11	.655			
		E12	.817			
		E13	.796			
		E14	.763			
Principle (PCP)		E16	.767	.879	.903	.509
		E17	.718			
		E19	.725			
		E20	.704			
		E21	.697			
		E22	.697			
		E24	.672			
		E25	.747			
		E26	.696			
	Ethical climate (EC)	EGO	.839	.894	.934	.826
		BVL	.839			
		PCP	.954			

Table 4.8 (Continued)

Constructs 1st Order	2nd Order	Items	Loadings	α	ρ_c	AVE
Quality (QUAL)		D1	.822	.875	.904	.574
		D2	.766			
		D3	.711			
		D4	.826			
		D5	.711			
		D6	.781			
		D7	.675			
Delivery (DELI)		D8	.815	.723	.844	.644
		D9	.762			
		D10	.829			
Flexibility (FLEX)		D11	.809	.810	.876	.639
		D12	.740			
		D13	.796			
		D14	.848			
Time (TIME)		D15	.730	.901	.928	.724
		D16	.935			
		D17	.759			
		D19	.924			
		D20	.884			
Cost (COST)		D21	.842	.723	.830	.552
		D22	.801			
		D23	.673			
		D24	.637			
	Manufacturing Performance (MP)	QUAL	.887	.892	.922	.798
		DELI	.811			
		FLEX	.920			
		TIME	.866			
		COST	.716			

In this measurement model, several items/indicators (i.e. B24, B25, B33, B35, D18, D24, D25, C19, C20, C21, C22, C24, E7, E8, E9, E15, E18 and E23) have been dropped from the model to achieve convergent and discriminant validity requirements. According to Hair Jr et al. (2017), researchers are allowed to drop not more than 20%

items for any particular construct from total items in the model in order to achieve convergent and discriminant validity requirements. Hence, it was acceptable to drop 18 out of 110 items (i.e. ≈16%) from this model.

Ultimately, the results in Table 4.8 shows that all constructs have passed the internal consistency reliability (i.e. α and ρ_c more than .708) and convergent validity (i.e. AVE more than .50) tests (Fornell & Larcker, 1981; Gefen, Straub, & Boudreau, 2000; Hair Jr et al., 2014). Although outer loadings of some items are below than the benchmarking value (i.e. .708 according to Hair Jr et al. (2014)) the values were still acceptable in regards to other relevant sources (Hair Jr, Tatham, Anderson, & Black, 1998; Stevens, 1992; Tabachnick & Fidell, 2007). In addition, researchers were allowed to retain any item with outer loading .40 and above if the AVE value for its construct already achieve .50, which is the minimum indication for convergent validity (Hulland, 1999).

Then, measurement model was further assessed by verifying the discriminant validity. Three (3) types of test were involved in assessing the discriminant validity namely; i) cross-loadings comparison (Appendix 5), ii) Fornell and Larcker (1981) criterion (see Table 4.9), and iii) HTMT ratio (see Table 4.10). As can be seen in Appendix 6, the outer loading values were always exceeding the cross-loading values, thus indicates discriminant validity between all constructs in the model have been established.

Fornell-Larcker criterion was a measure of discriminant validity that compares the square root of each construct's AVE with its correlations with all other constructs in the model. In particular, the square root of each construct's AVE must be greater than its highest correlation with any other construct.

Table 4. 9

Results of Fornell & Larcker (1981) criterion

Constructs	SUS	LMP	EC	MP
SUS	**.893**			
LMP	.665	**.895**		
EC	.521	.474	**.909**	
MP	.784	.611	.705	**.839**

In Table 4.9, values with the bold fonts inside the diagonal columns represent the square root of each construct's AVE. Values in the diagonal columns should be higher than all other values in the row and column of the table. As can be seen, all diagonal values are higher than other values, hence it can be concluded that measurements have established discriminant validity.

Besides, current criticism on the cross-loadings approach and Fornell-Larcker criterion to examine a lack of discriminant validity under several circumstances have led to the suggestion of using HTMT ratio to assess discriminant validity. As such, this study has tested discriminant validity using this newly proposed method and the results are shown in Table 4.10.

Table 4. 10

Results of HTMT ratio

Constructs	SUS	LMP	EC	MP
SUS				
LMP	.728			
EC	.584	.502		
MP	.882	.658	.777	

Table 4.10 shows that majority of the values were below .85, while only SUS-MP value is below .90. Hence, it was confirmed that there was no discriminant validity problem between all constructs in the model. Since all conditions of convergent validity and

discriminant validity have been fulfilled, this study proceeds to structural model assessment in the next section.

4.8 Structural Model

In this study, structural model analysis was performed to answer the main research objectives. Using bootstrapping procedures with 5000 resamples (Hair Jr et al., 2014, 2017) in SmartPLS 3.2.8 software (Ringle, Wende, & Becker, 2015), the empirical t-values (t-statistics) were computed to indicate the significance of the hypothesised relationships. The structural model for this study was illustrated in Figure 4.4.

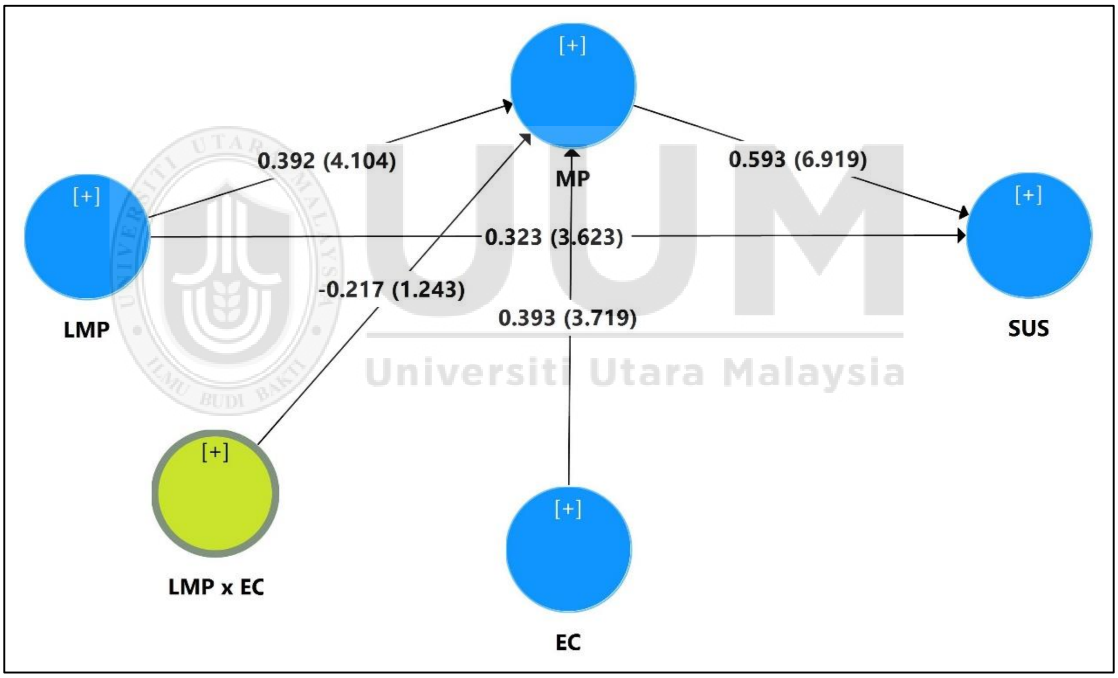


Figure 4. 4
Structural model

Figure 4.2 illustrated the structural model of this study which demonstrated the latent variables (i.e. SUS, LMP, EC and MP) and their path relationships (i.e. hypotheses). The arrows represented the relationships between latent variables with the values of path coefficient (β) and the empirical t-values (i.e. values inside brackets). Sustainability (SUS) was the endogenous (i.e. dependent) variable, while lean manufacturing practices (LMP), ethical climate (EC) and manufacturing performance (MP) were the exogenous variables or predictors to SUS. MP also works as the mediator between LMP and SUS. In addition, construct named LMP x EC represented the interaction between LMP and EC which was created to test the moderating effect of EC on LMP-MP relationship.

Table 4.11 shows the result o hypothesis testing whereas Table 4.12 shows the results of multi-collinearity, variance explained and effect sizes as part of the reporting.

Table 4. 11
Results of Hypotheses Testing

Hypotheses	β	Std. Dev	T Stats	P values	Confidence Interval		Decisions
					2.5%	97.5%	
H1: LMP->SUS	.323	.089	3.623***	0.000***	.152	.501	Accepted
H2: LMP->MP	.392	.095	4.104***	0.000***	.200	.571	Accepted
H3: MP->SUS	.593	.086	6.919***	0.000***	.414	.745	Accepted
H4: EC->MP	.393	.106	3.719***	0.000***	.188	.603	Accepted
H5: LMP->MP->SUS	.232	.065	3.589***	0.000***	.112	.363	Accepted
H6: LMP x EC->MP	-.217	.175	1.243	0.209	-.433	.367	Not accepted

Note. Two-tailed test. Significant at $p < .05$*, $p < .01$**, $p < .001$***

Table 4. 12
Results of Multi-Collinearity, Variance Explained and Effect Sizes

Hypotheses	VIF	Effect Size (f^2)	Variance Explained (R^2)	Effect Size (q^2)	Predictive Relevance (Q^2)
H1: LMP->SUS	1.595	.215	.676	.113	.502
H3: MP->SUS	1.595	.723		.300	
H2: LMP->MP	1.290	.234	.491	.171	.353
H4: EC->MP	1.290	.236		.173	
H6: LMP x EC-> MP	1.000	.073		.030	

The results in Table 4.11 and Table 4.12 conclude that LMP (β = .323, t = 3.623, p < .001, f^2 = .215) and MP (β = .593, t = 6.919, p < .001, f^2 = .723) were positively influenced SUS, explaining 67.6% (R2 = .676) of the variance in SUS. Meanwhile, LMP was also positively influenced MP at β = .392, t = 4.104, p < .001 and f^2 = .226.

However, the interaction of LMP x EC does not statistically significant to MP (β = -0.217, t = 1.243, p = .214, f^2 = .073) which means EC does not moderate the relationship between LMP and MP. Hence, variance explained of MP was only contributed by LMP and EC with the magnitude of 49.1% (R2 = .491). Nevertheless, MP does significantly mediate the relationship between LMP and SUS at β = .232, t = 3.589, p < .001.

The significance of hypothesised relationships was depending on the value of t-statistics (i.e. empirical t-value must be larger than the critical t-value, to reject the null hypothesis). Commonly used benchmark of critical values in two-tailed tests were 2.33, 1.96, and 1.28, for $p < .10$, $p < .05$, and $p < .01$ respectively (Hair Jr et al., 2014). Meanwhile, p value represents the probability of error for assuming that a path coefficient was significantly different from zero (Hair Jr et al., 2017). p values of .01, .05, and .10 were also implying the confidence levels of 99%, 95%, and 90% respectively. In this study, t-statistics and p value was observed to decide whether the path coefficient (β) was statistically significant.

Path coefficient was the estimated path relationship between latent variables in a structural model which was identical to standardized beta (β) values in a regression model (Hair Jr et al., 2014, 2017). Estimated path coefficients close to +1 represent a strong positive relationship and vice versa for negative values. The closer the estimated coefficients to 0, the weaker the relationship. Very low values close to 0 were usually non-significant (i.e., not significantly different from zero). Kock & Hadaya (2018) asserted that β values that are ranging from 0 to .10 may indicated the hypothesised relationship was not significant, while β values that were exceeding .20 are more likely indicating a significant relationship. Meanwhile, the values in between (i.e. .11 to .19) were cannot clearly determined the significance of hypothesised relationship.

In the same vein, confidence interval values also prove that H1, H2, H3 and H4 can be accepted, with all confidence interval values in Table 4.11 were positive for both lower limit (2.5%) and upper limit (97.5%). Hair Jr et al. (2017) stated that confidence interval provides an estimated range of values that was likely to include an unknown population parameter. It was determined by its lower and upper bounds, which depend on predefined probability of error and the standard error of the estimation for a given set of sample data. When zero does not fall into the confidence interval, an estimated parameter can be assumed to be significantly different from zero. In simple words, upper limit (UL) and lower limit (LL) values must be either both positive or both negative which indicates zero does not fall into the range of upper and lower bound values.

There is also no serious collinearity issue as indicated by VIF values in Table 4.12. Collinearity occurs when two or more predictor variables are highly correlated in a regression model (Field, 2009; Hair Jr et al., 2017). VIF values below than 3.30 in Table 4.12 were implying that there is no serious collinearity among the predictors in this structural model (Diamantopoulos & Siguaw, 2006; Kock & Lynn, 2012). The following subsections interpret results presented in Table 4.11 and Table 4.12 in detail following the hypothesised relationships.

4.8.1 Direct Relationships of LMP and MP on SUS

Table 4. 13
Results of of LMP and MP on SUS

Hypotheses	β	Std. Dev	T Stats	P values	Decisions
H1: LMP->SUS	.323	.089	3.623***	0.000***	Accepted
H3: MP->SUS	.593	.086	6.919***	0.000***	Accepted

Note. Two-tailed test. Significant at $p < .05$*, $p < .01$**, $p < .001$***

Table 4.13 have demonstrated that t-statistics of H1 and H3, were above 1.96 and p values were less than .01 which means there were significant and positive relationship between LMP and SUS as well as MP and SUS. Thus, H1 and H3 were accepted. These findings are consistent with the study of Iranmanesh et. al (2019) where it was found that there was a positive impact lean manufacturing practices toward sustainable performance. Furthermore, study by Piercy and Rich (2015) also reported that lean operations meet a wide range of sustainability. Meanwhile, Hong, Yang and Dobrzykowski (2014) and Lacy, Haines and Hayward (2012) also have proved that manufacturing performance contributes to sustainability in the organisation.

4.8.2 Direct Relationship of LMP and EC on MP

Table 4. 14
Results of LMP and EC on MP

Hypotheses	β	Std. Dev	T Stats	P values	Decisions
H2: LMP->MP	.392	.095	4.104***	0.000***	Accepted
H4: EC->MP	.393	.106	3.719***	0.000***	Accepted

Note. Two-tailed test. Significant at $p < .05$*, $p < .01$**, $p < .001$***

Further, t-statistics of H2 was above 1.96 (i.e. t = 4.014) with p value was less than .01 which means there was a significant relationship between LMP and MP as shown in Table 4.14. Hence, H2 was accepted. In the same vein, H4 was also accepted at t = 3.719 and p < .001. These findings were in line with the study of Shurrab and Hussain

(2018) which was found the significant relationship between lean manufacturing practices towards performance in their research. In fact, lean has received attention from academics and practitioners alike as a competitive advantage source in both developing and developed economies. Likewise, study by Hashmi, Khan and Haq (2015) has found a positive connection between manufacturing performance and its implementation of lean manufacturing techniques.

4.8.3 Indirect Relationship between LMP and SUS through MP

Table 4. 15
Results of Indirect Relationship between LMP and SUS through MP (Mediating)

Hypotheses	β	Std. Dev	T Stats	P values	Decisions
H5: LMP->MP->SUS	.232	.065	3.589***	0.000***	Accepted

Note. Two-tailed test. Significant at $p < .05$*, $p < .01$**, $p < .001$***

As the results, Table 4.15 exhibits that H5 which represented the indirect relationship between LMP and SUS was significant at t-value equals to 3.589 and p value was less than .01, which means MP does mediate the relationship between LMP and SUS. Hence, H5 was accepted. The same finding was also evident in reflection upon on the result of manufacturing performance, number of respective scholars like Nawanir, Lim and Othman (2016); Nawanir et al., (2013) and Fullerton and Wempe (2009) supports manufacturing performance as a role of mediator to examine the relationship between lean and other performances such as business performance and financial performance. Meanwhile, as to obtain VAF value, the calculation was as the following:

$$VAF = \frac{a * b}{(a * b) + c}$$

$$VAF = \frac{0.232}{(0.232) + 0.323}$$

$$VAF = 0.418$$

Based on the calculated VAF, the value indicated 41.8% variance and can be characterised as a typical partial mediation. On the other hand, VAF value of 80% or above indicates full mediation, while VAF below than 20% is assumed as no mediation (Hair Jr et al., 2017).

4.8.4 Moderation of EC on Relationship between LMP and MP

Table 4. 16
Results of Moderaing Effect

Hypotheses	β	Std. Dev	T Stats	P values	Decisions
H6: LMP x EC->MP	-.217	.175	1.243	0.209	Not accepted

Note. Two-tailed test. Significant at $p < .05$*

The moderating effect of EC on LMP and MP relationship demonstrates *t*-statistics of H6 was below 1.96 ($t = 1.243$) and $p = .209$ which was more than .10 a shown in Table 4.16. It means there was no significant interaction between LMP and EC, suggesting that EC does not moderate the relationship between LMP and MP. Thus, H6 was not accepted. However, the interaction plot diagram shows that the intersection between LMP and EC curves will eventually appear at some point (see Figure 4.5).

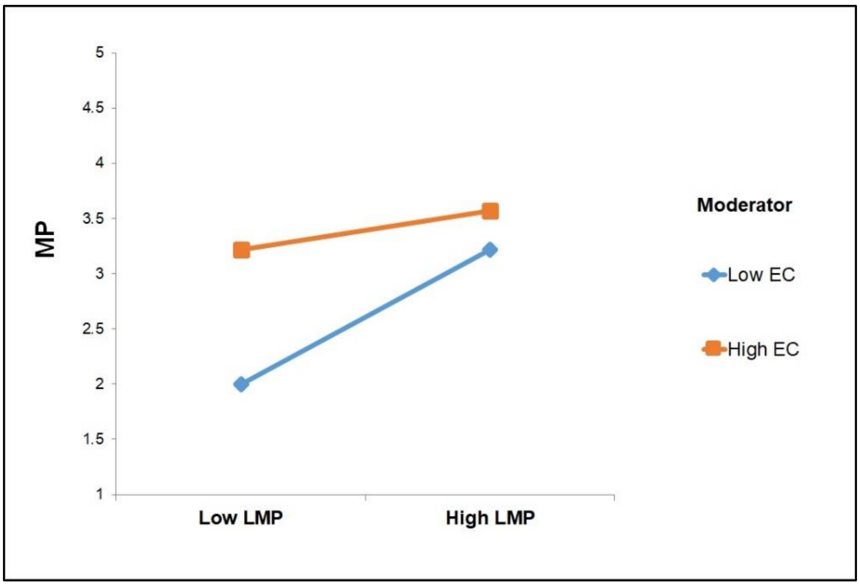


Figure 4. 5
Interaction plot between LMP and EC

Since the two linear curves in Figure 4.5 were not really parallel to one another, there was a chance that interactions between these two variables will occur, given considerable condition such as larger sample sizes. Further discussions regarding this finding were included in the last chapter.

4.8.5 Variance Explained and Effect Sizes

R2 value interprets the proportion or percentage of variance in endogenous construct that was explained by exogenous constructs. Generally, R2 values of 0.75, 0.50, and 0.25 were regarded as substantial, moderate, and weak respectively (Hair Jr et al., 2017). Referring to Figure 4.6, it seems SUS have moderate level of variance explained (R2 = .676) which indicate LMP and MP were the adequate predictors of SUS. Similarly, MP have moderate level of variance explained (R2 = .491) and implying that LMP and EC have sufficiently predicted MP.

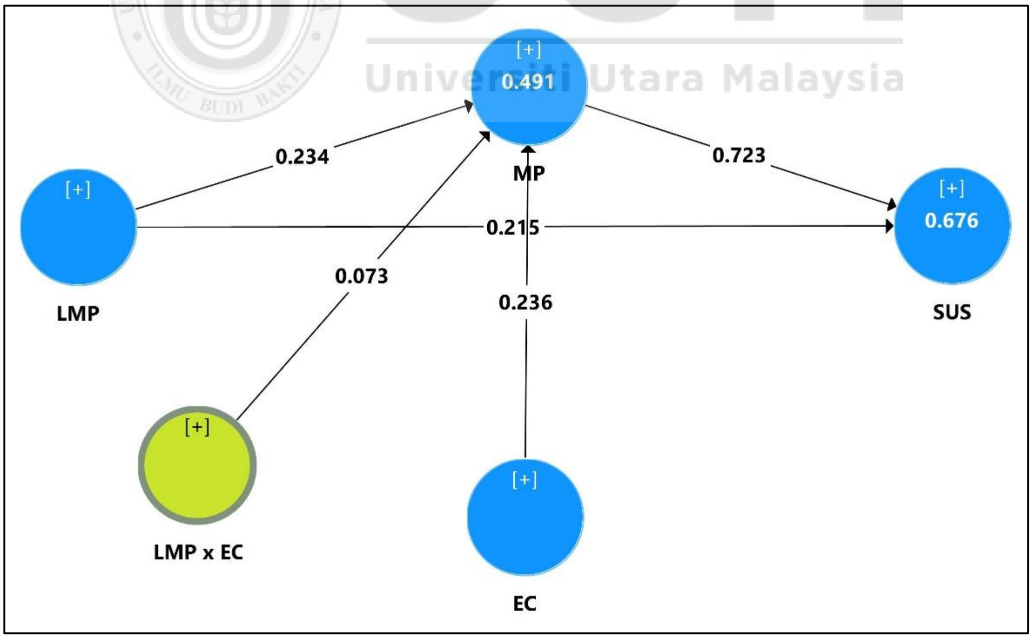


Figure 4. 6
Path diagram with R^2 and f^2 values
Note. Values on arrows indicate f^2. Value within endogenous construct represent R^2.

In assessing structural model, Hair Jr et al. (2014) also suggested that the change in the R2 value when a specified exogenous construct was omitted from the model should be examined. Such change was more important especially when the model consist of a moderator variable (Ramayah et al., 2018). The change in the R2 value was called effect sizes (f2). Effect sizes (f2) was computed to evaluate whether the omitted construct has a substantive impact on the endogenous construct. As recommend by Hair Jr et al. (2014), Jacob Cohen's guideline was used to determine the magnitudes of the effect size. The magnitudes are .020, .150, and .350, representing small, medium, and large effects respectively (Cohen, 1988). Table 4.17 summarised the computed f^2 magnitudes and its ratings.

Table 4. 17
Results of Computed Effect Sizes (f^2)

Relationships	Effect Size (f^2)	Ratings
LMP->SUS	.215	Medium
MP->SUS	.723	Large
LMP->MP	.234	Medium
EC->MP	.236	Medium
LMP x EC-> MP	.073	Small

Table 4.17 shows that LMP has medium effect on both SUS and MP. Similarly, EC has medium effect on MP. In contrast, MP has large effect on SUS. Surprisingly, the interaction between LMP and EC has at least small effect on MP, despite being not statistically significant to MP. Typically, there was no effect (i.e. f2 < .020) when a relationship between two variables was not significant. This magnitude somehow supports the possibility of moderating effect of EC towards LMP and MP relationships can be significant under considerable circumstances such larger sample size.

4.8.6 Predictive Relevance of the Model

Table 4. 18

Results of Predictive Relevance of the Model Q^2

Hypotheses	Effect Size (q^2)	Predictive Relevance (Q^2)
H1: LMP->SUS	.113	.502
H3: MP->SUS	.300	
H2: LMP->MP	.171	.353
H4: EC->MP	.173	
H6: LMP x EC-> MP	.030	

Further to that, predictive relevance (Q2) of the model was also assessed to examine whether a model accurately predicts data not used in the estimation of model parameters. In PLS-SEM, Q2 value was computed using the blindfolding procedure. Blindfolding was a sample reuse technique that omits part of the data matrix and uses the model estimates to predict the omitted part. It indicated a model's out-of-sample predictive power (Chin, 1998; Hair Jr et al., 2017; Henseler, Ringle, & Sinkovics, 2009). Q2 value larger than 0 indicates the model has predictive relevance for a certain endogenous construct and otherwise (i.e. if the value is less than 0) (Fornell & Cha, 1994; Hair Jr et al., 2014). From Table 4.18, it can be seen that the Q2 values for SUS and MP are .502 and .353 respectively which are more than 0. These values are suggesting that this model has sufficient predictive relevance. Hence, this result concludes the finding section.

Table 4. 19
Result of Research Testing

Hypothesis	Statements of Hypothesis	Decision
H_1	There is a relationship between lean manufacturing practices and sustainability in the manufacturing organisation.	Supported
H_2	There is a relationship between lean manufacturing practices and manufacturing performance.	Supported
H_3	There is a relationship between manufacturing performance and sustainability.	Supported
H_4	There is a relationship between ethical climate and manufacturing performance	Supported
H_5	Manufacturing performance is mediate variable that influence of lean practices on sustainability.	Supported
H_6	Ethical climate is moderate influencing lean manufacturing practices on manufacturing performance.	Not supported

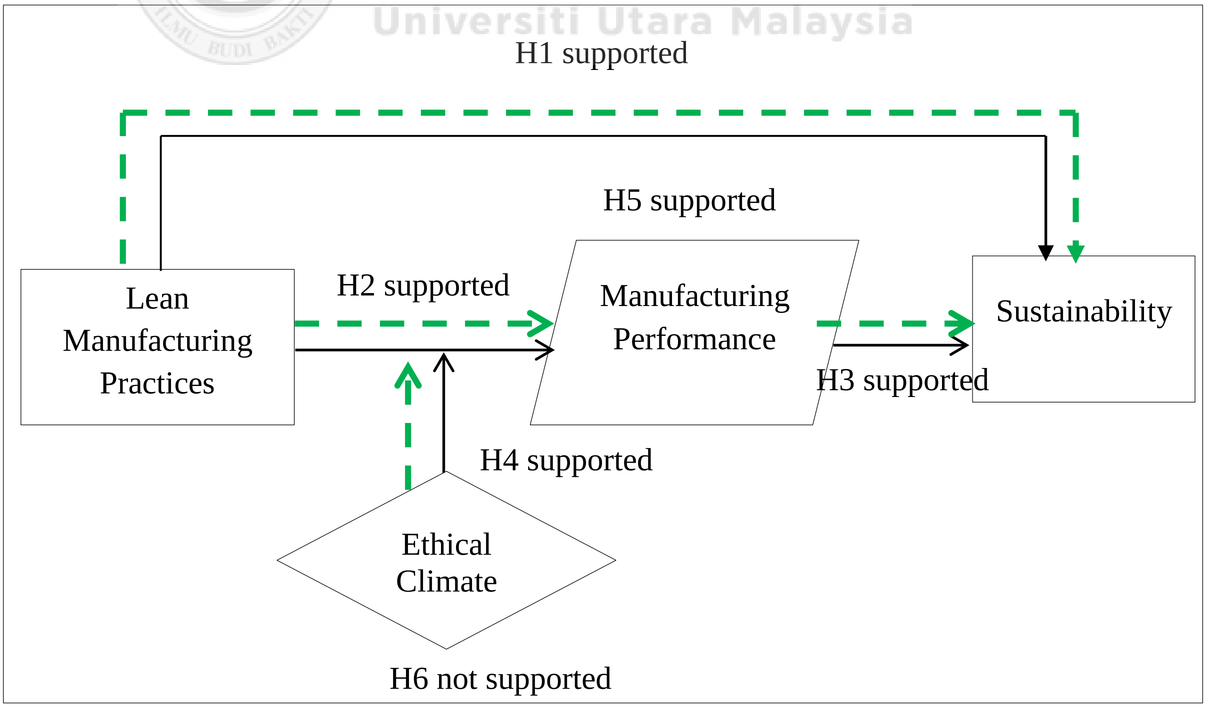


Figure 4. 7
Hypothesis Findings

4.9 Chapter Summary

Data screening and examination verified that the dataset was free of biases (i.e. non-response and CMB), thus all studied constructs were also confirmed reliable and valid. Meanwhile, findings from the hypotheses testing reveal that all hypothesised relationships were statistically significant except for H6, which was the moderating effect of EC on LMP and MP relationship. On the contrary, MP does mediate the relationship between LMP and SUS. In addition, all predictor variables (i.e. LMP, EC and MP) have sufficiently explained the variance in criterion variable (i.e. SUS) with R2 of 67.6%. Lastly, it was proven that this model was relevant with Q^2 of 0.502.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This final chapter deliberates the findings obtained in chapter four as well as to review the main ideas based on the research objectives. This chapter is divided into seven sections which are Section 5.1 on Introduction; Section 5.2 on Overview, Section 5.3 presents the summary of findings concerning the research objectives, while Section 5.4 and 5.5 explains the research implications and limitation of this study. Finally, Section 5.6 highlights the potential recommendation for future research and a brief conclusion ends this chapter in Section 5.7.

5.2 Recapitulation and Summary of Findings

As discussed in Chapter one, there was a need to examine the influence of lean manufacturing practices on manufacturing performance towards sustainability among manufacturing organisations in Malaysia. This was due to past research unable to incorporate these elements in their study which the researcher intends to conduct this study empirically, specifically, limited researches have been found in the Malaysia context.

As such, a conceptual framework was developed, underpinned by theories such as stakeholder theory and resource based view theory to test six hypotheses in determination to answer these following questions:

i. Is there any relationship between lean manufacturing practices and sustainability in the manufacturing organisation?

ii. Is there any relationship between manufacturing performance and lean manufacturing practices?
iii. Is there any relationship between sustainability and manufacturing performance?
iv. Is there any relationship between ethical climate and manufacturing performance?
v. Does the manufacturing performance mediate the relationship between lean manufacturing practices and sustainability?
vi. Does the ethical climate moderates the relationship between lean manufacturing practices and manufacturing performance?

Chapter two have attentively reviewed and synthesised the main variables based on the established theories. Accordingly, this chapter had described the definition of each variable which include lean manufacturing practices, manufacturing performance, ethical climate and sustainability. The definition and the dimension of these variables further supported by illustrating it into the table to summarise the variables based on past studies. Subsequent, the relationship of each variable was elucidated and justified to certify it is aligning with the research objectives and research questions. Moreover, in this chapter also emphases on the conceptual framework and hypothesis development. The conceptual framework was proposed to help in elucidating the relationship of this study and it was underpinned by selected theories. From the conceptual framework, six hypotheses were developed in order to test the relationship between variables whether the result was supported or not supported.

Chapter three focuses on the conceptual framework and hypothesis development. The conceptual framework was proposed to help in explaining the relationship of this study and it was underpinned by selected model and theories. From the conceptual framework, six hypotheses were developed in order to test the relationship between variables whether the result was supported or not supported.

Then, Chapter four highlights the research methodology that encompasses several steps on how to conduct a quantitative study. Two types of studies were identified namely descriptive study to describe the demographics of respondents and inferential study to test the relationship. The population of this study was the manufacturing organisations in Malaysia and 335 a total of sample size has been chosen. Simple random sampling technique was employed to select which manufacturing organisations need have to participated. Then, the validity test was conducted using face validity and content validity with the purpose to confirm the questionnaire is easy to understand by the respondents. After the validation was conducted, several indicators or items was found in need to be changed. 5 Likert scale was used to measure the item and SPSS as well as Smart PLS were performed to analyse the data.

Chapter five concentrated on findings and analysis. The findings of this study were derived in Chapter Five where Partial Least Squares – Structural Equation Modelling (PLS-SEM) was employed to analyse the data obtained using SmartPLS3 software. This second generation technique was primarily used to develop theories in exploratory research by highlighting the variance in the dependent variables when examining the model (Hair, et al, 2017). This technique was perfectly well-matched for this study due to some key characteristics of PLS-SEM such as no distributional assumptions, no issues with small sample sizes and it can handle complex model. Commonly, to assess the path model in PLS-SEM, requires two evaluations comprising of measurement models (to measure the relationships between indicators and the variables) and structural models (measures between the variables) which were conducted for this study. Finally, the following section discloses the discussion of hypothesis findings, research recommendation and conclusion.

5.3 Discussion of Hypothesis Findings

Afterwards, to see whether the hypothesis is supported or not, evaluation of the structural model was performed. In consequence, the hypothesis statement was built based on the previous literature to examine the direct influence of the exogenous variables (lean manufacturing practices) on the endogenous variable (sustainability) with the mediator and moderator variable namely manufacturing performance and ethical climate. As a result, among the six formulated hypothesis, five were supported while one hypothesis was not supported where the findings will be elaborated further in the next section.

5.3.1 Lean Manufacturing Practices and Sustainability

Research Objective 1: To examine the relationship between lean manufacturing practices and sustainability in the manufacturing organisation.

The first hypothesis was tested and the result indicated that positive relationship was found between lean manufacturing and sustainability which demonstrated a variable was significantly important in manufacturing organisations. This result was also consistent with the study of Iranmanesh et. al (2019) where it was found that there is a positive impact of lean manufacturing practices toward sustainable performance. Furthermore, a study by Piercy and Rich (2015) also reported that lean operations meet a wide range of sustainability. The researcher believes that significant relationship between lean manufacturing practices towards sustainability due to important role of lean manufacturing to enhance companies' performance, not only performed at the operations levels but also at the business level and at once led to sustainability in the organisations (Nawanir et al., 2018). Likewise, lean manufacturing practices have been proven to be a valuable manufacturing strategy far beyond its original industry (i.e. automobile industry); it has recently been applied in a wide variety of industries, not only automobile industry, but also other sectors like textile, machinery equipment, electrical, electronics, and even wood and furniture industries (Nawanir et al., 2018).

Meanwhile, a study by Shrafat and Ismail (2019) has found that lean manufacturing practices have gained increasing importance in the area of manufacturing development. Numerous companies were assessing and evaluating the current status of their operations in a way that enables them to adopt lean manufacturing approach. Besides, lean manufacturing has drawn the interest of businesses seeking market advantage through strengthened management practises (Shrafat & Ismail, 2019).

Furthermore, in the manufacturing sector, some of the studies confirmed to have a significant result between lean manufacturing and economic performance (Zhu & Sarkis, 2004) environmental performance (Hajmohammad, Vachon, Klassen, & Gavronski, 2013; Torielli, Abrahams, Smillie, & Voigt, 2011) and financial performance (Olsen, 2004). However, these studies were conducted by independently assessing the sustainability component instead of investigate collectively. Undeniably, lean was the most important practice in the organisation and in fact delivers efficiently to the many types of organisations. It has become a driving force in conserving the environment and sustainability (Ho, 2010). Besides, according to King and Lenox, (2001); Rothenberg, Pil and Maxwell, (2001), lean practices were managerial actions that reduced or removed wastes in all forms. Hence, lean practices were supportive of a particular organisation to eliminate pollutant and dangerous emissions by means of decrease in logistic and as a result reduce non-value added activities. Additionally, lean practices also play a role in order to sustain the environmental performance (King & Lenox, 2001; Shah & Ward, 2003). Langenwalter (2006) also mentioned that lean leads in the direction of sustainability initiatives. Meanwhile, a study by Longoni and Cagliano (2015) identified that lean manufacturing can also have an impact on environmental and social sustainability practices. In fact, sustainability was not only concerning about how to sustain current operational levels and penetrating new markets in order to replace lost ones, likewise attempt to achieving development so that organisation can be well growth. Hence, the organisation must be able to support the manufacturing operations by a lean implementation.

Undeniably the result indicated that lean manufacturing practices brings great influence towards sustainability in the Malaysia manufacturing organisations although lean manufacturing has existed for years ago. To put in a nutshell, manufacturing organisations with fully practised of lean was apparently to attain greater sustainability.

5.3.2 Lean Manufacturing Practices and Manufacturing Performance

Research Objective 2: To examine the relationship between lean manufacturing practices and manufacturing performance

The second hypothesis was tested and the result indicated that positive relationship was found between lean manufacturing and manufacturing performance which demonstrated a variable was significantly important in manufacturing organisations.

This result was also consistent with the study of Shurrab and Hussain (2018) which was found the significant relationship between lean manufacturing practices towards performance in their research. They believe that lean has received attention from academics and practitioners alike as a competitive advantage source in both developing and developed economies.

Manufacturing organisations have increasingly incorporating lean manufacturing practices into their operations, seeing lean manufacturing practices as an essential component of their strategy to maintain a competitive position in the market. Hashmi, Khan and Haq (2015) found a vigorous positive relationship between a company's manufacturing performance and its adoption of lean manufacturing techniques. Alluding to Rasi, Rakiman and Ahmad (2015), the connection between lean manufacturing practices and manufacturing performance was made up of four main ideas such as quality, delivery, cost and flexibility. Meanwhile, the influence of lean manufacturing practices that consists of JIT, technology and innovation, on operation performance has been measured by Agus and Iteng (2013). As a result, they have found an affirmative relationship between lean manufacturing implementation and upgraded operation performance. Likewise, a study by Fullerton and Wempe (2009) found that the effects of implementing lean manufacturing practices on the financial performance of manufacturing companies were mediated by many operation performance measures that were similar to the manufacturing performance such as cycle time, productivity and delivery. This statement was supported by Shrafat and Ismail (2019) which they have agreed that lean manufacturing practices able to enhance manufacturing performance.

Alternatively, Singh, Garg and Sharma (2010) revealed that using lean manufacturing practices tended to help manufacturers by decreasing work-in-process inventory by 89 percent, finished goods inventory by 1.8 percent, production lead time by 83 percent and processing time by 13 percent. On the other hand, it was increasing labor productivity by 43 percent. These results were consistent with the finding of Godinho Filho, Ganga and Gunasekaran (2016) of a positive and critical relationship between lean manufacturing practices and manufacturing performance.

In the same way, study by Yadav, Jain, Mittal, Panwa and Lyons (2019) revealed that the SMEs have been found to primarily use eight practices, namely, customer involvement, employee involvement, pull system, 5S, TPM, statistical process control, SMED and production levelling resulting in a positive impact on the manufacturing performance. Henceforth, it shows that the adoption of lean in SMEs is likely to make a significant contribution to manufacturing performance. The results suggest that even with the limited number of implemented practices, lean may help to enhance the manufacturing performance in SMEs.

On the contrary, a case study made by Iwao and Marinov (2018) explicitly mentioned that the implementation of lean especially continuous improvement in Toyota Motor Plant and Matsuo Construction company can lead to manufacturing performance enhancement. The results achieved from each case are quite dissimilar. Improvement activities at Toyota significantly contribute to performance improvement, while Matsuo Construction has found itself in a curious situation wherein a large number of improvement activities and proposals do not lead to an improvement in performance.

By comparing these two cases, this study attempts to shed light on the type of management that successfully links improvement activities to performance.

A study by Saleh, Sweis and Saleh (2018) on the other hand had revealed that continuous improvement and SPC play a major role in gaining the desired manufacturing performance. It was also shown that TQM practices in the manufacturing sector include; continuous improvement, statistical process control (SPC), process management, quality tools and techniques shows a significant relationship with manufacturing performance that include quality and inventory management performance. Also, the findings showed that continuous improvement and SPC practices play a major role in obtaining the desired results of operational performance.

Hence, unquestionably the result indicates that lean manufacturing practices have a relationship between manufacturing performance in the Malaysia manufacturing organisations. Therefore, the rationalisation of the above finding has concluded that there was a positive relationship between lean manufacturing practices and manufacturing performance in the Malaysia manufacturing organisation. In other words, the influence of manufacturing practices has made manufacturing performance become greater.

5.3.3 Manufacturing Performance and Sustainability

Research Objective 3: To examine the relationship between manufacturing performance and sustainability.

The result of this next hypothesis indicated that manufacturing performance has positive relationship towards sustainability in Malaysia's manufacturing organisations. Manufacturing performance was expected to improve sustainability based on a prior research that has measured manufacturing performance inversely to ensure sustainability is performed. For instance a study conducted by Galpin et al., (2015); Hong, Yang and Dobrzykowski (2014) and Lacy, Haines and Hayward (2012) have verified manufacturing performance contributes to sustainability in the organisation. Nevertheless, sustainability put attentions on financial performance and environmental performance in the manufacturing sector but not in terms of social performance.

Meanwhile, Thomas et al., (2016) found that there was a relationship that exists between the sustainability technique and application of tools, models and the resulting levels of manufacturing performance in their study. Likewise, a study by Iranmanesh et al., (2019) indicated that process and equipment, product design, supplier relationships, and customer relationships in lean manufacturing practices have a positive and significant effect on sustainability.

A study by Ruben, Vinodh and Asokan (2019) had revealed that integrated lean sustainable manufacturing system can be defined as a system that creates value for the customers by eliminating wastes consistently and adopting processes that are eco-friendly, economically viable and safe for the employees to produce green products that enhance the social performance. Meanwhile, it was no longer justifiable for firms to choose out of practising sustainability strategically by substituting narrow incremental sustainability techniques for having a business strategy that integrates sustainability considerations, such as new product development, closed-loop manufacturing, and continuous innovation into a cohesive whole system (Cavaleri & Shabana, 2018).

This hypothesis result, indicated that the manufacturing organisations have taken an initiative to improve the organisation's efficiency and to save indispensable costs in order to sustain. This study also has measured manufacturing performance in terms of quality, delivery, flexibility, time and cost which it can be seen that most of the respondents have scaled fairly agree to strongly agree for all indicators.

Consequently, findings of the present study continue to recognize the positive relationship between manufacturing performance and sustainability which in earlier findings have indicated that both variables were expressively influenced by lean manufacturing practices aspects. Therefore, it can be concluded from the above discussion, that manufacturing performance is a vital element in giving the impact on sustainability in manufacturing organisations.

5.3.4 Ethical Climate and Manufacturing Performance

Research Objective 4: To determine the relationship between ethical climate and manufacturing performance

The next hypothesis was tested and the result indicated that positive relationship was found between ethical climate and manufacturing performance which demonstrated a variable was significantly related. This result was also consistent with the study of Khademfar, Idris, Omar, Ismail and Arabamiry (2013) where it was found that there is a positive impact between manufacturing performance and ethical climate in Malaysia manufacturing firms. They have found that ethical climate can contribute to the performance of the organisations.

Meanwhile, a study conducted by Sabiu, Ringim, Mei and Joarder (2019) had revealed that ethical climate linked to manufacturing performance. The result exposed that there was a direct effect between ethical climate and manufacturing performance. In this regards, the ethical climate plays an imperative role in improving manufacturing performance. It is considered as the essential organisational set of ethical values for its employees as well as providing an enabling atmosphere that encourages ethical behaviour, capable leadership, trust, commitment and creates workforce value to improve manufacturing performance.

Similarly, a study conducted by Hijal-Moghrabi, Sabharwal and Berman (2015) in Western Context United State of America (USA) in particular with 1,695 samples in quantitative analysis, the result shows that there is a positive relationship between ethical climate and manufacturing performance. On the other hand, a study that was carried out by Sabiu, Mei and Joarder (2016) in African context Nigeria in particular, investigated the influence of ethical climate on manufacturing performance using 181 samples from some selected public educational sector from North-western region have found that ethical climate is significant associated with manufacturing performance.

The aforementioned, Arulrajah (2015) stated that ethical climate may result in a big effect on the performance. In fact, doing it unethically will harm the manufacturing process and the entire system. Hence, researcher believes that ethical climate able to boosts and enforces the employees to acquire suitable ethical behaviour in discharging their responsibilities within the organisation.

Referring to Sabiu et al., (2019), still there were needs for more empirical investigation on the link between performance appraisal ethical climate and manufacturing performance in spite of the argument in the literature to extend the literature. Despite the lack of literature regarding ethical climate and manufacturing performance specifically in Malaysia, but the researcher still can still summarise that ethical climate was an important variable in giving the impact on manufacturing performance in manufacturing organisations.

5.3.5 Mediating Role of Manufacturing Performance

Research Objective 5: To examine the mediating effect of manufacturing performance in between lean manufacturing practices on sustainability.

Manufacturing performance has been measured in a different way depending on the purpose and suitability of the study. For this study, manufacturing performance variable has been identified as the same variable of operation performance due to the dimensions and items used by the researcher as discussed in chapter 2. According to Voss, Ahlstrom and Blackmon (1997); Tan and Wong (2015); Hon (2005), operational performance and manufacturing performance have used the same metrics to monitor and measure the performance and efficiency in the particular organisation. Therefore, this study is also the using operation performance as reference as it is the same variable with manufacturing performance.

Another substantial study was done by Belekoukias, Garza-reyes, et al., (2014); Nawanir, Teong and Othman (2013); Shah and Ward (2003); and Voss et al., (1997) that measured the effect of lean production or lean bundles towards operational performance that acted as a dependent variable in the manufacturing sector. Nawanir et al.,(2013); Fullerton and Wempe (2009) have also tested the manufacturing performance to study other performances such as business performance and financial performance.

Similarly, previous studies by Hadid, Mansouri and Gallear (2016); Tan and Wong, (2015); Belekoukias, Garza-Reyes, et al., (2014); Hadid and Mansouri (2014); Karim and Arif-Uz-Zaman (2013); Chen and Tan (2011) have placed manufacturing performance as a dependent variable as well. In conjunction to this studies, manufacturing performance was tested in observing the performance indicators in the organisations respectively.

In reflection upon on the result of the manufacturing performance, numerous scholars such as Nawanir, Lim and Othman (2016); Nawanir et al., (2013) and Fullerton and Wempe (2009) are supporting the manufacturing performance as a role of mediator to examine the relationship between lean and other performances such as business performance and financial performance. Besides, Hasan, Mohd Asaad and Iteng (2018) have also proposed that manufacturing performance be a moderator between lean manufacturing practices and sustainability in manufacturing organisations.

The current study hypothesises the role of manufacturing performance as a mediator on the relationship between lean manufacturing practices and sustainability. As predict, the results of the study indicated that manufacturing performance did certainly function as a partial mediator between lean manufacturing practices and sustainability at manufacturing organisations in Malaysia. Consistent with a study by Nawanir et al., (2013), manufacturing performance partially mediates between lean practices and business performance in the manufacturing sector. Business performance was measured by profitability, sales and customer satisfaction. Profitability and sales growth are consequently parallel with the indicators of sustainability in terms of the financial elements of this present study. Inversely, this resent study measured the manufacturing performance by quality, delivery, flexibility, time and cost.

Meanwhile, study by Anuar, Saad and Yusoff (2017) has indicated that operational performance has been established as a mediator between lean health care practice towards sustainability in healthcare organisations in Malaysia. Correspondingly, the impact of lean manufacturing practices has been scrutinised between non-financial performance (NFP) and financial performance which resulting in the operational performance (NFP) mediating the relationship between lean manufacturing and financial performance through the study by Fullerton and Wempe (2009). To some extent, lean manufacturing practices from the respective studies have been deployed into various categories which also technically has produced lean manufacturing practices as a combinations of lean practices such as cellular layout, pull system/ *kanban*, quick setup, total quality management (TQM), total productive maintenance (TPM), small lot of production based on the past literature.

5.3.6 Moderating Role of Ethical Climate

Research Objective 6: To examine the moderating effect of ethical climate of lean manufacturing practice on manufacturing performance.

Previous result has shown lean manufacturing practices were significant for manufacturing performance. Furthermore, current literature has deliberately explained ethical climate in different context. Ethical climate was measured by examining the effect of ethical climate on the relationship between lean manufacturing practices towards manufacturing performance. With that purpose, this study was endeavoured to establish ethical climate as moderating variable between both variables which has been described above.

Previous discussed in Chapter Two, ethical climate was operationalized as a view of employee pertaining what constitutes ethically right or wrong behaviour and through which ethical issues are managed, will become a psychological mechanism in an organisation and affects decision making and performances in the particular organisation. Likewise, previous scholars indicate that swapping the unethical behaviour of members in an organisation through the help of ethical climate may have important impact on organisational performance and entire system (Arulrajah, 2015).

Yet, previous outcomes on the relationship between ethical climate and moral judgment, or the ability to discern ethical concerns, have been somewhat mixed and depend on factors such as the nature of consequences of failing to achieve quota or the type of control system. Conversely, the studies by Zehir, Gogus and Karakadilar, (2016); Zehir, Müceldili and Zehir (2012) established the role of ethical climate as a moderator between job satisfaction and organisation commitment and also between job satisfaction and organisation citizenship. Similarly, Sabiu, Mei and Raihan Joarder, (2016) revealed the significant moderating effect of ethical climate between recruitment and selection towards operational performance.

Accordingly, a hypothesis was formulated to examine the moderating effect of ethical climate based on the interaction between the lean manufacturing practices with the manufacturing performance. Unfortunately, that result has unexpectedly shown the hypothesis was not supported. In this regards, it specifies the significant negative relationship between lean manufacturing practices and manufacturing performance was not dependent on the ethical climate establishment. Thus, the result proposes the creation of ethical climate does not have significant moderating effect on the positive influence of lean manufacturing practices and manufacturing performance. It upholds that lean manufacturing practices of manufacturing organisations were the perfect determinant of manufacturing performance of Malaysia's manufacturing organisations without concerning ethical climate.

Related to this finding, lean manufacturing practices consequence on manufacturing performance is not liable on ethical climate due to lean manufacturing practices have strongly characterized the elements of ethical in the basis of lean practices. Driving the lean process and rigorous standardization are people who work hard as a team to achieve common objectives follow the ethical and set of beliefs about what makes up a good process as stated in the Toyota Production System House (Liker & Morgan, 2006).

Furthermore, in the context of manufacturing industries in Malaysia, Wong et al., (2009) highlighted that it is very clear that the firms involved in their study gained various benefits after practicing the concept of lean manufacturing. The benefits gained included lower cost, lower non-value added activities, lower inventory level, higher profit, higher quality, higher flexibility, better productivity, and better response time without considering the ethical.

Subsequently, the common research theme that regarding the lean manufacturing in Malaysian manufacturing settings is to reduce waste (Manzouri, Nizam Ab Rahman, Saibani, & Rosmawati Che Mohd Zain, 2013; Rose, Ab Rashid, Nik Mohamed, & Ahmad, 2016; Abu, Gholami, Mat Saman, Zakuan, & Streimikiene, 2019) to focus on customers (Nordin et al., 2010; Rose et al., 2016; Abu et al., 2019) to increase flexibility

(Nordin et al., 2010; Manzouri et al., 2013) to reduce cost (Manzouri et al., 2013; Abu et al., 2019) and to improve long term quality competitiveness (Rose et al., 2016; Abu et al., 2019). In addition, Osman et al. (2020) asserted that current database shows that common survey studies tend to report the lean manufacturing adoption results using latent constructs (indirect measurements) such as organisational performance, operational performance, and business performance. There is no research theme regarding ethical, consequently one of the reason ethical climate has failed to contribute and enrich manufacturing performance ensued by lean manufacturing practices.

In connection with that, Puvanasvaran et al. (2008) asserted that "respect for people" which is a basic of Toyota Production System House need to be emphasize. Respect for people which mainly focuses on the lean behaviors that each employee in organization should build in their mind. Top managers who practice lean management must make greater efforts to ensure that they understand the true meaning of "respect for people" principles because most management practitioners, thus hindering efforts to correctly practice lean management and improve business performance (Emiliani, 2006). Respect for people in lean process management is another crucial factor in developing the ethical throughout organization (Puvanasvaran et al., 2008). With the elucidations above, ethical climates has failed to play as moderating effect and unable to support the hypothesis.

Normally, most of the study will suggest to increase the respondents in order to have the moderating effect. However, the numbers of respondents for this study is not affect the moderation result because a response of 20-30% is normal for data collection method that associated with the online mail survey (Yusof & Aspinwall, 2000); Mohd

Fuzi et al., 2019). Nevertheless, compared to the study by Zehir et al., (2016), they were using 600 respondent in their study whereas Nafei (2015) managed to get 295 respondents. Meanwhile Zehir et al., (2012) succeeded to get 192 organisations as respondents for data collection. Besides, 339 data was collected by Tanner et al., (2015) in their study. Remarkably, all those studies revealed that there were moderating effect found. Likewise, study by Sabiu, Mei and Joarder (2016) only managed to get 81 respondents in their study. Nonetheless, the result of their study found ethical climate partially moderate. Therefore, researcher believe that the numbers of respondents for this study is not influencing the result of moderation effect as for this study 101 data has been analyses.

Arguably, there is still a need for ample space to strengthening ethical climate in order to enrich the benefits gained from lean manufacturing practices for manufacturing performance.

5.4 Research Implications and Contributions

As has been stated in Chapter One, the purpose of this study is to investigate the relationship between lean manufacturing practices on manufacturing performance towards sustainability in Malaysia's manufacturing organisation; as well as to investigate the moderating effect of ethical climate on the relationship between lean manufacturing practices with manufacturing performance. These respective variables have been chosen based on the past literature and it was underpinned by trustworthy theories namely Stakeholder Theory and Resources Based View Theory. Thus, six hypotheses were developed to examine the relationship between the variables and further, the findings were discussed. Subsequently, the implications of the study in the aspect of theoretical, managerial and methodological would be deliberated in the next section and finally limitations of study, recommendation and conclusion are presented.

5.4.1 Theoretical Implication of the Study

The theoretical implications have brought the findings of this study into three main contributions. Firstly, the contribution towards management research in introducing new variables, model and findings. Secondly, the study discussed the application of two theories namely Stakeholder Theory and Resources Based View Theory. Finally, explanation of contribution towards methodological.

5.4.1.1 Contribution towards Management Research

It is noted that most of the quantitative research was conducted in the manufacturing sector. Nevertheless, the research that highlights of four variables; lean manufacturing practices, manufacturing performance, ethical climate and sustainability still not made by past studies. Thus, this present study has added three variables that stand as mediator (manufacturing performance), moderator (ethical climate) and dependent variable (sustainability) which have not been tested before simultaneously in the manufacturing organisation.

Previous scholars have conducted empirical studies between lean practices (social and technical) towards operational performance and lean practices towards financial performance in the manufacturing and service sector. However, it seems that not many researchers examine lean manufacturing practices and sustainability that emphasizes on triple bottom line; social, economic and environmental and to the very best of the researcher’s knowledge, none of the study conducted to examine these four respective variables concurrently. Commonly, past studies have measured separately on sustainability rather than to evaluate cooperatively. Besides, sustainability has been perceived in different ways by several researchers.

Therefore, this study has given a positive result whereby Malaysia's manufacturing organisation can be sustainable through lean manufacturing practices with manufacturing performance as mediating effect. Unfortunately, ethical climate was not moderated between lean manufacturing practices with manufacturing performance.

5.4.1.2 Contribution towards Theories

This study attempts to integrate established theories; Stakeholder Theory and Resources Based View Theory in strengthening the proposed of a conceptual framework. Since sustainability is placed as endogenous variable in this study, hence, Stakeholder Theory has been introduced to reinforce the conceptual framework. This theory also has been extended to look at sustainability in the organisation instead of profitability or business alone. Sustainability comprises economic, social and environmental has blended in the manufacturing industry to place attention and kindness in protecting the stakeholders' right.

Meanwhile, Resource Based View Theory highlighted that human capital asset creates competitive advantage and improve organisational performance through employees behaviour. Consequently, workers can perform over effective operation of internal resources base on human resource practices. In Resource Based View Theory viewpoint, ethical climate has been related to add value to manufacturing performance in terms of playing an important role to achieve organisational triumph. In addition, ethical climate highlights on taking strategic value for organisation and how human resource systems may support that value to reach the goals. Besides, Resource Based View Theory was represented as a direction and application of relational lean practices to support organisation to reached competitive advantages towards manufacturing performance and at the same time as the short run competitive advantage into sustainability in terms of social, economic and environmental.

Aforementioned, many studies have been conducted in manufacturing organisations but not same variables with this study. Researcher highlighted four main variables such as lean manufacturing practices as independent variable, manufacturing performance stand as mediator, ethical climate as moderator and dependent variable was sustainability which have not been tested before simultaneously in the manufacturing organisation.

Therefore, these trustworthy theories have been translated, interpreted and more importantly it has been integrated to this study in order to explain the implementation of lean manufacturing practices, manufacturing performance, ethical climate and sustainability comprehensively in Malaysia's manufacturing organisations.

5.4.1.3 Contribution towards Methodological

Underpinned by philosophical assumptions, this study was designed thoroughly with tha quantitative approach. This study constructed a comprehensive measure of lean manufacturing practices, manufacturing performance, sustainability and ethical climate through combining measurements from various past studies. Data was analyzed by using PLS-SEM software. Applying this approach, all the parameters involved in the study are simultaneously estimated, so that measurement errors were well controlled.

PLS-SEM as a second generation of statistical tool in analysing the data provides complete information regarding the extent to which a model is supported by data. So that, biasness were rigorously eliminated. This study provided strong justifications for applying this method, and has successfully obtained meaningful results. Besides, in spite of rigorous studies have been done using PLS-SEM related to lean; much of it has been tested in the dissimilar setting and variables. Accordingly, PLS-SEM has supported the submission of this tool in the Malaysian context and it is recommended for use with similar statistical tools in conducting future research with more variables should be added.

5.4.2 Managerial Implication of the Study

Managerial implications are provided to complement the theoretical implication of the study that can be drawn by academicians, policy makers and regulatory authorities, and manufacturing organisations as well as some recommendations are also being given to these respective managerial levels.

5.4.2.1 Significance to Academicians

Captivatingly, the implementation of lean manufacturing practices currently has been practiced in everywhere. It was not only practice among manufacturing industries but at various place such as government office, hospital, universities either in public or private institutions and many more. Generally, the common practices of lean in somewhere other than manufacturing industries are such as the implementation of 5S which had been acknowledge as a compulsory to the government sector in years back. Meanwhile the Malaysian government has encouraged all tertiary institution to make their own income, it is thus an initiative and accountability to take up the challenge in ensuring the higher education industry is sustained in the future. In line with the findings of this study, the academicians possibly will obtain the benefit through the following:

1. The academicians could imitate this study by looking from the educational perspective. It is suggested to add more practices of lean practice such as visual factory and *andon* system in the laboratory and workshop, *kanban* system in library and many more which depends the applicability of the study.

2. The practices of lean manufacturing practices could be adopted in every single institution in order to realize the significance of impact implementing and adapt lean manufacturing practices concept in order to increase the performance and lead to sustainability. In fact, nowadays Malaysian Polytechnic is just started introducing lean management to all branches of the Polytechnic in Malaysia.

3. Taking into consideration of sustainability in the organisation, academicians should be more involved in their contribution to the society, economic and environmental awareness and be profitable and less cost if the implementation of lean manufacturing practices and manufacturing performance endlessly take place.

4. The top down communication is essential. In order to ensure the information or knowledge of lean manufacturing practices and sustainability is well conveyed, the leaders should communicate efficiently among academicians and staff. For instance, lean management just newly introduced at Malaysian Polytechnic. Therefore, before lean management is disseminated to polytechnic staff for adoption, top management

must master it first. If the top management have better understanding the original concept of lean management, it is easier to ensure that staff understand and practice it and capable to improve the performance of the Polytechnic as well as lead o sustainability.

5. Sharing sessions with other institutions could be done to share their beliefs and thoughts about the practice of lean manufacturing practices which will result in the institutions being more efficient and sustainable. For instance, the implementation of Sustainable Consumption and Production (SCP) in the future which has been specified in the Eleventh Malaysia Plan, tertiary education should take an opportunity to carry out SCP curriculum that surely will touch the elements of sustainability; economics, social and environmental. It is about promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all. Its implementation helps to achieve overall development plans, reduce future economic, environmental and social costs, strengthen economic competitiveness and reduce poverty. Furthermore, it is hoped to instil sustainable behaviour among educators and students as stated in Malaysian 11th Plan (2015).

5.4.2.2 Significance to Policymakers and Regulatory Authorities

Regulatory frameworks need to be improved in order to increase global competitiveness as stated in the Eleventh Malaysia Plan. A strong regulation provides a good impact on productivity and can be valuable to the organisation in terms of economic, social and environmental.

Additionally, policy makers should take into account the findings of this study to strengthen and improvise the prevailing policy with regards to lean manufacturing practice and sustainability of organisations as the results may well benefit in productivity and cost-effectiveness.

5.4.2.3 Significance to Manufacturing organisations in Malaysia

Irrefutably, the establishment of manufacturing industries in Malaysia has given a significant impact enormously to the nation especially the growth of GDP. Besides, manufacturing industries has given a big opportunity to the stakeholders whether internally or externally to share expertise in various field, full utilization of facilities, technological advancements, job vacancies, undertaking corporate social responsibility (CSR) and many more to ensure the organisation is able to sustain in the long term. Subsequently, referring the result of this study, the manufacturing industries can acquire several benefits through the followings:

1. The realization about lean manufacturing practices could help the organisations to increase the performance and sustainability.

2. A positive cooperation among various parties is crucial by breaking down departmental silos to ensure the implementation of lean manufacturing practices towards sustainability is successful.

3. Findings of this study will assist the top management and all managers to plan strategically on how to implement lean manufacturing practices tactically in the organisation.

4. Manufacturing organisations can attract investors or outsider's intentions to venture into the business due to better performance in the areas of economic, social and environmental.

5. A clear explanation about the importance of lean manufacturing practices and manufacturing performance towards sustainability should be made by top level managers to their respective subordinates in a flexible way such as two-way communication to enhance better understanding. Furthermore, leaders should carry along the staff on a journey towards the organisation's mission and vision.

Fundamentally, Malaysia's government has taken an initiative which has been projected in the Eleventh Malaysia Plan where improvements in quality of life are in coherence with the sustainability of the environment and natural resources. As such, the plan had introduced Sustainable Consumption and Production (SCP) to promote economic growth for future generations without risking it.

5.5 Limitations of the Study

Although mail questionnaires provide opportunities to study a wide geographical area to include various manufacturing firms across Malaysian regions in a short time period, fortunately it was associated with adequate response rates among the manufacturing industries. However, some of the firms in the sample were unwilling to complete the questionnaire due to some reasons including confidential issue and time constraints.

Since this is the first time of examining the relationship of lean manufacturing practices and manufacturing performance towards sustainability with the moderating effect of ethical climate and mediating effect of manufacturing performance in Malaysia's manufacturing organisations, definitely some limitations or boundaries exist in conducting this research which explained as follows.

1) Lack of cooperation from the representative of manufacturing organisation in Malaysia due to time constraints and privacy of information. Generally, most of the manufacturing industries have their own policy in revealing any relevant information about the organisation. After the researcher made a follow up with the company involved in this study, unlucky the company has refused to cooperate due to the organisations policy, certain respondents unable to participate directly to give any information or data.

2) The evidence to support the findings of this study is quite limited due to past studies that have shown most of the researches have been conducted in different setting and variables. Lack of study pertaining moderating effect of ethical climate in manufacturing industries.

3) In the quantitative phase, data pertaining to all the variables were collected using online survey method. Single respondent embodied the whole company. Although the respondents were key persons that involving with the lean manufacturing and organizational performance in the surveyed organizations, a number of factors might be influenced the answer, such as their experiences, knowledge, self-perception, work situation, and even personal condition. Besides, even though the questionnaire had passed the validity and reliability tests, but respondents' answer may have differed

from that intended. To avoid this limitation, the future studies may consider collecting quantitative data from multiple respondents in one organization.

5.6 Recommendation of Future Research

Even though there are limitations to this study, but this research can be further explored in different directions in order to attain comprehensive understanding of lean manufacturing practices, manufacturing performance, ethical climate and sustainability in the future. Future researcher has the opportunity to further explore several potential problem as follow.

Firstly, future researcher should be tested the role of moderating effect by sustain the ethical climate in order to prove that it is a good variable to play a role as a moderator. This is because the current result shows the tendency to get the positively moderate due to the interaction plot diagram shows that the intersection between lean manufacturing practices and ethical climate curves will eventually appear at some point. Consequently, it can be extended the literature as well.

Secondly, since this study has been used manufacturing performance indicators such as quality, delivery, cost, time and flexibility and indicated the positive result, therefore for the future study may use inventory (Nawanir et al., 2013; Chen & Tan, 2011; Sakakibara, Flynn, Schroeder, & Morris, 1997; Corbett, 1998; Kaplan, 1983) and productivity (Nawanir et al., 2013; Rahman, Aosirihongthong, et al., 2010;Cordero et al., 2009) as suggested by previous scholar. The dimensions of manufacturing performance which contributes most towards the sustainability shall be later identified.

Thirdly, this study relied on perceptual measure of lean manufacturing practices for measuring manufacturing performance, ethical climate and sustainability. According to Johnson, Onwuegbuzie and Turner (2007), mixed methods research combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, and inference techniques) for the broad purposes of extensiveness and depth of understanding and corroboration. Besides, Jick (1979) asserted that the weaknesses in each single method can be compensated by strengths in another. Hence, by using mixed methods approach led to the closer to a full representation about the phenomena intended to be investigated (Lieber & Weisner, 2010). Therefore, integrating the two methods, quantitative and qualitative, are powerful to reach a deeper understanding to the interested phenomena. Furthermore, although there are still subjective in nature, qualitative self-reported measures have been widely used in previous studies (Klassen & Whybark, 1999). Thus, future research is suggested to use both quantitative and qualitative measures in assessing the study in order to verify the validity of the data as well as a depth study.

Fourthly, as stated by Sinaga et al. (2020), in selecting and implementing general strategies to enhance and preserve the organisation, sustainability offers an overview for businesses. Likewise, Gupta and Singh (2020) also expressed that the organizations were incorporating sustainability dimensions in their business strategies for their growth (Gupta & Singh, 2020). Therefore, while looking at the sustainability of lean manufacturing practices in this study, it is suggested to not focus on triple bottom line where presently sustainability has been viewed in different perspective. Whether the element of sustainability can be extended to examine culture (Marshall et al., 2015; Galpin et al., 2015), technology (Liboni & Cezarino, 2014; Agyekum-Mensah et al.,

2012) sustainability practices (Wickramasinghe & Wickramasinghe, 2017; Hong, Roh, & Rawski, 2012) or others or how to ensure the implementation of lean manufacturing practices can be sustainable in the long period.

Additionally, future research also should embark in longitudinal studies because with a snapshot of data, the use of longitudinal data would be more useful to examine the changes in certain variable as suggested by Wong & Wong (2011). Even though it can be done empirically, but the response rate of manufacturing organisation in Malaysia is quite low and therefore could affect the generalization of the study. Thus, to enrich the implementation of lean manufacturing practices in organisation, it should be conducted over several years to ensure the practices of lean manufacturing and sustainability is undoubtedly successful. Longitudinal studies are suggested for future research to prove the causal inferences among lean manufacturing practices, ethical climate, manufacturing performance and sustainability that outlined in this study. Consequently, by doing longitudinal studies and multiple case studies in different industrial setting, the findings of these study are valuable for better understanding of sustainable manufacturing.

Besides, empirical study also can be done if the variables of lean manufacturing practices can be formed into multidimensionality which current study had tested lean manufacturing practices in unidimensionality. Multidimensionality perhaps could identify precise practices of lean manufacturing practices in contribution to increase the manufacturing performance towards sustainability. As Malaysia is now moving forward to become a high income country, transforming manufacturing organisation is required by adopting lean manufacturing practices in organisations which will create efficiency, processes and outcome as well as to escalate the productivity growth of the country.

5.7 Conclusion

Lean manufacturing practices is the important mechanism that should be applied in the organisation. It has been contended by Ho (2010) that it was the most crucial word for any organisation in this present world. Beside, lean manufacturing practices also has made the manufacturing organisation doing more with less, but how far lean can contribute to sustainability which this study propositions to explore on the subject of relationship of lean manufacturing practices; manufacturing performance and their influence on sustainability in manufacturing organisations. The awareness of this study was derived after identifying the fragmented and discrepancies result of past studies. As a result, it has commanded the researcher to conduct this study with the aims to link the gap strategically.

The literature reviews were accessible comprehensively in order to direct the study in developing the conceptual framework, hypothesis development and research instruments. Further, the conceptual framework for this study taken the theoretical gaps into sustainability (endogenous variable) elucidated by the lean manufacturing practices (exogenous variable) through their manufacturing performance (mediator), which is influenced by ethical climate (moderator). This study has been underpinned with one two theories namely Stakeholder Theory and Resource Based View as the foundation to support the study and six hypotheses was formulated to test the relationship between variables.

Afterwards, PLS-SEM using SmartPLS 3.0 was performed to analyse the data and transferred into coherent and realistic findings. Captivatingly, the result was found positive where it shows six hypotheses were supported but contradictory result has found in the other one hypothesis. Herewith are the five hypothesis which supported this; all the variables include lean manufacturing practices and manufacturing performance have positive relationship with sustainability. Manufacturing performance had proven that it can be mediated between lean manufacturing practices towards sustainability. These results someway have elucidated clearly and confirmed the practice of lean manufacturing contributes to sustainability in the manufacturing organisations which can be seen the previous studies that have been conducted also in the manufacturing and service sector. Unfortunately, ethical climate did not perform as a moderator between lean manufacturing practices with manufacturing performance.

With these reliable findings, it has provided contributions theoretically, practically and methodologically with the imperative implications to the academicians, policy makers and manufacturing organisations specifically. For the academicians, the present study can be replicated for future study by extending to the population, using the same instrument to measure the respondents and the existing variables can be tested using other variable for moderator since the moderator of this study was not supported. Academicians as well as students perhaps can adopt the practices of lean manufacturing into the education sector since 5s is currently in practise in the universities. For the policy makers, the regulations and policies need to be strengthened to avoid future concerns.

Therefore, as has been reported by Economic Planning Unit, it is hoped that manufacturing organisation in Malaysia returns high benefit to Malaysia's socio-economic upon their adaptation of lean manufacturing practices. Aforementioned, manufacturing industry should be put attention since manufacturing sector contribute the third largest in Malaysia economic (Economic Planning Unit, 2015). Predominantly, lean manufacturing practices provides a better insight to Malaysia's manufacturing organisations by taking into account manufacturing performance and sustainability of economic, social and environmental aspects. In line with a strong call from the government, a reputable image for Malaysian manufacturing organisation locally and internationally will be projected. As a result, other than able to stabilize the manufacturing industry, at once it also can encourage foreign to invest in Malaysia and put the country in the eyes of the world.

REFERENCES

Abdel-maksoud, A., Dugdale, D., & Luther, R. (2005). Non-financial performance measurement in manufacturing companies. *The British Accounting Review*, *37*, 261–297. https://doi.org/10.1016/j.bar.2005.03.003

Abdelhadi, A. (2016). Using Lean Manufacturing as Service Quality Benchmark Evaluation Measure. *International Journal of Lean Six Sigma*, *7*(1), 25–34. https://doi.org/10.1108/EL-01-2014-0022

Abdul-Rashid, S. H., Sakundarini, N., Raja Ghazilla, R. A., & Thurasamy, R. (2017). The impact of sustainable manufacturing practices on sustainability performance. *International Journal of Operations & Production Management*, *37*(2), 182–204.

Abu, F., Gholami, H., Mat Saman, M. Z., Zakuan, N., & Streimikiene, D. (2019). The implementation of lean manufacturing in the furniture industry: A review and analysis on the motives, barriers, challenges, and the applications. *Journal of Cleaner Production*, *234*(June), 660–680. https://doi.org/10.1016/j.jclepro.2019.06.279

Adebanjo, D., Teh, P., & Ahmed, P. K. (2016). The impact of external pressure and sustainable management practices on manufacturing performance and environmental outcomes. *International Journal of Operations & Production Management*, *36*(9), 995–1013. https://doi.org/10.1108/IJOPM-11-2014-0543

Agus, A., & Iteng, R. (2013). Lean Production and Business Performance: The Moderating Effect of the Length of Lean Adoption. *Journal of Economics, Business and Management*, *1*(4), 324–328. https://doi.org/10.7763/JOEBM.2013.V1.70

Agyekum-Mensah, G., Knight, A., & Coffey, C. (2012). 4Es and 4 Poles model of sustainability: Redefining sustainability in the built environment. *Structural Survey*, *30*(5), 426–442. https://doi.org/10.1108/02630801211288206

Ahmad, M., Dhafr, N., Benson, R., & Burgess, B. (2005). Model for establishing theoretical targets at the shop floor level in specialty chemicals manufacturing organizations. *Robotics and Computer-Integrated Manufacturing*, *21*(4–5), 391–400. https://doi.org/10.1016/j.rcim.2004.11.016

Ahmad, Shamraiz, & Wong, K. Y. (2018a). Sustainability assessment in the manufacturing industrial review of recent studies. *Benchmarking: An International Journal*, *25*(8), 3162–3179.

Ahmad, Shamraiz, & Wong, K. Y. (2018b). Sustainability assessment in the manufacturing industry: a review of recent studies. *Benchmarking*, *25*(8), 3162–3179. https://doi.org/10.1108/BIJ-08-2017-0214

Ahmad, Shamraiz, Wong, K. Y., & Rajoo, S. (2019). Sustainability indicators for manufacturing sectors: A literature survey and maturity analysis from the triple-bottom line perspective. *Journal of Manufacturing Technology Management*, *30*(2), 312–334. https://doi.org/10.1108/JMTM-03-2018-0091

Ahmad, Sohel, Schroeder, R. G., & Sinha, K. K. (2003). The role of infrastructure practices in the effectiveness of JIT practices : implications for plant competitiveness. *Journal of Engineering and Technology Management*, *20*, 161–191. https://doi.org/10.1016/S0923-4748(03)00017-1

Aikens, C. H. (2011). *Quality inspired management: The key to sustainability*. New Jersey: Pearson Education, Inc.

Al-Jawazneh, B. E. (2012). Manufacturing Flexibility and Operational Performance of Pharmaceutical Manufacturing Companies in Jordan. *International Journal of Business and Management*, *7*(4), 181–194. https://doi.org/10.5539/ijbm.v7n4p181

Alaskari, O., Ahmad, M. M., & Pinedo-Cuenca, R. (2016). Developement of a Methodology to Assist Manufacturing SMEs in The Selection of Appropriate Lean Tools. *International Journal of Lean Six Sigma*, *7*(1), 62–84.

Ali, Q., Hussain, A., & Jamal, M. (2011). Theoretical Underpinnings Behind Resource Based View: A Marketing Perspective. *Interdisciplinary Journal of …*, *3*(3), 1324–1332. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1911362

Allaraj, H., & Bakri, A. (2019). The Effect of Lean Manufacturing on the Financial Performance : Case of the Manufacturing Companies in South Lebanon. *Jounal of Business and Social Review in Emerging Economies*, *5*(2), 237–246. https://doi.org/10.26710/jbsee.v5i2.794

Aminpour, P., Gray, S., Richardson, R., Singer, A., Castro-Diaz, L., Schaefer, M., … Chikowore, N. R. (2020). Perspectives of scholars on the nature of sustainability: a survey study. *International Journal of Sustainability in Higher Education*, *21*(1), 34–53. https://doi.org/10.1108/IJSHE-05-2019-0161

Amrina, E., & Yusof, S. M. (2011). Key performance indicators for sustainable manufacturing evaluation in automotive companies. *IEEE International Conference on Industrial Engineering and Engineering Management*, (May 2014), 1093–1097. https://doi.org/10.1109/IEEM.2011.6118084

Anaza, N. A., Rutherford, B., Rollins, M., & Nickell, D. (2015). Ethical climate and job satisfaction among organizational buyers : an empirical study. *Journal of Business & Industrial Marketing*, *30*(8), 962–972. https://doi.org/10.1108/JBIM-03-2014-0047

Anuar, A. (2018). *The mediating effect of operational performance on the relationship between lean healthcare and sustainability of Malaysia ' s private hospitals moderated by safety climate*. Universiti Utara Malaysia.

Anuar, A., Saad, R., & Yusoff, R. Z. (2017). Operational Performance as a Mediator on The Relationship Between Lean Healthcare and Sustainability Among Private Hospitals In Malaysia Using PLS-SEM. *Journal of Information System and Technology Management*, *2*(6), 84–104. Retrieved from www.jistm.com

Anvari, A., Ismail, Y., & Hojjati, S. M. H. (2011). A Study on Total Quality Management and Lean Manufacturing: Through Lean Thinking Approach. *World Applied Sciences Journal*, *12*(9), 1585–1596. Retrieved from http://idosi.org/wasj/wasj12(9)/34.pdf

Appelbaum, S. H., Deguire, K. J., & Lay, M. (2005). The relationship of ethical climate to deviant workplace behaviour. *Corporate Governance: The International Journal of Business in Society*, *5*(4), 43–55. https://doi.org/10.1108/14720700510616587

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, *XIV*, 396–402.

Arulrajah, A. A. (2015). Contribution of Human Resource Management in Creating and Sustaining Ethical Climate in the Organisations. *Sri Lankan Journal of Human Resource Management*, *5*(1), 31–44.

Babin, B. J., Boles, J. S., & Robin, D. P. (2000). Representing the perceived ethical work climate among marketing employees. *Journal of the Academy of Marketing Science*, *28*(3), 345–358. https://doi.org/10.1177/0092070300283004

Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, *421–458*.

Baker, M. J. (2001). Selecting a Research methodology. *The Marketing Review*, *1*, 373–397.

Balok, D. V. (2012). *Critical team sucess factors and lean manufactruing: An empirical study*. Trident University International.

Bansal, P. (2005). Evolving sustainably: A longitudinal study of corporate sustainable development. *Strategic Management Journal*, *26*(3), 197–218. https://doi.org/10.1002/smj.441

Barnett, T., & Vaicys, C. (2000). The Moderating Effect of Individuals ' Perceptions of Ethical Work Climate on Ethical Judgments and Behavioral Intentions. *Journal of Business Ethics*, *27*(4), 351–362.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Barney, J. B. (2002). *Gaining and sustaining competitive advantage*. Upper Saddle River, NJ: Prentice Hall.

Barney, J. B., & Clark, D. N. (2007). *Resource-based theory: Creating and sustaining competitive advantage*. Oxford, UK: Oxford University Press.

Barney, J. B., & Griffin, R. W. (1992). *The Management of Organization: Strategy, Structure, Behavior*. Houghton Mifflin Company, Boston, MA.

Baron, R. M., & Kenny, D. a. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Ournal of Personality and Social Psychology*, *51*(6), 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173

Barron, K., & Chou, S. Y. (2017). Towards a spirituality mode of firms sustainability strategic planning processes. *Society and Business Review*, *12*(1), 46–62.

Begam, M., Swamynathan, R., & Sikkizhar, J. (2013). Current Trends on Lean Management – A review. *International Journal of Lean Thinking*, *4*(2), 15–21.

Belak, J., & Mulej, M. (2009). Enterprise ethicl climate changes over life cycle stages. *Kybernetes*, *38*(7/8), 1377–1398.

Belekoukias, I., Garza-reyes, J. A., & Kumar, V. (2014). The impact of lean methods and tools on the operational performance of manufacturing organisations. *International Journal of Production Research*, *52*(18), 5346–5366. https://doi.org/10.1080/00207543.2014.903348

Belekoukias, I., Garza-Reyes, J. A., & Kumar, V. (2014). The impact of lean methods and tools on the operational performance of manufacturing organisations. *International Journal of Production Research*, *52*(18), 5346–5366. https://doi.org/10.1080/00207543.2014.903348

Bell, S. C., & Orzen, M. A. (2011). Lean IT: Enabling and sustaining your lean transformation. In *Lean IT: Enabling and Sustaining Your Lean Transformation*. https://doi.org/10.1201/EBK1439817568

Berrone, P., Surroca, J., & Tribó, J. A. (2007). Corporate ethical identity as a determinant of firm performance: A test of the mediating role of stakeholder satisfaction. *Journal of Business Ethics*, *76*(1), 35–53. https://doi.org/10.1007/s10551-006-9276-1

Bhamu, J., & Sangwan, K. S. (2014). Lean manufacturing:literature review and rsearch issues. *International Journal of Operations & Production Management*, *34*(7), 876–940.

Bhuiyan, N., Baghel, A., & Wilson, J. (2006). A sustainable continuous improvement methodology at an aerospace company. *International Journal of Productivity and Performance Management*, *55*(8), 671–687.

Bjorklund, M., Forslund, H., & Isaksson, M. P. (2016). Exploring logistics-related environmental sustainability in large retailers. *International Journal of Retail & Distribution Management*, *44*(1), 38–57.

Björklund, M., Forslund, H., & Persdotter Isaksson, M. (2016). Exploring logistics-related environmental sustainability in large retailers. *International Journal of*

Retail and Distribution Management, *44*(1), 38–57. https://doi.org/10.1108/IJRDM-05-2015-0071

Brent, A. ., & Labuschagne, C. (2004). Sustainable Life Cycle Management: Indicators to assess the sustainability of engineering projects and technologies. *International Engineering Management Conference2*, 99–103.

Brown, S., Squire, B., & Blackmon, K. (2007). The Contribution of Manufacturing Strategy Involvement and Alignment To World-Class Manufacturing Performance. *International Journal of Operations & Production Management*, *27*(3), 238–302.

Bryman, A. (2012). *Social Research Methods* (4th ed.). Retrieved from http://library1.nida.ac.th/termpaper6/sd/2554/19755.pdf

Bulgacov, S., Ometto, M. P., & May, R. M. (2015). Differences in sustainability practices and stakeholder involvement. *Social Responsibility Journal*, *11*(1), 149–160. https://doi.org/10.1108/SRJ-02-2013-0023

Cain, M. K., Zhang, Z., & Yuan, K.-H. (2017). Univariate and multivariate skewness and kurtosis for measuring nonnormality: Prevalence, influence and estimation. *Behavior Research Methods*, *49*(5), 1716-1735.

Callen, J. L., Fader, C., & Krinsky, I. (2000). Just-in-time : A cross-sectional plant analysis. *Journal of Production Economics*, *63*, 277–301.

Carlborg, P., Kindström, D., & Kowalkowski, C. (2013). A lean approach for service productivity improvements: Synergy or oxymoron? *Managing Service Quality*, *23*(4), 291–304. https://doi.org/10.1108/MSQ-04-2013-0052

Cavaleri, S., & Shabana, K. (2018). Rethinking sustainability strategies. *Journal of Strategy and Management*, *11*(1), 2–17. https://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216

Cedergren, S., Wall, A., & Norström, C. (2010). Evaluation of performance in a product development context. *Business Horizons*, *53*(4), 359–369. https://doi.org/10.1016/j.bushor.2010.03.001

Cemberci, M., Civelek, M. E., & Gunel, D. (2016). The Mediator Effect of Ethical Climate on the Relation between Ethical Leadership and Organizational Commitment. *Research Journal of Politics, Economics and Management*, *4*(1), 147–160.

Central Bank Malaysia. (2017). *Economic Developement*.

Chakrabarty, A., & Tan, K. C. (2007). The current state of six sigma application in services. *Managing Service Quality*, *17*(2), 194–208. https://doi.org/10.1108/09604520710735191

Chauhan, G. (2016). An Analysis of The Status of Resource Flexibility and Lean

Manufacturing in a Textile Machinery Manufacturing Company. *International Journal of Organizational Analysis*, *24*(1), 107–122. https://doi.org/10.1108/EL-01-2014-0022

Chauhan, G., & Chauhan, V. (2019). A phase-wise approach to implement lean manufacturing. *International Journal of Lean Six Sigma*, *10*(1), 106–122. https://doi.org/10.1108/IJLSS-09-2017-0110

Chauhan, G., & Singh, T. . (2012). Measuring parameters of lean manufacturing realization. *Measuring Business Excellence*, *16*(3), 57–71. https://doi.org/10.1108/13683041211257411

Chen, Z., & Tan, K. H. (2011). The perceived impact of JIT implementation on operations performance Evidence from Chinese firms. *Journal of Advances in Management Research*, *8*(2), 213–235. https://doi.org/10.1108/09727981111175957

Chenhall, R. H. (1996). Strategies of Manufacturing Flexibility , Manufacturing Performance Measures and Organizational Performance : An Empirical Investigation. *Integrated Manufacturing Systems*, *7*(5), 25–32.

Chin, W. W. (1998). Statistical power analysis for the behavioral sciences. *Modern Methods for Business Research*, *29*(2), 295–336.

Choi, B. K., Moon, H. K., & Ko, W. (2013). An organization ' s ethical climate , innovation , and performance. *Management Decision*, *51*(6), 1250–1275. https://doi.org/10.1108/MD-Sep-2011-0334

Chong, H., White, R. E., & Prybutok, V. (2001). Relationship among organizational support , JIT implementation , and performance. *Industrial Management & Data Systems*, *101*(6), 273–281.

Christiansen, T., Berry, W. L., Bruun, P., & Ward, P. (2003). A Mapping of Competitiveness Priorities, Manufacturing Practices, and Operational Performance in Groups of Danish Manufacturing Comanies. *Internatioal Journal of Operation & Production Management*, *23*(10), 1163–1183.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). New Jersey, USA: Lawrence Earlbaum Associates.

Cooper, C. ., & Schindler, P. . (2008). *Business research methods* (10th Ed., Ed.). MacGraw Hill Int.

Cooper, D. R., & Schindler, P. S. (2014). *Business research methods* (12th ed.). New York, NY: McGraw-Hill/Irwin.

Corbett, L. M. (1998). Benchmarking Manufacturing Performance in Australia and New Zealand. *Benchmarking: An International Journal*, *5*(4), 271–282.

Cordero, R., Walsh, S. T., & Kirchhoff, B. A. (2009). Organization Technologies,AMT and Competent Workers:Exploring Relationships With Manufacturing Performance. *Journal of Manufacturing Technology Management*, *20*(3), 298–313.

Creswell, J. . (2014). *Research Design* (4th ed.). Thousand Oaks, California: SAGE Publication.

Cua, K. O., Mckone, K. E., & Schroeder, R. G. (2001). Relationships between implementation of TQM , JIT , and TPM and manufacturing performance. *Journal of Operations Management*, *19*, 675–694.

Cullen, J. B., Parboteeah, K. P., & Victor, B. (2003a). The effect of ethical climates on organizational commitment: A two-study analysis. *Journal of Business Ethics*, *46*(2), 127–141. https://doi.org/10.1023/A

Cullen, J. B., Parboteeah, K. P., & Victor, B. I. (2003b). The Effects of Ethical Climates on Organizational Commitment: A Two-Study Analysis. *Journal of Business Ethics*, *46*(2), 127–141. https://doi.org/10.1023/A

Cullen, J. B., & Victor, B. (1993). The Ethical Climate Questionnaire : An Assessment of Its Development and Validity. *Psychlogy Reports*, *667–674*(73). https://doi.org/10.2466/pr0.1993.73.2.667

Das, M., Rangarajan, K., & Dutta, G. (2020). Corporate sustainability in SMEs: an Asian perspective. *Journal of Asia Business Studies*, *14*(1), 109–138. https://doi.org/10.1108/JABS-10-2017-0176

Daud, A., & Zailani, S. (2011). Lean supply chain practices and performance in the context of Malaysia. In *Supply chain management: Pathways for research and practice* (In D. Onka, pp. 1–14). Rijeka, Croatia: IntechOpen Limited.

Dawson, C. (2007). *A practical guide to research methods: a user friendly manual for mastering research techniques and projects* (3rd Ed.). Retrieved from http://medcontent.metapress.com/index/A65RM03P4874243N.pdf

De Vaus, D. (2002). *Surveys in social research* (5th ed). New South Wales, Australia: Allen & Unwin.

Demeter, K., & Matyusz, Z. (2011). The impact of lean practices on inventory turnover. *International Journal of Production Economics*, *133*(1), 154–163. https://doi.org/10.1016/j.ijpe.2009.10.031

Department of Statistic Malaysia. (2017). *Press Release: Index of Services Fourth Quarter*.

Department of Statistics Malaysia. (2020). *Monthly Manufacturing Statistics*. Retrieved from file:///C:/Users/User/Desktop/MMS Oktober 2019.pdf

Dhanda, U., & Shrotryia, V. K. (2020). Corporate sustainability: the new organizational reality. *Qualitative Research in Organizations and Management: An International*

Journal, 1746–5648. https://doi.org/10.1108/qrom-01-2020-1886

Diamantopoulos, A., & Siguaw, J. A. (2006). Formative versus reflective indicators in organizational measure development: A comparison and empirical illustration. *British Journal of Management*, *17*(4), 263–282.

Dienhart, J. W., Moberg, D. J., & Duska, R. F. (2001). The next phase of business ethics : integrating psychology and ethics. In *Research in ethical issues in organizations*.

Doolen, T. L., & Hacker, M. E. (2005). A review of lean assessment in organizations: An exploratory study of lean practices by electronics manufacturers. *Journal of Manufacturing Systems*, *24*(1), 55–67. https://doi.org/10.1016/S0278-6125(05)80007-X

Duane, D. (1996). *Business research for desision making* (5 ed.). South-Western College Pub.

Dutta, S., Zbaracki, M. J., & Bergen, M. (2003). Pricing Process as a Capability: A Resource-Based Perspective. *Strategic Management Journal*, *24*(7), 615–630.

Economic Planning Unit. (2015). *Eleventh Malaysia Plan 2016-2020*. Percetakan Nasional Malaysia Berhad.

Economic Planning Unit. (2016). *The Malaysian Economy in Figures*. https://doi.org/10.1016/S0197-2456(02)00197-6

El Mola, K. G., & Parsaei, H. (2010). Dimensions and measures of manufacturing performance measurement. *40th International Conference on Computers and Industrial Engineering: Soft Computing Techniques for Advanced Manufacturing and Service Systems, CIE40 2010*, (966). https://doi.org/10.1109/ICCIE.2010.5668236

Elkington, J. (1994). Towards the sustainable corporation: win-win-win business strategies for sustainable development. *California Management Review*, *36*(2), 90–199.

Elkington, J. (1997). *The triple bottom line of 21 st century business Cannibals with forks*. (April).

Emiliani, M. L. (2006). Origins of lean management in America: The role of Connecticut businesses. *Journal of Management History*, *12*(2), 167–184. https://doi.org/10.1108/13552520610654069

Eriksson, D., & Svensson, G. (2016). A balance model of theoretical sustainability – framework and propositions. *Corporate Governance*, *16*(1), 21–34. https://doi.org/10.1108/CG-01-2015-0006

Fein, E. C., Tziner, A., Lusky, L., & Palachy, O. (2013). Relationships between ethical climate, justice peceptions, and LMX. *Leadership & Organizationa Development*

Journal, *34*(2), 147–163.

Fernando, R. (2012). Sustainable globalization and implications for strategic corporate and national sustainability. *Corporate Governance*, *12*(4), 579–589. https://doi.org/10.1108/14720701211267883

Ferro, C., Padin, C., Svensson, G., Varela, J. C. S., Wagner, B., & Hogevold, N. M. (2017). Validating a framework of stakeholders in connection to business sustainability efforts in supply chains. Journal of Business & Inustrial Marketing, 32(1), 124–137. https://doi.org/10.1108/JBIM-12-2015-0253

Field, A. (2009). *Discovering statistics using SPSS* (3rd ed). London, United Kingdom: SAGE Publications Ltd.

Fornell, C., & Cha, J. (1994). Partial least squares. *Advanced Methods of Marketing Research*, *407*(3), 52–78.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.

Fournier, C. (2010). The Moderating Role of Ethical Climate on Salesperson Propensity to Leave. *Journal of Perdonal Selling and Sales Management*. https://doi.org/10.2753/PSS0885-3134300101

Frazer, L., & Lawley, M. (2000). *Questionnaire design & administration*. Australia: John Wiley & Sons.

Frechting, J. (2002). *An overview of quantitative and qualitative data collection methods*. Retrieved from http://eric.ed.gov/ERICWebPortal/recordDetail?accno=ED468812

Freeman, R. E. (1984). *Stategic management: A stakeholder approach*. Boston:Pitman.

Freeman, R. E., Phillips, R., & Sisodia, R. (2018). Tensions in Stakeholder Theory. *Business and Society*, 1–19. https://doi.org/10.1177/0007650318773750

Freeman, R. E., Wicks, A. C., & Parmar, B. (2004). Teoría de las Partes Interesadas y “El Objetivo Corporativo Revisitado”. Stakeholder Theory and “The Corporate Objective Revisited.” *Organization Science*, *15*(3), 364–369. https://doi.org/10.1287/orsc.1040.0066

Fullerton, R. R., & Mcwatters, C. S. (2001). The production performance benefits from JIT implementation. *Journal of Operations Management*, *19*, 81–96.

Fullerton, R. R., Mcwatters, C. S., & Fawson, C. (2003). An examination of the relationships between JIT and financial performance. *Journal of Operations Management*, *21*, 383–404. https://doi.org/10.1016/S0272-6963(03)00002-0

Fullerton, R. R., & Wempe, W. F. (2009). Lean manufacturing , non-financial performance measures , and financial performance. *International Journal of Operations & Production Management*, *29*(3), 214–240. https://doi.org/10.1108/01443570910938970

Furlan, A., Dal, G., & Vinelli, A. (2011). On the complementarity between internal and external just-in-time bundles to build and sustain high performance manufacturing. *Intern. Journal of Production Economics*, *133*(2), 489–495. https://doi.org/10.1016/j.ijpe.2010.07.043

Furlan, A., Vinelli, A., & Dal Point, G. (2011). Complementarity and lean manufacturing bundles: an empirical analysis. *International Journal of Operations & Production Management*, *3*(8), 835–850. https://doi.org/10.1108/01443571111153067

Galpin, T., Whitttington, J. L., & Bell, G. (2015). Is your sustainability strategy sustainable? Creating a culture of sustainability. *Corporate Governance: The International Journal of Business in Society*, *15*(1), 1–17. https://doi.org/10.1108/CG-01-2013-0004

Gaskin, J. (2016). *Data screening: SEM series*. California, USA: YouTube.

Gaskin, J. (2017). *Common method bias (CMB) in PLS (partial least squares).* California, USA: YouTube.

Gefen, D., Straub, D., & Boudreau, M. C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems*, *4*(1), 7.

Gibson, C. B., Zellmer-Bruhn, M. E., & Schwab, D. P. (2003). Team Effectiveness in Multinational Organizations: Evaluation Across Contexts. In *Group and Organization Management* (Vol. 28). https://doi.org/10.1177/1059601103251685

Godinho Filho, M., Ganga, G. M. D., & Gunasekaran, A. (2016). Lean manufacturing in Brazilian small and medium enterprises: implementation and effect on performance. *International Journal of Production Research*, *54*(24), 7523–7545. https://doi.org/10.1080/00207543.2016.1201606

Gomes, C. F., Yasin, M. M., & Lisboa, J. V. (2011). Performance Measurement Practices in Manufacturing Firms Revisited. *Internatioal Journal of Operation & Production Management*, *31*(1), 5–30. https://doi.org/10.1108/01443571111098726

Gonzalez-Padron, T., Hult, G. T. M., & Calantone, R. (2008). Exploiting innovative opportunities in global purchasing: An assessment of ethical climate and relationship performance. *Industrial Marketing Management*, *37*(1), 69–82. https://doi.org/10.1016/j.indmarman.2007.06.013

González, T. F., & Guillén, M. (2002). Leadership ethical dimension: a requirement in TQM implementation. *The TQM Magazine*, *14*(3), 150–164. https://doi.org/10.1108/09544780210425892

Graubner, C.-A., Pelzeter, A., & Pohl, S. (2016). A new approach to measure sustainability in German facility management. *Facilities*, *34*(1/2), 28–42.

Guo, Z., & Sheffield, J. (2008). A paradigmatic and methodological examination of knowledge management research: 2000 to 2004. *Decision Support Systems*, *44*(3), 673–688. https://doi.org/10.1016/j.dss.2007.09.006

Gupta, A., & Singh, R. K. (2020). Study of sustainability issues in an Indian logistics service provider: SAP-LAP approach. *Qualitative Research in Organizations and Management: An International Journal*. https://doi.org/10.1108/QROM-02-2020-1897

Habidin, N. F. (2012). *Structural analysis and tool for lean six sigma, strategic control systems and organizational performance* (Engineering Doctorate (Engineering Business), Ed.). Universiti Teknologi Malaysia, Johore, Malaysia.

Hadid, W., & Mansouri, S. A. (2014). The lean-performance relationship in services: a theoretical model. *International Journal of Operations & Production Management*, *34*(6), 750–785. https://doi.org/10.1179/str.2006.53.4.005

Hadid, W., Mansouri, S. A., & Gallear, D. (2016). Is lean service promising? A socio-technical perspective. *International Journal of Operations & Production Management Is*, *36*(6), 618–642.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A Primer on Partial Least Squares Structural Equation Model (PLS-SEM)*. Sage Publications, Inc.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM) (Second Edi)*. United Stated of America: Sage Publications, Inc.

Hair, J.F., Tatham, R. L., Anderson, R. E., & Black, W. (2006). *Multivariate Data Analysis*. Pearson Prentice Hall. Bill Black, Louisiana State University, Baton Rouge, NJ,.

Hair, Joseph F., Ringle, C. M., & Sarstedt, M. (2013). Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance. *Long Range Planning*, *46*(1–2), 1–12. https://doi.org/10.1016/j.lrp.2013.01.001

Hair Jr, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2010). *Multivariate data analysis: A global perspective* (7th ed). New Jersey, USA: Pearson Prentice Hall.

Hair Jr, J. F., Tatham, R. L., Anderson, R. E., & Black, W. C. (1998). *Multivariate data analysis* (5th ed). New Jersey, USA: Prentice-Hall Inc.

Hajmohammad, S., Vachon, S., Klassen, R. D., & Gavronski, I. (2013). Lean management and supply management: Their role in green practices and performance. *Journal of Cleaner Production*, *39*, 312–320. https://doi.org/10.1016/j.jclepro.2012.07.028

Hallgren, M., & Olhager, J. (2009). Lean and agile manufacturing : external and internal drivers and performance outcomes. *Internatioal Journal of Operation & Production Management*, *29*(10), 976–999. https://doi.org/10.1108/01443570910993456

Hami, N. (2015). *Sustainable Manufacturing Practice And Sustainability Performance Mediated By Innovation Performance*. Universiti Teknikal Malaysia Melaka.

Hami, N., Muhamad, M. R., & Ebrahim, Z. (2016). The impact manufacturing sustainability of sustainable practices on sustainability. *Jurnal Teknologi*, *78*(1), 139–152. https://doi.org/10.11113/jt.v78.3090

Hardesty, D. M., & Bearden, W. O. (2004). The use of expert judges in scale development. Implications for improving face validity of measures of unobservable constructs. *Journal of Business Research*, *57*(2), 98–107. https://doi.org/10.1016/S0148-2963(01)00295-8

Hasan, M. Z., Mohd Assad, M. N., & Iteng, R. (2017). Does Manufacturing Performance Mediates on Lean Manufacturing Practices and Sustainability. *Journal of Humanities, Language, Cultural and Business, 1*(2), 40–49.

Hasan, Mohd zulfabli, Mohd Asaad, M. N., & Iteng, R. (2018). The Mediating Role of Manufacturing Performance on the Relationship between LMP and Sustainability. *Journal of Information System and Technology Management (JISTM), 3*(7), 45–54.

Hasan, MZ, Asaad, M., & Iteng, R. (2017). Lean Manufacturing Practices and Manufacturing Performance: the Moderating Effect of Ethical Climates. *Journal of Global Business and Social Entrepreneurship (GBSE), 3*(5), 189–200. Retrieved from http://gbse.com.my/v3no5may17/Paper-90-.pdf

Hashmi, H., Khan, N. R., & Haq, M. A. (2015). The impact of lean management implementation on organizational operational performance. *LogForum, 11*(4), 375–385. https://doi.org/10.17270/J.LOG.2015.4.6

Hasle, P., Bojesen, A., Jensen, P. L., & Bramming, P. (2012). Lean and the working environment: a review of the literature. *International Journal of Operations & Production Management*, *22*(7), 829–849.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, *76*(4), 408–420. https://doi.org/10.1080/03637750903310360

Henseler, J., Hubona, G., & Ash, P. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems*, *116*(1), 2–20.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). *The use of partial least squares path modeling in international marketing New challenges to international marketing*. Emerald Group Publishing Limited.

Herzog, V., & Tonchia, N. (2014). An Instrument for Measuring the Degree of Lean Implementation in Manufacturing. *Journal of Mechanical Engineering*, *60*(12), 797–803. https://doi.org/10.5545/sv-jme.2014.1873

Hijal-Moghrabi, I., Sabharwal, M., & Berman, E. M. (2015). The Importance of Ethical Environment to Organizational Performance in Employment at Will States. *Journal of Business Venturing*, *49*(9), 1346–1374.

Hines, P., Holweg, M., & Rich, N. (2004). Learning to evolve. *International Journal of Operations & Production Management*, *24*(10), 994–1011. https://doi.org/10.1108/01443570410558049

Hines, P., Howeg, M., & Rich, N. (2004). Learning to evolve: A review of contemporary lean thinking. *International Journal of Operations & Production Management*, *24*(10), 994–1011. https://doi.org/http://dx.doi.org/10.1108/09564230910978511

Ho, S. K. M. (2010). Integrated lean TQM model for global sustainability and competitiveness. *The TQM Journal*, *22*(2), 143–158.

Hofer, C., Eroglu, C., & Rossiter Hofer, A. (2012). The effect of lean production on financial performance: The mediating role of inventory leanness. *International Journal of Production Economics*, *138*(2), 242–253. https://doi.org/10.1016/j.ijpe.2012.03.025

Holden, M., & Lynch, P. (2004). Choosing the Appropriate Methodology: Understanding Research Philosophy. *The Marke*, *4*, 397–409.

Hon, K. K. B. (2005). Performance and Evaluation of Manufacturing Systems. *CIRP Annals - Manufacturing Technology*, *54*(2), 139–154. https://doi.org/10.1016/S0007-8506(07)60023-7

Hong, P., Roh, J. J., & Rawski, G. (2012). Benchmarking sustainability practices: evidence from manufacturing firms. *An International Journal*, *19*(4/5), 634–648.

Hong, P., Yang, M. G. (Mark), & Dobrzykowski, D. D. (2014). Strategic customer service orientaton, lean manufacturing practices and performances outcomes. *Journal of Service Management*, *25*(5), 699–723.

How, S. M., Lee, C. G., & Brown, D. M. (2019). Shareholder Theory Versus Stakeholder Theory in Explaining Financial Soundness. *International Advances in Economic Research*, *25*(1), 133–135. https://doi.org/10.1007/s11294-019-09722-x

Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic Management Journal*, *20*(2), 195–204.

Huson, M., & Nanda, D. (1995). The impact of just-in-time manufacturing on firm performance in the US. *Journal of Operations Management*, *12*(3–4), 297–310. https://doi.org/10.1016/0272-6963(95)00011-G

Ibrahim, F., Mustapha, S. M., Mokhtar, A. H. A., Shah, D. F. J. S. H., & Nie, K. S. (2019). Youth as stakeholders and their engagement towards government programmes (GP). *Jurnal Komunikasi: Malaysian Journal of Communication*, *35*(2), 211–226. https://doi.org/10.17576/JKMJC-2019-3502-13

Ikeda, A. A. (2009). Reflections on qualitative research in business. *Revista de Gestão*, *16*(3), 49–64. https://doi.org/10.5700/rege372

Iranmanesh, M., Zailani, S., Hyun, S. S., Ali, M. H., & Kim, K. (2019). Impact of Lean Manufacturing Practices on Firms ' Sustainable Performance : Lean Culture as a Moderator. *Sustainability*, *11*(4), 1112. https://doi.org/10.3390/su11041112

Iteng, R. (2013). *The relationship between lean production, operational performance and business performance in Malaysian manufacturing industry*. (Doctor of Philosophy) Universiti Kebangsaan Malaysia (UKM), Selangor, Malaysia.

Iteng, Rosman, Ariffin, A. S., & Abdul Rahim, M. K. I. (2015). Assessing Convergent And Discriminant Validity Of Lean Production Constructs. *International Academic Research Journal of Business and Technology*, *1*(2), 16–21.

Iwao, S., & Marinov, M. (2018). Linking continuous improvement to manufacturing performance. *Benchmarking: An International Journal*, *25*(5), 1319–1332. https://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216

Jabbour, A. B. L. de S., Junior, J. C. O., & Jabbour, C. J. C. (2014). Extending lean manufacturing in supply chains: a successful case n Brazil. *Benchmarking: An International Journal*, *21*(6), 1070–1083.

Jasti, N. V. K. (2016). An Empirical Study for Implementation of Lean Principles in Indian Manufacturing Industry. *Benchmarking: An International Journal*, *23*(1), 183–207.

Jayaram, J., Vickery, S., & Droge, C. (2008). Relationship building , lean strategy and firm performance : an exploratory study in the automotive supplier industry. *International Journal of Production*, *46*(20), 5633–5649. https://doi.org/10.1080/00207540701429942

Jekiel, C. M. (2011). *Lean human resources: Redesigning HR processes for a culture of continuous improvement*. New York: Taylor and Francis Group, Productivity Press.

Jick, T. D. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly*, *24*(4), 602. https://doi.org/10.2307/2392366

John, L., & Narayanamurthy, G. (2015). Converging sustainability definitions: industry independent dimensions. *World Journal of Science , Technology and Sustainable Development*, *12*(3), 206–232.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a Definition of

Mixed Methods Research. In *Journal of Mixed Methods Research* (Vol. 1). https://doi.org/10.1177/1558689806298224

Jones, P., Hiller, D., & Comfort, D. (2016). Sustainability in the hospitality industry : some personal reflections on corporate challenges and research agendas. *Journal of Contemporary Hospitality Management*, *28*(1), 36–67.

Jones, P., Hillier, D., & Comfort, D. (2016). Sustainability in the hospitality industry: Some personal reflections on corporate challenges and research agendas. *International Journal of Contemporary Hospitality Management*, *28*(1), 36–67.

Jorsfeldt, L. M., Hvolby, H. H., & Nguyen, V. T. (2016). Implementing environmental sustainability in logistics operations: a case study. *Strategic Outsourcing*, *9*(2), 98–125. https://doi.org/10.1108/SO-09-2015-0023

Juettner, U., Windler, K., Podleisek, A., Gander, M., & Meldau, S. (2020). Implementing supplier management strategies for supply chain sustainability risks in multinational companies. *TQM Journal*, *32*(5), 923–938. https://doi.org/10.1108/TQM-05-2019-0136

Kakabadse, N. K., & Rozuel, C. (2006). Meaning of corporate social responsibility in a local French hospital : a case study. *Social Responsibility Journal*, *6*(2), 268–285. https://doi.org/10.1108/17465680610643364

Kannan, V. R., & Choon, K. (2005). Just in time , total quality management , and supply chain management : understanding their linkages and impact on business performance. *The International Journal of Management Science*, *33*, 153–162. https://doi.org/10.1016/j.omega.2004.03.012

Kaplan, R. ., & Saccuzzo, D. . (2009). *Psychological testing: Principle, applications, and issue* (7th ed). United States: Wadsworth Cengage Learning.

Kaplan, R. S. (1983). Measuring Manufacturing Performance : A New Challenge for Managerial Accounting Research. *The Accounting Review*, *58*(4), 686–705.

Kaplan, R. S., & Norton, D. P. (1996). Using the balanced scorecard as a strategic management system. *Harvard Business Review*, *74*(1), 75–85.

Karim, A., & Arif-Uz-Zaman, K. (2013). A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations. *Business Process Management Journal*, *19*(1), 169–196.

Karlsson, C., & Ahlstrom, P. (1996). Assessing changes towards lean production. *Internatioal Journal of Operation & Production Management*, *16*(2), 24–41.

Karman, A., & Savanevičienė, A. (2020). Enhancing dynamic capabilities to improve sustainable competitiveness: insights from research on organisations of the Baltic region. *Baltic Journal of Management*. https://doi.org/10.1108/BJM-08-2020-0287

Kebede Adem, M., & Virdi, S. S. (2020). The effect of TQM practices on operational performance: an empirical analysis of ISO 9001: 2008 certified manufacturing organizations in Ethiopia. *TQM Journal*. https://doi.org/10.1108/TQM-03-2019-0076

Khademfar, M., Idris, K., Omar, Z., Ismail, I. A., & Arabamiry, S. (2013). Ethical work climate and firm performance. *International Journal of Business and Social Science*, *4*(11), 319–328.

Khalfallah, M., & Lakhal, L. (2020). The impact of lean manufacturing practices on operational and financial performance: the mediating role of agile manufacturing. *International Journal of Quality and Reliability Management*. https://doi.org/10.1108/IJQRM-07-2019-0244

Khan, N. U., Saufi, R. A., & Rasli, A. M. (2019). Green Human Resource Management Practices among ISO14001-certified Malaysian Manufacturing Firms. *Green Behavior and Corporate Social Responsibility in Asia*, 73–79. https://doi.org/10.1108/978-1-78756-683-520191009

Khusaini, N., Ismail, A., & Rashid, A. (2016). *Investigation of the prominent barriers to lean manufacturing implementation in Malaysian food and beverages industry using Rasch Model*. Paper presented at the 2nd International Manufacturing Engineering Conference and 3rd Asia-Pacific Conference on Manufacturing Systems (iMEC-APCOMS 2015), Kuala Lumpur, Malaysia.

King, A. A., & Lenox, M. J. (2001). Lean and green? An empirical examination of the relationship between lean production and environmental performance. *Production and Operations Management*, *10*(3), 244–256. https://doi.org/10.1111/j.1937-5956.2001.tb00373.x

Klassen, R. D., & Whybark, D. C. (1999). The Impact of Environmental Technologies on Manufacturing Performance. *The Academy of Management Journal*, *42*(6), 599–615.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed). New York, USA: The Guilford Press.

Kline, W., & McDermott, K. (2019). Evolutionary stakeholder theory and public utility regulation. *Business and Society Review*, *124*(2), 283–298. https://doi.org/10.1111/basr.12172

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of E-Collaboration (IJeC)*, *11*(4), 1–10.

Kock, N., & Gaskins, L. (2014). The mediating role of voice and accountability in the relationship between Internet diffusion and government corruption in Latin America and Sub-Saharan Africa. *Information Technology for Development, 20(1)*, *20*(1), 23–43.

Kock, N., & Hadaya, P. (2018). Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. *Information Systems Journal*, *28*(1), 227–261.

Kock, Ned, & Lynn, G. (2012). Lateral Collinearity and Misleading Results in Variance-Based SEM: An Illustration and Recommendations. *Journal of the Association for Information Systems*, *13*(7), 546–580. https://doi.org/10.17705/1jais.00302

Koh, H., & Boo, E. (2004). Organisational ethics and employee satisfaction and commitment. *Management Decision*, *42*(5), 677–693. https://doi.org/10.1108/00251740410538514

Kohlberg, L. (1981). *The philosophy c/moral developement*. New York:Harper & Row.

Koo, H., Byoung, M., Choi, K., Koo, H., Byoung, M., Choi, K., … Stachowicz-stanusch, A. (2014). How an organization's ethical climate contributes to customer satisfaction and financial performance :Perceived organizational innovation perspective. *European Journal of Innovation Management*, *17*(1), 85–106.

Krafcik, J. . (1988). Triumph of the lean production system. *Sloan Management Review*, *30*(1), 41–52.

Krejcie, R. V, & Morgan, D. W. (1970). Determining Sample Size for Research Activities Robert. *Educational and Psychological Measurement*, *38*(1), 607–610. https://doi.org/10.1177/001316447003000308

Krishnan, V., & Parveen, C. M. (2013). Comparative Study of Lean Manufacturing Tools Used in Manufacturing Firms and Service Sector. *Proceedings of the World Congress on Engineering*, *I*, 3–7.

Kumar, C. (2013). Set up Reduction A perfect way for productivity improvement of computer numerical control (CNC) set up in manufacturing company. *Journal of Mechanical Engineering Research*, *5*(8), 166–170. https://doi.org/10.5897/JMER12.003

Kumar, M., Talib, S. A., & Ramayah, T. (2013). *Business Research Methods*. Selangor: Oxford Fajar.

Kundu, G. K., & Manohar, M. (2016). Prioritizing lean practices for implementation in IT support services. *Journal of Information and Knowledge Systems*, *46*(1). https://doi.org/10.1108/VJIKMS-12-2014-0064

Kwon Choi, B., Koo Moon, H., & Ko, W. (2013). An organization's ethical climate, innovation, and performance: Effects of support for innovation and performance evaluation. *Management Decision*, *51*(6), 1250–1275. https://doi.org/10.1108/MD-Sep-2011-0334

Lacy, P., Haines, A., & Hayward, R. (2012). Developing strategies and leaders to succeed in a new era of sustainability: Findings and insights from the United Nations Global Compact-Accenture CEO Study. *Journal of Management*

Development, *31*(4), 346–357. https://doi.org/10.1108/02621711211218997

Langenwalter, G. (2006). “ Life” is Our Ultimate Customer: From Lean to Sustainability. *Target*, *22*(1), 5–15. Retrieved from http://www.ame.org/sites/default/files/target_articles/06-22-1-Lean_Sustainability.pdf

Leachman, C., Pegels, C. C., & Shin, S. K. (2005a). Manufacturing Performance: Evaluation and Determinants. *2International Journal of Operations & Production Management*, *25*(9), 851–874.

Leachman, C., Pegels, C. C., & Shin, S. K. (2005b). Manufacturing Performance:Evaluation And Determinants. *Internatioal Journal of Operation & Production Management*, *25*(9), 851–874.

Lee, S. M., & Paek, J. H. (1995). An enlarged JIT programme : its impact on JIT implementation and performance of the production system. *Production Planning & Control : The Management of System*, *6*(2), 185–191. https://doi.org/10.1080/09537289508930268

Lee, S., & Teece, D. J. (2013). The Functions of Middle and Top Management in the Dynamic Capabilities Framework. *Kindai Management Review*, *1*, 28–40.

Liboni, L. B., & Cezarino, L. O. (2014). Strategy for sustainability in a Brazilian sugarcane industry. *World Journal of Entrepreneurship, Management and Sustainable Development*, *10*(1), 2–12. https://doi.org/10.1108/wjemsd-02-2013-0018

Lieber, E., & Weisner, T. S. (2010). Meeting the Practical Challenges of Mixed Methods Research. In *SAGE Handbook of Mixed Methods in Social & Behavioral Research* (SAGE Handb). https://doi.org/10.4135/9781506335193.n22

Liker, J.K. (2004). *The Toyota Way-14 Management Principles form the World’s Greatest Manufacturer*. McGraw-Hill. New York.NY.

Liker, Jeffrey K., & Morgan, J. M. (2006). The Toyota Way in Services: The Case of Lean Product Development. *Academy of Management Perspectives*, *20*(2), 5–20. https://doi.org/10.5465/AMP.2006.20591002

Linke, B. S., Corman, G. J., Dornfeld, D. A., & Tönissen, S. (2013). Sustainability indicators for discrete manufacturing processes applied to grinding technology. *Journal of Manufacturing Systems*, *32*(4), 556–563. https://doi.org/10.1016/j.jmsy.2013.05.005

Ljungblom, M. (2014). How does Lean connect to ethics and leadership. *QMOD Conference*.

Long, B. S., & Driscoll, C. (2008). Codes of Ethics and the Pursuit of Organizational Legitimacy : Theoretical and Empirical Contributions. *Journal of Business Ethics*, *77*(2), 173–189. https://doi.org/10.1007/s10551-006-9307-y

Longoni, A., & Cagliano, R. (2015). Cross-functional executive involvement and worker involvement in lean manufacturing and sustainability alignment. *International Journal of Operations & Production Management*, *35*(9), 1332–1358.

Longoni, A., Pagell, M., Johnston, D., & Veltri, A. (2013). When does lean hurt? – an exploration of lean practices and worker health and safety outcomes. *International Journal of Production Research*, *51*(11), 3300–3320. https://doi.org/10.1080/00207543.2013.765072

Losonci, D., Kása, R., Demeter, K., Heidrich, B., & Jenei, I. (2017). The impact of shoop floor culture and subculture on lean production practices. *International Journal of Operations & Production Management*, *37*(2), 205–225.

Luo, X., & Bhattacharya, C. B. (2006). Corporate Social Responsibility , Customer Satisfaction , and Market Value. *Journal of Marketing*, *70*(4), 1–18.

Mackelprang, A. W., & Nair, A. (2010). Relationship between just-in-time manufacturing practices and performance : A meta-analytic investigation. *Journal of Operations Management*, *28*(4), 283–302. https://doi.org/10.1016/j.jom.2009.10.002

MacKenzie, S. B., & Podsakoff, P. M. (2012). Common method bias in marketing: causes, mechanisms, and procedural remedies. *Journal of Retailing*, *88*(5), 542–555.

Madhani, P. M. (2010). Resource Based View (RBV) of Competitive Advantage: An Overview. *Icfai University Press, Hyderabad, India*, 3–22. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1578704

Maguad, B. A., & Krone, R. M. (2009). Ethics and moral leadership: Quality linkages1. *Total Quality Management & Business Excellence*, *20*(2), 209–222. https://doi.org/10.1080/14783360802623043

Mainardes, E. W., Alves, H., & Raposo, M. (2011). Stakeholder theory : issues to resolve. *Management Decision*, *49*(2), 226–252. https://doi.org/10.1108/00251741111109133

Manzouri, M., Nizam Ab Rahman, M., Saibani, N., & Rosmawati Che Mohd Zain, C. (2013). Lean supply chain practices in the Halal food. *International Journal of Lean Six Sigma*, *4*(4), 389–408. https://doi.org/10.1108/IJLSS-10-2012-0011

Mardia, K. V. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika*, *57*(3), 519–530.

Marshall, D., McCarthy, L., McGrath, P., & Claudy, M. (2015). Going above and beyond: how sustainability culture and entrepreneurial orientation drive social sustainability supply chain practice adoption. *Supply Chain Management: An International Journal*, *20*(4), 434–454. https://doi.org/10.1108/SCM-08-2014-0267

Martin, K. D., & Cullen, J. B. (2006). Continuities and Extensions of Ethical Climate Theory : A Meta-Analytic Review. *Journal of Business Ethics*, *69*(2), 175–194. https://doi.org/10.1007/s10551-006-9084-7

Martínez-Mesa, J., González-Chica, D. A., Duquia, R. P., Bonamigo, R. R., & Bastos, J. L. (2016). Sampling: How to select participants in my research study? *Anais Brasileiros de Dermatologia*, *91*(3), 326–330. https://doi.org/10.1590/abd1806-4841.20165254

Matsui, Y. (2007). An empirical analysis of just-in-time production in Japanese manufacturing companies. *International of Production Economics*, *108*, 153–164. https://doi.org/10.1016/j.ijpe.2006.12.035

McLachlin, R. (1997). Management Initiatives and JIT Manufacturing. *Journal of Operations Management*, Vol. 15, pp. 271–292.

Melton, T. (2005). The Benefits of Lean Manufacturing: What Lean Thinking has to Offer the Process Industries. *Chemical Engineering Research and Design*, *83*(A6), 662–673. https://doi.org/10.1205/cherd.04351

Meredith, J. R. (1992). *The management of operations: A conceptual emphasis* (4th ed.). New York: John Wiley and Sons, Inc.

Meybodi, M. Z. (2013). The links between lean manufacturing practices and concurrent method of new product developemnt. *Benchmarking: An International Journal*, *20*(3), 362–376.

Miidom, D. F., & Sholokwu, B. M. (2017). Operations Management Activities and Organizational Sustainability in Oil and Gas Companies in Rivers State, Nigeria, West Africa. *International Journal of Advanced Academic Research*, *3*(1), 2488–9849. Retrieved from http://www.ijaar.org/articles/Volume2-Number11/Social-Management-Sciences/ijaar-sms-v2n10-oct16-p13.pdf

Mohamed Ismail, R. (2014). *Mediation impact of manufacturing strategies on external environmental factors and manufacturing performance*. (Doctor of Philosophy), Universiti Utara Malaysia, Kedah, Malaysia.

Mohd Fuzi, N., Habidin, N. F., Janudin, S. E., & Ong, S. Y. Y. (2019). Critical success factors of environmental management accounting practices: findings from Malaysian manufacturing industry. *Measuring Business Excellence*, *23*(1), 1–14. https://doi.org/10.1108/MBE-03-2018-0015

Mohd Fuzi, N., Habidin, N. F., Janudin, S. E., Ong, S. Y. Y., & Ku Bahador, K. M. (2019). Environmental management accounting practices and organizational performance: the mediating effect of information system. *Measuring Business Excellence*, *23*(4), 411–425. https://doi.org/10.1108/MBE-12-2018-0109

Monden, Y. (1983). *Toyota Production System: Practical Approach to Production Management*. Institute of Industrial Engineers,Norcross, GA.

Montoya-Torres, J. R. (2006). Manufacturing Performance Evaluation in Wafer Semiconductor Factories. *International Journal of Productivity and Performance Management*, *5*(3/4), 300–310.

Motwani, J. (2003). A business process change framework for examining lean manufacturing: a case study. *Industrial Management & Data Systems*, *103*(5), 339–346. https://doi.org/10.1108/02635570310477398

Muhamad, M. R., Ebrahim, Z., & Hami, N. (2014). The Influence of Innovation Performance towards Manufacturing Sustainability Performance. *The Proceeding of 2014 International Conference on Industrial Engineering and Operations Management*, (JANUARY 2014), 2539–2547.

Mulki, J. P., Jaramillo, F., & Locander, W. B. (2006). Effects of Ethical Climate and Supervisory Trust on Salesperson'S Job Attitudes and Intentions To Quit. *Journal of Personal Selling and Sales Management*, *26*(1), 20–26. https://doi.org/10.2753/PSS0885-3134260102

Nafei, W. A. (2015). Ethical Climate as a Moderator of the Relationship Between Job Satisfaction and Organizational Commitment : Evidence from Industrial Companies in Egypt. *International Journal of Investment Management and Financial Innovations*, *1*(1), 1–15.

Narkhede, B. E. (2017). Advanced manufacturing strategy and firm performance: An empirical study in a developing environment of small- and medium-sized firms. *Benchmarking:An International Journal*, *24*(1), 62–101.

Nawanir, G. (2016). *The Effect of Lean Manufacturing on Operations Performance and Business Performance in Manufacturing Companies in Indonesia*. Universiti Utara Malaysia.

Nawanir, G., Binalialhajj, M., Teong Lim, K., & Hanafiah Ahmad, M. (2019). Becoming Lean: The Way towards Sustainability of Higher Educations Institutions. *KnE Social Sciences*, *2019*, 603–626. https://doi.org/10.18502/kss.v3i22.5078

Nawanir, G., Lim, K. T., Lee, K. L., Okfalisa, Moshood, T. D., & Ahmad, A. N. A. (2020). Less for more: The structural effects of lean manufacturing practices on sustainability of manufacturing SMEs in Malaysia. *International Journal of Supply Chain Management*, *9*(2), 961–975.

Nawanir, G., Lim, K. T., & Othman, S. N. (2016). Lean Manufacturing Practices in Indonesian Manufacturing Firms: Are There Business Performance Effects? *International Journal of Lean Six Sigma*, *7*(2), 1–28.

Nawanir, G., Lim, K. T., Othman, S. N., & Adeleke, A. Q. (2018). Developing and validating lean manufacturing constructs: an SEM approach Gusman. *Benchmarking: An International Journal*, *25*(5), 1382–1405. https://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216

Nawanir, G., Teong, L. K., & Othman, S. N. (2013). Impact of lean practices on operations performance and business performance: Some evidence from Indonesian manufacturing companies. *Journal of Manufacturing Technology Management*, *24*(7), 1019–1050. https://doi.org/10.1108/JMTM-03-2012-0027

Nawanir, G., Teong, L. K., & Othman, S. N. (2015). Measurement Instrument for Lean Manufacturing School of Technology Management and Logistics. *International Journal of Applied Science and Technology*, *5*(4), 102–111.

Negrão, L. L. L., Filho, M. G., & Marodin, G. (2017). Lean practices and their effect on performance: a literature review. *Production Planning and Control*, *28*(1), 33–56. https://doi.org/10.1080/09537287.2016.1231853

Neuman, W. L. (2014). *Social Research Methods: Qualitative and Quantitative Approaches* (7th editio). https://doi.org/10.2307/3211488

Neville, B. A., Bell, S. J., & Mengüç, B. (2005). Corporate reputation, stakeholders and the social performance-financial performance relationship Benjamin. *European Journal of Marketing*, *39*(9/10), 1184–1198.

Nie, K. S., Ibrahim, F., Mustapha, S. M., Mokhtar, A. A. H., & Shah, S. H. D. F. J. (2019). A reflection on the stakeholder theory : Impact of government policies. *Search Journal of Media and Communication Research*, *11*(3), 111–126.

Nordin, N., Md Deros, B., & Abd Wahab, D. (2010). A survey on lean manufacturing implementation in Malaysian automotive industry. *International Journal of Innovation, Management and Technology*, *1*(4), 374–380.

Nordin, Noraini, Md Deros, B., & Wahab, A. D. (2010). A Survey on lean manufacturing implementation in Malaysian automotive component industry. *International Journal of Automotive and Mechanical Engineering*, *4*(1), 374-. https://doi.org/10.15282/ijame.8.2013.33.0121

Novais, L., Marín, J. M. M., & Moyano-Fuentes, J. (2020). Lean Production implementation, Cloud-Supported Logistics and Supply Chain Integration: interrelationships and effects on business performance. *International Journal of Logistics Management*, *31*(3), 629–663. https://doi.org/10.1108/IJLM-02-2019-0052

Nunally, J. C. (1978). *Psychometric Theory*. McGraw Hill, New York, NY.

Nunnally, J. C. (1978). *Psychometric theory* (2nd Ed, Ed.). New York, USA: McGraw-Hill Education.

Ohno, T. (1988). *Toyota Production System*. Productivity Press,Portland, OR.

Ohno, Taiichi. (1988). *Toyota production system*. Diamond,Inc., Tokyo, Japan.

Olsen, E. (2004a). *Lean Manufacturing: The Relationship Between Practice and Firm Level Financial Performance*. The Ohio State University.

Olsen, E. (2004b). *Lean manufacturing Management: The relationship between practice and firm level financial performance*. https://doi.org/10.1007/s13398-014-0173-7.2

Orlitzky, M., Schmidt, F. L., & Rynes, S. L. (2003). Corporate Social and Financial Performance: A Meta-analysis. *Organizations Studies, 24*(3), 403–441. https://doi.org/10.1177/0170840603024003910

Osman, A. A., Othman, A. A., & Abdul Rahim, M. K. (2020). Lean Manufacturing Adoption in Malaysia: A Systematic Literature review. *International Journal of Supply Chain, Operation Management and Logistics, 1*(1), 1–35. https://doi.org/10.35631/IJSCOL.11001

Page, C., & Meyer, D. (2000). *Applied Research Design for Business and Management*. Australia: McGraw Hill.

Papadopoulou, T. C., & Özbayrak, M. (2005). Leanness: experiences from the journey to date. *Journal of Manufacturing Technology Management*, *16*(7), 784–807. https://doi.org/10.1108/17410380510626196

Papaioannou, G., & Wilson, J. M. (2010). The evolution of cell formation problem methodologies based on recent studies (1997-2008): Review and directions for future research. *European Journal of Operational Research*, *206*(3), 509–521. https://doi.org/10.1016/j.ejor.2009.10.020

Paulraj, A. (2011). Understanding the relationships between internal resources and capabilities, sustainable supply management and organizational sustainability. *Journal of Supply Chain Management*, *47*(1), 19–37. https://doi.org/10.1111/j.1745-493X.2010.03212.x

Peng Lin, C., Lang Tang, L., & Hsiao, C. Y. (2005). Testing a Joint Moderator of Ego Strength and Ethical Climate : A Study of the Process of Peer Reporting Intentions in IT Ethics. *Asia Pasific Management Review*, *10*(2), 145–153.

Penrose, E. T. (1995). *The Theory of The Growth of The Firm (3rd edition).* Oxford: Oxford University Press.

Pham, D. T., & Thomas, A. J. (2012). Fit manufacturing: a framework for sustainability. *Journal of Manufacturing Technology Management*, *23*(1), 103–123.

Piercy, N., & Rich, N. (2015). The relationship between lean operations and sustainable operations. *International Journal of Operations & Production Management*, *35*(2), 282–315.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879.

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

Polit, D. F., & Beck, C. T. (2010). Generalization in quantitative and qualitative research: Myths and strategies. *International Journal of Nursing Studies*, *47*(11), 1451–1458. https://doi.org/10.1016/j.ijnurstu.2010.06.004

Pont, G. D., Furlan, A., & Vinelli, A. (2008). Interrelationships among lean bundles and their effects on operational performance. *Operation Management Resource*, *1*, 150–158. https://doi.org/10.1007/s12063-008-0010-2

Ponto, J. (2015). Understanding and Evaluating Survey Research. *Journal of the Advanced Practitioner in Oncology*, *6*(2), 168–16871.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*(3), 879–891.

Puvanasvaran, A. P., Megat, M. H. M. A., Tang, S. H., Muhamad, M. R., & Hamouda, a. M. S. (2008). A review of problem solving capabilities in lean process management. *American Journal of Applied Sciences*, *5*(5), 504–511. https://doi.org/10.3844/ajassp.2008.504.511

Rahman, S., Aosirihongthong, T., & Sohal, A. S. (2010). Impact of lean strategy on operational performance : a study of Thai manufacturing companies. *Journal of Manufacturing Technology Management*, *21*(7), 839–852. https://doi.org/10.1108/17410381011077946

Rahman, S., Laosirihongthong, T., & Sohal, A. S. (2010). Impact of lean strategy on operational performance: A study of Thai manufacturing companies. *Journal of Manufacturing Technology Management*, *21*(7), 839–852. https://doi.org/10.1108/17410381011077946

Ramarapu, N. K., Mehra, S., & Frolick, M. N. (1995). A comparative analysis and review of JIT " implementation " research. *International Journal of Operations & Production Management*, *15*(1), 38–49.

Ramayah, T., Yeap, J., Ahmad, N. H., Abdul Halim, H. A., & Abidur Rahman, S. (2017). Testing a confirmatory model of facebook usage in SmartPLS using consistent PLS. *International Journal of Business and Innovation*, *3*(2), 1–14.

Ramon-Jeronimo, J. M., Florez-Lopez, R., & Araujo-Pinzon, P. (2019). Resource-based view and SMEs performance exporting through foreign intermediaries: The mediating effect of management controls. *Sustainability*, *11*(12), 3241. https://doi.org/10.3390/SU11123241

Randhawa, J. S., & Ahuja, I. S. (2018). An investigation into manufacturing performance achievements accrued by Indian manufacturing organization through strategic 5S practices. *International Journal of Productivity and Performance Management*, *67*(4), 754–787.

Rasi, R. Z. R. M., Rakiman, U. S., & Ahmad, M. F. Bin. (2015). Relationship between lean production and operational performance in the manufacturing industry. *IOP Conference Series: Materials Science and Engineering*, *83*(1). https://doi.org/10.1088/1757-899X/83/1/012016

Ratiu, C., & Anderson, B. B. (2015). The multiple identities of sustainability. *World Journal of Science, Technology and Sustainable Development*, *12*(3), 194–205.

Rezvani, Z. (2017). Who is a Middle Manager: A literature Review. *International Journal of Family Business and Management*, *1*(2), 1–9. https://doi.org/10.15226/2577-7815/1/2/00104

Rigdon, E. E., Ringle, C. M., & Sarstedt, M. (2015). Structural modeling of heterogeneous data with Partial Least Squares. *Review Marketing and Research*, *7*, 255–296.

Ringle, C. M., Wende, S., & Becker, J. M. (2015). SmartPLS 3. Retrieved from http://www.smartpls.com

Robbin, D. (2009). *Robbins, D. (2009). Understanding Research Methods: A Guide for The Public and Nonprofit Manager*. United Stated of America: CRC Press Taylor & Francis Group.

Rose, A. N. M., Ab Rashid, M. F. F., Nik Mohamed, N. M. Z., & Ahmad, H. (2016). Similarities of lean manufacturing approaches implementation in SMEs towards the success: Case study in the automotive component industry. *MATEC Web of Conferences*, *87*. https://doi.org/10.1051/matecconf/20178702024

Rothenberg, S., Pil, F. K., & Maxwell, J. (2001). Lean, Green and the quest for superior environmental performance. *Production and Operations Management*, *10*(3), 228–243.

Roy, S., Tarafdar, M., Ragu-Nathan, T. S., & Marsillac, E. (2012).). The Effect of Misspecification of Reflective and Formative Constructs in Operations and Manufacturing Management Research. *Electronic Journal of Business Research Methods*, *10*(1), 34–52.

Ruben, R. Ben, Vinodh, S., & Asokan, P. (2019). State of art perspectives of lean and sustainable manufacturing. *International Journal of Lean Six Sigma*, *10*(1), 234–256. https://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216

Sabiu, M. S., Mei, T. S., Hasanur, M., & Joarder, R. (2015). MEDIATING EFFECT OF ETHICAL CLIMATES ON HRM PRACTICES AND ORGANISATIONAL PERFORMANCE : A PROPOSED. *Conference on Business Management Research Ii*, 130–142.

Sabiu, M. S., Mei, T. S., & Joarder, M. H. R. (2016). An empirical analysis of HRM practices and organizational performance relationship in the context of developing nation: the moderating effect of ethical climates. *International Journal of Management Research and Review*, *6*(10), 1463–1481.

https://doi.org/10.5162/sensor2017/C5.4

Sabiu, M. S., Mei, T. S., & Raihan Joarder, M. H. (2016). Moderating role of ethical climates on HRM practices and organizational performance: A proposed conceptual model. *Mediterranean Journal of Social Sciences*, *7*(1), 291–300. https://doi.org/10.5901/mjss.2016.v7n1p291

Sabiu, M. S., Ringim, K. J., Mei, T. S., & Joarder, M. H. R. (2019). Relationship between human resource management practices, ethical climates and organizational performance, the missing link. *PSU Research Review*, *3*(1), 50–59. https://doi.org/10.1108/PRR-12-2016-0022

Sahoo, S. (2019). Lean manufacturing practices and performance: the role of social and technical factors. *International Journal of Quality and Reliability Management*. https://doi.org/10.1108/IJQRM-03-2019-0099

Sahoo, S., & Yadav, S. (2018). Lean implementation in small- and medium-sized enterprises: An empirical study of Indian manufacturing firms. *Benchmarking*, *25*(4), 1121–1147. https://doi.org/10.1108/BIJ-02-2017-0033

Sakakibara, S., Flynn, B. B., & Schroeder, R. G. (1993). A Framework and measurement instrument for Just In Time Manufacturing. *Production and Operations Management*, *2*(3).

Sakakibara, S., Flynn, B. B., Schroeder, R. G., & Morris, W. T. (1997a). *The Impact of Just-in-Time Manufacturing and Its Infrastructure on Manufacturing Performance*. (August 2015).

Sakakibara, S., Flynn, B. B., Schroeder, R. G., & Morris, W. T. (1997b). The Impact of Just-In-Time Manufacturing and Its Infrastructure on Manufacturing Performance. *Management Sciences*, *43*(9), 1246–1257.

Saleh, R. A., Sweis, R. J., & Saleh, F. I. M. (2018). Investigating the impact of hard total quality management practices on operational performance in manufacturing organizations. *Benchmarking: An International Journal*, *25*(7), 2040–2064.

Salimi, M., Hadjali, H. R., & Sorooshian, S. (2012). A lean production framework for Malaysian automotive and heavy machinery industry. *Journal of Applied Sciences*, *12*(13), 1402.

Salvador, F., Rungtusanatham, M., Forza, C., & Trentin, A. (2007). Mix flexibility and volume flexibility in a build-to-order environment: Synergies and trade-offs. *International Journal of Operations and Production Management*, *27*(11), 1173–1191. https://doi.org/10.1108/01443570710830584

Sang, S., Lee, J., & Lee, J. (2010). E-government adoption in Cambodia; a Partial Least Squares approach. *Transforming Government: People, Process and Policy*, *4*(2), 138–157.

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2014). *PLS-SEM: Looking back and moving* *forward. Long Range Planning*. *47*(3), 132–137.

Sarstedt, Marko, Hair, J. F., Cheah, J., Becker, J., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal*, *27*(3), 197–211. https://doi.org/10.1016/j.ausmj.2019.05.003

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed). United Kingdom: Pearson Education Ltd.

Saunders, Mark, Lewis, P., & Thornhill, A. (2016). Research Methods for Business Students (7th edition). In *Harlow, United Kingdom: Pearson Education Ltd.* Retrieved from https://www.m-culture.go.th/mculture_th/download/king9/Glossary_about_HM_King_Bhumibol_Adulyadej's_Funeral.pdf

Schonberger, R. J. (2007). Japanese production management: An evolution-With mixed success. *Journal of Operations Management*, *25*(2), 403–419. https://doi.org/10.1016/j.jom.2006.04.003

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling* (3rd ed.). https://doi.org/10.1002/9781118133880.hop202023

Sekaran, U., & Bougie, R. (2013). *Research Methods for Business; A Skill-Building Approach (Sixth Edit)*. United Stated of America: John Wiley & Sons, Inc.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach* (7th ed). Chichester, West Sussex, United Kingdom: John Wiley & Sons.

Sekaran, Uma. (2003). *Research methods for business: A skill building approach* (4th Ed). New York: John Wiley and Sons.

Sekaran, Uma. (2006). *Research methods for business: A skill building approach*. John Wiley & Sons.

Shah, R., & Goldstein, S. M. (2006). Use of structural equation modeling in operations management research: Looking back and forward. *Journal of Operations Management*, *24*(2), 148–169. https://doi.org/10.1016/j.jom.2005.05.001

Shah, R., & Ward, P. T. (2003a). Lean Manufacturing : Context , Practice Bundles , and Performance Lean Manufacturing : Context , Practice Bundles , and Performance. *Journal of Operations Management*, *21*, 129–149.

Shah, R., & Ward, P. T. (2003b). Lean manufacturing: Context, practice bundles, and performance. *Journal of Operations Management*, *21*(2), 129–149. https://doi.org/10.1016/S0272-6963(02)00108-0

Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management*, *25*(4), 785–805. https://doi.org/10.1016/j.jom.2007.01.019

Shang, K., Lu, C., & Li, S. (2010). A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan. *Journal of Environmental Management*, *91*(5), 1218–1226. https://doi.org/10.1016/j.jenvman.2010.01.016

Sharma, R., Jabbour, C. J. C., & Jabbour, A. B. L. de S. (2020). Sustainable manufacturing and industry 4.0: what we know and what we don't. *Journal of Enterprise Information Management*. https://doi.org/10.1108/JEIM-01-2020-0024

Shokouhyar, S., Seddigh, M. R., & Panahifar, F. (2020). Impact of big data analytics capabilities on supply chain sustainability. *World Journal of Science, Technology and Sustainable Development*, *17*(1), 33–57. https://doi.org/10.1108/wjstsd-06-2019-0031

Shrafat, F. D., & Ismail, M. (2019). Structural equation modeling of lean manufacturing practices in a developing country context. *Journal of Manufacturing Technology Management*, *30*(1), 122–145. https://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216

Shurrab, J., & Hussain, M. (2018). An empirical study of the impact of lean on the performance of the construction industry in UAE. *Journal of Engineering, Design and Technology*, *16*(5), 694–710.

Silva, A. da T., Gohr, C. F., & Santos, L. C. (2019). Lean production from the perspective of the resource-based view: A study in an organization in the footwear industry. *Gestão & Produção*, *26*(2), 2480. https://doi.org/10.1590/0104-530X2480-19

Simha, A., & Cullen, J. B. (2012). Ethical Climates and Their Effects on Organizational Outcomes : Implications From the Past and Prophecies for the Future. *2Academy of Management Perspectives*, *26*(4), 20–34.

Sinaga, M., Suharyono, Musadieq, M. Al, & Iqbal, M. (2020). The effect of maintenance operation, time utility and occupancy to sustainability with transit oriented development moderation. *Journal of Quality in Maintenance Engineering*, 1355–2511. https://doi.org/10.1108/JQME-06-2020-0058

Singh, B., Garg, S. K., & Sharma, S. K. (2010). Scope for lean implementation: a survey of 127 Indian industries. *International Journal of Rapid Manufacturing*, *1*(3), 323–333. https://doi.org/10.1504/ijrapidm.2010.034253

Singh, Jagdeep, Singh, H., & Kumar, A. (2020). Impact of lean practices on organizational sustainability through green supply chain management – an empirical investigation. *International Journal of Lean Six Sigma*. https://doi.org/10.1108/IJLSS-06-2017-0068

Singh, Jagmeet, & Singh, H. (2020). Application of lean manufacturing in automotive manufacturing unit. *International Journal of Lean Six Sigma*, *11*(1), 171–210. https://doi.org/10.1108/IJLSS-06-2018-0060

Singh, S. K., Kumar, D., & Gupta, T. (2014). Elimination of Wastes In Die Casting Industry By Lean Manufacturing : A Case Study. *IOSR Journal of Engineering*, *04*(07), 29–35.

Sneider, C. A., & Carries, K. (2008). Sustainability based on lean thinking and ethics. *Geotechnical Special Publication*, (178), 829–836. https://doi.org/doi:10.1061/40971(310)103

Sohal, A. S. (1996). Developing a lean production organization: an Australian case study. *International Journal of Operations & Production Management*, *16*(2), 91–102. https://doi.org/10.1108/01443579610109866

Stamenkovic, S., Ratkovic Njegovan, B., & Vukadinovic, M. S. (2018). Intra-national diversity: Perception of organizational justice and ethical climate in organizations in Serbia. *Cross Cultural and Strategic Management*, *25*(3), 425–442. https://doi.org/10.1108/CCSM-05-2017-0061

Stare, J., & Klun, M. (2017). An Analysis of the Ethics Infrastructure and Ethical Climate in Slovenian Public Administration. *NISPAcee Journal of Public Administration and Policy*, *9*(2), 147–164. https://doi.org/10.1515/nispa-2016-0018

Steinlicht, C. L. (2010). *Lean Production and the organization life cycle: A survey of lean tool effectiveness in young and mature organizatins*.

Steinlicht, C. L. C. (2010). *Lean Production and the Organizational Life Cycle: a Survey of Lean Tool Effectiveness in Young and Mature Organizations*.

Stemhanou, S. ., & Spiegl, F. (1992). *The manufacturing challenge:from concept to production*. VNR, New York.

Stevens, J. (1992). *Applied multivariate statistics for the social sciences* (2nd ed). New Jersey, USA: Lawrence Erlbaum Associates.

Stevenson, W. J. (2012). *Operations management (11th ed.).* New York: McGraw-Hill/Irwin.

Stoughton, A. M., & Ludema, J. (2012). The driving forces of sustainability. *Journal of Organizational Change Management*, *25*(4), 501–517. https://doi.org/10.1108/09534811211239191

Straub, D., & Gefen, D. (2004). Validation Guidelines for IS Positivist Research. *Communications of the Association for Information Systems*, *13*, 380–427. https://doi.org/10.17705/1cais.01324

Stubblefield Loucks, E., Martens, M. L., & Cho, C. H. (2010). Engaging small- and medium-sized businesses in sustainability. *Sustainability Accounting, Management and Policy Journal*, *1*(2), 178–200. https://doi.org/10.1108/20408021011089239

Suzaki, K. (1985). Japanese manufacturing techniques: their importance to U.S manufactures. *Journal of Business Strategy*, 10–19.

Swarnakar, V., Tiwari, A. K., & Singh, A. R. (2020). Evaluating critical failure factors for implementing sustainable lean six sigma framework in manufacturing organization: A case experience. *International Journal of Lean Six Sigma*. https://doi.org/10.1108/IJLSS-05-2019-0050

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed). New Jersey, USA: Allyn & Bacon/Pearson Education.

Tabachnick, B. G., & Fidell, L. S. (2014). *Using multivariate statistics* (6th ed). Harlow, UK: Pearson Education Ltd.

Taherdoost, H. (2016). Sampling Methods in Research Methodology ; How to Choose a Sampling Technique for Research. *International Journal of Academic Research in Management, 5*(2), 18–27. https://doi.org/10.2139/ssrn.3205035

Taj, S., & Morosan, C. (2011a). The impact of lean operations on the Chinese manufacturing performance. *Journal of Manufacturing Technology Management, 22*(2), 223–240. https://doi.org/10.1108/17410381111102234

Taj, S., & Morosan, C. (2011b). The Impact of Lean Operations on the Chinese Manufacturing Performance. *2Journal of Manufacturing Technology Management*, *22*(2), 223–240.

Tan, L. P., & Wong, K. Y. (2015). Linkage between knowledge management and manufacturing performance : a structural equation modeling approach. *Journal of Knowledge Management*, *19*(4), 814–835. https://doi.org/10.1108/JKM-11-2014-0487

Tanner, E. C., Tanner, J. F., & Wakefield, K. (2015). Panacea or paradox? The moderating role of ethical climate. *Journal of Personal Selling and Sales Management*, *35*(2), 175–190. https://doi.org/10.1080/08853134.2015.1010540

Thanki, S. J., & Thakkar, J. (2014). Status of Lean Manufacturing Practices in Indian Industries and Goverment Initiatives: A Pilot Study. *Journal of Manufacturing Technology Management*, *25*(5), 655–675.

Thomas, A., Byard, P., Francis, M., Fisher, R., & White, G. R. T. (2016a). Profiling the resiliency and sustainability of UK manufacturing. *Journal of Manufacturng Technology Management*, *27*(1), 82–99.

Thomas, A., Byard, P., Francis, M., Fisher, R., & White, G. R. T. (2016b). Profiling the resiliency and susutainability of UK manufacturing companies. *Journal of Manufacturing Technology Management*, *27*(1), 82–99.

Torielli, R. M., Abrahams, R. A., Smillie, R. W., & Voigt, R. C. (2011). *Using lean methodologies for economically and environmentally sustainable foundries. China Foundry.*

Trevino, L. K., Butterfield, K. D., & McCabe, D. L. (1998). The ethical context in organizations: Influences on employee attitudes and behaviors. *Research in Ethical Issues in Organizations*, *8*(3), 447–476. https://doi.org/10.2307/3857431

United Nations Global Compact. (2013). *Global corporate sustainability report*.

Urbach, N., & Ahleman, F. (2010). Structural equation modeling in information systems research using Partial Least Squares. *Journal of Information Technology Theory and Application*, *50*(4), 427–441.

Vachon, S., & Mao, Z. (2008). Linking supply chain strength to sustainable development: a country-level analysis. *Journal of Cleaner Production*, *16*(15), 1552–1560. https://doi.org/10.1016/j.jclepro.2008.04.012

Valente, C. M., Sousa, P. S. A., & Moreira, M. R. A. (2019). Assessment of the Lean effect on business performance: the case of manufacturing SMEs. *Journal of Manufacturing Technology Management*, *31*(3), 501–523. https://doi.org/10.1108/JMTM-04-2019-0137

Valentine, S., & Barnett, T. (2007). Perceived Organizational Ethics and the Ethical Decisions of Sales and Marketing Personnel. *Journal of Personal Selling and Sales Management*, *27*(4), 373–388. https://doi.org/10.2753/PSS0885-3134270407

Victor, B, & Cullen, J. . (1987). A theory and measure of ethical climate in organizations. *Research in Corporate Social Performance and Policy*, *9*, 51–71.

Victor, Bart, & Cullen, V. B. (1988). The Organizational bases of Ethical Work Climates. *Administrative Science Quarterly*, *33*(1), 101–125.

Voss, C.A, & Robinson, S. . (1987). Application of Just-in-Time Manufacturing tecniques in the United Kingdom. *Internatioal Journal of Operation & Production Management*, *7*(4), 46–52.

Voss, Christopher A., Ahlstrom, P., & Blackmon, K. (1997). Benchmarking and operational performance : some empirical. *Ibternational Journal of Operations & Production Management*, *17*(19), 1046–1058.

Wagner, M., & Schaltegger, S. (2004). The effect of corporate environmental strategy choice and environmental performance on competitiveness and economic performance: An empirical study of EU manufacturing. *European Management Journal*, *22*(5), 557–572. https://doi.org/10.1016/j.emj.2004.09.013

Wang, J. X. (2011). *Lean Manufacturing: Business Bottom-Line Based*. Line Based. United Stated of America: CRC Press Taylor & Francis Group.

WCED. (1987). Our common Future: (World Commission on Environment and Development). In *Oxford University Press, London*.

Wickramasinghe, G. L. D., & Wickramasinghe, V. (2017). Implementation of lean production practices and manufacturing performance: The role of lean duration. *Journal of Manufacturing Technology Management*, *28*(4), 531–550.

Wiengarten, F., Gimenez, C., Fynes, B., & Ferdows, K. (2015). Exploring the importance of cultural collectivism on the efficacy of lean practices. *International Journal of Operations & Production Management*, *35*(3), 370. https://doi.org/10.1108/IJOPM-09-2012-0357

Womack, J. P., & Jones, D. T. (1996). Beyond Toyota: How to root out waste and pursue perfection. In *Harvard Business Review1*.

Womack, J. P., Jones, D. T., & Roos, D. (1990). *The machine that changed the world: The Story of Lean Production*. Harper, New York, NY.

Wong, K. . (2013). 28/05 - Partial Least Squares Structural Equation Modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin*, 1–32.

Wong, W. P., & Wong, K. Y. (2011). Supply chain management, knowledge management capability, and their linkages. *Business Process Management Journal*, *17*(6), 940–964.

Wong, Y. C., Wong, K. Y., & Ali, A. (2009). A study on lean manufacturing implementation in the Malaysian electrical and electronics industry. *European Journal of Scientific Research*, *38*(4), 521–535.

Worley, J. ., & Dolen, T. . (2006). The role of communication and management support in a lean manufacturing implementation. *Management Decision*, *44*(2), 228–245. https://doi.org/10.1108/00251740610650210

Worley, J. ., & Doolen, T. . (2006). The role of communication and amangement support in a lean manufacturing implementaton. *Management Decision*, *44*(2), 228–245. https://doi.org/http://dx.doi.org/10.1108/09564230910978511

Xu, S., Cavusgil, S. T., & White, J. C. (2006). The Impact of Strategic Fit Among Strategy , Structure , and Processes on Multinational Corporation Performance : A Multimethod Assessment. *Journal of International Marketing*, *14*(2), 1–31.

Yadav, V., Jain, R., Mittal, M. L., Panwar, A., & Lyons, A. (2019). The impact of lean practices on the operational performance of SMEs in India. *Industrial Management & Data Systems*, *119*(2), 317–330. https://doi.org/10.1108/IMDS-07-2014-0202

Yang, M. G. (Mark), Hong, P., & Modi, S. B. (2011). Impact of lean manufacturing and environmental management on business performance : An empirical study of manufacturing firms. *Intern. Journal of Production Economics*, *129*(2), 251–261. https://doi.org/10.1016/j.ijpe.2010.10.017

Yusof, S. M., & Aspinwall, E. M. (2000). Critical success factors in small and medium enterprises: Survey results. *Total Quality Management*, *11*(4–6), 448–462. https://doi.org/10.1080/09544120050007760

Zahraee, S. M. (2016). A survey on Lean Manufacturing implementation in a selected manufacturing in Iran. *International Journal of Lean Six Sigma*, *7*(2), 99–118.

Zehir, C., Gogus, C. G., & Karakadilar, I. S. (2016). The Moderating Role of Ethical Climate on Relationships Among Job Satisfaction, Corporate Entrepreneurship and Organizational Citizenship. *Journal of Global Strategic Management*, *2*(10), 107–124. https://doi.org/10.20460/jgsm.20161024360

Zehir, C., Müceldili, B., & Zehir, S. (2012). The Moderating Effect of Ethical Climate on the Relationship between Job Satisfaction and Organizational Commitment: Evidence from Large Companies in Turkey. *Procedia - Social and Behavioral Sciences*, *58*, 734–743. https://doi.org/10.1016/j.sbspro.2012.09.1051

Zhang, Q., Vonderembse, M. A., & Lim, J. S. (2003). Logistics flexibility: Defining and analyzing relationships among competence, capability, and customer satisfaction. *Proceedings - Annual Meeting of the Decision Sciences Institute*, *21*, 1587–1592.

Zhang, Z., & Yuan, K. H. (2018). Practical Statistical Power Analysis Using Webpower and R (Eds). Retrieved from https://webpower.psychstat.org

Zhao, X., Lynch, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. *Journal of Consumer Research*, *37*(2), 197–206. https://doi.org/10.1086/651257

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese Manufacturing Enterprises. *Journal of Operations Management*, *22*(3), 265–289.

Zhu, X., & Lin, Y. (2017). Does lean manufacturing improve firm value? *Journal of Manufacturing Technology Management*, *28*(4), 422–437. https://doi.org/10.1108/JMTM-05-2016-0071

Zikmund, W. G. (2003). *Exploring marketing research* (8th ed.). Sydney: Thomson.

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2009). *Business research methods* (8th ed). Boston, MA: Cengage Learning.

Appendix 1: Questionnaires

Universiti Utara Malaysia
School of Technology Management & Logistic

Respected participant,

Questionnaire on Relationship between Lean Manufacturing Practices towards Sustainability in Manufacturing Organisations: Mediating effect of Manufacturing performance and Moderating effect of Ethical Climate

I am Mohd Zulfabli Bin Hasan, a PhD student in the Department of School of Technology Management & Logistic, Universiti Utara Malaysia. I plan to focus my research on *The relationship between Lean Manufacturing Practices and Sustainability in Manufacturing Organisations*. The idea is to collect the relevant data by means of a structured questionnaire.

Please assist me in the data collection by filling in the questionnaire. Take note of the following things before filling the questionnaire:

There are no correct or incorrect answers. Simply give your own personal opinion
All the data collected will be treated confidentially and anonymously

The questionnaire is divided into the following sections:

Section A: Demographic Profile
Section B: Lean Manufacturing Practices
Section C: Sustainability Performances
Section D: Manufacturing Performance
Section E: Ethical Climate

The questionnaire will take approximately 20 minutes to complete. Thank you for your esteemed co-operation. It is highly appreciated.

Yours sincerely,

Mohd Zulfabli Bin Hasan
PhD's Student

SECTION A: DEMOGRAPHIC INFORMATION
BAHAGIAN A: MAKLUMAT DEMOGRAPHIC

Please tick (√) the box best describing about your organisation and state the following information below:
Sila tandakan (√)pada kotak yang berkaitan dengan organisasi anda dan nyatakan maklumat berikut di bawah:

1. Name of Company:____
   Nama syarikat

2. What is the main product produced by this company?
   Apakah produk utama yang dihasilkan oleh syarikat ini?

- ☐ *Electronics and electrical*
- ☐ *Textiles, clothing and footwear*
- ☐ *Wood products*
- ☐ *Rubber products*
- ☐ *Food, beverages and tobacco*
- ☐ *Petroleum products*
- ☐ *Chemical and plastic products*
- ☐ *Non-metallic mineral products*
- ☐ *Iron, steel and metal products*
- ☐ *Transport equipment*
- ☐ *Machinery, appliances and parts*
- ☐ *Other manufactured goods (please specify):*_______________

3. Number of full time employees in this company
   Bilangan pekerja sepenuh masa di syarikat ini

- ☐ ≤50
- ☐ 51-150
- ☐ ≥151

4. Jenis syarikat

☐ Multinational Corporation (MNC)

Perbadanan Multinasional (MNC)

☐ Joint ventures

Usaha sama

☐ Locally owned

Perkongsian tempatan

☐ Government Linked Company (GLC)

Syarikat berkaitan/milik Kerajaan

☐ Others (please specifiy):___________________

SECTION B: LEAN MANUFACTURING PRACTICES
BAHAGIAN B: AMALAN PEMBUATAN LEAN
Please circle your agreement or disagreement using the scale from 1-5, based on the following statement about Lean Manufacturing Practices.
Berdasarkan pernyataan berikut tentang Amalan Pembuatan Lean, sila bulatkan pilihan setuju atau tidak setuju anda menggunakan skala dari 1-5.

Strongly disagree *Sangat tidak setuju*	Disagree *Tidak setuju*	Neutral	Agree *Setuju*	Strongly agree *Sangat Setuju*
1	2	3	4	5

No *No*	Items *Item*	Statements *Kenyataan*	Scale *Skala*				
	CL 1	We group dissimilar machines into work centres (called cells) based on product families (product families can be determined based on shapes/design similarity, processing requirement similarity, or routing requirement similarity). *Kami mengumpulkan mesin yang berbeza ke pusat kerja (dipanggil sel) berdasarkan kumpulan produk (kumpulan produk boleh ditentukan berdasarkan bentuk / persamaan reka bentuk, persamaan keperluan pemprosesan, atau persamaan keperluan routing).*	1	2	3	4	5
	CL 2	Our processes are located close together, so that material handling and part storage are minimized. *Proses kami terletak berdekatan, supaya pengendalian bahan dan bahagian stor diminimumkan.*	1	2	3	4	5
	CL 3	The design of the cells/workstations is easily changed depending on the product being manufactured. *Reka bentuk sel / stesen kerja mudah diubah bergantung kepada produk yang dihasilkan.*	1	2	3	4	5
	CL 4	We have laid out the shop-floor so that processes and machines are in close proximity to each other. *Kami telah menyusun semula shop floor supaya proses dan mesin-mesin berada berdekatan antara satu sama lain.*	1	2	3	4	5
	CL 5	The cells/work centres/machines are arranged in relation to each other so that material movement, material handling, and transit times are minimized. *Sel / pusat kerja / mesin disusun berhubung satu sama lain supaya pergerakan bahan, pengendalian bahan, dan masa transit diminimumkan*	1	2	3	4	5
	CL 6	Our processes physically move closer together and transportation between stations runs simply. *Proses kami secara fizikal bergerak lebih dekat dan pengangkutan di antara stesen berjalan secara ringkas.*	1	2	3	4	5
	PS 1	We use a production system in which items are produced only when called for by the users of those items. *Kami menggunakan sistem pengeluaran di mana item dihasilkan hanya apabila diminta oleh pengguna barangan tersebut.*	1	2	3	4	5
	PS 2	Production is performed based on the shipment of goods from previous workstation.	1	2	3	4	5

		Pengeluaran dilakukan berdasarkan penghantaran barang dari stesen kerja sebelumnya.					
	PS 3	We use a production system in which items are produced only in necessary quantities, no more and no less. *Kami menggunakan sistem pengeluaran di mana item dihasilkan hanya dalam kuantiti yang diperlukan, tidak lebih dan tidak kurang.*	1	2	3	4	5
	PS 4	We use Kanban to authorize the production or withdrawal the goods. *Kami menggunakan Kanban untuk membenarkan pengeluaran atau pengeluaran barangan.*	1	2	3	4	5
	PS 5	To authorize the order, we use a supplier Kanban that rotates between factory and suppliers. *Untuk membenarkan pesanan itu, kami menggunakan Kanban pembekal yang digunakan di antara kilang dan pembekal.*	1	2	3	4	5
	PS 6	Production at a workstation is performed based on the current demand of the subsequent workstation. *Pengeluaran di stesen kerja dilakukan berdasarkan permintaan semasa stesen kerja berikutnya.*	1	2	3	4	5
	QS 1	Our shop-floor employees perform their own setups to reduce the time required. *Para pekerja kami melakukan persediaan/setup mereka sendiri untuk mengurangkan masa yang diperlukan*	1	2	3	4	5
	QS 2	Our plant emphasizes the importance of good housekeeping, with tools in their normal storage location. *Kilang kami menekankan pentingnya pengemasan yang baik, dengan peralatan di lokasi penyimpanan biasa mereka.*	1	2	3	4	5
	QS 3	We are aggressively working to lower machine setup times in our plant. *Kami bekerja dengan agresif untuk menurunkan masa persediaan/setup mesin di kilang kami.*	1	2	3	4	5
	QS 4	We have converted most of our machine setups to external setups that can be performed while the machine is running. *Kami telah menukar kebanyakan persediaan/setup mesin kami kepada persediaan/ setup luaran yang boleh dilakukan semasa mesin sedang dijalankan.*	1	2	3	4	5
	QS 5	We have low machine setup times in our plant. *Kami mempunyai masa persediaan/setup mesin rendah di kilang kami.*	1	2	3	4	5
	TQM1	We always train employees on the use of statistical tools *Kami sentiasa melatih kakitangan mengenai penggunaan alat statistik.*	1	2	3	4	5
	TQM2	We always use statistical tools like control charts *Kami sentiasa menggunakan alat statistik seperti carta kawalan*	1	2	3	4	5
	TQM3	We always measure process capability for key processing steps *Kami sentiasa mengukur keupayaan proses untuk langkah-langkah pemprosesan utama.*	1	2	3	4	5
	TQM4	We always use continuous process improvement (CPI) tools *Kami sentiasa menggunakan alat penambahbaikan proses berterusan (CPI)*	1	2	3	4	5
	TQM5	We always use experimental design methods to improve operations	1	2	3	4	5

		Kami sentiasa menggunakan kaedah reka bentuk eksperimen untuk meningkatkan operasi					
	TQM6	We always use Failure Modes and Effects Analysis (FMEA) to eliminate failures *Kami sentiasa menggunakan Mod Kegagalan dan Analisis Kesan (PFMEA) untuk menghapuskan kegagalan*	1	2	3	4	5
	TQM7	We always seek quality certifications such as ISO. *Kami sentiasa mendapatkan pensijilan kualiti seperti ISO.*	1	2	3	4	5
	TQM8	We always apply for quality awards. *Kami sentiasa memohon untuk anugerah kualiti.*	1	2	3	4	5
	TPM 1	Our equipment is in a high state of readiness for production at all times. *Peralatan kami dalam keadaan bersedia untuk pengeluaran sepanjang masa.*	1	2	3	4	5
	TPM 2	We kept the records of routine maintenance. *Kami menyimpan rekod rutin penyelenggaraan rutin.*	1	2	3	4	5
	TPM 3	We scrupulously clean equipment, tools, workspaces, and machines to make unusual occurrences more noticeable. *Kami sengaja membersihkan peralatan, alat, ruang kerja, dan mesin untuk membuat kejadian luar biasa lebih ketara.*	1	2	3	4	5
	TPM 4	We dedicate a periodic inspection and maintenance system to keep machines in operation. *Kami menjalankan sistem pemeriksaan dan penyelenggaraan berkala untuk memastikan mesin beroperasi.*	1	2	3	4	5
	TPM 5	We dedicate a system of daily maintenance, periodic inspection, and preventive repairs designed to reduce the probability of machine breakdown. *Kami menyediakan sistem penyelenggaraan harian, pemeriksaan berkala, dan pembaikan pencegahan yang direka untuk mengurangkan kebarangkalian kerosakan mesin.*	1	2	3	4	5
	SLP 1	We emphasize producing small quantity of items together. *Kami menekankan penghasilan jumlah item yang banyak bersama-sama.*	1	2	3	4	5
	SLP 2	We are aggressively working to lower lot sizes in our plant. *Kami secara agresif bekerja untuk mengurangkan saiz lot di kilang kami.*	1	2	3	4	5
	SLP 3	We emphasize small lot sizes to increase manufacturing flexibility. *Kami menekankan saiz lot kecil untuk meningkatkan fleksibiliti pembuatan.*	1	2	3	4	5
	SLP 4	We reduce the average level of inventory by producing in more frequent but smaller lot size. *Kami mengurangkan tahap purata inventori dengan menghasilkan saiz lot yang lebih kerap tetapi lebih kecil.*	1	2	3	4	5
	SLP 5	We tend to have small lot-sizes in our master schedule *Kami cenderung mempunyai banyak saiz besar dalam jadual induk kami*	1	2	3	4	5

SECTION C: SUSTAINABILITY
BAHAGIAN C: KEMAMPANAN

This section attempts to determine sustainability in the manufacturing organisations. Please indicate the extent to which you agree with the following statements as they relate to changes in your organisation in the last three years caused by the current practices (as you indicate in SECTION B), by circling the appropriate number against each item, using the given scale.
Bahagian ini cuba menentukan kelestarian/kemampanan dalam organisasi perkilangan. Sila nyatakan sejauh mana anda bersetuju dengan kenyataan berikut kerana ia berkaitan dengan perubahan dalam organisasi anda dalam tiga tahun terakhir yang disebabkan oleh amalan semasa (seperti yang anda nyatakan dalam BAHAGIAN B), dengan memilih nombor yang sesuai terhadap setiap item, menggunakan skala yang diberikan.

Strongly disagree *Sangat tidak setuju*	Disagree *Tidak setuju*	Neutral	Agree *Setuju*	Strongly agree *Sangat Setuju*
1	2	3	4	5

	ECONOMIC SUSTAINABILITY In the last three years, please describe sustainability of your company for both operational and business resulting from the undertaken efforts as stated in SECTION B. *KEMAMPANAN EKONOMI* *Dalam tempoh tiga tahun yang lalu, sila terangkan kelestarian/kemampanan syarikat anda untuk kedua-dua operasi dan perniagaan yang terhasil daripada usaha yang dijalankan seperti yang dinyatakan dalam BAHAGIAN B.*						
No *No*	Items *Item*	Statements *Kenyataan*	Scale *Skala*				
	ECO 1	Reduced cost *Mengurangkan kos*	1	2	3	4	5
	ECO 2	Improved product quality *Kualiti produk yang bertambah baik*	1	2	3	4	5
	ECO 3	Reduced lead times (i.e. time between when customer order is made and when the order is completely satisfied) *Mengurangkan masa menunggu (iaitu masa di antara apabila pesanan pelanggan dibuat dan apabila permintaan itu dipenuhi sepenuhnya)*	1	2	3	4	5
	ECO 4	Improved customer service. *Perkhidmatan pelanggan bertambah baik.*	1	2	3	4	5
	ECO 5	Increased productivity *Peningkatan produktiviti*	1	2	3	4	5
	ECO 6	Increase revenues *Meningkatkan pendapatan*	1	2	3	4	5
	ECO 7	Increased market share *Peningkatan pasaran*	1	2	3	4	5
	ECO 8	Improved reputation *Reputasi bertambah baik*	1	2	3	4	5
	ECO 9	Better new market opportunities *Peluang pasaran baru yang lebih baik*	1	2	3	4	5
	ENVIRONMENTAL SUSTAINABILITY In the last three years, please describe sustainability of your company in reducing the resources usage, pollution emitted and waste generated resulting from undertaken efforts as stated in SECTION B		1	2	3	4	5

	Dalam tempoh tiga tahun yang lalu, sila jelaskan kemampanan syarikat anda dalam mengurangkan penggunaan sumber, pencemaran yang dipancarkan dan sisa buangan yang terhasil daripada usaha yang dilakukan seperti yang dinyatakan dalam BAHAGIAN B.						
	ENV 1	Reduced water usage *Penggunaan air berkurangan*	1	2	3	4	5
	ENV 2	Reduced energy consumption *Penggunaan tenaga berkurangan*	1	2	3	4	5
	ENV 3	Reduced non-renewable resources usage *Mengurangkan penggunaan sumber tidak boleh diperbaharui*	1	2	3	4	5
	ENV 4	Reduced hazardous inputs usage *Mengurangkan penggunaan input berbahaya*	1	2	3	4	5
	ENV 5	Reduced solid waste *Sisa pepejal dikurangkan*	1	2	3	4	5
	ENV 6	Reduced waste water emissions *Pengurangan pelepasan air sisa*	1	2	3	4	5
	ENV 7	Reduced emission of polluting gases *Mengurangkan pelepasan gas pencemaran*	1	2	3	4	5
	SOCIAL SUSTAINABILITY In the last three years, please describe sustainability of your company in creating social welfare (for various stakeholders including supplier, employee, customer and local communities) resulting from undertaken efforts as stated in SECTION B *Dalam tempoh tiga tahun yang lalu, sila nyatakan kemapanan syarikat anda dalam mewujudkan kesejahteraan sosial (untuk pelbagai pihak yang berkepentingan termasuk pembekal, pekerja, pelanggan dan masyarakat setempat) yang terhasil daripada usaha yang dilakukan seperti yang dinyatakan dalam BAHAGIAN B.*						
	SOC 1	Increased employee satisfaction *Peningkatan kepuasan pekerja*	1	2	3	4	5
	SOC 2	Better recruitment and staff retention *Pengambilan dan pengekalan kakitangan yang lebih baik*	1	2	3	4	5
	SOC 3	Increased occupational health and safety *Meningkatkan kesihatan dan keselamatan pekerjaan*	1	2	3	4	5
	SOC 4	Improved employee education and skill *Pendidikan dan kemahiran pekerja bertambah baik*	1	2	3	4	5
	SOC 5	Improved supplier commitment *Komitmen pembekal yang bertambah baik*	1	2	3	4	5
	SOC 6	Increased certified suppliers *Peningkatan pembekal yang disahkan*	1	2	3	4	5
	SOC 7	Increased customer satisfaction *Peningkatan kepuasan pelanggan*	1	2	3	4	5
	SOC 8	Increased public health and safety *Peningkatan kesihatan dan keselamatan awam*	1	2	3	4	5
	SOC 9	Reduced local community complaint *Mengurangkan aduan komuniti tempatan*	1	2	3	4	5

SECTION D: MANUFACTURING PERFORMANCE
BAHAGIAN D: PRESTASI PEMBUATAN

The following questions are designed to measure your firm's performance. Please circle the answer that indicates your organisation performance compares to your competitors in your industry on local or global basis.
Soalan berikut direka untuk mengukur prestasi firma anda. Sila bulangkan jawapan yang menunjukkan prestasi organisasi anda berbanding pesaing anda dalam industri anda secara tempatan atau global.

Strongly disagree *Sangat tidak setuju*	Disagree *Tidak setuju*	Neutral	Agree *Setuju*	Strongly agree *Sangat Setuju*
1	2	3	4	5

No	Items	Statements	Level				
	QL 1	Products that do not meet the quality specifications have reduced. *Produk yang tidak memenuhi spesifikasi kualiti telah dikurangkan.*	1	2	3	4	5
	QL 2	We have superior quality of products compared to our competitors'. *Kami mempunyai kualiti produk yang lebih baik berbanding pesaing kami.*					
	QL 3	Activities in fixing defective products to conform to the quality specifications (reworks) have reduced. *Aktiviti dalam membetulkan produk yang cacat untuk mematuhi spesifikasi kualiti (reworks) telah berkurangan.*	1	2	3	4	5
	QL 4	Poor quality products that must be discarded (scraps) have reduced. *Produk berkualiti rendah yang mesti dibuang (lebihan potongan) telah dikurangkan.*	1	2	3	4	5
	QL 5	The percentage of product that passes final inspection the first time (first-pass quality yield) has increased. *Peratusan produk yang melepasi pemeriksaan akhir kali pertama (hasil kualiti lulus pertama) telah meningkat.*	1	2	3	4	5
	QL 6	We have superior quality of service compared to our competitors'. *Kami mempunyai kualiti perkhidmatan yang lebih baik berbanding pesaing kami.*	1	2	3	4	5
	QL 7	We can produce consistent products with low defects rate. *Kami dapat menghasilkan produk yang konsisten dengan kadar kecacatan yang rendah.*	1	2	3	4	5
	DEL 1	Our ability to deliver products to the market quickly has increased. *Keupayaan kami untuk menyampaikan produk ke pasaran dengan cepat telah meningkat.*	1	2	3	4	5
	DEL 2	Our ability to deliver products to the customer as promised has increased. *Keupayaan kami untuk menyampaikan produk kepada pelanggan seperti yang dijanjikan telah meningkat.*	1	2	3	4	5
	DEL 3	We are capable of delivering products to the market faster than our competitors.	1	2	3	4	5

		Kami mampu menyampaikan produk ke pasaran lebih cepat daripada pesaing kami.					
	FLX1	We can vary product combinations from one period to the next *Kita boleh mengubah kombinasi produk dari satu tempoh ke seterusnya*	1	2	3	4	5
	FLX2	We can produce a wide variety of products in our plants *Kami boleh menghasilkan pelbagai jenis produk dalam plant kami*	1	2	3	4	5
	FLX3	We can produce different product types without major changeover *Kita boleh menghasilkan jenis produk yang berbeza tanpa perubahan besar*	1	2	3	4	5
	FLX4	We can changeover quickly from one product to another *Kita boleh menukar dengan cepat dari satu produk ke produk lain*	1	2	3	4	5
	T1	Our team able to meets deadlines of customer's order. *Pasukan kami dapat memenuhi tarikh akhir pesanan pelanggan.*	1	2	3	4	5
	T2	Our team is not wastes time. *Pasukan kami tidak membazirkan masa.*	1	2	3	4	5
	T3	Our team provides deliverables (e.g. products, or services) on time. *Pasukan kami menyediakan penghantaran (contohnya produk, atau perkhidmatan) tepat pada waktunya.*	1	2	3	4	5
	T4	Our team is work aggressively. *Pasukan kami bekerja dengan agresif.*	1	2	3	4	5
	T5	Our team adheres to its schedule. *Pasukan kami ini mematuhi jadualnya.*	1	2	3	4	5
	T6	Our team takes a reasonable amount of time to complete its work *Pasukan kami mengambil masa yang munasabah untuk menyelesaikan tugasnya*	1	2	3	4	5
	COST 1	Unit manufacturing cost has reduced. *Kos pengilangan unit telah berkurang.*	1	2	3	4	5
	COST 2	Our unit manufacturing cost is lower than our competitors. *Kos pembuatan unit kami lebih rendah daripada pesaing kami.*	1	2	3	4	5
	COST 3	Internal failure costs (i.e., defect, scrap, rework, process failure, price reduction, and downtime) have reduced. *Kos kegagalan dalaman (iaitu, kecacatan, sekerap, kerja semula, kegagalan proses, pengurangan harga, dan downtime) telah berkurangan.*	1	2	3	4	5
	COST 4	External failure costs (i.e., complaints, returns, warranty claims, liability, and lost) have reduced. *Kos kegagalan luar (iaitu, aduan, pulangan, tuntutan waranti, liabiliti, dan kehilangan) telah berkurangan.*	1	2	3	4	5

SECTION E: ETHICAL CLIMATE
BAHAGIAN E: CLIMATE ETIKA

Please circle your agreement or disagreement using the scale from 1-5, based on the following statement about ethical climate.
Sila bulatkan persetujuan anda menggunakan skala dari 1-5, berdasarkan pernyataan berikut tentang climate etika.

Strongly disagree *Sangat tidak setuju*	Disagree *Tidak setuju*	Neutral	Agree *Setuju*	Strongly agree *Sangat Setuju*
1	2	3	4	5

No	Items	Statements	Level				
	EC	Efficient is the major responsibility for employees in this company. *Cekap adalah tanggungjawab utama bagi para pekerja dalam syarikat ini.*	1	2	3	4	5
	EL	Employees are expected to do anything to further the company's interests. *Demi kepentingan syarikat, para pekerja dijangka akan berbuat apa sahaja.*	1	2	3	4	5
	FL	It is very important to follow strictly the company's rules and procedures here. *Mematuhi peraturan dan prosedur syarikat ini adalah sangat penting.*	1	2	3	4	5
	EL	Work is considered substandard when it affects the interests of the company. *Kerja dianggap lemah apabila ia menjejaskan kepentingan syarikat.*	1	2	3	4	5
	BL	Company only concern all the good deed in the company. *Syarikat hanya mengambil kira segala perbuatan baik dalam syarikat.*	1	2	3	4	5
	Pc	The first consideration is whether a decision violates any law. *Pertimbangan pertama adalah sama ada keputusan melanggar mana-mana undang-undang.*	1	2	3	4	5
	PC	Employees in this company are expected to comply with the law and professional standards and on other considerations. *Pekerja dalam syarikat ini dijangka mematuhi undang-undang dan piawaian profesional dan di atas pertimbangan lain.*	1	2	3	4	5
	PL	Everyone is expected to stick by company rules and procedures. *Setiap orang dijangka akan mematuhi peraturan dan prosedur syarikat.*	1	2	3	4	5
	EL	Employees in this organisation are actively concerned about the customer's and the public's interest. *Orang dalam organisasi ini secara aktif mengambil berat tentang kepentingan pelanggan dan orang ramai.*	1	2	3	4	5
	PL	Successful employee in this company go by standard operation procedure (S.O.P). *Pekerja yang berjaya di syarikat ini adalah berdasarkan prosedur operasi standard (S.O.P).*	1	2	3	4	5
	EC	The most efficient way is always the right way, in this company.	1	2	3	4	5

		Dalam syarikat ini,cara yang paling berkesan adalah cara yang betul.					
	PC	In this company, employee are expected to strictly follow legal or professional standards. *Dalam syarikat ini, pekerja dijangka mengikut undang-undang atau standard professional.*	1	2	3	4	5
	BL	Our major consideration is what is best for everyone in the company. *Pertimbangan utama kami adalah apa yang terbaik untuk semua orang dalam syarikat.*	1	2	3	4	5
	PL	Successful employees in this company strictly obey the company policies. *Pekerja-pekerja yang berjaya dalam syarikat ini mematuhi sepenuhnya dasar syarikat.*	1	2	3	4	5
	PC	In this company, the law or ethical code of theft profession is the major consideration. *Dalam syarikat ini, undang-undang atau kod etika kecurian profesion adalah pertimbangan utama.*	1	2	3	4	5
	EC	In this company, each employee expected, above all, to work efficiently. *Dalam syarikat ini, setiap pekerja dijangka seperti semua di atas untuk bekerja dengan cekap.*	1	2	3	4	5
	E1	In this company employees are mostly going out to settle both, work matters and personal matters during working hour. *Dalam syarikat ini kebanyakan pekerja keluar untuk menyelesaikan kedua-dua perkara,iaitu urusan kerja dan urusan peribadi semasa waktu kerja.*	1	2	3	4	5
	P1	In this company, employees are expected to follow their own personal and moral beliefs. *Dalam syarikat ini, pekerja akan mengikuti cara dan kepercayaan mereka sendiri.*	1	2	3	4	5
	B1	In this company, employees look out for each other's good. *Dalam syarikat ini, para pekerja melihat kebaikan satu sama lain.*	1	2	3	4	5
	El	There is no room for one's own personal morals or ethics in this company. *Tidak ada ruang untuk moral atau etika peribadi seseorang dalam syarikat ini.*	1	2	3	4	5
	P1	Each employee in this company decides for their self what is right and wrong. *Setiap pekerja di syarikat ini membuat keputusan apa yang betul dan salah untuk diri sendiri.*	1	2	3	4	5
	El	In this company, employees protect their own interest. *Dalam syarikat ini, para pekerja melindungi kepentingan mereka sendiri.*	1	2	3	4	5
	P1	The most important consideration in this company is each person's sense of right and wrong. *Pertimbangan yang paling penting dalam syarikat ini adalah rasa betul dan salah setiap orang.*	1	2	3	4	5
	BI	In this company, our major concern is always what is best for the other person.	1	2	3	4	5

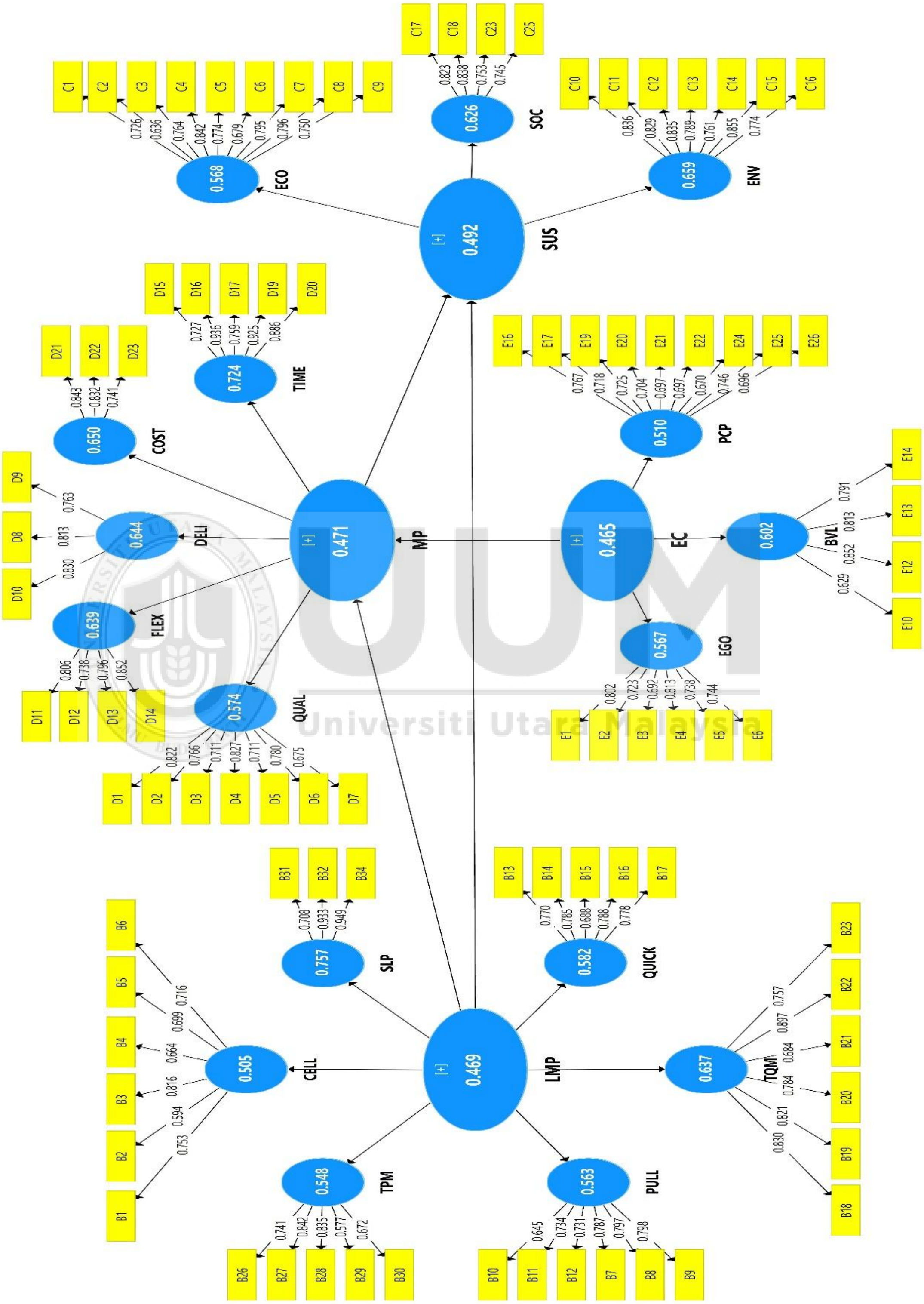
		Dalam syarikat ini, perhatian utama kami adalah apa yang terbaik untuk orang lain.					
	Fl	In this company, employees are guided by their own personal ethics. *Dalam syarikat ini, pekerja berpandukan etika peribadi masing-masing.*	1	2	3	4	5
	BC	It is expected that company will always do what is right for the customer and public. *Syarikat diharapkan agar sentiasa melakukan apa yang betul untuk pelanggan dan orang ramai.*	1	2	3	4	5

Appendix 2: Determining Sample Size

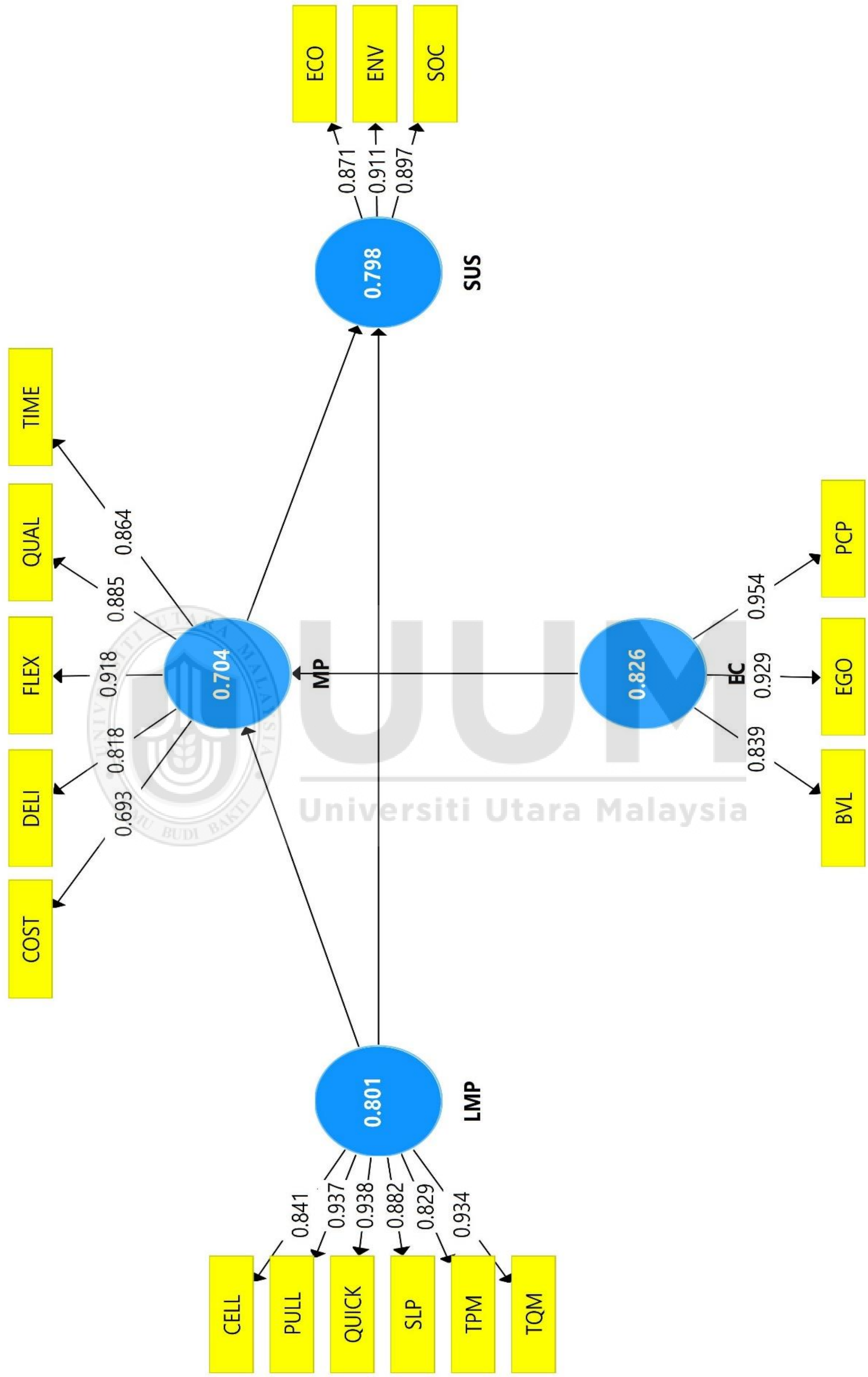
N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70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

N – population
S – sample size
Source: Krejcie & Morgan (1970)

Appendix 3: Measurement Model Stage 1



Appendix 4: Measurement Model Stage 2



Appendix 5: Cross Loading Results

	ECO	ENV	SOC	CELL	PULL	QUICK	TQM	TPM	SLP	EGO	BVL	PCP	QUAL	DELI	FLEX	TIME	COST
C1	**0.726**	0.648	0.473	0.461	0.468	0.503	0.439	0.371	0.465	0.399	0.264	0.324	0.456	0.416	0.500	0.384	0.309
C2	**0.636**	0.583	0.396	0.460	0.437	0.412	0.397	0.484	0.396	0.320	0.284	0.288	0.305	0.252	0.390	0.398	0.274
C3	**0.764**	0.496	0.434	0.417	0.356	0.416	0.389	0.410	0.351	0.375	0.351	0.292	0.484	0.485	0.565	0.575	0.308
C4	**0.842**	0.551	0.489	0.389	0.332	0.342	0.308	0.377	0.342	0.293	0.221	0.162	0.438	0.372	0.508	0.496	0.241
C5	**0.774**	0.533	0.523	0.459	0.419	0.391	0.395	0.456	0.447	0.275	0.256	0.249	0.476	0.457	0.492	0.384	0.228
C6	**0.679**	0.360	0.356	0.379	0.319	0.418	0.383	0.328	0.382	0.200	0.122	0.090	0.271	0.247	0.378	0.382	0.157
C7	**0.795**	0.519	0.475	0.365	0.363	0.396	0.293	0.357	0.308	0.266	0.146	0.146	0.427	0.335	0.507	0.534	0.206
C8	**0.796**	0.529	0.544	0.423	0.376	0.383	0.377	0.513	0.306	0.261	0.191	0.204	0.442	0.329	0.463	0.499	0.265
C9	**0.750**	0.547	0.648	0.462	0.520	0.469	0.501	0.470	0.492	0.407	0.293	0.374	0.568	0.455	0.555	0.514	0.427
C10	0.616	**0.836**	0.522	0.335	0.375	0.386	0.374	0.492	0.440	0.395	0.438	0.457	0.446	0.481	0.540	0.598	0.339
C11	0.524	**0.829**	0.482	0.239	0.322	0.373	0.348	0.418	0.387	0.306	0.394	0.334	0.331	0.306	0.464	0.475	0.240
C12	0.634	**0.835**	0.676	0.403	0.429	0.488	0.448	0.420	0.430	0.443	0.307	0.398	0.511	0.415	0.592	0.573	0.394
C13	0.495	**0.789**	0.533	0.325	0.331	0.375	0.341	0.384	0.312	0.309	0.329	0.342	0.351	0.299	0.481	0.555	0.320
C14	0.475	**0.761**	0.558	0.378	0.488	0.490	0.491	0.519	0.494	0.385	0.442	0.459	0.472	0.416	0.510	0.497	0.398
C15	0.614	**0.855**	0.683	0.443	0.535	0.527	0.485	0.505	0.466	0.439	0.339	0.459	0.541	0.499	0.621	0.605	0.433
C16	0.636	**0.774**	0.704	0.366	0.408	0.451	0.434	0.446	0.423	0.411	0.249	0.378	0.493	0.448	0.594	0.521	0.388
C17	0.518	0.631	**0.823**	0.315	0.368	0.342	0.360	0.423	0.345	0.369	0.252	0.366	0.454	0.331	0.524	0.497	0.416
C18	0.575	0.690	**0.838**	0.386	0.368	0.432	0.454	0.480	0.343	0.418	0.249	0.411	0.488	0.490	0.591	0.571	0.427
C23	0.515	0.575	**0.753**	0.394	0.556	0.499	0.521	0.461	0.550	0.425	0.332	0.417	0.644	0.602	0.604	0.531	0.455
C25	0.416	0.390	**0.745**	0.322	0.493	0.426	0.451	0.521	0.413	0.346	0.268	0.266	0.596	0.479	0.527	0.481	0.345
B1	0.416	0.271	0.315	**0.753**	0.587	0.598	0.483	0.447	0.416	0.312	0.143	0.282	0.303	0.288	0.348	0.302	0.254
B2	0.345	0.224	0.267	**0.594**	0.380	0.384	0.359	0.332	0.352	0.140	0.129	0.135	0.266	0.411	0.368	0.285	0.091
B3	0.338	0.275	0.192	**0.816**	0.467	0.485	0.403	0.399	0.324	0.330	0.157	0.313	0.213	0.257	0.294	0.260	0.298

B4	0.472	0.270	0.323	**0.664**	0.434	0.470	0.369	0.485	0.332	0.305	0.250	0.286	0.334	0.225	0.432	0.454	0.233
B5	0.421	0.353	0.349	**0.699**	0.510	0.515	0.416	0.484	0.320	0.214	0.108	0.188	0.228	0.215	0.375	0.344	0.252
B6	0.402	0.422	0.414	**0.716**	0.754	0.690	0.800	0.548	0.828	0.386	0.145	0.295	0.235	0.311	0.382	0.348	0.362
B7	0.441	0.360	0.418	0.581	**0.787**	0.687	0.595	0.443	0.526	0.354	0.151	0.300	0.383	0.315	0.428	0.395	0.381
B8	0.472	0.465	0.412	0.633	**0.797**	0.717	0.832	0.555	0.836	0.326	0.125	0.265	0.235	0.309	0.383	0.331	0.309
B9	0.407	0.467	0.430	0.601	**0.798**	0.758	0.820	0.578	0.883	0.357	0.195	0.304	0.255	0.306	0.391	0.296	0.356
B10	0.333	0.254	0.313	0.598	**0.645**	0.596	0.519	0.556	0.430	0.307	0.166	0.291	0.420	0.366	0.435	0.296	0.333
B11	0.312	0.293	0.441	0.458	**0.734**	0.575	0.510	0.422	0.387	0.377	0.135	0.339	0.381	0.351	0.461	0.339	0.396
B12	0.406	0.414	0.487	0.568	**0.731**	0.642	0.512	0.536	0.506	0.462	0.309	0.431	0.349	0.207	0.402	0.349	0.472
B13	0.425	0.382	0.506	0.515	0.737	**0.770**	0.618	0.537	0.551	0.438	0.247	0.393	0.399	0.295	0.434	0.397	0.449
B14	0.457	0.429	0.401	0.594	0.664	**0.785**	0.639	0.565	0.514	0.363	0.145	0.321	0.449	0.432	0.510	0.358	0.327
B15	0.473	0.452	0.383	0.509	0.498	**0.688**	0.479	0.542	0.425	0.296	0.371	0.303	0.429	0.337	0.485	0.438	0.296
B16	0.333	0.354	0.314	0.630	0.671	**0.788**	0.666	0.480	0.567	0.296	0.183	0.316	0.173	0.179	0.298	0.231	0.313
B17	0.421	0.467	0.429	0.641	0.782	**0.778**	0.823	0.603	0.915	0.361	0.202	0.316	0.286	0.339	0.418	0.381	0.330
B18	0.469	0.469	0.511	0.661	0.780	0.733	**0.830**	0.599	0.831	0.383	0.201	0.318	0.320	0.339	0.426	0.378	0.400
B19	0.438	0.485	0.515	0.539	0.721	0.728	**0.821**	0.576	0.647	0.397	0.130	0.403	0.357	0.466	0.458	0.373	0.404
B20	0.384	0.357	0.442	0.482	0.661	0.657	**0.784**	0.547	0.575	0.372	0.165	0.296	0.378	0.425	0.410	0.310	0.432
B21	0.364	0.228	0.282	0.482	0.508	0.560	**0.684**	0.582	0.469	0.391	0.253	0.350	0.354	0.256	0.315	0.301	0.338
B22	0.465	0.467	0.465	0.690	0.807	0.775	**0.897**	0.612	0.896	0.370	0.123	0.310	0.282	0.312	0.399	0.347	0.352
B23	0.317	0.426	0.444	0.482	0.603	0.641	**0.757**	0.597	0.596	0.488	0.274	0.370	0.285	0.348	0.456	0.337	0.477
B26	0.306	0.291	0.356	0.486	0.486	0.532	0.474	**0.741**	0.432	0.292	0.299	0.298	0.459	0.351	0.358	0.312	0.251
B27	0.426	0.424	0.410	0.518	0.539	0.562	0.552	**0.842**	0.474	0.330	0.440	0.351	0.376	0.318	0.391	0.439	0.286
B28	0.366	0.388	0.417	0.465	0.493	0.505	0.525	**0.835**	0.406	0.361	0.311	0.364	0.367	0.310	0.345	0.370	0.367
B29	0.463	0.403	0.495	0.428	0.478	0.522	0.559	**0.577**	0.479	0.238	0.202	0.210	0.314	0.323	0.364	0.406	0.310
B30	0.484	0.548	0.493	0.475	0.538	0.511	0.577	**0.672**	0.497	0.490	0.328	0.476	0.476	0.453	0.516	0.482	0.486
B31	0.517	0.469	0.392	0.422	0.523	0.538	0.521	0.456	**0.708**	0.293	0.299	0.256	0.451	0.425	0.389	0.348	0.277
B32	0.432	0.436	0.476	0.582	0.774	0.742	0.823	0.545	**0.933**	0.297	0.128	0.240	0.264	0.295	0.370	0.280	0.293
B34	0.429	0.473	0.476	0.664	0.814	0.784	0.842	0.613	**0.949**	0.371	0.224	0.333	0.291	0.341	0.410	0.342	0.369
E1	0.413	0.464	0.481	0.431	0.424	0.408	0.421	0.363	0.298	**0.802**	0.435	0.674	0.418	0.345	0.541	0.492	0.701

E2	0.379	0.327	0.329	0.249	0.248	0.263	0.258	0.287	0.208	**0.723**	0.558	0.626	0.493	0.348	0.411	0.377	0.576
E3	0.193	0.225	0.180	0.258	0.235	0.273	0.319	0.228	0.181	**0.692**	0.331	0.566	0.277	0.254	0.337	0.340	0.513
E4	0.305	0.408	0.415	0.264	0.384	0.355	0.366	0.425	0.280	**0.813**	0.611	0.744	0.421	0.307	0.429	0.358	0.824
E5	0.288	0.393	0.428	0.393	0.462	0.450	0.502	0.468	0.363	**0.738**	0.416	0.647	0.376	0.395	0.440	0.373	0.797
E6	0.285	0.310	0.370	0.269	0.405	0.329	0.375	0.319	0.326	**0.744**	0.455	0.624	0.357	0.282	0.367	0.366	0.753
E10	0.131	0.144	0.125	0.081	0.010	0.052	0.036	0.184	0.053	0.443	**0.629**	0.464	0.250	0.149	0.137	0.228	0.406
E12	0.351	0.499	0.340	0.170	0.221	0.252	0.253	0.415	0.230	0.536	**0.852**	0.613	0.372	0.335	0.440	0.426	0.482
E13	0.320	0.410	0.290	0.250	0.268	0.377	0.210	0.336	0.260	0.491	**0.813**	0.546	0.382	0.223	0.414	0.425	0.448
E14	0.156	0.262	0.291	0.159	0.210	0.199	0.195	0.384	0.171	0.476	**0.791**	0.602	0.346	0.289	0.316	0.294	0.478
E16	0.218	0.310	0.296	0.305	0.285	0.241	0.287	0.397	0.184	0.651	0.497	**0.767**	0.352	0.272	0.389	0.355	0.599
E17	0.171	0.249	0.318	0.254	0.324	0.286	0.287	0.324	0.222	0.649	0.470	**0.718**	0.340	0.236	0.297	0.280	0.590
E19	0.208	0.353	0.330	0.320	0.367	0.363	0.442	0.324	0.306	0.670	0.386	**0.725**	0.277	0.419	0.394	0.409	0.658
E20	0.190	0.249	0.339	0.148	0.297	0.272	0.302	0.293	0.188	0.608	0.404	**0.704**	0.305	0.256	0.321	0.203	0.607
E21	0.232	0.399	0.424	0.373	0.390	0.414	0.493	0.365	0.432	0.643	0.522	**0.697**	0.333	0.427	0.374	0.302	0.680
E22	0.290	0.501	0.363	0.214	0.287	0.285	0.306	0.295	0.246	0.642	0.402	**0.697**	0.346	0.287	0.463	0.416	0.587
E24	0.289	0.425	0.370	0.277	0.282	0.303	0.251	0.317	0.174	0.494	0.552	**0.670**	0.281	0.306	0.391	0.317	0.489
E25	0.161	0.338	0.313	0.155	0.240	0.269	0.163	0.337	0.147	0.549	0.698	**0.746**	0.405	0.276	0.383	0.345	0.498
E26	0.290	0.384	0.263	0.266	0.249	0.342	0.198	0.328	0.147	0.629	0.679	**0.696**	0.333	0.260	0.422	0.413	0.550
D1	0.502	0.506	0.591	0.376	0.458	0.427	0.418	0.501	0.397	0.457	0.428	0.401	**0.822**	0.664	0.652	0.571	0.439
D2	0.537	0.512	0.584	0.437	0.519	0.508	0.511	0.531	0.476	0.401	0.269	0.351	**0.766**	0.676	0.602	0.546	0.354
D3	0.477	0.553	0.535	0.306	0.326	0.386	0.347	0.454	0.402	0.423	0.411	0.430	**0.711**	0.626	0.559	0.584	0.401
D4	0.452	0.442	0.620	0.251	0.329	0.315	0.292	0.397	0.206	0.404	0.380	0.361	**0.827**	0.628	0.655	0.588	0.398
D5	0.350	0.263	0.319	0.038	0.143	0.181	0.037	0.272	0.040	0.328	0.305	0.272	**0.711**	0.470	0.494	0.397	0.313
D6	0.453	0.393	0.456	0.263	0.228	0.290	0.222	0.348	0.197	0.367	0.277	0.323	**0.780**	0.543	0.541	0.513	0.292
D7	0.252	0.233	0.452	0.224	0.257	0.213	0.275	0.334	0.162	0.375	0.234	0.306	**0.675**	0.528	0.488	0.465	0.351
D8	0.340	0.389	0.452	0.295	0.351	0.317	0.384	0.378	0.312	0.318	0.206	0.323	0.611	**0.813**	0.475	0.422	0.365
D9	0.407	0.335	0.517	0.302	0.290	0.327	0.334	0.398	0.292	0.331	0.299	0.341	0.653	**0.763**	0.573	0.499	0.254
D10	0.448	0.493	0.465	0.359	0.343	0.349	0.359	0.372	0.340	0.379	0.279	0.358	0.625	**0.830**	0.610	0.484	0.378
D11	0.556	0.562	0.577	0.464	0.492	0.488	0.462	0.462	0.391	0.496	0.331	0.493	0.594	0.560	**0.806**	0.594	0.449

D12	0.446	0.496	0.559	0.418	0.366	0.335	0.388	0.391	0.358	0.407	0.292	0.426	0.618	0.610	**0.738**	0.535	0.403
D13	0.499	0.538	0.563	0.331	0.481	0.507	0.423	0.411	0.392	0.442	0.388	0.389	0.625	0.508	**0.796**	0.739	0.403
D14	0.560	0.553	0.571	0.438	0.414	0.448	0.375	0.455	0.281	0.449	0.367	0.407	0.588	0.539	**0.852**	0.816	0.406
D15	0.524	0.552	0.508	0.459	0.478	0.437	0.424	0.429	0.392	0.491	0.376	0.454	0.581	0.545	0.634	**0.727**	0.454
D16	0.571	0.620	0.624	0.432	0.410	0.439	0.388	0.501	0.331	0.415	0.375	0.388	0.649	0.561	0.793	**0.936**	0.387
D17	0.530	0.550	0.461	0.283	0.264	0.310	0.334	0.401	0.203	0.489	0.430	0.441	0.529	0.430	0.671	**0.759**	0.409
D19	0.521	0.581	0.629	0.412	0.389	0.418	0.359	0.532	0.327	0.409	0.395	0.405	0.614	0.478	0.770	**0.925**	0.377
D20	0.475	0.564	0.563	0.396	0.334	0.383	0.314	0.455	0.292	0.382	0.338	0.339	0.578	0.470	0.716	**0.886**	0.326
D21	0.295	0.361	0.463	0.281	0.371	0.336	0.367	0.405	0.243	0.803	0.615	0.745	0.442	0.333	0.437	0.351	**0.843**
D22	0.290	0.419	0.459	0.259	0.462	0.428	0.449	0.418	0.367	0.708	0.465	0.660	0.395	0.411	0.454	0.371	**0.832**
D23	0.287	0.286	0.330	0.361	0.355	0.319	0.389	0.288	0.259	0.738	0.318	0.566	0.325	0.248	0.357	0.389	**0.741**

Appendix 6: Outer Loading

Constructs 1st Order	2nd Order	Items	Outer Loadings
Economy (ECO)		C1	.726
		C2	.636
		C3	.764
		C4	.842
		C5	.774
		C6	.679
		C7	.795
		C8	.796
		C9	.750
Environment (ENV)		C10	.836
		C11	.829
		C12	.835
		C13	.789
		C14	.761
		C15	.855
		C16	.774
Social (SOC)		C17	.823
		C18	.838
		C23	.753
		C25	.745
	Sustainability (SUS)	ECO	.871
		ENV	.911
		SOC	.897
Cellular Layout (CELL)		B1	.753
		B2	.594
		B3	.816
		B4	.664
		B5	.699
		B6	.716
Pull System (PULL)		B7	.787
		B8	.797
		B9	.798
		B10	.645
		B11	.734
		B12	.731
Quick Setup (QUICK)		B13	.770
		B14	.785
		B15	.688
		B16	.788

		B17	.778
Total Quality Management (TQM)		B18	.830
		B19	.821
		B20	.784
		B21	.684
		B22	.897
		B23	.757
Total Productive Maintenance (TPM)		B26	.741
		B27	.842
		B28	.835
		B29	.577
		B30	.672
Small Lot Production (SLP)		B31	.708
		B32	.933
		B34	.949
	Lean Manufacturing Practices (LMP)	CELL	.841
		PULL	.937
		QUICK	.938
		TQM	.934
		TPM	.829
		SLP	.882
Egoism (EGO)		E1	.787
		E2	.718
		E3	.682
		E4	.818
		E5	.721
		E6	.721
Benevolence (BVL)		E10	.594
		E11	.655
		E12	.817
		E13	.796
		E14	.763
Principle (PCP)		E16	.767
		E17	.718
		E19	.725
		E20	.704
		E21	.697
		E22	.697
		E24	.672

		E25	.747
		E26	.696
	Ethical climate (EC)	EGO	.839
		BVL	.839
		PCP	.954
Quality (QUAL)		D1	.822
		D2	.766
		D3	.711
		D4	.826
		D5	.711
		D6	.781
		D7	.675
Delivery (DELI)		D8	.815
		D9	.762
		D10	.829
Flexibility (FLEX)		D11	.809
		D12	.740
		D13	.796
		D14	.848
Time (TIME)		D15	.730
		D16	.935
		D17	.759
		D19	.924
		D20	.884
Cost (COST)		D21	.842
		D22	.801
		D23	.673
		D24	.637
	Manufacturing Performance (MP)	QUAL	.887
		DELI	.811
		FLEX	.920
		TIME	.866
		COST	.716

Appendix 7: Expert Review Form

Review from Expert (Academician and Practitioners)

Construct: Lean Manufacturing Practices

Kindly evaluate the following survey items in terms of their representativeness and clarity of content domain of lean manufacturing practices construct. That is, to what extent do you think the items on the survey measures lean manufacturing practices? Are the instruments clear and easy to answer? Kindly evaluate the comprehensiveness of the entire items in their ability to measure the construct.

<table>
<tr><th colspan="3">Conceptual Definition: Lean Manufacturing Practices</th><th>Representativeness</th><th>Clarity</th><th>Comments</th></tr>
<tr><td colspan="3">Lean manufacturing practices refer to an incorporated system that includes pertaining fundamentals and varied organisation practices whereby it’s goals are to upsurge productivity, diminish lead time and cost and as well as increase quality (Abdelhadi, 2016; Nawanir, Teong, & Othman, 2013). For this study lean manufacturing practices comprises to six (6) components which are cellular layout, pull system/ Kanban, quick setup, total quality management (TQM), total preventive maintenance (TPM), small lot of production.</td><td>1 = item is not representative
2 = item needs major revisions to be representative
3 = item needs minor revisions to be representative
4 = item is representative</td><td>1 = item is not clear
2 = item needs major revisions to be clear
3 = item needs minor revisions to be clear
4 = item is clear</td><td></td></tr>
<tr><th>No</th><th>Items</th><th>Statement</th><th>Please rate from 1 – 4</th><th>Please rate from 1 – 4</th><th></th></tr>
<tr><td>1.</td><td>CL 1</td><td>We group dissimilar machines into work centres (called cells) based on product families (product families can be determined based on shapes/design similarity, processing requirement similarity, or routing requirement similarity).
Kami mengumpulkan mesin yang berbeza ke pusat kerja (dipanggil sel) berdasarkan kumpulan produk (kumpulan produk boleh ditentukan berdasarkan bentuk / persamaan reka bentuk, persamaan keperluan pemprosesan, atau persamaan keperluan routing).</td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>CL 2</td><td>Our processes are located close together, so that material handling and part storage are minimized.
Proses kami terletak berdekatan, supaya pengendalian bahan dan bahagian stor diminimumkan.</td><td></td><td></td><td></td></tr>
<tr><td>3.</td><td>CL 3</td><td>The design of the cells/workstations is easily changed depending on the product being manufactured.</td><td></td><td></td><td></td></tr>
</table>

		Reka bentuk sel / stesen kerja mudah diubah bergantung kepada produk yang dihasilkan.			
4.	CL 4	We have laid out the shop-floor so that processes and machines are in close proximity to each other. *Kami telah menyusun semula shop floor supaya proses dan mesin-mesin berada berdekatan antara satu sama lain.*			
5.	CL 5	The cells/work centres/machines are arranged in relation to each other so that material movement, material handling, and transit times are minimized. *Sel / pusat kerja / mesin disusun berhubung satu sama lain supaya pergerakan bahan, pengendalian bahan, dan masa transit diminimumkan*			
6.	CL 6	Our processes physically move closer together and transportation between stations runs simply. *Proses kami secara fizikal bergerak lebih dekat dan pengangkutan di antara stesen berjalan secara ringkas.*			
7.	PS 1	We use a production system in which items are produced only when called for by the users of those items. *Kami menggunakan sistem pengeluaran di mana item dihasilkan hanya apabila diminta oleh pengguna barangan tersebut.*			
8.	PS 2	Production is performed based on the shipment of goods from previous workstation. *Pengeluaran dilakukan berdasarkan penghantaran barang dari stesen kerja sebelumnya.*			
9.	PS 3	We use a production system in which items are produced only in necessary quantities, no more and no less. *Kami menggunakan sistem pengeluaran di mana item dihasilkan hanya dalam kuantiti yang diperlukan, tidak lebih dan tidak kurang.*			
10.	PS 4	We use Kanban to authorize the production or withdrawal the goods. *Kami menggunakan Kanban untuk membenarkan pengeluaran atau pengeluaran barangan.*			
11.	PS 5	To authorize the order, we use a supplier Kanban that rotates between factory and suppliers. *Untuk membenarkan pesanan itu, kami menggunakan Kanban pembekal yang digunakan di antara kilang dan pembekal.*			

12.	PS 6	Production at a workstation is performed based on the current demand of the subsequent workstation. *Pengeluaran di stesen kerja dilakukan berdasarkan permintaan semasa stesen kerja berikutnya.*			
13.	QS 1	Our shop-floor employees perform their own setups to reduce the time required. *Para pekerja kami melakukan persediaan/setup mereka sendiri untuk mengurangkan masa yang diperlukan*			
14.	QS 2	Our plant emphasizes the importance of good housekeeping, with tools in their normal storage location. *Kilang kami menekankan pentingnya pengemasan yang baik, dengan peralatan di lokasi penyimpanan biasa mereka.*			
15.	QS 3	We are aggressively working to lower machine setup times in our plant. *Kami bekerja dengan agresif untuk menurunkan masa persediaan/setup mesin di kilang kami.*			
16.	QS 4	We have converted most of our machine setups to external setups that can be performed while the machine is running. *Kami telah menukar kebanyakan persediaan/setup mesin kami kepada persediaan/ setup luaran yang boleh dilakukan semasa mesin sedang dijalankan.*			
17.	QS 5	We have low machine setup times in our plant. *Kami mempunyai masa persediaan/setup mesin rendah di kilang kami.*			
18.	TQM1	We always train employees on the use of statistical tools *Kami sentiasa melatih kakitangan mengenai penggunaan alat statistik.*			
19.	TQM2	We always use statistical tools like control charts *Kami sentiasa menggunakan alat statistik seperti carta kawalan*			
20.	TQM3	We always measure process capability for key processing steps *Kami sentiasa mengukur keupayaan proses untuk langkah-langkah pemprosesan utama.*			
21.	TQM4	We always use continuous process improvement (CPI) tools *Kami sentiasa menggunakan alat penambahbaikan proses berterusan (CPI)*			
22.	TQM5	We always use experimental design methods to improve operations			

		Kami sentiasa menggunakan kaedah reka bentuk eksperimen untuk meningkatkan operasi			
23.	TQM6	We always use Process Failure Modes and Effects Analysis (PFMEA) to eliminate failures *Kami sentiasa menggunakan Mod Kegagalan dan Analisis Kesan (PFMEA) untuk menghapuskan kegagalan*			
24.	TQM7	We always seek quality certifications such as ISO. *Kami sentiasa mendapatkan pensijilan kualiti seperti ISO.*			
25.	TQM8	We always apply for quality awards. *Kami sentiasa memohon untuk anugerah kualiti.*			
26.	TPM 1	Our equipment is in a high state of readiness for production at all times. *Peralatan kami dalam keadaan bersedia untuk pengeluaran sepanjang masa.*			
27.	TPM 2	We kept the records of routine maintenance. *Kami menyimpan rekod penyelenggaraan rutin.*			
28.	TPM 3	We scrupulously clean equipment, tools, workspaces, and machines to make unusual occurrences more noticeable. *Kami sengaja membersihkan peralatan, alat, ruang kerja, dan mesin untuk membuat kejadian luar biasa lebih ketara.*			
29.	TPM 4	We dedicate a periodic inspection and maintenance system to keep machines in operation. *Kami mendedikasikan sistem pemeriksaan dan penyelenggaraan berkala untuk memastikan mesin beroperasi.*			
30.	TPM 5	We dedicate a system of daily maintenance, periodic inspection, and preventive repairs designed to reduce the probability of machine breakdown. *Kami menyediakan sistem penyelenggaraan harian, pemeriksaan berkala, dan pembaikan pencegahan yang direka untuk mengurangkan kebarangkalian kerosakan mesin.*			
31.	SLP 1	We emphasize producing large quantity of items together. *Kami menekankan penghasilan jumlah item yang banyak bersama-sama.*			

32.	SLP 2	We are aggressively working to lower lot sizes in our plant. *Kami secara agresif bekerja untuk mengurangkan saiz lot di kilang kami.*			
33.	SLP 3	We emphasize small lot sizes to increase manufacturing flexibility. *Kami menekankan saiz lot kecil untuk meningkatkan fleksibiliti pembuatan.*			
34.	SLP 4	We reduce the average level of inventory by producing in more frequent but smaller lot size. *Kami mengurangkan tahap purata inventori dengan menghasilkan saiz lot yang lebih kerap tetapi lebih kecil.*			
35.	SLP 5	We tend to have large lot-sizes in our master schedule *Kami cenderung mempunyai banyak saiz besar dalam jadual induk kami*			

Construct: Sustainability

Kindly evaluate the following survey items in terms of their representativeness and clarity of content domain of sustainability construct. That is, to what extent do you think the items on the survey measures sustainability? Are the instruments clear and easy to answer? Kindly evaluate the comprehensiveness of the entire items in their ability to measure the construct.

<table>
<tr><th colspan="2">Conceptual Definition: Sustainability</th><th>Representativeness</th><th>Clarity</th><th>Comments</th></tr>
<tr><td colspan="2">Sustainability is considered an enduring or long-term objective that should be strategic in nature (Ferro et al., 2017). Meanwhile Barron & Chou (2017) and and Hami et al. (2016) viewed sustainability as a triple bottom line which will be measured by three pillars model which is economic, social and environment.</td><td>1 = item is not representative
2 = item needs major revisions to be representative
3 = item needs minor revisions to be representative

4 = item is representative</td><td>1 = item is not clear
2 = item needs major revisions to be clear
3 = item needs minor revisions to be clear
4 = item is clear</td><td></td></tr>
<tr><td colspan="2">ECONOMIC SUSTAINABILITY
In the last three years, please describe sustainability of your company for both operational and business resulting from the undertaken efforts as stated in SECTION B (Lean Manufacturing Practices).
KEMAMPANAN EKONOMI
Dalam tempoh tiga tahun yang lalu, sila terangkan kelestarian/kemampanan syarikat anda untuk kedua-dua operasi dan perniagaan yang terhasil daripada usaha yang dijalankan seperti yang dinyatakan dalam BAHAGIAN B (Lean Manufacturing Practices)..</td><td></td><td></td><td></td></tr>
<tr><td>No.</td><td>Statement</td><td>Please rate from 1 – 4</td><td>Please rate from 1 – 4</td><td></td></tr>
<tr><td>1.</td><td>Reduced cost
Mengurangkan kos</td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Improved product quality
Kualiti produk yang bertambah baik</td><td></td><td></td><td></td></tr>
<tr><td>3.</td><td>Reduced lead times (i.e. time between when customer order is made and when the order is completely satisfied)
Mengurangkan lead times (iaitu masa di antara apabila pesanan pelanggan dibuat dan apabila permintaan itu dipenuhi sepenuhnya)</td><td></td><td></td><td></td></tr>
<tr><td>4.</td><td>Improved customer service.</td><td></td><td></td><td></td></tr>
</table>

	Perkhidmatan pelanggan yang bertambah baik.			
5.	Increased productivity *Peningkatan produktiviti*			
6.	Increase revenues *Meningkatkan pendapatan*			
7.	Increased market share *Peningkatan pasaran*			
8.	Improved reputation *Reputasi yang bertambah baik*			
9.	Better new market opportunities *Peluang pasaran baru yang lebih baik*			
ENVIRONMENTAL SUSTAINABILITY In the last three years, please describe sustainability of your company in reducing the resources usage, pollution emitted and waste generated resulting from undertaken efforts as stated in **SECTION B (Lean Manufacturing Practices)**. *Dalam tempoh tiga tahun yang lalu, sila jelaskan kemampanan syarikat anda dalam mengurangkan penggunaan sumber, pencemaran yang dipancarkan dan sisa buangan yang terhasil daripada usaha yang dilakukan seperti yang dinyatakan dalam* ***BAHAGIAN B (Lean Manufacturing Practices)***.				
10.	Reduced water usage *Penggunaan air berkurangan*			
11.	Reduced energy consumption *Penggunaan tenaga berkurangan*			
12.	Reduced non-renewable resources usage *Mengurangkan penggunaan sumber tidak boleh diperbaharui*			
13.	Reduced hazardous inputs usage *Mengurangkan penggunaan input berbahaya*			
14.	Reduced solid waste *Sisa pepejal dikurangkan*			
15.	Reduced waste water emissions *Pengurangan pelepasan air sisa*			
16.	Reduced emission of polluting gases *Mengurangkan pelepasan gas pencemaran*			
SOCIAL SUSTAINABILITY In the last three years, please describe sustainability of your company in creating social welfare (for various stakeholders including supplier, employee, customer and local communities) resulting from undertaken efforts as stated in **SECTION B (Lean Manufacturing Practices)**. *Dalam tempoh tiga tahun yang lalu, sila nyatakan kemapanan syarikat anda dalam mewujudkan kesejahteraan sosial (untuk pelbagai pihak yang berkepentingan termasuk pembekal, pekerja, pelanggan dan masyarakat setempat) yang terhasil daripada usaha yang dilakukan seperti yang dinyatakan dalam* ***BAHAGIAN B (Lean Manufacturing Practices)***.				

17.	Increased employee satisfaction *Peningkatan kepuasan pekerja*			
18.	Better recruitment and staff retention *Pengambilan dan pengekalan kakitangan yang lebih baik*			
19.	Increased occupational health and safety *Meningkatkan kesihatan dan keselamatan pekerjaan*			
20.	Improved employee education and skill *Pendidikan dan kemahiran pekerja yang bertambah baik*			
21.	Improved supplier commitment *Komitmen pembekal yang bertambah baik*			
22.	Increased certified suppliers *Peningkatan pembekal yang disahkan*			
23.	Increased customer satisfaction *Peningkatan kepuasan pelanggan*			
24.	Increased public health and safety *Peningkatan kesihatan dan keselamatan awam*			
25.	Reduced local community complaint *Mengurangkan aduan komuniti tempatan*			

Construct: Manufacturing Performance

Kindly evaluate the following survey items in terms of their representativeness and clarity of content domain of manufacturing performance construct. That is, to what extent do you think the items on the survey measures manufacturing performance? Are the instruments clear and easy to answer? Kindly evaluate the comprehensiveness of the entire items in their ability to measure the construct.

Conceptual Definition: Manufacturing Performance			**Representativeness**	**Clarity**	**Comments**
Manufacturing performance refer to the strength of the firm is ascertained based on the capability or output provided such as cost, quality, delivery time and delivery time reliability, performance, flexibility and innovativeness to satisfy the customer (Narkhede, 2017; Al-Jawazneh, 2012). Therefore, this study utilized quality, flexibility, time, delivery and cost reduction to measure manufacturing performance. This research would like to examine manufacturing performance of Malaysia manufacturing organisations by taking several aspects to measure lean manufacturing practices with sustainability.			1 = item is *not representative* 2 = item needs *major revisions to be representative* 3 = item needs *minor revisions to be* representative 4 = item is *representative*	1 = item is not clear 2 = item needs major revisions to be clear 3 = item needs minor revisions to be clear 4 = item is clear	
No.	**Items**	**Statement**	**Please rate from 1 – 4**	**Please rate from 1 – 4**	
1.	QL 1	Products that do not meet the quality specifications have reduced. *Produk yang tidak memenuhi spesifikasi kualiti telah dikurangkan.*			
2.	QL 2	We have superior quality of products compared to our competitors'. *Kami mempunyai kualiti produk yang lebih baik berbanding pesaing kami.*			
3.	QL 3	Activities in fixing defective products to conform to the quality specifications (reworks) have reduced. *Aktiviti dalam membetulkan produk yang cacat untuk mematuhi spesifikasi kualiti (reworks) telah berkurangan.*			
4.	QL 4	Poor quality products that must be discarded (scraps) have reduced. *Produk berkualiti rendah yang mesti dibuang (lebihan potongan) telah dikurangkan.*			
5.	QL 4	The percentage of product that passes final inspection the first time (first-pass quality yield) has increased.			

		Peratusan produk yang melepasi pemeriksaan akhir kali pertama (hasil kualiti lulus pertama) telah meningkat.			
6.	QL 5	We have superior quality of service compared to our competitors'. *Kami mempunyai kualiti perkhidmatan yang lebih baik berbanding pesaing kami.*			
7.	QL 6	Products that do not meet the quality specifications have reduced. *Produk yang tidak memenuhi spesifikasi kualiti telah dikurangkan.*			
8.	DEL 1	Our ability to deliver products to the market quickly has increased. *Keupayaan kami untuk menyampaikan produk ke pasaran dengan cepat telah meningkat.*			
9.	DEL 2	Our ability to deliver products to the customer as promised has increased. *Keupayaan kami untuk menyampaikan produk kepada pelanggan seperti yang dijanjikan telah meningkat.*			
10.	DEL 3	We are capable of delivering products to the market faster than our competitors. *Kami mampu menyampaikan produk ke pasaran lebih cepat daripada pesaing kami.*			
11.	FLX1	We can vary product combinations from one period to the next *Kita boleh mengubah kombinasi produk dari satu tempoh ke seterusnya*			
12.	FLX2	We can produce a wide variety of products in our plants *Kami boleh menghasilkan pelbagai jenis produk dalam plant kami*			
13.	FLX3	We can produce different product types without major changeover *Kita boleh menghasilkan jenis produk yang berbeza tanpa perubahan besar*			
14.	FLX4	We can changeover quickly from one product to another *Kita boleh menukar dengan cepat dari satu produk ke produk lain*			

15.	T1	Our team able to meets deadlines of customer's order. *Pasukan kami dapat memenuhi tarikh akhir pesanan pelanggan.*			
16.	T2	Our team is not wastes time. *Pasukan kami tidak membazirkan masa.*			
17.	T3	Our team provides deliverables (e.g. products, or services) on time. *Pasukan kami menyediakan penghantaran (contohnya produk, atau perkhidmatan) tepat pada waktunya.*			
18.	T4	Our team is work aggressively. *Pasukan kami bekerja dengan agresif.*			
19.	T5	Our team adheres to its schedule. *Pasukan kami ini mematuhi jadualnya.*			
20.	T6	Our team takes a reasonable amount of time to complete its work *Pasukan kami mengambil masa yang munasabah untuk menyelesaikan tugasnya*			
21.	COST 1	Unit manufacturing cost has reduced. *Kos pengilangan unit telah berkurang.*			
22.	COST 2	Our unit manufacturing cost is lower than our competitors. *Kos pembuatan unit kami lebih rendah daripada pesaing kami.*			
23.	COST 3	Internal failure costs (i.e., defect, scrap, rework, process failure, price reduction, and downtime) have reduced. *Kos kegagalan dalaman (iaitu, kecacatan, sekerap, kerja semula, kegagalan proses, pengurangan harga, dan downtime) telah berkurangan.*			
24.	COST 4	External failure costs (i.e., complaints, returns, warranty claims, liability, and lost) *Kos kegagalan luar (iaitu, aduan, pulangan, tuntutan waranti, liabiliti, dan kehilangan)*			

Construct: Ethical Climate

Kindly evaluate the following survey items in terms of their representativeness and clarity of content domain of ethical climate construct. That is, to what extent do you think the items on the survey ethical climate? Are the instruments clear and easy to answer? Kindly evaluate the comprehensiveness of the entire items in their ability to measure the construct.

Conceptual Definition: Ethical Climate		**Representativeness**	**Clarity**	**Comments**
Ethical climate refers to the view of employee pertaining what constitutes ethically right or wrong behaviour and through which ethical issues are managed will becomes a psychological mechanism in an organization and effects decision making and performances in the particular organization (Cullen & Victor, 1993; Martin & Cullen, 2006; Sabiu, Mei, & Raihan Joarder, 2016)		1 = item is *not representative* 2 = item needs *major revisions to be representative* 3 = item needs *minor revisions to be* representative 4 = item is *representative*	1 = item is not clear 2 = item needs major revisions to be clear 3 = item needs minor revisions to be clear 4 = item is clear	
No.	**Statement**	**Please rate from 1 – 4**	**Please rate from 1 – 4**	
1.	Efficient is the major responsibility for employees in this company. *Cekap adalah tanggungjawab utama bagi para pekerja dalam syarikat ini.*			
2.	Employees are expected to do anything to further the company's interests. *Demi kepentingan syarikat, para pekerja dijangka akan berbuat apa sahaja.*			
3.	It is very important to follow strictly the company's rules and procedures here. *Mematuhi peraturan dan prosedur syarikat ini adalah sangat penting.*			
4.	Work is considered substandard when it affects the interests of the company. *Kerja dianggap lemah apabila ia menjejaskan kepentingan syarikat.*			
5.	Company only concern all the good deed in the company. *Syarikat hanya mengambil kira segala perbuatan baik dalam syarikat.*			
6.	The first consideration is whether a decision violates any law. *Pertimbangan pertama adalah sama ada keputusan melanggar mana-mana undang-undang.*			
7.	Employees in this company are expected to comply with the law and professional standards and on other considerations. *Pekerja dalam syarikat ini dijangka mematuhi undang-undang dan piawaian profesional dan di atas pertimbangan lain.*			

8.	Everyone is expected to stick by company rules and procedures. *Setiap orang dijangka akan mematuhi peraturan dan prosedur syarikat.*			
9.	Employees in this organisation are actively concerned about the customer's and the public's interest. *Orang dalam organisasi ini secara aktif mengambil berat tentang kepentingan pelanggan dan orang ramai.*			
10.	Successful employee in this company go by standard operation procedure (S.O.P). *Pekerja yang berjaya di syarikat ini adalah berdasarkan prosedur operasi standard (S.O.P).*			
11.	The most efficient way is always the right way, in this company. *Dalam syarikat ini,cara yang paling berkesan adalah cara yang betul.*			
12.	In this company, people are expected to strictly follow legal or professional standards. *Dalam syarikat ini, pekerja dijangka mengikut undang-undang atau standard professional.*			
13.	Our major consideration is what is best for everyone in the company. *Pertimbangan utama kami adalah apa yang terbaik untuk semua orang dalam syarikat.*			
14.	Successful employees in this company strictly obey the company policies. *Pekerja-pekerja yang berjaya dalam syarikat ini mematuhi sepenuhnya dasar syarikat.*			
15.	In this company, the law or ethical code of theft profession is the major consideration. *Dalam syarikat ini, undang-undang atau kod etika kecurian profesion adalah pertimbangan utama.*			
16.	In this company, each employee expected, above all, to work efficiently. *Dalam syarikat ini, setiap pekerja dijangka seperti semua di atas untuk bekerja dengan cekap.*			
17.	In this company employees are mostly going out to settle both, work matters and personal matters during working hour. *Dalam syarikat ini kebanyakan pekerja keluar untuk menyelesaikan kedua-dua perkara,iaitu urusan kerja dan urusan peribadi semasa waktu kerja.*			
18.	In this company, employees are expected to follow their own personal and moral beliefs. *Dalam syarikat ini, pekerja akan mengikuti cara dan kepercayaan mereka sendiri.*			

19.	In this company, employees look out for each other's good. *Dalam syarikat ini, para pekerja melihat kebaikan satu sama lain.*			
20.	There is no room for one's own personal morals or ethics in this company. *Tidak ada ruang untuk moral atau etika peribadi seseorang dalam syarikat ini.*			
21.	Each employee in this company decides for their self what is right and wrong. *Setiap pekerja di syarikat ini membuat keputusan apa yang betul dan salah untuk diri sendiri.*			
22.	In this company, employees protect their own interest. *Dalam syarikat ini, para pekerja melindungi kepentingan mereka sendiri.*			
23.	The most important consideration in this company is each person's sense of right and wrong. *Pertimbangan yang paling penting dalam syarikat ini adalah rasa betul dan salah setiap orang.*			
24.	In this company, our major concern is always what is best for the other person. *Dalam syarikat ini, perhatian utama kami adalah apa yang terbaik untuk orang lain.*			
25.	In this company, employees are guided by their own personal ethics. *Dalam syarikat ini, pekerja berpandukan etika peribadi masing-masing.*			
26.	It is expected that company will always do what is right for the customer and public. *Syarikat diharapkan agar sentiasa melakukan apa yang betul untuk pelanggan dan orang ramai.*			

Construct: Organisation's Demographic

Kindly evaluate the following survey items in terms of their representativeness and clarity of organisation's demographic content. That is, to what extent do you think the items on the survey measures organisation are demographic? Are the instruments clear and easy to answer? Kindly evaluate the comprehensiveness of the entire items in their ability to measure the construct.

Conceptual Definition: Organisation's Demographic		**Representativeness**	**Clarity**	**Comments**
Organizations in this study refer to those who representing an organisation that involve with the manufacturing practice starting from supervisors and up to the top management.		1 = item is *not representative* 2 = item needs *major revisions to be representative* 3 = item needs *minor revisions to be* representative 4 = item is *representative*	1 = item is not clear 2 = item needs major revisions to be clear 3 = item needs minor revisions to be clear 4 = item is clear	
No.	**Statement**	**Please rate from 1 – 4**	**Please rate from 1 – 4**	
1.	What is the main product produced by this company? *Apakah produk utama yang dihasilkan oleh syarikat ini?* ☐ Electric ☐ Electronic ☐ Automotive ☐ Chemical ☐ Others (Please state): ____________			
2.	Number of full time employees in this company Bilangan pekerja sepenuh masa di syarikat ini ☐ <50 ☐ 51-150 ☐ 151 and more			
3.	Annual sales turnover (in RM) Perolehan jualan tahunan (dalam RM) ☐ Less than RM10 millions ☐ RM10-RM25millions ☐ More than RM25 millions			

4.	Types of company Jenis syarikat ☐ Multinational Corporation (MNC) ☐ Joint ventures ☐ Locally owned			
5.	How long have your firm been implementing lean? Berapa lamakah firma anda telah mengamalkan lean? ☐ Never implement ☐ <1 year ☐ 1-3 years ☐ More than 3 years			
6.	What is your position in your company? Apakah kedudukan anda dalam syarikat anda? ☐ Supervisor ☐ Engineer/Executive ☐ Manager ☐ Others (Please state):___________			
7.	Which department do you attached to? Apakah jabatan yang anda sedang berada sekarang? ☐ Maintenance/ engineering Production ☐ QC/QA ☐ Others (Please state):___________			

Thank you for your cooperation and participation.

Reviewer's comment

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(Name & Signature)