CHAPTER 1

INTRODUCTION

1.1 Introduction

Customers consistently demand higher quality product at a lower price and in a shorter
delivery time in today’s fierce competition business world. Therefore, the organization
struggles to continuously improve production in their organization. It would be better for
people to choose the right initiative that suitable for organization’s context and provide
value to the organization help to avoid unnecessary waste and frustration. The concept
of Lean Production System (LPS) was spread around the world and industries due to
intense challenges such as unstable demand, rising customers’ expectation, and
competition in the globalized markets (Foo, et al., 2015). Lean Production Systems (LPS)
has made a remarkable affect in both the academic and industrial community in last
decade (Hines et al., 2004). Lewis (2000), described LPS is a reduced level of input
resources in the LPS for a given level of output by removing waste from the system in
the form of resources such as raw material that is converted and also includes converting
resources such as process technology, people, facilities etc. Organizations around the
globe are choosing to adopt LPS to eliminate waste and increase their productivity
because this approach has demonstrated an overwhelming influence on the restructuring
of the global industry. Therefore, most of the organizations have implemented LPS, as it
basically purposes to increase production efficiency via the elimination of wastes in all
its forms (Abdul Raman & Jamaludin, 2008). Most of these wastes are involved to
human factors, organizations are required to give an extra respect and empowerment to
the human resources by promoting a more favorable working cultures and continuous improvement (CI) in their organization (AL-Najem, 2014). If LPS is adopted accurately, it could help the organization towards global manufacturing excellence (Papadopoulou & Ozbayrak, 2005). LPS has become increasing popular with manufacturing philosophy which all size of organizations all over the world has implemented to remain competitive, growth profits, and reduce costs. The key core thrust of LPS is that the lean practices work synergistically to build high-quality systems that can produce finished products to meet customer demand with little or no waste (Shaw & Ward, 2003). LPS benefits organizations by identifying and eliminating wastes related to time, material, and effort to reach the goal of increasing productivity. Elimination of waste in every production area, includes customer relations, product design, factory management and supplier networks is the objective of manufacturing (Karlsson & Ahlstorm, 1996). LPS is based on the Japanese quality movement specifically at the Toyota Production System (TPS) and was popularized by Womack and Jones (1996). LPS is a process that assists an organization to eliminate or at least reduce the waste. All non-value added action or those which didn’t offer value to the customer are all considered as waste in LPS. LPS is a disciplined, process-oriented system which is concentrated on optimizing the limited material resource and human by identifying the major sources of waste, and then using those tools such as 5S, Total quality management, Just-In-Time, production smoothing, total preventive maintenance, setup reduction and others to remove the waste. The seven wastes in physical production include in overproduction, waiting time, unnecessary inventory, transportation, excess motion, inappropriate processing, and defective products and Quantitative and Qualitative underutilization of human resources (Dibia & Onuh, 2010). Therefore, the selection and the implementation of the accurate lean production tools and techniques are expected to result in improved the operational outcomes, such as higher quality, lower inventories, and shorter throughput times which results in the improvement of operational performance (Yahya et al., 2016). The main purpose of adopting lean thinking is to eliminate waste, save time and save cost. With LPS, an organization can eliminate mistake by analyzing each previous mistake, find out what is the root cause of it and correct the causes to prevent and eliminate repeat errors. These principles are simple to adopt but it requires full participation and relentless
attention of all the employee. Even a partial implementation can benefit manufacturing operations and improve performance by reducing waste. Many companies have attempted the successful implementation of lean management throughout the whole organization. Even though some enterprises have managed to reap substantial benefits, most of the organizations failed in this attempt. One of the reasons can be linked to the fact that only a few enterprises attempt to assess the organizational readiness before implementing lean thinking (Gurumurthy, Mazumdar, & Muthusubramanian, 2013). Factors such as the levels of departmental working, sub-optimal management styles and distractions from other demands, for example, performance reporting can influence the successful implementation of lean. Capacity and a mind-set for change and improvement at a strategic level are required to realize the full benefits of Lean (Radnor, Walley, Stephens, & Bucci, 2006). Without knowing the requirements of implementing lean, the failure rate rises significantly (Ramakrishnan & Testani, 2012). All of these aspects can be attributed to one single cause, which is lack of understanding of the key elements of LS. Knowing the requirements of LS is key before trying to implement it; in other words, the organization must measure its readiness for LS and try to understand its requirements, which could save them time, effort and money. Many researchers, such as Radnor et al. (2006), have emphasized the need to understand LR before attempting LS; however, there is currently no definitive model to enable an organization to understand its readiness. Antony et al. (2008) explained that SMEs have some weaknesses towards readiness for quality and that these come from different sources such as planning, employee perspective, top management and human development. There are some tools under lean to help a manufacturing process reduces wastage such as production smoothing (Heijunka), “pull” production (Kanban) and Mistake proofing (Poka-yoke). Different tools will be focusing on solving different waste.

1.2 Research Background

In Malaysia, manufacturing industry involves automotive industry, petrochemical industry, rubber product, wood-based, textile and apparel, electrical and electronics industry, machinery and equipment industry, aerospace industry and shipbuilding and
ship repair industry. It is important for a manufacturing company to produce their product at low cost while still maintaining their quality. This means they will be able to strengthen their relationship with a customer by their quality product while creating a higher profit for the company. The manufacturing sector in September 2017, sales value recorded RM65.4 billion, it has an increase of 10.6% (RM6.3 billion) as compared to the year before RM59.1 billion. In this sector, total employees involved in September 2017 were 1,054,682 persons, an increase of 2.5% (25,943 persons) as compared with the same month of the previous year were 1,028,739 persons. Wages and salaries paid increased by 10.0% or RM325.2 million to record RM3,577.0 million. Sale value in September 2017 was due to increase in sector of wood, furniture, paper products and printing (11.2%), sector of chemical, petroleum product, coal, rubber and plastic (15.5%), sector of food and beverage (10.2%) and sector of non-metallic products, basic metal and fabricated metal products (6.9%) (Department of Statistic Malaysia, 2017). LPS consists of a number of techniques and tools, and some of the studies have identified the Critical Success Factors for successful use of lean, comprehension of which is vital for the success of LPS (AL-Najem, 2014). But more important is before an organizations choose the tools and techniques that can fit their situation, they must know exactly what they need and expect from LPS (Balle, 2005); this requires awareness of lean tools and their benefits, strategic thinking, commitment, and relationship-building with external factors such as customer and suppliers. Some research is persuaded that the opportunity of LPS prevailing depends critically on a broad public understanding of its advantage (Womack et al., 1990). There are a few factors that will affect a company readiness of adopting a new technology like lean, in which they are the process, planning and control, customer relations, supplier relations, human resource, top management and leadership. Based on Liker (2004), the proper process will produce the good results. Processes which have the similar operation can avoid unnecessary step by placing those processes closed to each other. Processes are designed sequences of tasks aimed at creating value-adding transformations of inputs to achieve intended outputs (Upton, 1996). Customer relations is one of the important factors in an organization because it raises the awareness of a company about which product feature customer prefer and willing to purchase. Based on Panizzolo (1998), an organization is able to recognize, satisfied
customer needs and predicts their demands correctly, as it is important to achieve a perfect match between production flows and market demands by setting up a good relationship with the customer. Beside from customer relations, leadership is also a factor where it is the capability to stimulate confidence and support amongst those needed to reach organizational aims (Sheety, 1994; Hackett & Spurgeon 1998). Leader able to relocate workers properly based on their skills, qualification, and experiences so that the workers can increase production and reduce waste in the organization. A firm which has effective selection of criteria are able to help them determine suppliers which can provide better delivery service, offer competitive pricing and better product quality and variety (Tracey & Tan, 2001). An organization can avoid delay of shipment by select supplier which their distance is close to each other. King (2009) and Pool et al (2011) recently has been introduced by the different scholar with lean production planning and control (PPC) tools application in process in order to reduce waste and smooth the production process.

1.3 Problem Statement

Many Malaysian organizations have faced difficulties in adopting the LPS although it is widely utilized (Othman, 2016), for instance financial constraints, weak leadership, low workers’ skills and culture (Achanga et al., 2006). Research found that the leadership quality will influence the success of LPS implementation. Leader required to take a long-term view, provide resources needed and manage it is a change management process such as managing changes to the work organization and SOPs. They also found that barely managed LPS initiatives sometime disorder and undermine the very process they are supposed to develop (Othman, 2016). Furthermore, it is important to improving workers’ capabilities through skill development for the success LPS were found in other studies. In skill development, having internal expertise on LPS is also key for the success of LPS initiatives. A case study by Gunasekaran and Lyu (1997), Daioku, a small company, report that many difficulties especially with raw material replenishment and suppliers started to crop out during the usage of LPS. Unavailability of resources such as material, people, and machine with advance technology, time and expert
guidance could be a factor for interrupt the implementing of LPS in manufacturing industries (Bakas et.al, 2011). Resource constraints with reference to volume of production have discouraged machine tool manufacturers from use of lean principles (Eswaramoorthi et.al, 2011) According to Howell (1999), one of the major factors affecting the implementation of LPS is human attitude. Attitudinal issues such as poor understanding of customer’s brief, faulty understanding about lean practice, lack of committed leadership, lack of cooperation by workers, lack of teamwork, faulty understanding about lean practice, poor house-keeping, lack of self-criticism and fear of unfamiliar practices (Suresh et al. 2012). Some studies report that the barriers to lean implementation such as poor of well-designed process unclear links between among business strategies, deficiencies in the measurements and lack of organization support in the restructuring project (Proudlove et al. 2008). The complication and challenges of implementing LPS concepts have influenced the success rate of organizations adopting lean practices. Notwithstanding, various companies under this industry are attracted to the lean manufacturing system and trying to adopting lean tools. But, previous studies express that in Malaysia, the level of implementation and adoption of lean manufacturing has yet to develop comprehensive and is being applied only in certain stages and known areas currently (Wong, Wong & Ali, 2009; Salleh, Kasolang & Jaffar, 2011). Therefore, this may help the organizations to know about the essential factor required from Lean System and the factor that affect the most to adopt Lean System in order to increase productivity in the organization without waste.

1.4 Research Objectives

This research consists of two objectives. The objectives are shown as follows:

i. To identify the major factor influencing the adoption of Lean Production System

ii. To determine the major barrier interrupting the Lean Production System adoption
1.5 Research Questions

The research question can be listed as follows:

i. Which is the major factor influencing the adoption of Lean Production System?

ii. What is the major barrier interrupting the Lean Production System adoption?

1.6 Research Scopes

The study is to determine the major factor influencing the adoption of Lean Production System. Besides that, it also aims to identify the major barrier interrupting the adoption of LPS in manufacturing industries. To make the research more effective and manageable, the research scope of this study focused on:

i. The study is conducted in the selected manufacturing industry of Batu Pahat, Johor.

ii. The respondents of survey respondents targeted in this research are the administrative level of employees in the manufacturing industry in Batu Pahat, Johor.

iii. The data are collected by using questionnaire and then proceed with quantitative data analysis.

1.7 Significance of Study

The failure rate of lean implementation has been significant in the manufacturing industry as a whole (Bhasin & Burcher, 2006). Some companies might just give up because they believe they can adopt Lean Management easily without knowing the factors that influence the result. Therefore, this research discusses in detail involve studies related to factor influencing the Lean Production System adoption and the major factor barrier interrupting the adoption of Lean Production System. The adoption of LPS can reduce all forms of waste in a manufacturing industry. Those forms of waste such as
overproduction, waiting, transportation, overprocessing, inventory, rework and motion. Thus, implementing LPS plays an important role to improve production activities by reducing cost while increase quality of a product.

1.8 Summary

In short, lean is a practice that the main purpose of it is to exterminate or at least minimize waste along the entire organizations and creates more value for them. Lean has mainly been applied in manufacturing section and it is notable as this practice originates from Toyota and Toyota Production System. The main purpose of this study is to determine the major factor influencing the Lean Production System adoption as well as to identify the major barrier interrupting the adoption of Lean Production System. This chapter provides a picture of what the research is about including the research objective, research question, research scope and significance of the study.
CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This beginning of this chapter will cover about the concept and definition of Lean Production System. Next, the following section will explain detailed about the factors influencing Lean Production System Adoption. After that, the next section will presented about the barriers that interrupting Lean Production System adoption.

2.2. Definition of Lean

Lean philosophy has been recognized and applied well by many manufacturers (Poppendieck, 2002). There is no brief and clear definition for Lean System, as many researchers have explained and commented the term from the idea of view by themselves (Wong et al., 2009), which sometimes cause of the problems occur relating to understanding it. According to Stone (2012b), different explanations and interpretations of Lean System have created different approaches in the development, bringing high confusion in terms of understanding the accurate meaning of lean and how it should be implemented in manufacturing. The terms that used interchangeably are lean, lean production, lean manufacturing, and Toyota Production System. Lean Production System (LPS) is defined as a set of procedures that creates or add value by eliminating unnecessary work thus avoiding future wastes (Emiliani, 1998). Stone (2012a) defines Lean Production System as a system for identifying and removing wastes that influence
productivity. Atkinson (2010) explained LPS as a commitment, a process of improvement continuously that can major affect competitiveness of an organization. Lean is a strategic tool for settle severe organizational problems and can bond together some of the change initiatives that are currently running in a business. According to Taj (2005), LPS means the organisation must manufacture without generating wastes during processes, while wastes are anything that add no value to the end customer (Womack & Jones, 2003). Anvari et al., (2011) explained Lean Production System is about controlling the resources in accordance with the customers’ needs and to reduce unnecessary wastes. LPS as suggested by Shah and Ward (2003) that is an integrated system made up of various elements united together, and consist of different management practices such as JIT, teamwork, quality systems and cellular manufacturing. Liker and Wu (2000) defined that LPS is a manufacturing philosophy that centralize on sending the final product to customers on schedule with high quality but at the lowest cost. Wong et al. (2009) state that LPS as a process that can provide high value to the consumer by removing wastes from the human design element and process. Hayes and Pisano (1994) described LPS as a process that uses a minimum or smaller amount of everything that requiring involvement from all organizational departments to produce a final product. Lean Production System requires that not should fully understood about technical questions only, but also existing relationships between manufacturing and the other areas of the firm should also be determined in depth, such as other external factors external to the firm (Womack and Jones, 1994). As an integrative concept, the adoption of LPS can be evaluated by a collective set of key areas or factors. These key areas encompass a broad array of practices which are believed to be critical for its implementation. They are, scheduling, inventory, material handling, equipment, work processes, quality, employees, layout, suppliers, customers, safety and ergonomics, product design, management and culture, and tools and techniques (Wong et al., 2009). There are seven wastes in LPS such as overproduction, waiting, transportation, overprocessing, inventory, rework and motion. Waste was defined as anything other than the minimum amount of equipment, materials, parts, space, and time which are absolutely essential to add value to the product (Russell & Taylor 2000).
2.3 Framework of Lean Production System

The LR framework is divided into two phases which consists lean pillars, lean principles, the lean objective is to prevent the 8 wastes and creates value, key drives and techniques, and practices. In block, one consists two pillars that are continuous improvement and respect for people. The organization is guided to become a learning organization through continuous improvement. Through the block two, an organization can understand the lean principles which involve value, value stream, flow, pull and perfection. In block 3, an organization will know about the source of lean waste. There are eight wastes such as motion, transport, over processing, overproductions, defect, unused talent, inventory and waiting. The organization can identify the key driver for lean via block 4. Key drivers for LPS are process, planning and control, human resources, top management and leadership, customer relations and supplier relations. In block 5, organization measure
level of readiness based on the firm current practices by asking the question to see if their current practice are fit with lean or not. For example in customer relations consists of eight questions, which purpose to identify the quality of the companies’ suppliers, number of suppliers they cooperate with, the suppliers’ involvement in product design, and the companies’ long-term relations with its suppliers.

2.4 Lean Production System tools

2.4.1 Production Smoothing (Heijunka)

The word “Heijunka” is a Japanese term that literally means “leveling”. Oudhuis, & Tengblad,. (2013) said Heijunka was introduced in order to counter different kinds of imbalances in the Production System. It is known as a technique that reduces unevenness in a production cycle which able to end up reducing waste from the aspect of waiting and motion. The different process will have different cycle time, by calculating TAKT-time, the manager will be able to arrange worker in a sequence of the process that will not exceed the TAKT-time. Pankaj Aggarwal (2010) mention that TAKT-time is the maximum amount of time which a product need to keep up in order to satisfy customer demand.

2.4.2 A “Pull” production (Kanban)

Vijaya Ramnath., Elanchezhian. and Kesavan. (2010) said that the word Kanban has come to stand for a variety of items ranging from shelves, bins, electronic messages, and order slips to the entire reorder point system. In manufacturing, Kanban is a sign board system that mostly related to the card but sometimes it is a cart and even maybe a marked space. The purpose of it is to observe the flow of the product, bring about pull, knowing the limit of inventory by just looking at the system. Kanban system will be focusing on solving inventory and over production waste. When a company knows the quantity of a certain product, it will not overproduce it and cause stock piling in the end.
2.4.3 Mistake Proofing (Poka-Yoke)

Poka-yoke is a technique that makes a product cycle as easy as possible to achieve error proofing and thereby make the process more solid. Poka-yoke consists of two types of inspection which are those that control, meaning shut down the process or isolate the product upon finding a defect and those that warn the operator (Apreutesei, Arvinte, & Suciu, 2010). Stop, fix and continue to prevent the following production become defect and the worker have to spend more time on reworking it.

2.5 Waste of Lean Production System

2.5.1 Overproduction.

Wilson (2010) said that overproduction is the most egregious of all the wastes since it not only is a waste itself but aggravates the other six wastes. The manufacturer might worry that they are unable to produce fast enough they will have the mind set on standby for an emergency. It will lead them to produce too much too soon and causes additional waste such as material handling, storage, and transportation.

2.5.2 Waiting

Waiting can occur when workers are not working for whatever reason. It could be short terms waiting, such as what occurs in an unbalanced line, or longer waits, such as for stock-outs or machinery failure (Wilson, 2010). Waiting occurs when supply unable to keep up or produce much faster than demand. For example, resources wait for flow units, leading to ideal time. When waiting time increases, the flow time of a product increases and make it longer than the value added time.
2.5.3 Transportation.

Transportation is the waste of moving parts around and it occurs between processing lines, between processing steps, and happens when a product is shipped to the customer (Wilson, 2010). Transportation does not just mean receiving or delivering product to supplier or customer. It can also be an internal transport. For example, a forklift carrying semi-finish goods around. The process should be laid out such that the physical layout reflects the process flow to minimize the distances flow units must travel through a process.

2.5.4 Overprocessing.

Overprocessing refer to Worker often spends more time on a flow unit than necessary. Meaning, doing value-added process more than once making the 2nd time in value added. Take this as an example, in the automotive industry, they are parts of the car may not be visible. Spending time trimming material in areas of the part that will not be seen in the vehicle is a waste (Wilson, 2010).

2.5.5 Inventory

According to Wilson (2010), all inventories are a waste unless the inventory translates directly into sales. It makes no difference whether the inventory is raw materials, WIP, or finished goods. It is waste if it does not directly protect sales. Any accumulated inventory has the potential to be wasteful. It often hides other problems in the process as it leads to long information turnaround time and eases the pressure to find and eliminate underlying root causes.
2.5.6 Rework

Base on Wilson (2010), rework happen when a company made mistake and create scrap. A famous saying in the Toyota production system “Do it right the first time”. Rework Spends extra time, cost and human power which are not necessary if you do it right in the first place. If a worker is measuring a material for a cutting process, if he does it right for the first time, he doesn’t need to measure it the second or the third time.

2.5.7 Motion.

Motion refer to perform a particular task on the assembly line. According to the pioneers of the industrial revolution, including Frederick Taylor, and Frank, and Lilian Gilbreth, there is only one “RIGHT WAY” to do otherwise it’s wasteful. The “Right Way” also means that the way that requires the shortest cycle time to produce a product while able to pass the quality gate.

2.6 Benefits of Lean Production System

LPS is a powerful tool designed to provide recent manufacturing enterprises' challenges in reducing human errors, cost, delivery times and lead-time while the quality of the final product is increasing and continuous flow in the manufacturing process (Upadhye, 2010). Knowing the LPS can benefit a more in-depth understanding of them within an organization. An organization can improve customer responsiveness and quality, and reduce cycle time by adopting LPS (Spann et al., 1999). Melton (2005) suggested that some of the benefits are financial savings and knowledge management, increasing levels of customer satisfaction and reducing process wastes and inventories. There are many other benefits relating to the adoption LPS; it can create manufacturing space, complement human efforts and improve quality (Zayko et al., 1997). According to Monden (1983), LPS can play an important role towards the improvement of production activities in different types of industries if it is adapted. According to Bergmiller and
McCright (2009), LPS can help to cut costs, increase efficiency, reduce customer response time, enhance the organization’s image and improve profitability. Moreover, LPS can guide to sustainable development by reducing cost and delivery time, increasing customer satisfaction and communication, as it is a systematic approach that helps managers to identify wastes and omit them from the organization at every step in the process, which will bring organizational a better performance and make the company free from waste. (Upadhye et al., 2010a).

2.7. Factors influencing Lean Production System Adoption

2.7.1 Process

Process management is one of the most important factors in terms of identifying non-value-adding activities and increasing quality. Ineffective processes lead to more waste and lower productivity per employee (Zhang et al., 2012). A total of 12 questions were included in this category to evaluate the firms’ practices with respect to whether they support lean practices in terms of process flow, housekeeping, production rate, cycle time, TPM, the flow of material, designated area and labeled items.

a) Housekeeping (5s)

• The workplace must be well organized and tidy.

• Items and equipment should be labeled and located in the right zone to ensure that they are easily recognized.

• An auditing routine needs in a company to ensure that every item is returned to (Shah & Ward, 2007) where it belongs so that it can be found easily (Spear & Bowen, 1999) if needed to avoid “motion wastes”.

b) Cellular manufacturing

• The processes should be designed to help the flow. So, equipment and items must be placed at where they are needed and processes using similar activities should be
conducted close to each other to help eliminate unnecessary movement (Saurin et al., 2011).

• Skilled workers will be running and leading the process.

• Each process should be operated by qualified people (Saurin et al., 2011).

c) Total Productive Maintenance (TPM)

• Routine maintenance should be performed by skilled people.

• Equipment records should be shown on the shop floor, to avoid confusion and to keep employees up to date, which will mitigate the risk of equipment breakdown (Saurin et al., 2011).

d) Documentation

• The organization should have a well-documented system that includes machine settings and any information needed to change these (Almstrom & Kinnander, 2011).

• In order to improve, the organization should revise the cycle time for each process on a regular basis.

e) Production based on pull

• Production should be based on external and internal customer demand (Shah & Ward, 2007).

2.7.2 Planning and control

Many authors from different research (e.g. Gotzamani & Tsiotras, 2001; Chin & Pun, 2002; Goodson, 2002; Lewis et al., 2006) have highlighted the importance of this factor. According to Chong and Rundus (2004), the use of quality control systems and scientific methods to solve problems, as well as Visual management (VM), help to ensure Continuous Improvement (CI) as it is the key for enhancing the firm’s performance and eventually leads to higher levels of customer satisfaction. This category consists of five
questions, with the aim of shedding light on quality and management practices in terms of VM, a scientific method for solving problems, focus groups, benchmarks, etc.

a) Problem solving
- A problem-solving technique is a key to help an organization with respect to CI. Problem-solving needs the involvement of skilled people and should be conducted as a group, which come up ideas that help to reduce waste within the organization (Furlan et al., 2011).

b) Benchmarking
- In order to improve, an organization needs to be aware of its competitors. Benchmarking performance against other top-class industries will allow an organization to understand threats from competitors, which could drive improvement (Salaheldin, 2009).

c) Standardized activity
- The organization should implement standards such as specific routes for loading raw materials and removing end products, and standard picking time (Saurin et al., 2011) in order to avoid misunderstanding or confusion regarding work processes and procedures which could result in waste.

d) Visual Management (VM)
- Managing the workplace visually is highly recommended by LPS as it can help to keep the process smooth and reduce defect rates; this can take many forms, such as showing the defect rate, key performance indicators, next job activity, etc.

2.7.3 Customers

As highlighted by many authors (Goodson, 200; Golicic & Medland, 2007; Zu et al. 2010;) maintaining customers’ happiness is the aim of any company, since all departments are ultimately working to satisfy their customers’ needs. To this end, a company must understand its customers’ requirements (Found & Harrison, 2012).
Moreover, the organization needs to respond quickly to customer complaints. According to Anvari et al. (2011), LPS will not be applicable if the customer demands are unstable or unpredictable, so the organization must have close relationships with its suppliers. There are eight questions under this category, which aims to identify the level of awareness about customers in terms of understanding them, identifying the level of customer involvement and participation, and dealing with customer complaints.

a) Understanding the customer

• The organization must understand its customers’ needs and requirements so that they are able to ensure production is in line with customers’ orders and demands, as LPS is about creating the value that customers are willing to pay for, with any excess considered waste (Aziz, 2013).

b) Customer involvement

• The organization needs to build a relationship with its customers in order to understand them. This can be done by involving the customer in company’s product design, which will ensure that they will be willing to pay for the product (Nordin et al., 2010). In order for the company to produce based on customer demand (pull and JIT) strong relations and mutual trust must be built with customers (Golicic & Medland., 2007). Customers’ complaints need to be taken seriously to avoid future mistakes and to retain the customer base.

c) Customer feedback

• To retain customers, the organization should involve them and use their feedback and suggestions (Salaheldin, 2009).

2.7.4 Suppliers

Again, this factor has been mentioned in many articles (Medland, 2007 and Zu et al., 2010). Quality suppliers enable companies to produce quality products (Zhang et al.,
2000); this is important in LPS, as the long-term relationships with suppliers will enable the company to perform JIT, which is essential for LPS (Found & Harrison, 2012). In this category, there are eight questions, which aim to identify the quality of the companies’ suppliers, the number of suppliers they work with, the suppliers’ involvement, and the companies’ long-term relations with its suppliers. According to Taj (2005), having fewer suppliers but having a long-term relationships with them, making suppliers’ part of the firm’s team, is healthy and essential for LPS.

a) Quality suppliers

• A quality of suppliers is very important for LPS. Quality means providing goods on time with good quality to save up the time for further inspection. To this end, the organization should have a clear strategy to deal with suppliers (Sharma et al., 2011).

b) Supplier location

• This aspect is very important, as many authors suggest dealing only with suppliers in close proximity to enable them to perform JIT manufacturing effectively (Bhasin, 2011).

c) Number of suppliers

• Many authors have emphasized dealing with small numbers or a single supplier for each item, as this will help in building long-term relationships with suppliers, and in turn will make suppliers to be more committed to supply quality products and providing JIT delivery (Shah & Ward, 2007).

d) Supplier relationship

• Maintaining long-term relationships with suppliers is important in LPS, as it will reflect positively on supplier performance and in terms of finances. Many authors have stressed the importance of relationships with suppliers as it is a critical factor for lean implementation, and is essential for JIT manufacturing (Vanichchinchai, 2012).
e) Supplier involvement

- It is strongly recommended to involve suppliers in the area, such as product design and development, inventory management, etc. This could help organizations to improve the quality of supplier’s products (Nordin et al., 2010).

f) Supplier feedback

- Shah and Ward (2007) emphasized providing suppliers with regular feedback on delivery and the quality of products, as this will help to improve the relationship and avoid mistakes in the future.

2.7.5 Human Resources Management

Training, empowerment, involvement, and recognition are important factors in terms of LPS success (Zhang et al., 2012), and are required in order to produce high-quality products. Employees are the core of a company, and therefore need to be encouraged and involved in company strategy and direction, especially when implementing LPS. Without skilled workers, LPS will not last (Tsang & Antony, 2001). This category contains 11 questions which aim to evaluate the level of employee involvement, training, empowerment, and teamwork, as well as incentive and reward systems, communications between employees and communications between departments. This category represents the core of LPS, as many authors and researchers have stressed the role of HR.

a) Involvement and participation

- Since LPS requires everyone in the organization to be involved in providing suggestions to improve the system, involvement and participation have been emphasized in the literature. To do this, employees need to be aware of their roles in the organization, as well as having the right skills (Vanichchinchai, 2012).

b) Skills and multi-skilled workers
• Workers need to be skilled to participate in improving the system and to contribute to problem-solving. Furthermore, LPS requires multi-skilled people that are able to perform different tasks (Nordin et al., 2012).

c) Training

• In order to perform different tasks and contribute to problem-solving, workers need to be trained in problem-solving and cross-trained in different sections of the company (Bhasin, 2011).

d) Motivation

• Motivation is essential to encourage people to participate and provide new ideas. Workers can motivate by rewarding them for their efforts, and this can do via empowerment and by having a clear rewards system and incentives (Saurin et al., 2011).

e) Communication

• Effective communication between employees and departments is essential. Without it, LPS cannot be successful, since communication enables workers to understand their job requirements and avoid conflict with other departments. For example, there has to be communication between the sales and production department, since the sales department needs to understand the capacity and product specification and all these data will come from the production department. This could save the organization time and money (Furlan et al., 2011).

f) Teamwork

• Teamwork will help employees to share knowledge and ideas. According to Ichimura et al. (2007), teamwork helps to improve work by providing suggestions to develop processes and is essential for CI. It also creates challenges between workers, which can serve to motivate them (Furlan et al., 2011). Therefore, it is needed in LPS.
2.7.6 Top Management and Leadership

The level of top management commitment and leadership is crucial for LPS. This commitment is manifest in many forms, such as providing clear vision, allocating resources and funding, and providing strategic leadership (Tsang & Antony, 2001). To ensure the success of LPS implementation, it is essential for top management to create a quality culture by empowering other employees (Zhang et al., 2000). This factor has been emphasized in various articles (e.g. Chin & Pun, 2002; Achanga et al., 2006; Kumar et al., 2009; Mefford, 2009; Zu et al., 2010; Snee, 2010; Angelis et al., 2011; Bakås et al., 2011). This category contains five questions that aim to identify the level of top management commitment in terms of appearance in the working area, locating the right people in the right place, providing job security, investing in consultancy and expert advice, and investing in training. Without top management and leadership commitment, LPS implementation will not succeed.

a) Visible management

- It is essential in LPS for top management to be visible in the workplace to motivate people (Nordin et al., 2012a).

- Top management must be motivated and committed towards improvement, as this will stimulate their workers (Nordin et al., 2012a).

b) Investment and commitment to improvement

- LPS requires investments in training, consultancy, and hiring experts to improve the work, and this involves commitment from managers and leaders who believe in improving the system (Kundu & Manohar, 2012).

c) Knowing people’s capabilities

- In order to get the best from people, the organization needs to understand their employees’ capabilities and assign them to jobs that best match their skills (Kundu & Manohar, 2012).
d) Job security

- One of the main values of Toyota is their “lifetime employment policy”. This practice helps to build trust between the company and its employees and encourages people to be more committed and loyal to the company. As a result, employees will attempt to improve every day. Toyota believes that providing job security will unleash employee creativity and improve their ability to work (Radeka, 2009).

### 2.8 Barriers Interrupting Lean Production System Adoption

Achanga et al. (2006) suggested that the implementation of LPS, like any other productivity improvement initiative, is believed to create a lot of difficulties (Camagu, 2010). Despite the vast benefits gained from LPS implementation that is highlighted, in reality, not many companies successfully implement this system (Nordin et al., 2010). There are numerous reported problems and issues regarding the failure of LPS implementation. According to Nordin et al. (2010), implementing LPS is not a simple task. For any change in an organization to take hold and succeed, the resistance forces or barriers need to be recognized and understood. Failure to access organizational and individual change readiness may end with the management to spend significant time and energy. Dealing with resistance to change will face a lot of risk and requires a lot of hard work (Stanleigh, 2008).

#### 2.8.1 Top Management Resistance

A study by Sohal and Egglestone (1994) indicated that resistance is represented in all functions of a company, including senior managers, middle managers and shop floor personnel. According to Axelsson et al. (2005), primary reasons for resistance are often a lack of clearness and certainty of the change, pressure, interference with interests and the challenge to learn something new (Hagstr & Wollner, 2011). A survey carried out by Staudacher and Tantardini (2007) showed that in LPS, the area of resistance or limited support from top management received 15 per cent of hits.
2.8.2 Lack of Top/Senior Management Focus Leadership

LPS is the goal for the management, it requires a set of guidelines such as a vision, strategy, goals and a direction to keep lean on the right path (Urban, 2009). Housmand and Jamshidnezhad (2006) mentioned that lack of a strategic direction and vision of the company toward LPS is just like a pitfall (Ducharme & Lucansky, 2002). Indeed, weak leadership has been identified as the reason for poor sustainability of lean change (Hines et al., 2008). Sim and Rogers (2008) mentioned that the lack of committed leadership is a barrier to implement lean (Veiga et al., 2011).

2.8.3 Lack of Top/Senior Management Involvement (Commitment and Support)

The only way to fully implement LPS is with a strong leadership at the top of an organization – including the chief executive officer. This includes not only intellectual support but also physical engagement in the program (Tracy, 2007). It is important for top management to understand and give sufficient support to sustain the LPS (Wong et al., 2009). Lack of commitment may lead to other concerns, such as limited access to resources, lengthy decision-making processes and communication breakdowns (Scherrer-Rathje et al., 2009).

2.8.4 Lack of Communication between Management and Workers

Employers need to be properly inform their workers about the changes that are being implemented (Cudney & Elrod, 2010). Scherrer-Rathje et al. (2009) mentioned that lack of team autonomy and lack of organizational communication led to the termination of the lean project such as Lean benefits such as cost reduction and lead time reduction were not being communicated effectively at all levels of the organization. Employees in LPS and other functional areas were not aware of the success of the project and, as a result, there was little support from them.