IMPACT OF JIT PRACTICES AND LEAN PRACTICES ON OPERATIONAL PERFORMANCE IN MALAYSIA PACKAGING INDUSTRY: INTERNAL INTEGRATION AS A MEDIATOR

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ABSTRAK

Kajian ini akan fokus dan menerokai hubungan antara amalan JIT (Tepat pada masa penghantaran oleh pembekal, pautan tepat pada masa dengan pelanggan, tarik sistem, jadual induk dilemparkan, pengurangan masa persediaan, susun atur JIT dan pelbagai fungsi pekerja), amalan lean (pengurangan sisa pepejal dan pengurusan aliran), integrasi dalaman dan prestasi operasi dalam industri pembungkusan di Malaysia. Data dikumpulkan melalui soal selidik yang ditadbir sendiri. Jumlah 86 responden telah dijalankan dalam industri pembungkusan di Malaysia yang mewakili 87.76 peratus kadar tindak balas dalam kajian ini. Analisis perisian Statistical Package for the Social Sciences (SPSS) dan Partial Least Square (PLS) digunakan untuk menguji ketepatan hipotesis yang dicadangkan. Hasil kajian didapati daripada analisis menunjukkan tepat pada masa penghantaran oleh pembekal adalah faktor penting yang mempengaruhi prestasi operasi dan integrasi dalaman, seterusnya diikuti dengan jadual induk dilemparkan dan pengurangan sisa pepejal. Sebaliknya, tepat pada masa hubungan dengan pelanggan, tarik sistem, pengurangan masa persediaan, pekerja pelbagai fungsi dan pengurusan mengalir tidak signifikan dengan prestasi operasi dan integrasi dalaman. Susun atur JIT telah mendapati bahawa ia adalah hubungan yang signifikan negatif dengan prestasi operasi dan integrasi dalaman. Integrasi dalaman ditemui sebagai pengantara penghantaran tepat pada masa dengan pembekal, menyamakan kedudukan jadual induk, susun atur JIT dan pengurangan sisa dengan prestasi operasi dalam industri pembungkusan di Malaysia. Kesimpulan kajian ini telah disediakan dengan implikasi teori dan implikasi praktikal serta cadangan bagi tingkah laku masa depan pengajian sama ada di Malaysia atau negara-negara lain.

ABSTRACT

The study tries to focus and explore the relationship between JIT practices (Just-in-time delivery by suppliers, just-in-time link with customers, pull system, leveled master schedule, setup time reduction, JIT layout and multi-functional employees), lean practices (waste minimization and flow management), internal integration and operational performance in packaging industry in Malaysia. Data were collected through self-administrated questionnaires. A survey of 86 respondents was conducted in the packaging industry in Malaysia representing 87.76 percent response rate in this study. Statistical Package for the Social Sciences (SPSS) and Partial Least Square (PLS) were conducted to test the validity of the proposed hypotheses. The result driven from analysis revealed that just-in-time delivery by suppliers is an essential factor that influences operational performance and internal integration, followed by leveled master schedule and waste minimization. In contrast, just-in-time link with customers, pull system, setup time reduction, multi-functional employees and flow management were not significantly related to operational performance and internal integration. JIT layout was found that it was negative significant relationship with operational performance and internal integration. Internal integration was found to mediate between just-in-time delivery by suppliers, leveled master schedule, JIT layout and waste minimization with operational performance in the packaging industry in Malaysia. The conclusion of this study was provided with the theoretical implications and practical implications as well as the suggestions for future conduct of the studies either in Malaysia or other countries.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The study aims to explore the relationship between Just-in-time (JIT) practices and Lean practices on operational performance in Malaysian packaging industry. Accordingly, the study starts by giving general knowledge about the research and the problem of the study as the introductory chapter. The background includes the explanation of the concept and importance of JIT practices, Lean practices and operational performance in Malaysian packaging industry. The chapter then explains the problem of the study and the research questions and objectives. Next, the chapter portrays the significance of the study and its expected contributions. The key terms of the study and the organization of the report is defined at the end of the chapter.

1.2 Background of the study

In recent years, operational performance has become widely accepted as a critical success factor for companies across packaging industries. The packaging industry is one of the most dynamic growth sectors within the Malaysian manufacturing sector. Packaging industry have become more competitive due to globalization and growing competition. In order to compete in today's global markets, organizations strive to deliver their products and services in both an efficient and effective manner.

According to Malaysian-German Chamber of Commerce & Industry, Market Watch (2012), the plastics products industry can be divided into four sub-sectors, which included plastic packaging, E&E and automotive components, consumer and industrial

products. The largest sub-sector for the plastic industry remains plastic packaging involving both flexible and rigid including bags, films, bottles and containers with 40% of total industry output. The plastic packaging industry mainly includes the production process of injection moulding, film extrusion, blow moulding and foam moulding.

In view of its steadily growth, the packaging industry is now considered as one of the most dynamic growth sectors within the Malaysian manufacturing sector, it provides platforms to assist members in order to be globally competitive. Lead time can be an effective competitive weapon due to customers become less patient and unwilling to wait long for the delivery of products. Therefore, lead time has become the critical factor in enhancing performance as well as competitive capabilities of manufacturers across various industries (Treville, 2004). Specifically, there are two practices have been widely adopted to improve the operational performance in packaging industries which are just-in-time (JIT) practices and Lean practices.

Just-in-time (JIT) practice is considered as a powerful tool to reduce waste and inefficiency, speed up production process and delivery performance (Pamela, Pietro, and Thomas, 2011). A good JIT implementation in the industry produces high quality product based on the customer demand (Ward & Zhou, 2006); minimizing levels of inventory and improve relationship with suppliers (Aghazadeh, 2003); reducing the labor turnover rate, reducing manufacturing lead times, reducing set up time (Wafa and Yasin, 1998); reducing operations and materials handling costs and maximizing the use of space (Petersen, 2002).

Although the contribution of JIT in improving operational performance is widely recognized (Motwani, 2003; Shah and Ward, 2003), however, the potential existence

effects is crucial to predict the impact of JIT practices on operational performance (Mackelprang and Nair, 2010). In this study, JIT practices include seven dimensions such as JIT delivery by suppliers, JIT link to customer, pulls system, leveled master schedule, setup time reduction, JIT layout, and multi-functional employee.

On the other hand, Lean practice is usually used in reducing the lead time in work in process inventories and flow of production. Impact of the Lean practices as the strategy is important in the packaging industries and also for the entire internal integration. In order to achieve waste reduction coordination of activities is critically important (Xu and Beamon, 2006). Part of coordination links between chain partners involves communication and information sharing with the intention of influencing trading partners to forge closer relationships (Berry, 1995; Holden and O'Toole, 2004) which improve operational performance. Participation in such relationships is recognized as contributing to firm performance (Webster, 1992; Dwyer *et* al, 1987; Frazier, 1999; Kalwani and Narayandas, 1995). Furthermore, Lean enables the supply chain to hold minimum inventories while still being able to react pull strategies in relation to customer demand (Shams, Tritos and Amrik, 2010).

Nevertheless, implementation of lean strategy is enormous difficulties. One of the main goals to implement a lean strategy is the elimination of everything that does not add value to the product or services (Womack and Jones, 1996). In addition, a Lean practice also requires frequent, rapid flows of information and goods along the value chain (as cited in Shams *et* al, 2010). Previous study proven that lean manufacturing can result in a 50% reduction of human effort, manufacturing space, tool investment and product

development time, and a 200% to 500% improvement in quality (Zayko, Broughman and Hancock, 1997).

The study of operational performance of packaging manufacturing firms has become more important today than it has been in the past as what influence the operational performance of packaging manufacturing firms needs to be understood. Hence, improving operational performance remains a challenge for many packaging manufacturing firms. Therefore, it is necessary to look into enhancing the operational performance of packaging manufacturing firms by understanding whether JIT and Lean practices can lead to increased performance via internal integration.

1.3 Problem Statement

Packaging industry is one of the most important sectors in Malaysia manufacturing industry. The characteristics of the packaging industry in the Malaysia are towards high growth rates with a strong domestic orientation and national markets. However, most of the company facing the reduction of the inventory exposes the quality problem and leads to fail to improve operational performance in the company (Ayman and Phan, 2007). To fill the gap, this research focusing in the study in order to identify alternative paths to improve operational performance in Malaysia packaging industry.

In order to improve the operational performance in the company, the packaging company should find ways to improve their operational performance in the company. Since 1980s, many researchers emphasized the effect of JIT practices on operational performance (Chi & Yoshiki, 2010). The JIT practices that impact operational performance can be included the elimination of waste by simplifying production process,

reductions in set up times, controlling material flows, emphasizing preventive maintenance which excess inventories can be eliminated and resources utilize more efficiently (Kannan and Tan, 2005). In addition, for previous researchers, JIT practices can be categorized in either a narrow view which a set of practices for inventory minimization; broad view which are business philosophy aiming to eliminate waste (Chi & Yoshiki, 2010). The relationship between JIT practices and operational performance of packaging industry are given special attention, many researchers attest that the success of JIT implementation (Mehra and Inman, 1992; Sakakibara *et* am, 1993; McLachlin, 1997; Ahmad *et* al, 2003; Callen *et* al, 2000; Matsui, 2007), while others indicated that JIT implementation failed to improve operational performance (Safayeni and Purdy, 1991; Inman and Brandon, 1992; Wafa and Yasin, 1998). Therefore, the study would like to examine the impact of JIT practices on company's operational performance which previous research on JIT practices provide little of explanation on why the same JIT practices can produce so much different results.

Besides, various studies had proven that the Lean practices have helped numerous of companies to improve the operational performance through waste elimination (Gusman, Lim & Siti, 2012). In addition, at operations level, several studies indicated that Lean practices has become a powerful practices in escalating operational performance in terms of quality (Fullerton and Wempe, 2009; Shah and Ward, 2003), inventory minimization (Chong, White and Prybutok, 2001; Fllerton and McWatters, 2001), delivery (Ahmad, Schroeder and Sinha., 2003; Ahmad, Mehra and Pletcher, 2004), productivity (Fullerton and Wempe, 2009; Singh *et* al., 2010), and cost reduction (Cua, McKone and Schroeder, 2001; Hallgren and Olhager, 2009). There are number of studies

which had proven that the Lean practices in operational performance, only fewer studies have investigated the impacts of Lean practices on operational performance (Bartezzaghi and Turco, 1989; Bhasin, 2008; Chang and Lee, 1995). Some of the researchers concluded that Lean practices and operational performance were examined individually, hence the results sometimes produced misleading information and misconceptions (Ahmad *et* al., 2003; Fullerton and Wempe, 2009; Furlan *et* al., 2011b). There has been no theory building and methodologically research had examined the impact of Lean practices and operational performance. Therefore, in order to address the gap, this research would like to examine the impact of Lean practices on company's operational performance.

Besides that, at the empirical level, the previous studies emphasized that internal integration in enhancing operational performance has been increasingly (Feng, Li and Wang, 2013). According to Pagell (2004), internal integration enables the utilization of each function's competencies and strength which can improve operational performance. Internal integration recognizes the need of different functions within a company to act as part of an integrated process (Feng *et* al., 2013). Since internal integration can improve company's operational performance (Flynn, Huo and Zhao, 2010), thus, impact of internal integration will be examined as mediator in the relationship between JIT practices and Lean practices towards operational performance in the company.

1.4 Research Objectives

With the reference of the problem statement, the following research objectives are formulated:

1. To examine whether JIT practices influence internal integration in the packaging firms.
2. To examine whether Lean practices influence internal integration in the packaging firms.
3. To investigate whether internal integration influence operational performance of the packaging firms.
4. To find out whether internal integration mediates the relationship between JIT practices and operational performance in the packaging firms.
5. To find out whether internal integration mediates the relationship between Lean practices and operational performance in the packaging firms.

1.5 Research Questions

In line with the research objectives, the questions of this research are as follows:

1. Do JIT practices influence the internal integration in the packaging firms?
2. Do Lean practices influence the internal integration in the packaging firms?
3. Does internal integration influence operational performance of the packaging firms?
4. Does internal integration mediate the relationship between JIT practices and operational performance in the packaging firms?

5. Does internal integration mediate the relationship between Lean practices and operational performance in the packaging firms?

1.6 Significance of Study

In order to benefit to both researchers and practitioners from the perspective of operational performance in Malaysia Packaging industry, this study further takes into consideration in the research area of JIT practices, Lean practice, internal integration and operational performance.

By integrating the research area of JIT practices and Lean practices to the operational performance, it is believe that combination of internal integration will directly affect the operational performance in the company. According to Mahesh and Lynn (2008), Theory of Constraints (TOC) in the role of operations must be evaluated in the context of the whole company and further its emphasizes the nature of company process by viewing a company as a network of chains of departments or productions input are transformed into variety of products and services which when sold become throughput. Further described by Mahesh and Lynn (2008), throughput is defined as anything has been produced and sold.

In the Theory of Constraints (TOC) view, it measures operational performance in key areas and used the result to streamline operations. It can be further explained that by repeated applications of the theory can increase efficiency and continuous improvement in order to achieve company's higher profit. The most important operational performance measure is throughput, by identified factor preventing in the company and reaching its goals (Mahesh and Lynn, 2008).

For the practical point of view, the finding of the study is that JIT practices and Lean practices can synchronously be associated with several performance indicators to improve the operational performance in the company. Scholars recognized JIT practices as the practical approach for the elimination of waste through simplifying the production process (Schonberger, 1986) by implementing kanban system and set-up time reduction (Monden, 1998). Besides, the prime purpose of lean practices is to eliminate waste (Tapping, 2006). The impact of lean practices is based on the empirical evidence that is improves the company's competitiveness (Oliver, Delbridge and Lowe, 1996; Doolen and Hacker, 2005). The impact of JIT practices and Lean practices on operational performance could be based on the infrastructure of the company. The impact of lean practices is important in the company (Shams *et* al., 2010). The goal of this paper therefore to review and understand the effectiveness in adopted of JIT practices and Lean practices towards packaging industry is gradually increasing to the importance role on operational performances.

1.7 Definition of Key Variables

The following section provides a brief explanation in this research.

1.7.1 Operational

Operation is the task or set of tasks a group of individuals perform to turn an input into a value added output. It refers to both something that is small in scale such as casting or machining an item as well as something that is large and complex, such as the set of

interrelated activities used to managed and improve an organization (Knod & Schonberger, 2001).

1.7.2 Operational Performance

Operational performance is the efficiency and effectiveness in the firm. Efficiency is a measure of how economically the company's resources are utilized when providing a given level of customer satisfaction while effectiveness refer to the extent to which customer requirement are met (as cited in Chi and Yoshiki, 2010).

1.7.3 JIT Practices

According to Ohno (1988), the originator of JIT, defines JIT as having the right part at precisely the right time, and in the right quantity, to go into assembly. In this study, according to Chi & Yoshiki (2010), seven dimensions have been proposed to measure different aspects of JIT which are JIT delivery by suppliers, JIT link to customer, pulls system, leveled master schedule, setup time reduction, JIT layout, and multi-functional employee. The definition of each dimension was adapted from Ayman & Yoshiki (2007).

- JIT delivery by suppliers is defined as the vendors have been integrated into production in terms of using kanban containers, making frequent (or just-in-time) delivery and quality certification.
- JIT link to customer is defined as the plant has applied the JIT delivery concept and the pull concept in the operational link with its customers.
- Pull system is defined as the plant has implemented the physical elements of kanban/pull system.

- Leveled master schedule is defined as there is time allotted for meeting each day's schedule including catching up after stoppages for quality considerations or machine breakdown.
- Setup time reduction is defined as the plant is taking measures to reduce setup times and lower lot sizes in order to facilitate JIT.
- JIT layout means use of manufacturing cells, elimination of forklifts and long conveyers, and use of smaller equipment designed for flexible floor layout, all associated with JIT.
- Multi-functional employee is defined as the implementation of JIT production practices which promote an environment that highly focuses on employee training, employee participation, and cross-functional communication and information sharing.

1.7.4 Lean Practices

Lean practices is a systematic approach to enhance value to the customer by identifying and eliminating waste (of time, effort and materials) through continuous improvement, by flowing the product at the pull of the customer, in pursuit of perfection (Shams *et* al, 2010). In this study, according Shams *et* al. (2010), two dimensions have been proposed to measure different aspects of Lean which are waste minimization and flow management.

- Waste minimization is defined as reduction of wastes at the point of generation with the perception of process due to wastes prevention and reduction (Shadi *et* al., 2014).

- Flow management means to focus on reducing the management or coordination costs (Voss and Robinson, 1987) and reducing coordination efforts by dealing with less suppliers (Coyle et al., 2003).

1.7.5 Internal Integration

Internal integration defined as the degree to which a firm can structure its own organizational strategies, practices and procedures into collaborative and synchronized process to meet customer requirements (Chen and Paulraj, 2004; Zhao, Huo, Selen and Yeung, 2011).

1.8 Organization of Thesis

This study is presented in five chapters. Chapter 1 illustrates the background of study, problem statement, research objective, research questions, and definition of variables. Chapter 2 provides the literature review, theoretical framework and hypotheses development. Chapter 3 discusses the research methodology as well as the detailed measurements and questionnaire. Chapter 4 presents the research findings, data analysis and results. Chapter 5 summarizes and concludes on the research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The chapter comprises of theory and research related to operational performance in Malaysia packaging industry, JIT practices, Lean practices and internal integration.

2.2 Packaging Industry in Malaysia

In the past few years, Malaysia is honorably recognized as a country with the greatest economic growth rate in the world. Papers, paper boards, metals, glasses, plastics, woods and so on were Malaysia's main materials in the packaging industry. This is a well-established industry for the corrugated board. Peninsular Malaysia has approximately 46 corrugated companies. Based on Andrew Lee (1996) study, it is estimated that the total capacity of the companies to produce is around the range of to be in the range of 833,000 metric tons. However, generally in Malaysia, the corrugated box company's capacity to produce is approximately 321,000 metric tons only.

The metal packaging industries in Malaysia can be divided into the general line cans, the beverage cans and the steel drum. The general line cans market is a very fragmented market with products ranging from sanitary cans for food items and others consumer product such as aerosol and paint cans with a large variety of sizes and specifications (Andrew Lee, 1996). For the steel drums, mainly for packaging which includes latex, edible oil, oleo chemicals, paint, agro-chemicals, flavors and fragrances, lubrication oil and chemicals.

The glass industries in Malaysia mainly cater for the soft drinks, beer, pharmaceutical and chemical goods. The glass bottle included returnable glass containers, single rip bottle, jars (wide mouth) and others. Besides that, there is estimated about 60%-70% of the production is for the domestic market while 30%-40% is for the export market mainly to East and West Asia (Andrew Lee, 1996).

Other than that, there is about 60%-70% of the plastics manufacturers in Malaysia are involves in the packaging industries. The plastics packaging industries in Malaysia can be divided into flexible which included bags, files, sheets and laminated plastics; rigid which included bottles, boxes, crates and drums (Andrew Lee, 1996).

2.2.1 Definition of Packaging

Packaging has been defined in many ways. Packaging can be defined as all the goods had made of any material to be used for the containment, delivery, handling, and protection, from the raw materials to produce products, and from the assembler to the consumer or end users (Prendergast, 1995). According to Talib and Johan (2012), packaging is a material used to contain, protect and handle goods.

Besides that, Lockhart (1995) defined packaging as marketing and industrial technique for containing, identifying, protecting, and facilitating the sale and delivery of industrial, agricultural, and customer products. Other than that, Packaging Institute International defined packaging as the enclosure of products, packages or items in a wrapped pouch, cup, box, tray, can, bag, tube, bottle or other container form to perform one or more of the functions which are containment, performance or utility, preservation

or protection, and communications. In addition, if the container or device performs one or more of the functions, so it is considered a package.

2.3 Operational Performance

Operational performance is part of the manufacturing performance which is commonly used in operations management. This type of result take into the company's performance in reaching the basic objectives, which is, quality, productivity and service (Alberto and Javier, 2002). In addition, based on Corbett and Van Wassenhove's (1993) model, considers three dimensions of operational performance; cost or efficiency, quality and time. Therefore, company must obtain high level of operational performance in order to improve and maintain the level of competitiveness.

Operations performance is well-established in operations literature which identifies speed, cost, flexibility, quality, and dependability as critical manufacturing competitive priorities (Vickery *et* al. 1997; Slack *et* al. 2004; Bahjat, 2012). Besides that, Feng *et* al. (2008) defined operational performance as the performance related to organizations' internal operations such as productivity, product quality and customer satisfaction.

Other than that, operation performance is one of the measurements to measure the company efficiency. Efficiency is the use of all available resources in order to maximize the output. Operational performance measures has been measured and defined in a wide variety of literature. According to Kaplan and Norton (1992), the traditional measurement of financial performance is no longer use for today's business demands. According to Alberto and Javier (2002), operational measurements of management are needed when

dealing with internal process, customer satisfaction and activities directed at innovation and improvement in the company, which lead to future financial returns.

At operational level, management requires to understand the (sometimes conflicting) objectives of its stakeholders and set its objectives accordingly (Slack *et* al., 2004). There are five basic dimensions that are considered to apply in operations. These all operational performance elements are on-time delivery, manufacturing cost, volume flexibility, inventory turnover and cycle time (Chi and Yoshiki, 2010). Besides, they also provide the key for operations management tools and techniques such as kanban, just-in-time (JIT) and Lean, which are focused on doing things better, efficiently, faster and more cheaper. Peng *et* al. (2008) stated that company's operational performance need to be assessed using varied measures of operational performance such as lead time, cycle time, operating expense throughput and inventory expense (Mabin and Balderstone, 2003). In this study, we used five measures which are manufacturing cost, on time delivery, volume flexibility, inventory turnover and cycle time.

2.3.1 Manufacturing Cost

The first dimension of operational performance is manufacturing cost, which is measure the ability to produce goods and products at the lower costs. Costs is always the frequently mentioned operational performance for examining JIT implementation (Cua *et* al., 2001; Hallgren and Olhager, 2009; Mackelprang and Nair, 2010). The preferable choice of materials, complexity of process manufacturing and design will determined the actual manufacturing cost. According to Michael Treacy and Fred Wiersema in a seminal

Harvard Business Review article, defined that minimize overhead costs and elimination of production steps will also influence manufacturing cost.

2.3.2 On-time Delivery

On-time delivery means the speed of production processes, which is measure as the time elapsing between material receivable and delivery of products to the customer. Since the time based competition strategy was introduced in late of 1980 and early 1990, on time delivery have become more and more crucial (Stalk, 1988; Stalk and Hout, 1990). One of the goals in Just-in-Time (JIT) is to improve the flow of production processes in order to respond more rapidly to customer demands (Alberto and Javier, 2002). Fulfilling customer expectation through setting standard of performance will influence on time delivery, ultimately improve customer satisfaction (Roland Mosimann *et* al, 2008).

2.3.3 Volume Flexibility

Volume flexibility also is one of the dimensions of operational performance. Flexibility can be defined as an absorber of environmental variability and uncertainty, in addition, flexibility has enlarge the occupying the attention of operations management scholars at broad lever (Gerwin, 1993; De Toni and Tnchia, 1998; Beach *et* al, 2000; Bahjat, 2012). Accordingly, flexibility also can be understood as the ability to change with a little penalty on time, cost effort, or performance. Besides that, flexibility allows firms to process the actual quantity products quickly with efficiently through setting up time reduction, quality improvement efforts, preventive maintenance, and reliable suppliers (Bahjat, 2012). Therefore, flexibility is possible on machines, equipment, material

handling, labor and routing flexibilities. Furthermore, Koste and Malhorta (1999) stated that volume flexibility is measure the change and the scale of fluctuation in aggregate output level, which the system can accommodate without obtaining high transition penalties or big changes in performance outcomes.

2.3.4 Inventory Turnover

According to Schonberger (2008), inventory turnover is used to measure the effectiveness of operational performance, which evaluating the number of times the inventory is sold or used in a time periods. Inventory turnover is also referring to the utilization of material to produce maximum output within time frame. The level of on hand inventory hold the key to transform material into profits, the more holding inventory, the less productivity and more wastage will be (Roland Mosimann *et* al, 2008). Company keeps the safety stock to handle with uncertain issues such as quality issues, machines breakdowns issues, and late delivery to assure to fulfill customer requirements on time.

2.3.5 Cycle Time

Cycle time use to measure the improvement in the reduction of the time taken in order response to customer demands and thereby offer short lead time from the moment the material is received to the moment the product is delivered to the customer (Alberto and Javier, 2002).

2.4 Just-in-Time (JIT) Practices

JIT production was represented by Taiichi Ohno, the godfather of Toyota production system. JIT means reducing the time line by removing the non-value added waste, which from the moment the user gives us the purchase order to the point when we collect the cash (Liker, 2004). The JIT practices will influence the operational performance in the company. According to Chi and Yoshiki (2010), JIT practices are the idea of producing the items in the necessary quantities at the necessary time, and eliminating waste in operations. According to the previous scholars, were found that as the practical approach, JIT production elimination waste through simplifying the production process (Schonberger, 1986). Further described by (Flynn *et* al., 1995; Ahmad *et* al., 2003; Matsui, 2007), defined JIT practices aimed at reducing inventories in production. Sakakibara *et* al. (1993) described JIT as a philosophy with continuous improvement through elimination of waste in all stages of production process.

There are seven modes of waste that identified by Toyota engineers which are waste of over production, waste of inventory, waste of repair or defects, waste of unnecessary movement, waste of delaying, waste of processing, and waste of transportation (Womack and Roos, 1990; Imai, 1997; Taylor and Brunt, 2001; Liker, 2004). Research has shown several benefits that implementing JIT practices in the company. According to Hay (1988), JIT help company to cut the response time to the markets and provides company with great increase in quality of their goods and products.

JIT practices focusing on reducing unproductivity and inefficiency time in the production operation in order to continue improvement the process of the quality of products or services. Besides that, employee involvement and reduction of inventory are

crucial to JIT operations. The JIT benefit which included inventory reduction, increase productivity and quality levels, improved customer service, improved relationship with suppliers, reduce work in process and raw materials, reduce lead time, increased inventory turnover, reduce downtime, and reduce workspace (Mehra and Inman, 1992; Sohal et al., 1993; Markham and McCart, 1995; Yasin and Wafa, 1996; Sriparavastu and Gupta, 1997; Imai 1997).

In this study, JIT practices consists of seven dimensions which are JIT delivery by suppliers, JIT link with customers, pull system, leveled master schedule, setup time reduction, JIT layout and multi-functional employees (Chi and Yoshiki, 2010). The detail of each dimensions will be further explain in the following section.

2.4.1 JIT Practices and Operational Performance

It is well known that implemented JIT practices can benefit company performance (Crawford and Cox, 1991; Gilbert, 190; Huson and Nanda, 1995; Im and Lee, 1989; Hum and Ng, 1995; Fullerton and McWatters, 2001; Ahmad *et* al., 2004; Salaheldin, 2005; Meybodi, 2009). Based on some empirical studies, the benefit of JIT practices are differs greatly from one company to another and some performance measure cannot be improved in light of expectation (Meybodi, 2009), but as entirely, JIT practices can benefit performance (Shah and Ward, 2003; Mackelprang and Nair, 2010). JIT implementation provided improved performance in following area such as lead times, labor productivity, employee relationships, inventory levels and manufacturing cost (Im and Lee, 1989; Huson and Nanda, 1995; White *et* al., 1999). JIT practices can benefit company operation

performance and many company tried to adopt the JIT practices in order to improve the efficiency of their production systems.

2.4.2 Just-in-Time Delivery by Suppliers

JIT delivery by suppliers' measures whether suppliers have been integrated into production by using kanban containers, making just-in-time or frequently delivery and quality certification (Matsui, 2007). This concept places a lot of strain on the vendors to deliver high quality ingredients on time. Besides, company also link with the vendor in the early of goods design in order to avoid trouble after production has begun. In addition, companies also cooperate with their suppliers' vendors to achieve JIT inventory flow throughout whole supply chain (White *et* al., 2009).

Close work between firms and the vendors can be a win-win situation for everyone. Better communication between firms and the vendors, enables efficient and effective of the inventory planning and delivery scheduling by vendors, moreover improving supplier's profit margin (Chen and Tan, 2011). JIT systems found that cooperative orientation with vendors is crucial, close suppliers relations can be established in maintain a long term and profitable relationship (Jacob *et* al., 1999).

2.4.3 Just-in-Time Link with Customers

JIT link with customers described whether the firm has practiced the JIT delivery approach and the pull approach in the operational link with the customers. Claycomb *et* al. (1999) defined JIT link with customers as the use of the integrated and problem solving initiatives of a JIT philosophy concentrating on improving quality and facilitating

timeliness in supply and distribution to the external customers. JIT link with customers especially designed to coordinate the movement of the marketing and manufacturing functions, by that strengthening the entire supply chain in the company (Claycomb *et* al., 1999). The measurement scale that developed by Claycomb *et* al. (1999) related to the integration of manufacturer and customer activities which are related to design, logistics, quality certification process. Besides that, Green and Inman (2006) have discovered that JIT link with customers has developed strong relationship with customers.

2.4.4 Pull System

Pull system described that the firm has applied the physical components of Kanban or pull system. Kanban is the card that implements pull system to allow the supply of material at the workstation and to regulate material flows in JIT practices, Kanban can be defined as a signaling device (Jacobs *et* al., 2009). According to Chen and Tan (2011), the definition of Kanban has been extended; it is used to denote all kind of visual management tools.

JIT systems utilize the pull system of material flows. The flow of materials is from the beginning of the process of products to the final assembler to the customer. With the pull systems, as the customer purchase goods, the final assembler will check the inventory level of products, and when the inventory are almost depleted, then will order by filling Kanban container (Chi and Yoshiki, 2010). The pull systems will increase the operational performance in the production process by keep the stock at low level, because the two workers in the production can discuss and coordinate in the workstations. Pull

systems enables closer control of inventory and production at the workstation (Chi and Yoshiki, 2010).

2.4.5 Leveled Master Schedule

Leveled master schedule described whether there is delivery time located to meet the schedule of delivery daily such as blockage by taking up for machine breakdown and quality consideration. The JIT system works best is relatively uniform in the daily load on individual workstations. Leveled master schedule at all workstation create a uniform demand daily, in addition, leveled master scheduled by assembling the same type and number of units each day can be achieve. According to Jacobs *et* al. (2009), level master schedule in Japanese is called "Heijunka", which required material to be pulled into final assembly enough to allow the various elements of production to respond to pull signals. This aspect enable the work in process reduce the waste and obtain high flexibility to respond to diverse demand, further described by White *et* al. (1999), it also smooth and balance the production workload.

2.4.6 Setup Time Reduction

Setup time reduction indicated that the company is taking to measure in order to reduce lot sizes and setup time reduction in order to facilitate JIT. Shah and Ward (2003) stated that setup time reduction called quick changeover, this element is widely used by the company and mentioned by most literature. Setup time reduction is to cut down the time involved in developing from producing one output to other outputs (Shah and Ward, 2003). Other than that, setup time reduction will enable inventory decrease and economic

lot sizes decrease (White *et* al., 1999; Fullerton *et* al., 2003). In addition, small lot sizes are practices in JIT system. Besides that, small lot sizes help cut lead time in production process. Normally, the total processing time at each workstation is greater for large lot size than small lot size. Reduce lot size benefits less work in progress inventories, less space required and increased flexibility which enables JIT system to operate effectively (Zhu and Meredith, 1995).

2.4.7 JIT Layout

JIT layout described use of company cell, use of smaller equipment designed for flexible floor layout, destruction of long conveyor and forklifts, and all correlate with JIT. According to Im and Lee (1989), JIT layout in JIT practices such as U-shape layout is generally different from the ford system. JIT layout design for flexible floor layout can eliminate and operator motion waste and have flexibility in responding to demand variations (Matsui, 2007). According to Chen and Tan (2011), changing product flows and layout to a cellular design will improve the operational performance in production area.

2.4.8 Multi-Functional Employees

The greater is need for a multi-functional employee if more customized the service. Multi-functional employee in literature has different expressions, such as “flexibility of worker’s skill” (Brox and Fader, 2002), “cross-functional workforce” (Shah and Ward, 2003; Browning and Heath, 2009), “cross-functional training” (Cua *et* al., 2001) and so on. The main idea of multi-functional employees on different functions and different