

**IMPLEMENTATION STRATEGIES AND IMPLEMENTATION
PROBLEMS ON JIT SUCCESS IN SMEs**

by

TANG WEI KEE

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ABSTRAK

Persaingan perniagaan yang semakin hebat ini telah berterusan sejak 20 tahun yang lepas. Untuk meningkatkan keberkesanan operasi, firma khasnya yang berskala kecil and sederhana perlu menggunakan sistem pengeluaran baru supaya dapat mengharungi persaingan perniagaan. Adalah disyorkan bahawa penggunaan konsep JIT dalam pengeluaran dapat meningkatkan daya persaingan operasi dan menambahkan keupayaan firma untuk mengharungi turun-naiknya permintaan pasaran.

Kajian ini bertujuan untuk menghubungkan kejayaan JIT di SME dengan strategi berorientasikan prosedur, strategi berorientasikan operasi, masalah berkaitan dengan kemanusiaan dan masalah berkaitan dengan pembekal. Di samping itu, jenis proses, sifat produk dan produk standardisasi juga dikaji untuk menentukan sama ada wujudnya kesan rangsangan ke atas perhubungan tersebut.

Populasi dalam kajian ini ditujukan kepada SME di dalam sektor pengilangan di Pulau Pinang. Sejumlah 77 maklum balas yang menyumbangkan kadar tindakbalas sebanyak 22 peratus, telah digunakan dalam kajian ini. Ujian T, ANOVA satu hala, korelasi Pearson dan regresi berganda telah digunakan untuk menganalisis data.

Hasil kajian menunjukkan bahawa strategi yang berorientasikan prosedur dan operasi, serta masalah yang berkaitan dengan kemanusiaan dan pembekal mempengaruhi kejayaan JIT. SME yang melaksanakan strategi berorientasikan prosedur dan operasi, bukan sahaja kurang menghadapi masalah berkaitan dengan kemanusiaan dan pembekal, bahkan dapat meningkatkan kejayaan pelaksanaan JIT. Walau bagaimanapun, jenis proses, sifat produk dan standardisasi produk adalah disimpulkan bahawa tidak merangsangkan hubungan di antara empat pembolehubah tak bersandar dengan kejayaan JIT.

ABSTRACT

Competitive intensity has increased continually, and at times dramatically, over the past 20 years. Firms, especially small-scale and medium-scale companies, that need to survive in this competitive business world must adopt new production system to upgrade their operation effectiveness. It is widely suggested that the adoption of just-in-time (JIT) leads to marked improvements in an organization's competitiveness and ability to respond to rapid fluctuations in market demand.

The objective of this study is to relate procedure-oriented strategies, operation-oriented strategies, human-related problems, and suppliers-related problems to the level of JIT success in SMEs. Besides, type of process, product characteristic and product standardization are also tested to investigate the moderating effect on the above relationship.

The population for this study consists of SMEs in the manufacturing sector in Penang. A total of 77 usable responses were received, representing a response rate of 22%. Independent sample T-test, one way ANOVA, Pearson correlation analysis and multiple regression were used to analyze the data.

The results reveal that procedure-oriented strategies, operation-oriented strategies, human-related problems, and suppliers-related problems significantly impact JIT success. SMEs that exert higher level of effort in adopting the procedure-oriented strategies and operation-oriented strategies will tend to encounter less human-related problems and suppliers-related problems which, in turns, lead to achieving higher level of JIT success. However, type of process, product characteristic and product standardization are found not to be moderating the relationship between the four independent variables and JIT success.

Chapter 1

INTRODUCTION

1.1 Introduction

Competitive intensity has increased continually, and at times dramatically over the past two decades. In an effort to cope with heightened domestic and global competition, a manufacturing firm, regardless of its size, must devise ways to produce better quality products at a shorter lead time and lower costs. Various modern manufacturing technologies, systems and accompanied programs have been promoted in industry to meet this challenge. In this regard, the Just-In-Time (JIT) philosophy has been proposed and implemented as one of the ways to enhance operational efficiency, organizational effectiveness and customer responsiveness. According to Golhar, Stamm and Smith (1990), adopting and implementing JIT is one of the ways to be competitive in the global economy.

JIT originated in the 1950s at Toyota Motor company in Japan, through continuous efforts to solve manufacturing problems (Shingo, 1981). JIT requires only necessary units be provided in necessary quantities at necessary times (Russell & Taylor III, 1998). Three key principles of JIT include waste elimination, total quality control and worker participation in decision-making (Golhar, Stamm & Smith, 1990; Natarajan & Sersland, 1991).

JIT is being implemented in a wide variety of manufacturing firms as a comprehensive way to reduce production costs, shorten production lead-time, increase inventory turnover and improve quality (Crawford & Cox, 1991; Chang & Lee, 1995). Apart from that, JIT is also beneficial in terms of improving the relationships with suppliers and enhancing customer service (Norris, Swanson & Chu, 1994; Wafa & Yasin, 1998). Hence firms practicing JIT seem to be companies with a high degree

of business excellence (Kristensen, Dahlgaard, Juhl & Kenji, 1991). As a result, the concepts of JIT become more widespread. Hence, more manufacturing firms are expected to embrace the JIT philosophy in the future. This will increase the number of small-scale and medium-scale companies implementing JIT looking at the benefits that can be achieved. Moreover, as more of the large companies extend their JIT implementation to the supply chain, the need for small and medium scale companies to practise JIT will increase significantly. With the increasing interest in implementing JIT, it is critical for SME to adopt appropriate implementation practices that will help achieve successes associated with JIT.

1.2 The importance of SMEs in Malaysia

After having successfully attracted Multinational Corporations (MNCs) to establish production facilities here in the 1970s, the manufacturing sector has grown rapidly in terms of its contribution to Gross Domestic Product (GDP), export and employment. The share of the manufacturing sector in GDP has increased from 13.4% in 1970 to 34.4% in 1998 (The second Malaysia Plan 1971-1975 and mid-term review of The Seventh Malaysia plan 1996-2000). The growing of manufacturing sector has been conducive to the development of a large base of entrepreneurs and small and medium enterprises (SMEs) in Malaysia. Most of the SMEs are actually materials and parts suppliers to MNCs.

SMEs comprise about 84% of the manufacturing establishments in Malaysia. Their contribution to the manufacturing sector was 17.47% of total output, 19.13% of value added and 12.27% of total employment in 1997 (ACTETSME, 1998). According to Datuk Paul Low, chairman of the Federation of Malaysia Manufacturers (FMM), FMM has 1870 members and 140 affiliate members and three of every five

FMM members are small to medium sized companies (The Star, 1998). Therefore, the role of SMEs in the industrial development of an economy is a very important one.

As supplier and service providers to leading industries, the SMEs contribute towards the deepening and broadening of the industrial base through forward and backward industrial linkages (ACTETSME, 1998). Furthermore, SMEs provide an important "local content link" which form a strong foundation for industrial growth (PDC, 1999). Although SMEs cover a large spectrum of manufacturing in Malaysia, only 20% of the goods produced by local SMEs are exported, said Small and Medium Industries Development Corporation (SMIDEC) chief executive officer Kalsom Abdul Rahman (Business Times, 1998).

With the globalization of trade and investment, as well as dynamic technological changes taking place, the SMEs need to gear themselves to face stiffer competition in the future. Enhancing global competitiveness of the country's SMEs, thus, becomes an essential development strategy. Under the Seventh Malaysia Plan, SMEs were encouraged to adopt best manufacturing practices in order to improve production efficiency and product quality as well as promote adherence to international standards and product requirements. Therefore, SMEs entrepreneurs should consider implementing JIT in their organizations as one of the tools to enhance their overall efficiency and competitiveness.

1.3 Research Problems

JIT philosophy has the potential to give the organization great benefits which can be translated into strategic competitive advantages. On the other hand, before the organization reaches such an end, attention must be paid to the implementation process of JIT (Wafa & Yasin, 1998). If JIT is not properly implemented, desirable

benefits are not realized (Prasad, 1995; Zhu & Merdith, 1995). In theory, the concepts of JIT in terms of eliminating waste, improving quality, shortening production lead-time and reducing inventory are easy to understand. However, these concepts are difficult to implement in reality because of the need for fundamental organizational changes (Giunipero & Law, 1990). JIT implementation requires streamlining the production process, such as modifying a plant layout, imposing strict delivery schedules on suppliers, implementing small lot sizes, and reducing setup times. Such activities may require additional investment (Temponi & Pandya, 1995).

Typically large firms can easily meet the requirements for effective JIT implementation (Vora, Saraph & Petersen, 1990; Yasin, Small & Wafa, 1997). However, small manufacturing firms may be different from large firms because they lack sufficient resources to implement JIT, have no market power, and have insufficient exposure to the JIT philosophy (Finch, 1986; Lee, 1997). These differences suggest that small firms may experience different kinds of difficulties that tend to hinder JIT implementation success. Since SMEs assume a significant role in the country's industrialization programme, this study focuses on the strategies and management practices for successful JIT implementation in small and medium scale companies. Identifying such strategies is crucial in order to allow the small and medium manufacturing firms to fully achieve the benefits of JIT and thus improve their strategies competitive position.

1.4 Research Objectives

While JIT has received considerable conceptual and empirical attention, suitable strategies which are essential to successful JIT implementation in SMEs, have

been sorely neglected. This study provides an empirical evidence to fill this gap.

Specifically, the objective of this study are :

- 1) To identify the relationship between implementation strategies and JIT success in SMEs.
- 2) To examine whether implementation problems mediate the effects of the implementation strategies on JIT successfulness in SMEs.
- 3) To investigate whether JIT success resulted from engaging specific implementation strategies is moderated by manufacturing structure of the organization.

1.5 Definition of Terms

1.5.1 *Just-In-Time (JIT)*

Taiichi Ohno (1978), the recognized founder of the pioneering Toyota Production System, defined JIT as supplying the right item, at the right time, in the right quantity.

According to Russell and Taylor III (1998), the elements of JIT are flexible resources, cellular layout, pull production system, kanban production control, small-lot production, quick set ups, uniform production levels, quality at source, total productive maintenance, and supplier networks. The definitions of the elements are summarized in Table 1.1.

Throughout the remainder of this report, SMEs that implement at least one of the JIT elements are considered as JIT firms and are qualified to become the respondents of this study. It is very hard to find SMEs that are implementing large-scale or full-scale of JIT elements due to insufficient resources (Temponi & Pandya, 1995).

Table 1.1 : Definition of JIT Elements

JIT Elements	Definition
Flexible resources	Refer to multifunctional workers and general-purpose machines. Multifunctional workers able to perform more than one job, while general-purpose machines can perform several basic functions.
Cellular layouts	Refer to manufacturing cells that group dissimilar machines together to process a family of parts with similar shapes or processing requirements.
Pull system	Refer to the production system which require workers to go back to previous station and take only those parts they need and can process immediately.
Kanban production control	Refer to a "visible record" initiated by a downstream work center needing parts. It is a paperless system using dedicated container with a card attached to each
Small-lot production	Refer to producing item in smaller lot size
Quick set up	Refer to minimal time required to set up the machines for producing different products
Uniform production levels	Refer to smoothing the production requirement on the final assembly line by reducing the production variability
Quality at source	Identifying quality problems at the source, solving them before passing the defective items to the next section.
Total productive maintenance (TPM)	Refer to a system of periodic inspection and maintenance designed to keep a machine in operation. TPM is a minuscule subset of the total quality control concept inherent in the JIT philosophy.
Supplier network	Selecting a small number of suppliers and developing strong, long-term working relationships with them

Source : Russell and Taylor III (1998)

1.5.2 *Small and Medium Enterprises (SMEs)*

According to SMIDEC (SMIDEC, 1999), the definition for SME in the manufacturing sector effective January 1998 is as follows:

SMEs is defined as a company with full-time employees not exceeding 150 and with an annual sales turnover not exceeding RM 25 million.

Two categories of SMEs are also defined as follows:

Small-scale company : a company with full-time employees of not exceeding 50 and an annual sales turnover not exceeding RM 10 million.

Medium-scale company : a company with full-time employees between 51 and 150 and an annual sales turnover of more than RM 10 million, but less than RM 25 million.

1.5.3 *Implementation Strategies*

Implementation strategies are defined as the strategies adopted by the firms when implementing JIT. These may be classified as procedure-oriented strategies and operation-oriented strategies (Yasin, Small & Wafa, 1997). Procedure-oriented strategy is the group of implementation activities which directly relate to the procurement process and also to the communication and the transfer of knowledge regarding JIT. Likewise, operation-related strategy refers to the group of implementation activities that are directly related to the production area or the transformation process (Mehra & Inman, 1992).

1.5.4 *Implementation Problems*

JIT implementation problems refer to obstacles that hinder the success of JIT. These problems may be classified as human-related and supplier-related (Yasin, Small & Wafa, 1997).

1.5.5 *Success of JIT Implementation*

Successful JIT implementation is defined as the favourable JIT performance in terms of quality, delivery, productivity, cost, waste elimination, lead time, flexibility, customer responsiveness, supplier relationship and worker attitude. Performance represents the effectiveness of an outcome (Khaw, 1999). For this study, the indicators used in Yasin, Small and Wafa's research (1997) are adapted as the measure of

success of JIT implementation. These dimensions are inventory reduction, reduction of rejects of finished goods, lead time reduction, on-time receipts from suppliers, relationship improvement with suppliers and customers, labour turnover reduction, higher workers' morale, work load balancing improvement, overall production efficiency improvement, and recommendation of JIT to others.

1.5.6 *Manufacturing Structure*

Production process complexity and product complexity are the two primary dimensions of manufacturing structure (Kotha & Orne, 1989).

Production process complexity refers to the degree of interconnection among different stages in the process (Kotha & Orne, 1989). The type of process identified for this study are job shop, batch production, mass production and continuous production (Slack, Chambers, Harland, Harrison & Johnston, 1998). Job shop is used for one-off products with high variety and low volumes. On the other hand, batch production does not have quite the degree of variety associated with job shop. Batch production refers to the production system that processes many different jobs in small groups or batches. Mass production, on the other hand, produces large volumes of a standard product for a mass market. Mass production is usually associated with flow lines or assembly lines. While continuous process is used for very high volume, commodity products whose output is measured rather than counted. It is often deal with relatively inflexible, capital-intensive technologies with highly predictable flow (Russell & Taylor III, 1998).

Product complexity is a composite of end-product complexity and product standardization (Kotha & Orne, 1989). End-product complexity (term as product characteristic in this study) can be defined in terms of the number of manufacturing

steps. Product standardization refers to the variety of the product. Low standardized **products** are designed and produced for individual or few customers. Hence a lot of **product** modification need to be made in order to suit the different taste of different **customers**. Whereas highly standardized products are common for all customers with **minimal** or no options.

1.6 Research Design

This research involves an empirical study to examine the relationship between the interaction of two different independent variables and a dependent variable. The dependent variable is successful JIT, while the independent variables are JIT implementation strategies and implementation problems. Implementation problems are also treated as intervening variable. Whereas manufacturing structure which specifically refers to process complexity and product complexity form the moderating variables of this study.

The study is conducted by distributing a set of structured questionnaires to the small and medium-scale manufacturing firms. Simple random sampling is used in this study in order to provide the least bias and offer the most generalizability. The relationships are tested using independent sample t-test, one way ANOVA, Pearson Correlation analysis, and multiple regression analysis. Finally, implication of the study and the conclusion are discussed.

1.7 Significance of Study

The JIT manufacturing concepts have received a great deal of attention from academicians in recent years. However, most of the surveys are focused on large manufacturing firms (Markham & McCart, 1995; Lawrence & Lewis, 1993). Various

studies conclude that large manufacturing firms are reporting success with JIT implementation (Yasin, Small & Wafa, 1997; Chang & Lee, 1995; Norris, Swanson & Chu, 1994).

Since JIT has been embraced by large corporation, it is uncertain whether or not an average small and medium scale firm is able to adopt the essential implementation elements of the JIT philosophy and benefit from it. Although there are several articles published on the applicability of JIT and its practices to small firms (Temponi & Pandya, 1995; Golher, Stamm & Smith, 1990), most of these studies focus on whether or not JIT can be applied to US small firms, with little attention being given to their applicability to small and medium-scale manufacturing firms in developing countries such as Malaysia. There are numerous cultural, geographical, and philosophical differences between Malaysia and the Western countries. Additionally, previous research concluded that there are several implementation problems faced by developing countries such as lack of in-depth concepts and technical know-how, shortage of capital, lack of skilled man-power, and lack of R&D capability in practising the production management technique (like JIT, MRPII, OPT, Hybrid Techniques, etc.) (Hasin & Bohez, 1995). In short, there is a lack of empirical work concerning the application of JIT by SMEs in Malaysia, even though SMEs constitute about 84% of the total manufacturing establishments in this country.

SMEs play an important role in supporting the national industrialization efforts in Malaysia. During the remaining plan period of the Seventh Malaysia Plan, the government continues to accelerate the development of SMEs as ancillary industries to complement the activities of large-scale industries and multi-national corporations. Despite the importance and growing significance of SMEs to the

development of the country, little research has been conducted about how JIT can be implemented successfully in small and medium business in Malaysia context.

Besides, though desired type of manufacturing structure such as type of process, product characteristic and product standardization for JIT success are discussed in a few researches (Im & Lee, 1989; Bartezzaghi, Turco & Spina, 1992; Spencer, Daugherty & Rogers, 1996; Yasin & Wafa, 1996; Lee, 1997), there is still lack of empirical study to determine the moderating effects of those elements on success of JIT implementation.

By focusing on the Malaysia perspective, this study attempts to shed some light on the strategies that should be adopted during JIT implementation in order to achieve the greatest success of the JIT concept. It is hope that the identification of such strategies will contribute to the formulation of a working definition of JIT. Further, since JIT might be a totally new concept to some of the SMEs, it is interesting to investigate the level of JIT successfulness in SMEs. In additional, some insight can be gained about the implementation problems encountered by the SMEs. This study also contributes to ascertain whether different type of manufacturing structures will influence the relationship between JIT implementation strategies and successful JIT implementation.

Furthermore, the outcome of this study will also be able to serve as the guidelines to the SMEs to enhance their performance through implementing appropriate JIT practices. SMEs that are able to fully achieve the benefits associated with JIT, will improve their productivity, quality, efficiency as well as competitiveness (Orth, Hybil & Korzan, 1990), which leads, in turn, to higher domestic as well as global market shares.

1.8 Organization of Report

This report consists of five chapters. The first chapter introduces the research topic, followed by explaining the research problems and research objectives. Literature survey is discussed in Chapter 2. The past researches related to JIT are reviewed in details in this chapter. On the other hand, the theoretical framework, research hypotheses and research design for this study are presented in Chapter 3. Chapter 4 discusses the results and the statistical findings of this study. Lastly, chapter 5 concludes this study by providing implications and suggestions for future study as well as stating the limitation of this study.

1.9 Summary

Small and medium enterprises have become a dynamic and integral part of the Malaysian industrial development. To strengthen the competitiveness of SMEs in the domestic and global market, JIT can be adopted as a way of meeting this challenge.

In order to ensure that JIT achieves its potential benefits, appropriate JIT implementation practices must be adopted. Different implementation strategies will affect the successfulness of JIT. However, while the JIT implementation strategies play an important role for promoting the production efficiency of SMEs, strategies that will yield to effective JIT implementation in SMEs from the Malaysia perspective, have received very little attention. Therefore, this study is to address the appropriate implementation strategies that contribute to the successful JIT implementation in SMEs, and at the same time to understand the implementation problems associated with the adoption of the implementation strategies. It is also help to determine whether manufacturing structure plays an important role in moderating the implementation strategies and successful JIT implementation. The result of this

study will help to improve the organizational performance of SMEs and hence enhance their strategic position.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

In recent years, the business environment has become intensively competitive, with fierce challenge from both domestic and global arenas. Heightened competition has prompted manufacturers, especially small and medium scale firms to adopt new methods and technologies in order to be competitive in the market place. One new manufacturing technology, the JIT concept, is described by Schonberger (1982) as producing and delivering finished goods just in time to be sold, subassemblies just in time to be assembled into finished goods, fabricated parts just in time to go into sub assemblies, and purchased materials just in time to be transformed into fabricated parts.

The JIT philosophy is considered by many as a great competitive weapon to help firms improve their value-added capabilities. Since the introduction of JIT in Japan, much has been written regarding the strategic influence of JIT on Japanese manufacturing organizations (Schonberger, 1982). JIT also brings about a great improvement of manufacturing performance to the United States industries (Im & Lee, 1989; Gilbert, 1990). However, in the case of Malaysia, especially in small and medium scale companies, the strategic impact of JIT has not been cleared cut.

It has been stated in a few literatures that the potential benefits of JIT do not just happened (Wafa & Yasni, 1998). Before an organization can enjoy the success of JIT, it must adopt appropriate implementation strategies. JIT, only when effectively implemented, can yield significant positive results to the manufacturing firms and ultimately improve their strategic posture. Obviously, a JIT plan that do not carried

out properly can find itself far short of the vision of its authors, even to the extent of total failure (Mehra & Inman, 1992). With this regard, this section will stress on the implementation aspect of JIT in terms of implementation strategies and implementation problems.

2.2 Size of Company

It has been concluded indirectly in numerous literatures that overall larger size companies are more successful as certain JIT strategies are attainable only by larger companies (Finch & Cox, 1986). Furthermore, small companies are believed to lack financial resources to effectively implement most of the JIT strategies. Smaller sized companies also do not have enough leverage to insist their suppliers make frequent, reliable deliveries of small lots of very high quality parts (Inman & Mehra, 1990). In a field study by Lee (1997), many managers from the small-scale companies indicated that they faced size-related difficulties in implementing JIT techniques. Hence the larger the size of a company, the higher the ability of the company to implement the JIT strategies and the lower implementation problems will be encountered which, in turn, will lead to higher level of JIT success. In short, the medium-scale companies should perform better in terms of procedure-oriented strategies, operation-oriented strategies, human-related problems, suppliers-related problems, and JIT success compared to small-scale companies.

2.3 Type of Industry

JIT practices may not be equally applicable to all manufacturing industries as most of the previous researches were done on certain industries such as electronics and electrical, automobiles and plastic products (Crawford, Blackstone & Cox, 1988;

Sohal, Ramsay & Samson, 1993; Fawcett & Scully, 1995). It is often said that JIT is good for discrete manufacturing companies with a few items but in some volume, for instance automobiles, electronics and electrical industries. This can be proven by the JIT leadership status of such industries since the introduction of JIT practices in Japan (Im & Lee, 1989). However, according to Plossl (1987), the benefits due to the implementation of JIT can be felt regardless of discrete or process industry. This is further supported by Sohal, Ramsay and Samson (1993), by pointing out that there is no apparent correlation between the JIT outcome and the industry sector. As such the relationship between type of industry and JIT success need to be confirmed again in this study.

2.4 Rationale of JIT Implementation

Before an organization start implementing JIT, it must justify the reasons behind the implementation of JIT. According to Hall (1987), an organization must have goals and objectives that are easily understood by everyone. Formal declaration of corporate JIT objectives and intent minimizes misunderstanding and ambiguity, thereby allowing more focused efforts and a better prioritization of resources to achieve those objective.

One survey conducted by Crawford et al. (1988) found that inventory reduction is the major reason for JIT implementation. Other reasons cited include : to

use of JIT with the need to improve inventory control. Similarly, Hum and Ng (1995) concluded from their research on the large manufacturing firms in Singapore that reduction of inventory is ranked as the main reason for practising JIT. This represents what is referred to as the fundamental operational motivation for implementing JIT.

However the importance of the reasons behind implementing JIT varies among firms experiencing low, medium, and high levels of success. According to Markham and McCart (1995), the firms with medium and high levels of success ranked reducing inventory as an important reason for implementing JIT. Improving quality was also included as among the top five reasons. On the other hand, customer requiring JIT was ranked as the number two reason by most of the firms that experienced low success in JIT implementation. This study found that reasons for improving the internal working of the organization rather than externally driven forces are associated with higher levels of success in implementing JIT. It seems that to have at least medium success in JIT implementation, a firm should be inward driven, for instance motivated to examine how JIT can improve the organization itself, rather than implementing JIT merely to satisfy those who are external to the organization, such as the customers. This implies that firms that have a true understanding of the principle of JIT will have better success than firm that are undertaking JIT because "everyone else is doing it". Furthermore, the findings from a few studies (Hum & Ng 1995; Clarke & Mia 1993) also did not regard "to suit the client's JIT implementation" as a strong reason for JIT implementation.

However the result of the above researches appeared to be inconsistent with the findings of Billesbach (1991). A significant number of respondents indicated that customer requirements (47%) and competitive pressure (49%) influenced JIT

implementation in his study. However, Billesbach did not consider the level of success achieved by his respondents.

Majority of the surveys regarding the rationale of JIT implementation that mentioned above are focused on the large manufacturers. Based on the research of Finch and Cox (1986) on JIT management for small manufacturers, better customer service was ranked as the most important reason, while inventory and quality control the least. Hence it seems that the rationale behind implementing JIT are different for large-scale companies and SMEs. This argument is supported by Hum and Ng (1995) who indicated that most of the MNC operations considered customer requirements to be less important for JIT implementation. However, for those small and medium size local suppliers would regard this reason to be more significant as most of such MNC operations extend their JIT implementation to the supply chain and force their suppliers to adopt the JIT philosophy. These findings suggested that SMEs are under pressure from their JIT customers to adopt the JIT philosophy (Stamm & Golhar, 1991).

In summary, the rationale of JIT implementation is different among firms with varying size and with different degree of JIT success.

2.5 Implementation Strategies

To ensure a successful implementation of JIT, it is incumbent on management to understand the appropriate implementation strategies that significantly and positively improve the competitive strength of the company (Mehra & Inman, 1992).

Research has identified several factors that are important for the implementation process of JIT. Production strategy and vendor strategy are concluded to be necessary for a successful JIT implementation in one empirical study by Mehra

and Inman (1992) on critical elements of JIT implementation. Between these two, production strategy was found to be the most critical factor, while the vendor strategy showing somewhat less significant. These findings are supported by the research by Yasin, Small and Wafa (1997), who cited that firms that invest more extensive in operation-oriented and procedure-oriented strategy appear to realize significant greater JIT benefits. In their study, procedure-oriented strategy is the group of implementation activities covering training and suppliers aspects.

2.5.1 Operation-oriented Strategies

Study by Mehra and Inman (1992) defined production or operation strategy as the group of activities that are directly related to the production or transformation process. Implementation of those strategies required substantial and continuous changes in a manufacturing system. One of the major changes is the adjustment of plant layouts. Billesbach (1991) found that 83% of the companies responding to his survey of U.S firms using JIT considered a change in plant layout extremely important to successful JIT implementation. Plant reorganization is needed as part of the operation strategies, so that equipment or machines required for similar parts or products can be grouped together in order to minimize the travel distance and inventories between machines (Crawford & Cox 1991). This will yield reductions in workspace, and provide flexible and rapid changeovers which can result in decreased set-up times. Reductions in set-up time make it economically feasible to produce increasingly smaller lot sizes, thus decreasing internal manufacturing lead-time and inventory levels, while at the same time allowing flexible responses to market changes (Schonberger, 1982; Bartezzaghi & Turco, 1989).

On the other hand, using multifunctional machines in the workplace provide flexibility and eliminate the waste of movement to and setting up other machines (Russell & Taylor III 1998). Under JIT, it is important for operations to be as standardized and as simplified as possible (Spencer, Daugherty & Rogers 1996). Simplification reduces the number of parts, or assemblies in a product and thus lead to less manufacturing steps for a particular product. Whereas standardization reduces the variability in the operation, resulting in higher-volume production, easier material handling, and fewer difficulties in production (Russell & Taylor III 1998). Similarly, it is believed that higher level of automation will lead to higher extent of JIT success (Yasin & Wafa, 1996). Furthermore, machine downtime is also an important factor affecting JIT success, since machine breakdowns or set-ups in the absence of buffer or safety inventories will cause production interruptions. Reducing machine downtime, consequently, is essential to avoiding halts in the production process and in eliminating safety and buffer inventories, and thus add up to successful JIT implementation (Daniel & Reitsperger, 1991).

In general, it has been shown that the more extensive the adoption of the above mentioned operation strategies, the greater the likelihood of JIT success.

2.5.2 Procedure-oriented Strategies

Companies should be aware that the mere application of the operational aspects of JIT, with little regard for the other areas, such as training, human resources development, and suppliers relationship, will not ensure the full long-term benefits of JIT (Sohal, Ramsay & Samson, 1993).

Since JIT requires a significant change in work procedures and attitudes, there is a need for large-scale training and education of the workforce (Harber, Samson,

Sohal & Wirth, 1990). Billesbach and Schniederjans (1989) also advocated training administrative as well as production workers to facilitate the implementation of JIT. Similarly, Vora, Saraph and Petersen (1990) stressed the significance of proper employee and management training as essential for successful implementation of JIT in their study of fourteen electronic industry firms in Minnesota. Furthermore, the study by Hum and Ng (1994) on the JIT practices in Singapore, also cited that JIT education and training are the most extensive implemented compared to other strategies.

Firms should concentrate on the training for shopfloor employees and at the same time, do not neglect in giving senior management the necessary grounding in JIT concepts. In short, training and education for both workers and management are crucial for higher degree of success with JIT.

Apart from that, relation with suppliers has to be modified. Because as much as 75% of production cost can be incurred through the purchasing of goods from outside sources, manufacturers must take a proactive role in obtaining materials for the manufacturing process (Landry, 1990; Romero, 1991). It is also estimated that suppliers account for 30% of the quality problems and 80% of the lead-time in a JIT environment (Inman, 1990). In a JIT company, with the close focus on the elimination of waste and frequent purchasing of smaller quantities, it is hence very critical to have reliable suppliers, and ideally suppliers become part of the production line. The literature suggested that purchasing all of a certain product (or family of products) from a few sources can provide incentive to those suppliers who know that as long as they perform, the firm's business belongs to them. This assurance can encourage suppliers to spend time and money to improve quality, reduce lead times, and decrease lot sizes (Inman & Mehra, 1990). This implies that an emphasis on

reduction in the number of suppliers, increase the interaction and information exchange with suppliers, and quality certification of suppliers is seen as critical to the success of JIT.

Recognizing the importance of supplier cooperation for JIT success, Hum and Ng (1994) also looked into this area in their research on JIT practices. They found that suppliers-related strategy is less extensive implemented due to the nature of this strategy which require the full support of the suppliers, and hence it is not as easy as other process-related strategies to implement. In view of this, companies may choose not to go for this strategy at the initial stage of implementation. This is consistent with the research findings of Gilbert (1990) that JIT implementation should start from the internal programmes such as reduce set-up time and machine downtime first before requesting suppliers to speed delivery and reduce batch size.

On the whole, though suppliers-related strategy is crucial for enjoying the full benefits of JIT, it is more difficult to implement, especially for SMEs, because it required the complete support and cooperation of suppliers. Thus this strategy should be carried out during the later stage of JIT implementation.

2.6 Implementation Problems

Based on the literature on JIT implementation problems, two broad categories can be identified : human-related problems and suppliers-related problems (Yasin, Small & Wafa, 1997). The findings of this study appear to be consistent with the writings of Crawford, Blackstone and Cox (1988), who concluded that human-related problems are more significant. The likelihood of encountering implementation problems is higher if a firm does not invest extensively in modifying

the procedures, workforce and operation oriented activities during the implementation of JIT (Yasin, Small & Wafa, 1997).

2.6.1 *Human-related Problems*

Crawford, Blackstone and Cox (1988) in their study of “JIT implementation and operating problems” wrote that human-related problems could be categorized into cultural resistance to change, lack of top management support, and lack of organizational communication. Cultural resistance to change is the major obstacle that hinders the JIT success. These include lack of acceptance by workers, general resistance to change, and scepticism of the success of the project. Lack of top management understanding or commitment is another obstacle to JIT success indicated in this study. The possible reason for lack of management commitment is the management does not completely understand the magnitude of change necessary for JIT to work. This is further supported by the findings of Lee (1997) which indicated that the impediment to successful JIT implementation is the lack of top management commitment. This is the most frequent problem faced by the small firms in Korea. This finding also mentioned that top management is usually reluctant to make changes in production systems because they are worried about decreasing productivity resulting from the changes.

Furthermore, Lee (1997) also concluded that lack of knowledge is the next impeding factor. Lack of direct teaching of JIT techniques by local professional, lack of consultants in this field and lack of sharing of implementation experience among practitioners, will prevent the JIT implementation from progressing smoothly.

Insufficiency of training and education, on the other hand, will deteriorate the result of JIT. According to Crawford, Blackstone and Cox (1988), one obvious aspect

of successful JIT implementation is the commitment of sufficiently large resources in education and training in terms of JIT concept and cross training. As far as employees are concerned, they must be trained adequately to prepare for expanded job requirements. Apart from that, the potential for detrimental effects on employees should be considered as well, or turnover and morale problems may sabotage the effectiveness of JIT implementation (Brown & Mitchell, 1991).

2.6.2 *Suppliers-related Problems*

Major hindrances under suppliers related problems include unacceptable incoming material quality, late material receipts, inaccurate material supply, and lack of communication with suppliers (Yasin, Small & Wafa, 1997). All problems discussed above are caused by inappropriate and inadequate implementation of supplier-related strategies. These problems are the obstacles to the successful JIT implementation, especially in SMEs.

Just-in-time delivery of raw materials and components by suppliers is extremely difficult to implement, especially for the small buyers. Because of the small volume of their orders, SMEs do not have the leverage with their suppliers needed to demand frequent deliveries. This will result in a lack of negotiating power and difficulty in getting the needed cooperation (Finch & Cox, 1986). This is further supported by Stamm and Golhar (1991), citing that on-time receipt of raw materials under JIT delivery seems to be problematic. Other field of study that support the above explanation is the research done by Lee (1997), which indicated that it is in the best interest to SMEs for not starting the vendor strategies that are beyond their control in the early JIT implementation stage. About 32.1% of the respondents in this