



Chen, Chih Hsuan (2011) Inventory Performance Related to Financial Performance? A Case Study in Manufacturing Sector. [Dissertation (University of Nottingham only)] (Unpublished)

Access from the University of Nottingham repository:

http://eprints.nottingham.ac.uk/25368/1/DISSERTATION_ANDY.pdf

Copyright and reuse:

The Nottingham ePrints service makes this work by researchers of the University of Nottingham available open access under the following conditions.

- Copyright and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners.
- To the extent reasonable and practicable the material made available in Nottingham ePrints has been checked for eligibility before being made available.
- Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.
- Quotations or similar reproductions must be sufficiently acknowledged.

Please see our full end user licence at:

http://eprints.nottingham.ac.uk/end_user_agreement.pdf

A note on versions:

The version presented here may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher's version. Please see the repository url above for details on accessing the published version and note that access may require a subscription.

For more information, please contact eprints@nottingham.ac.uk

Submitted in part fulfillment of the requirements for the degree of Master of
Science in Management

**Inventory Performance Related to Financial Performance?
A Case Study in Manufacturing Sector**

By

Chen chih hsuan

School of Management
University of Nottingham

September 2011

© chen chih hsuan

Abstract

This study is to investigate the importance of inventory and the correlation to financial performance. The competitive marketplace has driven the supply chain environment complex and uncertain customer demand. The delivery speed is one of the significant factors to reach customer requirements in the manufacturing sector. The inability of delivering on time may cause the loss of business opportunities. Moreover, the inventory is a double edge sword to manufacturers, advantages and disadvantages appeared whether holding inventory or not.

The purpose of this research is to investigate the inventory. First, to seek the correlation between inventory performance and the supply chain, and how the company enhances inventory performance by the supply chain activity. Second, to find the influence of financial performance if inventory performance improved. The findings shows that the internal company operation and the external supply chain collaboration assisted and improved inventory performance. Secondly, effective inventory management and a clear manufacturing strategy (such as purchasing timing, forecasting customer demand, the supply chain collaboration) are able to improve company's financial performance, particularly on cash flow management.

Declaration of originality

"I hereby declare that this thesis has been composed by myself and has not been presented or accepted in any previous application for a degree. The work, of which this is a record, has been carried out by myself unless otherwise stated and where the work is mine, it reflects personal views and values. All quotations have been distinguished by quotation marks and all sources of information have been acknowledged by means of references."

Chen chih hsuan

Acknowledgements

I am greatly indebted to my supervisor, Dr. Paul Windrum, who spent considerable time and spared no effort to assist me during the last few months.

I also want to thank my parents and all of friends for their endless supports and concerns. Without those supports, this dissertation is not possible.

List of Tables

Table 5-2: The job allocation of managers.....	55
Table 5-3: The job allocation of staff.....	56
Table 5-6: The inventory statement (2006-2008).....	70
Table 6-1: Questions of shortage rate and turnover rate towards the skill and experience	73
Table 6-2: Questions of decision making and inventory performance through data collection method	75
Table 6-3: Questions of information sharing towards inventory performance ..	77

List of Figures

Figure 5-2: The organisational structure of the studied company	54
Figure 5-3: the flow of production arrangement and time to place order	59
Figure 5-4: The production flow of the supplier and the company	61
Figure 5-5: The monthly inventory curve	69
Figure 6-1: The correlation of shortage rate and turnover rate towards inventory performance	73
Figure 6-2: The correlation of the inventory performance and decision making towards the data collection method	75
Figure 6-3: The correlation of the inventory performance and decision making towards the data collection method	77

Table of Contents

Abstract.....	II
Declaration of originality	III
Acknowledgements	IV
List of Tables.....	V
List of Figures.....	VI
Table of Contents.....	VII
Abbreviations & Glossary	IX
Chapter 1 Introduction.....	1
1.1 Background to Study	1
1.2 Context.....	2
1.3 Purpose & Objectives.....	3
1.4 Overview of Dissertation	4
1.5 Definition of Terms.....	4
1.6 Conclusion	5
Chapter 2 Literature Review Part One	6
2.1 Supply Chain.....	6
2.2 Why Inventory is Important in Supply Chain Management.....	17
2.3 Inventory Performance and Financial Performance	24
Chapter 3 Literature Review Part two	30
3.1 The Revaluation of the Supply Chain in the Manufacturing Industry 30	
3.2 Why Financial Performance is Important for an Enterprise	33
3.3 Propositions	35
Chapter 4 Methodology	38
4.1 Aim of this Study	38
4.2 Research Question.....	39
4.3 Objective of this Study.....	39
4.4 Epistemology.....	40
4.5 Type of Design	41
4.6 Overview of the Company	42
4.7 Data collection.....	43

4.8	Data Analysis.....	45
4.9	Triangulation of evidence	45
Chapter 5 Findings.....		47
5.1	Company Overview	47
5.2	The Company Position	51
5.3	Staff Performance Enhancement.....	52
5.4	The Supply Chain Management Performance	56
5.5	The Inventory (Materials) Performance	61
5.6	The Testing of Propositions	65
Chapter 6 Discussion		71
6.1	Summaries of Conclusion	71
Chapter 7 Recommendations and Conclusion		79
7.1	Conclusions.....	79
7.2	Recommendation	79
7.3	Limitation of the Research.....	81
7.4	Future.....	81
References.....		83
Appendices		Error! Bookmark not defined.
Appendix 1: Ethics form		Error! Bookmark not defined.

Abbreviations & Glossary

Abbreviations	Glossary
SC	Supply Chain
SCM	Supply Chain management
ROS	Return of Shareholders
TQM	Total Quality Management
JIT	Just-in-time
VMI	Vendor Managed Inventory

Chapter 1 Introduction

1.1 Background to Study

The supply chain plays a vitally important role in firms competition in the global marketplace with high customer requirements (Van Heerdenn and Bosson, 2009). The development of supply chain management is constantly being evolved towards a variety of demands for companies. Companies are also seeking a best supply chain strategy to aid themselves to generate profit. Several researchers (Jacobides, 2005, chen, 2005, Dowlatshahi, 2000, Griffin et al., 1995, Beaumont and Sohal, 2004, and Jeffers et al., 2008) have investigated several different supply chain trends, such as outsourcing, Just-in-time, focusing of operation and so on. With the development of supply chain models organisations are able to choose the suitable model for them to enhance their capability and to sustain competitive advantages and acquire a successful business on the marketplace.

Today's marketplace is facing fierce competition and the coordination of supply chain has to accurately match customer requirements (delivery, quality and so on). It is an essential point that the supply chain enhances the capability of companies to offer better service (Aitken et al., 2003). Hence, it is one of the vital issues effectively manipulate supply chain activities to improve organisational inventory performance. Many companies manipulate the supply chain relationship to reduce the potential risk. Such as Dell Computer employs outsourcing, Toyota in using just-in-time. The inventory is always a double edge sword for organisations, on the positive side holding inventory able to support the business quickly. On the other hand, the negative side they have to consider the

problem of the cost of inventories and potentially obsolescence (Elliott, 1998).

The reduction of inventory is an initial improvement in organisations and can be a significant indicator of organisational overall performance (Schmenner and Swink, 1998). Moreover, Rajagopalan and Malhotra (2001) supported this argument in the empirical results. A potential risk of holding inventory is obsolescence and reduction of value. Organisations have employed several methods of inventory management to mitigate the risk, and the adopted method is always controlled by company financial performance (Lai et al., 2009). Consequently, does the inventory performance aid the company's financial performance? What is the impact of inventory performance in supply chain management? These factors will be examined in this study.

1.2 Context

The trend of globalisation and the development of the internet have constantly driven the production philosophy forward and has gradually departed it from traditional production of reaches, such as single market, localisation production, local supply chains. The supply chain is also being changing toward a new territory, the professional structure and complexity of organisation. This change has caused the difficulty of managing supply chain activities, particularly in a global supply chain operation, due to issues, such as geographical distances, increased inventory, source location and so on (levy, 1997, and Taylor, 2009). In addition, the component of products are become more complex because of the increase customer requirement and has made supply chain activities difficult

(Bozarth et al., 2009). To outperform the changing of globalisation and increase the organisational competitive capability the organisations have moved forward to integrate their supply chain. The activity of integration enhances the capability of coordination upstream suppliers and downstream customers, so that the organisation is able to reinforce the competitive advantage, to acquire complementary capability, and to reduce costs.

Lastly, the inventory performance is one of initial improvement that organisation will have to achieve and also one of indicators in influencing organisational overall performance. Linked to the preceding section, does the inventory performance aid the company's financial performance? The financial performance is an essential factor that organisations have to consider as it could impact on profitability, whether the firm could survive, and a vital indicator to stakeholders. Thus, this study will focus on examining the inventory performance and financial performance to seek the correlation among these two performances.

1.3 Purpose & Objectives

The objective of this study is to investigate inventory and financial performance in the manufacturing sector. Recently the increase of complexity and uncertainty has sharply changed the development of the supply chain. Several supply chain activities, such as outsourcing, integration, supplier base reduction and so on, has been created to aid the organisational operation as well as to sustain competitive advantages. One of the significant targets of today's organisation is

to seek the method of effective managing inventory in supply chain activities.

Hence, the purpose of this study is to, first, examine the vital factor that could influence organisational inventory performance. Second, whether supply chain management has influence on inventory performance, and if so, why supply chain management will influence inventory performance. Third, does the inventory performance relate to the financial performance?

1.4 Overview of Dissertation

Next, the study is organised as follows. In chapter 2, literatures derive trends in the supply chain, the relationship between the supply chain management and inventory management. The manipulation of inventory modes and how do these modes link to supply chain management. Lastly, how does the inventory performance influence the financial performance. In chapter 3, the literature review is dominated by the supply chain activity in manufacturing sector and the importance of the financial performance toward organisations. Chapter 4 introduces the adopted methodology of this study, which is a combination of qualitative method (structured interviews) and quantitative method (documentary data collection). In addition, a general overview of the case study company will be described. Chapter 5 and 6 will deliver the findings and discussion respectively. Lastly, chapter 7 presents the conclusion, the recommendations, limitation of this research and future research.

1.5 Definition of Terms

Raw materials: the input of the studied company which means steel.

1.6 Conclusion

In today's competitive market environment organisations drive improvement to enhance their own capability and profitability. The inventory management is one of significant factors to derive customer satisfaction and market share. However holding inventory is a combination of advantage and disadvantage in the organisational operation. Moreover, the growing complexity of the supply chain structure makes inventory management more difficult. This research is to investigate why the inventory management is difficult to implement in supply chain activities and the influence of the supply chain management towards inventory management. Further to investigate and explain the correlation between inventory performance and financial performance.

Chapter 2 Literature Review Part One

In this section, the literature provides a comprehensive review of supply chain management. First, an introduction will start from the definition of supply chain and the use of supply chain, and trends of supply chain and supply chain models will be examined then. Second, this section will investigate the importance of inventory performance in supply chain. The strength and weakness of inventory will be discussed. In the end of the section, the correlation of financial performance and inventory performance will be drawn.

2.1 Supply Chain

2.1.1 Supply chain and supply chain management defined

Definition of the supply chain

The supply chain refers to activities that relate to the flow and transformation of raw materials into finished products and to the end user, as well as the associated information flow. These activities (information flow and materials) include both upstream and downstream segments of the supply chain. Supply chain management (SCM) is a philosophy that relates improved relationships in supply chain activities to the development of an organisation's competitive advantage (Handfield and Ernest, 1999).

Jones (1995) states four primary uses of SCM: first, supply chains assist internal business activities in terms of materials and information flow from inbound to outbound ends of the business. Second, it is a concept of managing activities between two parties (supplier and customer). Third, the scope of the supply chain

could involve more than one tier, both up and down stream; for instance, upstream participants could refer to a supplier and a supplier's supplier, or another upper level. Likewise, downstream participants could associate with more than one level (Chase et al., 2004). Lastly, SCM provides a bridge for all participants via unobstructed communication to recognise the requirements of the customer in order to provide adequate products and services.

Thus, it can be argued that SCM includes multiple participants, such as suppliers, manufacturers, third party financial providers, distributors and varieties of intermediaries, in the process of production, services and information from the source threshold to the end user. SCM also involves activities such as operations, demand forecasting, procurement, logistics process management, information flow and physical flow, both inside and outside the organisation (Mentzer, 2001; Chow et al., 2002; Tsai, 2008).

[Use of the supply chain](#)

Several empirical studies have identified the main focal uses of the supply chain. Chow et al. (2006) surveyed organisations in the US and Taiwan regarding their middle level managers. The result shows that supply chain activities aid enterprises in achieving customer satisfaction and requirements, and efficiency has been enhanced by reinforcing the communication between the two parties. Soroor et al. (2009) investigated a shoe factory; they found that SCM consolidates the capability of responsibility identification, interdependence of the two firms, uncertainty and inter-functional conflict reconciliation. The firm (shoe factory) has the ability to focus on innovation, flexibility and speed in order to

outperform other competitors. Barnes-Schuster (2002) examines the correlation of channel coordination. Wholesales and retailers can be closely connected in the supply chain and the capability of operation (information flow) among them can be enlarged to exceed the previous stage.

Consequently, clarifying supply chain activities into long-term (customer satisfaction, market share and revenue) and short-term (the organisation's productivity, inventory reduction and cycle time) aspects assists an organisation in recognising the importance of focused activities. Thus, SCM aids organisations in acquiring advantages through a coordination of these activities. In addition, analysing the structure of the supply chain participants as a whole provides the organisation with an opportunity to link its capacity and demand. Hence, both suppliers and customers are able to achieve the requirement immediately via a fast and accurate interchange of information flow among different players (Lee, Padmanabhan and Whang, 1997; Tan, 2002).

2.1.2 Trends of the supply chain

As the preceding section mentioned, supply chain activities consist of a number of participants and lead to difficult on communication. The supply chain has emerged as a crucial factor in a business operation. Effective manipulation of supply chain activities could cause some beneficial advantages, such as cost reduction, faster new product development, avoiding the shortage of materials provision and so on. Hence, this section will examine the trends of the supply chain and how these tendencies aid firms in supply chain management.

Vertical disintegration

Vertical disintegration is an inverse strategy of vertical integration. Vertical integration means expanding or extending the portfolio of the firm by integrating preceding or successive production processes. Nevertheless, vertical integration could incur risk of increased cost and expense, loss of flexibility, additional administrative costs and so on (Dess et al., 2008). In other words, firms employ vertical disintegration to reduce risk (avoid investment in inappropriate technologies), notably a development strategy in growing industries (Wright and Thompson, 1986). The concept of vertical disintegration stems from Stigler's (1951) theory of vertical organisation. Chen (2005) and Jacobides (2005) suggested that vertical disintegration is the emergence of new intermediate markets that divide a previously integrated production process between two sets of specialized firms in the same industry. Li (2009) indicates that the consideration of geographic factors encourages a firm to adopt vertical disintegration. Grossman (1986) and Chen (2005) provide the evidence that economies of scale may lead to vertical disintegration.

Outsourcing

Outsourcing has become a popular strategic tool in business in recent years, particular in the manufacturing sector (Beaumont and Sohal, 2004; Kakabadse and Kakabadse, 2005). With globalisation, companies have chosen outsourcing to procure components and/or semi-finished products from other suppliers. As a result the manufacturing cost can be reduced and products can be delivered to the marketplace more quickly (Li et al., 2009). Likewise, the cost of investment in new technology can be avoided and companies only need to afford short-term

financial gain (Cohen and Agrawal, 1999). Companies are able to focus on their core competencies (Saunders et al., 1997; Venkatraman, 1997) and respond to the fast-changing environment (Dess et al., 1995).

Supplier base reduction

Supplier base reduction is an operational strategy that controls cost efficiently. In other words, it moves suppliers from many sources towards single/dual sourcing. This method has been discussed by a number of studies (Swift, 1995; Dowlatshahi, 2000). They investigate the reason that firms need to employ supply base reduction. First, development costs can be reduced by a small supply base. Second, close relationships are facilitated by using a limited number of suppliers. Consequently, communication among manufacturers and their suppliers can occur quickly, and the cost of communication and transactions is reduced (Sarkar, 2006).

Focusing of operation

Providing adequate products and services to customers is the key to meeting the demand of the market. The way that firms are able to improve their market position is through focusing on business processes which customers need (Slater and Narver, 1994; Griffin et al., 1995). In other words, the strategy of understanding and analysing the marketplace is a priority that firms should develop (Roy and Cochrane, 1999). Hence, the requirements of the marketplace can be summarised as order winners and qualifiers or by performance measures such as flexibility, quality, dependability, cost and speed (Slack et al., 2007).

Just-in-time

A simple definition of just-in-time (JIT) is 'producing what is needed when needed and no more' (Chase et al., 2006: 474), because everything that exceeds the minimum requirement is determined to be wasted. In other words, the goal of JIT is not only to develop the production system in terms of good organisation of production control and production skills, but also to implement the concept of the perfect production process as an ideal paradigm (Hallihan et al., 1997). By implementing JIT, quality control and inventory reduction can be seen. Thus, the JIT system helps the purchasing process to develop flexibly as well as an enhancement of the level of productivity and production skills (Lee and Ebrahimpour, 1984; Gupta, 1990).

Partnership and partnership sourcing

The concept of partnership sourcing is evolved in Western organisations (McIvor and McHugh, 2000). Partnership sourcing refers to a collaboration between a buying organisation and its suppliers, which closely cooperate together, sharing and mitigating risk, so that they can focus on any further required improvements (Ellram and Edis, 1996). Likewise, it is also a concept for creating change in purchasing. Examples of this change include total cost management, outsourcing, supplier development and early supplier involvement (Quinn and Hilmer, 1995; Dowlatshahi, 1998). Hence, partnership sourcing creates a superior performance due to the collaboration of the buyer and suppliers. In addition, it means the relationship of these participants will be improved if they can pursue mutual benefits (Boddy et al., 1998).

Information technology

In recent years, information technology (IT) has been the greatest development in terms of aiding organisations in achieving higher levels of competitive performance in the supply chain (Jeffers et al., 2008). Simultaneously, IT is a tool for competing in the globalised marketplace (Jayaraman et al., 2008). The skilful employing IT within operations helps information to flow quickly both inside and outside the organisation (Hayes and Pisano, 1994; Hill and Matusik, 1998). Furthermore, the efficiency of operation activities can be improved due to the speed of information flow reinforcing activities such as JIT, outsourcing, supplier base reduction and so on.

In conclusion, companies are able to choose the most suitable trend to implement in the supply chain operation. Through the cooperation with other companies the organisation could acquire the complementary strength or to improve the weakness. The next section will view supply chain models and how suppliers and buyers choose the best models to reduce the risk of holding inventory.

2.1.3 The SC model explains the use of inventory to manage and support the buyer–supplier exchange.

A supply chain operation may be categorised as pre-order, consignment or a combination of both modes (Harrison, 2009; Lai et al., 2009). The classification of the three modes underlies the way an organisation manages its flow of materials between suppliers and buyers. The purchasing of input is related to the style in which products are delivered to customers; details will be supplied in the

following paragraphs.

Pre-order

Pre-order refers to vendor-managed inventory (VMI), which is a business strategy that relates the supplier or vendor to the manufacture and storage of a product before receiving an initial order from the customer (Disney and Towill, 2003; Gumus et al., 2008). Thus, the vendor's decision on how much to make and store is dependent on the demand of the customer. The popularity of VMI has evolved in the grocery industry over the last decade because of the trend towards the holding mass inventories by companies, such as Wal-Mart and Procter & Gamble (P&G), Wal-Mart is good at sales and majority of inventories are held by P&G due to the goods can be quickly delivered to Wal-Mart stores (Stalk et al., 1992; Buzzell and Ortmeyer, 1995). Information sharing, along with coordination and integration of processes between suppliers and buyers, are crucial factors in exploiting VMI. In other words, buyers send demand information to suppliers so that they are able to take action at an early stage (Yao et al., 2007). The benefit of VMI is that buyers can mitigate the cost of inventory; conversely, this cost is transferred to suppliers' operation activity (Waller et al., 1999).

Consignment

Despite the apparent benefits of the VMI method for buyers, the consignment method has been developed and has become popular in recent year in industries such as health care (Dong and Xu, 2002). The technique of consignment is an inventory management tactic which relies upon buyers in supply chain coordination. Suppliers manufacture the product and immediately deliver to

buyers (intermediates). Thus, buyers hold inventories until products are sold and suppliers continuously replenish the goods to buyers (Valentini and Zavanella, 2003; Gumus et al., 2008). More and more business sectors have chosen consignment as their business strategy due to the fact that, first, the supplier maintains the ownership of the inventory and receives payment from its customer (retailer) according to the actual sales; second, the supplier can work to reduce the cost of the inventory and improve the efficiency of cash flow in their operations; and third, the accuracy of inventory carrying and demand forecasting via this tactic leads to the chance of improving other production and marketing efficiencies (Benefield, 1987; Cottrill, 1997; Lee and Chu, 2005).

Combination method

The application of either VMI or consignment may incur risks to suppliers or customers (retailers) based on who holds the inventory. Hence, a combination mode (VMI plus consignment) provides an opportunity to mitigate and share the risk among these participators (Lai et al., 2009). Cachon (2004) and Netessine (2006) indicate the types of firms that may employ this mode as their operational strategies. Capital constraints and demand uncertainty are reasons that a firm may use a combination. Capital constraints limit the size of inventories; thus, a firm would not be able to stock as much as they required. Simultaneously, demand uncertainty is related to the accuracy of marketing forecasting. Inaccuracy of marketing forecasting may not provide adequate information to suppliers to produce a precise quantity of products, plus retailers may not be able to hold enough stock. Lai et al. (2009) also point out the type of firms that may be affected by capital constraints, such a start-up firms, growing firms and those in

the traditional sector (with low margin and heavy investment).

Consequently, supply chain models (pre-order, consignment and combination) are the tactics for mitigating the potential risk of holding inventory. The chosen model influences the way in which inputs are purchased by the firm.

For instance, the pre-order model firms may regularly arrange the purchasing of input by a fixed schedule for suppliers. On the other hand, the consignment model, the purchasing of inputs (raw materials) will be influenced by the demand of the market. The manufacturer needs to quickly respond (in terms of purchasing raw materials) to the market demand if sales of the product are in a good condition. Hence, the way that firms accept order and sales may directly impact their inventory policies (raw materials) and purchasing behaviour.

2.1.4 Supply chain management and inventory: An explanation of the relationship between them

Supply chain management is a managerial tactic to cope with upstream and downstream activities regarding flow and transformation of products from materials into finished products (Handfield and Ernest, 1999). Short-term objectives (the organisation's productivity, inventory reduction and cycle time) are the complementary events that aid the delivery of long-term objectives (customer satisfaction, market share and revenue) (Tan, 2002). A key element of short-term objectives is the control of inventory. This is because organisational productivity is related to the achievement of planned product rates, and all of

outputs will be transferred as inventories. In addition, Ewing and Thompson (2008) indicate the difficulty of demand forecasting in the supply chain, but an accurate prediction could benefit supply chain activities. Further, Germain et al. (2008) argue that a predictable demand environment aids the degree of production productivity as well as the ability to control inventory.

A number of studies have shown the importance of inventory control in supply chain activities. Tsai (2008) identifies that control of stock days is related to the performance of daily payables and receivables. In other words, accurate control of (daily) inventory allows masterly manipulation of the credit period of payables and receivables, and shortening of the lead time of production, improving the efficiency of productivity. Consequently, the operation of cash flow will be affected. Several researchers have investigated the relationship between inventory performance and a firm's overall performance (Silver, 1981; Anderson, 1982; Cannon, 2008). They found that management of the cost of holding inventory is the way to mitigate the pressure on cash requirements. In addition, Burnetas and Ritchken (2005) examined the correlation of risk mitigation in supply chains. They found, notably in the retailer and manufacturing industries, that the risk of holding inventory is certainly a severe issue. Not only the upstream supplier needs to take note of the risk of holding inventory, but also the downstream buyer (wholesalers, retailers) has to manage the degree of inventory. For instance, in the IT industry, the development of brand new product is extremely fast, as are changing customers' tastes. Manufacturers or retailers must consider how much inventory should be held to respond to the demand. The value of holding inventory will drop quickly if the products held cannot be sold before the launch of

new generation.

This section illustrated trends of inventory management as well as practical tendencies of SCM. It is obvious that these trends are all beneficial operation toward the business and companies may choose the suitable trend to implement. Furthermore, supply chain activities and inventory have been shown to have a close correlation. The majority of recent SCM activities (outsourcing, JIT, information technology, and so on) are related to the performance of inventory. In conclusion, the inventory performance seems to be related to the supply chain operation. Hence, a research proposition is able to be extended from this framework.

The next section will explain the influence of inventory on business success and the correlation between inventory performance and financial performance will be identified.

2.2 Why Inventory is Important in Supply Chain Management

2.2.1 Inventory models

The cost of inventory is one of the biggest portions of the total cost of supply chain activities as well as a fundamental consideration of management (Kumar and Ganguli, 2009). Inventory holding activities can be categorised into three models. Make-to-stock is the most popular model, followed by the development of make-to-order models and finally a combination of both models (Kaminsky and Kaya, 2009).

Make-to-stock

The concept of make-to-stock, also called the 'push' system, is to hold the inventory at the end of the supply chain. In this system, the capability of accurately forecasting demand is crucial. Manufacturers need to recognise how many items should be produced and stored (Kaminsky and Kaya, 2009). The ultimate target is to recognise customer needs with a minimum stock cost (Wijngaard, 2004). Several researchers have presented the order-base-stock replenishment policy (an order-base-stock policy is one in which manufacturers hold the inventory until customers buy it. The trigger for replenishing the stock is the buying behaviour of customers rather than forecasting market demand.) (Buzacott and Shanthikumar, 1994; Hariharan and Zipkin, 1995; Gallego and Ozer, 2001). These studies show that manufacturers employ a continuously reviewed order-base-stock replenishment policy to recognise buyers' demands and deliver produced goods with a fixed lead time in order to meet customers' requirements.

Make-to-order

The concept of make-to-order, also called the 'pull' system, is that the manufacturer produces actual demand quantities (order quantities) rather than producing according to forecasting (Kaminsky and Kaya, 2009). The main advantages of using a make-to-order policy are that zero inventory can be kept and the manufacturer is able to react to the fast-changing global environment as well as maintaining a competitive advantage (Tyan et al., 2003; Wagner et al., 2003). In the past decade, a number of companies have employed a make-to-order policy instead of a make-to-stock policy in order to mitigate the risk

of storing inventory. New industry sectors such as high-technology have utilised the policy as well as more traditional sectors such as the automobile industry, which have also adopted make-to-order policies (Gunasekaran and Ngai, 2009). For instance, the computer company, Dell, employs a similar concept (build-to-order) which reduces a large portion of inventory cost and provides an efficient delivery system to end users. Hence, Dell can react to the changing environment and meet customer tastes (Bakos, 2001).

Semi-finished products

In order to maintain the benefits of either make-to-stock or make-to-order policies, such as holding semi-finished inventory and producing to meet the exact demand, companies are being driven to adopt a hybrid strategy; a combination of make-to-order and make-to-stock (push-pull) policies (Kaminsky and Kaya, 2009). Soman et al. (2004) investigated why a company might employ a combination policy. They found that these firms attempted to produce semi-finished products, so that they are able easily to switch the eventually products if the customer demand changed. Kerkanen (2007) states that a combination of both policies could recognise the production capacity and/or shorten the lead time for some products. In addition, he identifies potential problems if the managing of semi-finished products is poor; in this case this combination policy could be inefficient.

The inventory mode has been demonstrated in this section, these modes provide companies an instruction to manage the inventory in order to reduce the risk of holding inventory. Before choosing the mode the company still has to deliberate the limitation of implementing the inventory mode. The next section will discuss

the constraint of inventory.

2.2.2 Inventory constraints

Holding inventory could provide benefits within the operation, whereas the limitation of operations could reduce the capability of holding inventory in the organisation. A number of studies state the constraints of holding inventories. Lai et al. (2009) investigated capital constraint in firms. They found that firms, particular start-up ones, growing firms and those in traditional industries, are under capital pressure and may not be able to hold inventory in large quantities. Gertler and Gilchrist (1994) show the difference of inventory policies between large and small firms. A small manufacturer always deliberates upon its inventory status quo in terms of its financial position. On the other hand, a large firm could have a better financial capacity. Hence, the large firm is not as sensitive as the small firm. Babich et al. (2007) indicate that a manufacturer is always seeking ways in which to gain a closer relationship with its suppliers and improve its credit ranking in order to prolong the duration of payable and to mitigate the stress of managing cash flow. Consequently, all of the above studies show that the size of capital and/or financial position could influence decision-making regarding inventories and cause the limitation of inventories.

Researchers have also identified that uncertainty in situations can lead to the constraint of inventory. Cachon (2004) examined demand uncertainty, investigating the operation of the supply chain between suppliers and retailers. Either one of them needs to hold the inventory, yet the difficulty is the unknown of

demand. Xiaodong and Birge (2008) demonstrated that the production uncertainty could cause the risk of bankruptcy in the firm. They examined financial constraint and managerial incentives; these two factors could impact on a firm's production policy and mean that the firm is unable to meet market demand. Li et al. (2009) demonstrated the uncertainty of price. Companies are always wanting lower prices to buy what they need, but the uncertainty of price makes decision-making difficult. For instance, the downstream player considers the long-term contract as a stable resource, yet the uncertainty of price repulses long-term purchasing behaviour. As a consequence, uncertainty factors can be summarised into price, production, demand and obsolescence issues. These factors impact the approach to holding inventory and the manufacturer is always considering whether to hold inventory or not. Hence, capital constraint and uncertainty influence decisions regarding holding inventory and lead to poor circumstances in an organisation. Next section, the importance of holding inventories will be discussed as it still could assist firm's operation.

2.2.3 The importance of holding inventory

Several studies demonstrate the constraint of holding inventory and argue that inventories are correlated with a company's cash flow and profitability (Wang, 2002; Timme and Williams-Timme, 2003; Mazhar, 2008). In addition, as the preceding section mentioned, holding inventories can incur risk; this is not only the risk inside the company but also the risk outside the business environment. The development of SC models (pre-order, consignment, combination models) aids companies in mitigating or sharing risk with business partners, and

companies may choose one of the most beneficial inventory policies to arrange production. As a result, companies are willing to hold inventory because of the reduction of risk and additional benefits.

In this section the benefits of holding inventory will be addressed. Some researchers highlight the importance of holding inventory. For example, Gavirneni et al. (1999) examine the purchasing behaviour of customer. Customers generally look for immediate delivery after placing order with their suppliers. Without inventories or stock, the supplier is unable to attain customer satisfaction. Likewise, frequent shortages of inventory could erode customer patience and loyalty, leading to customers seeking another supplier with better credit and delivery. In addition, the efficiency of an operation can be improved by holding inventory, so that staff are able to focus on production (Moon and Ngai, 2008). Particularly in a long-term operation, the cost of starting up the assembly line can be reduced by the existing inventory.

On the one hand, some studies identify the production safety issue. Manufacturers have to consider the lead time of preparing raw materials during the production process (Chandra and Grabis, 2008). A shortage of inventory (raw materials) leads to a shut-down of the production line, so that preparing inventories allows production to be smoothly proceeded. In other words, the manufacturer has to keep a minimum quantity of raw materials in order to minimise the lead time preparation. Bourland et al. (1996) indicate the use of inventory as a buffer in production. The manufacturer keeps inventory to avoid the risk of unpredictable situations, such as an unreliable vendor, incorrect data

and so on. The inventory buffer provides a flexible space to ensure the safety of production.

On the other hand, the cost of purchasing and administration has also been investigated. Sharafali and Co (2000) explain the power of bulk purchasing. It is common that a powerful buyer purchases a large quantity of items, thus gaining more power to negotiate the price with higher-level suppliers. Simultaneously, the supplier is looking for the buyer who can purchase a large quantity and, in this case, the supplier is more willing to offer a discount on price. Lovell (2003) indicates that holding inventory is a tactic against the fluctuation of price. The JIT system is useful tool to manage and reduce inventory in the production line, but for small scale suppliers, keeping inventory on hand assists the company in avoiding price fluctuations, particularly when prices are increasing.

Hence, to summarise these reasons, holding inventory is a part of supply chain operations that improves production efficiency, avoids the fluctuation of inputs' purchasing price, reduces the potential risk within operational activities, and makes a well cooperation with suppliers and customers. The inventory management is different from other operational activities such as purchasing, manufacturing and marketing. The company is able to obtain a competitive advantage in operational activities through inventory holding and to reduce costs of downtime and lost sales. In conclusion regarding the above concepts, the encompassing point of view could be derived which holding inventory is related to its capital constraint and one of the most crucial activities in the supply chain management. In other words, the correlation between inventory management

and financial performance could be affected by holding inventory.

2.2.4 Inventory performance improvement

A significant factor that could aid the inventory performance is information sharing. Information sharing is one of significant developments this decade which can be referred to internal integration and external integration. Internal integration is related to inter-relationship within an organisation, external integration is related to coordination with suppliers and customers (Stank et al., 2001, Pagell, 2004). Gavirneni et al., (1999) investigated the inventory information sharing in the organisation. They found that organisations are able to effectively improve inventory performance by information sharing of market demand and factory productivity. Aviv (2001) examined the inventory and demand forecasting. He found that collaborative forecasting trends to be more successful in the presence of high diversification of forecasting capabilities across the supply chain.

Thus, information sharing, such as demand forecasting, factory productivity, inventory statement and so on, appears to be one of crucial factors to aid the organisational performance as well as inventory performance. As a consequent, the research proposition will be extended from this framework. In addition, link back to the previous section,

In the next section, how inventory and financial performance are related will be discussed in order to see the correlation among them.

2.3 Inventory Performance and Financial Performance

2.3.1 Inventory as an indicator of performance

After reviewing the literature on the reasons for inventory, does the inventory relate to or impact on the organisation's performance, notably financial performance? Several studies have addressed the correlation of financial performance and organisation operation. Deming (1975) indicated that the variances in the production process could drive instability and uncertainty. Once the instability and uncertainty have occurred, customer dissatisfaction is increased, leading to a drop in profitability and sales as well as a cost increase. Flynn et al. (1995) demonstrate JIT performance and total quality management (TQM) practices as indicators to measure organisational overall performance. They find that the impact of TQM practices on JIT performance could affect inventory turnover and cycle time. From the same point of view, Reiner and Hofmann (2006) examined the entire supply chain process of companies. They utilised dependency analysis and data envelopment analysis to identify the inter-organisational process. The adopted measuring indicator can be summarised as inventory days of supply, inventory carrying cost, cash-to-cash cycle time, delivery-to-request time, and time to delivery-to-commit date. Swamidass (2007) discovered the correlation between inventory and overall performance in US firms between 1981 and 1998. The evidence shows that firms with better inventory and sales performance seem to have less inventory than other firms. Furthermore, inventory continuously tended to dropped in the cases of firms acting much better than others. In contrast, inventory growth occurs frequently with low performers.

In addition, manufacturing strategy is one of factors influencing business

performance (Tunalv, 1992). Previous studies by Swamidass and Newell (1987) suggested that inventory policy plays as a bridge between manufacturing strategy and business performance. In other words, the manufacturing strategy of inventory control is a crucial factor to be manipulated inside the organisation. The tactics to operate the degree of inventory are closely related to the direct cost as well as the efficiency of production.

Schonberger (2003) examined inventory turnover in some companies such as Dell, Wal-Mart and General Electric. Two of these three companies (Dell and Wal-Mart) have a similar situation of increasing inventory turnover and a significant growth during the last decade. Thus, Schonberger argues that inventory turnover can be seen as an indicator in measuring companies' performance. Christensen et al. (2007) investigated the supply chain lead time and variability in financial performance by surveying more than 200 firms in the supply management field. In addition, they expand Taguchi's concept (a method of testing robustness of a design, such as products or services should be performance in extreme condition (Jones, and Robinson, 2009)) by examining the supply chain lead time variances in a successful organisation in terms of its financial performance. The research examined first-tier participants (first-tier upstream suppliers and first-tier downstream customers) and found a strong correlation between upstream suppliers and downstream customers in terms of organisational performance. Tayles and Walley (1997) explored the development of accounting management and manufacturing strategy. The developing of manufacturing strategy assists the firm to sustain competitive advantages and to improve weaknesses, particularly the method of inventory management. A clear

manufacturing strategy points out the way to exceed outcomes and provides a well-established approach towards the company's development. Hence, companies may achieve their goals and overall performance may be improved.

In reviewing the literature of the inventory management it is able to realise the correlation between upstream and downstream players in supply chain activities as well as identifying the outstanding activity. A clear company strategy assists companies in establishing a masterly strategy to follow up and lead to an outstanding operational activity. As a result companies may be able to enhance their overall performance and to evaluate their financial performance.

2.3.2 Inventory as an indicator of financial performance

As the previous section states, supply chain management in terms of manufacturing strategy, is one of the significant indicators for evaluating overall performance. Yet some parts of studies have argued that inventory turnover is not directly related to overall and financial performance; particular JIT and TQM philosophies have been adopted as some of the most important strategies in the manufacturing industry. Firms which have adopted JIT and TQM policies are concerning the way to reduce the surplus material and effectively utilise raw materials at right time and in the right quantities (Chase et al. 2006). In addition, despite inventory management being a measurement of financial performance, a firm's overall performance should be estimated by a variety of indicators, which should be a combination of internal and external matters (Neely, 1999).

Demeter (2003) examined more than 700 companies in the machinery field, surveying their manufacturing strategies and analysing their company competitiveness (inventory turnover, ROS) and their effect on overall performance. The control of inventory appears to an operational tactic in the production process; either JIT and TQM is to reinforce the competitiveness of firms, whereas inventory turnover is still influenced by varieties of internal and external factors, such as company size, characteristics of the market and the type of industry. The result therefore shows that company performance seems to be affected by ROS more than by inventory turnover.

Vastag and Whybark (2005) explored inventory turnover and the implementation of manufacturing practices. The result showed that an organisation could effectively adopt inventory management and evolve a superior management practice. Effective inventory turnover refers to operational practices; a firm can maintain its competitive advantages, yet inventory turnover is weakly, as a key indicator, to be related to overall performance.

Indeed, the reduction of inventory (raw materials and/or finished goods) may lead to an operational improvement as well as cost savings in terms of resources. According to above studies, inventory is not direct related to financial performance. Employing a JIT and/or TQM policy only reduces the work-in-process inventory and the main object is (1) to focus on the company's competitive advantages in terms of a clear manufacturing strategy; (2) to drive the company towards low-variety and mass production due to the recognition of customer needs (Skinner, 1974; Schmenner and Swink, 1998).

Chapter 3 Literature Review Part two

3.1 The Revaluation of the Supply Chain in the Manufacturing Industry

With the trend of globalisation and the development of the internet, organisations are being driven forward to a global production philosophy instead of a traditional production process (single market, focused market). The impact of globalisation has led to the revaluation of supply chain activities such as new selection criteria for suppliers and the consideration of internal capabilities before a business moves forward (Vachon et al., 2009). The increase in uncertainty appears to frequently underlie globalised production. Bozarth et al. (2009) highlight that there are several causes of increased uncertainty, such as system complexity, supply chain complexity, upstream complexity, downstream complexity and internal manufacturing complexity. Uncertainty and complexity may lead to difficulties in the production process and cooperation in the supply chain. Therefore the manufacturer needs to develop a direct and fast path to communicate with suppliers and customers to understand their demands. Levy (1997), Balaji and Viswanadham (2008) and Taylor (2009) indicate the difficulty of managing global supply chain activities, for example in terms of geographical distances, increased lead times, increased inventory, multi-modal transportation, cultural differences, and difficulties in demand forecasting, the choice of plant allocation, source location and domestic tax rate.

3.1.1 Complex network, ultimate products, semi-finished products, components

A good tactic leading to outperformance in the supply chain is to recognise the

complexity and uncertainty. Bozarth et al. (2009) explain the causes of complexity as system complexity, supply chain complexity, internal manufacturing complexity, downstream complexity and upstream complexity. System complexity is related to the distinct number of elements or components that compose a system. Thus, if more and more components comprise a system as a huge body, the impact will be unpredictable and the related network will be larger and more complicated. Additionally, Supply chain complexity represents a coordination of internal manufacturing complexity, downstream complexity and upstream complexity. Internal manufacturing complexity refers to the products, processes and relationship in the supply chain activity. For instance, customer demand is changing and following the development of technology. A brand new product is not a single-function product, as simple as in the past; the world trend and pressure from rivals have driven manufacturers to design multifunction and complex products. Downstream complexity includes the number of customers and the number of level of customers. Customers could be first-tier customers in a number of them, or there also could be various tiers of customers. Hence, the way in which to satisfy every single customer in a variety of ways is a difficult issue for the manufacturer. The concept of upstream complexity is similar to downstream complexity. In other words, as a broad view, the manufacturer could be viewed as a diverse player in a supply chain which depends on the located position and the scope of the supply chain.

3.1.2 Vertical integration and horizontal integration is common; cost reduction

In terms of the difficulties arising from uncertainty and complexity in supply chain

activities, it is much more important to consider them in a global manufacturing operation. The consideration should be extended outside the company. To reduce cost inside the company is just an essential (first) step; in reality the company should do more outside itself and deliberately widely and on different production levels (Miller and de Matta, 2009). Moreover, one of factors for gaining market share is the capability of launching a new product. Hardy (2009) points out this approach in explaining how the method of a company outperforms its competitor. He argues that the ability to leverage capability with vertical (hierarchical) corporations is the way to shorten the duration of launching a new product and the time to market. Therefore, following are a number of research accounts of the importance of integration activity in supply chain management.

Vachon et al. (2009) examined the type of interaction with suppliers and the alignment of competitive priorities in the supply chain. In addition, they conclude that several studies (Williamson, 1979; Spekman et al., 1998) and the evidence show that organisations should focus on, first, the scope of suppliers (meaning that manufacturers may consider the potential power and ability to influence outside world) and second, the cooperative relationship (this approach is related to the company's ability to coordinate suppliers or customers with itself). Thus, the company is able to meet its goal, such as customer satisfaction, lead-time reduction, removal of the shortage of raw materials, and so on. In addition, Nagurney (2009) addressed horizontal mergers in the same industry and concludes that, no matter whether by vertical or horizontal integration, organisations can leverage their competitive advantage with other suppliers to coordinate and reinforce their capability and profitability, notably in today's

globalised marketplace. Further, the organisation is able to reduce its operational costs, not only the internal production cost but also external expenses such as delivery costs and communication. One of the vital factors in any organisation is to maximise profit by increasing sales and/or reducing the operational cost.

In conclusion, globalisation has raised the complexity and uncertainty of organisational operation and driven the organisation forward to compete with and overcome competitive businesses. The complexity of product developments and supply chain cooperation are crucial factors that firms must deliberate in terms of their operational activities (such as improvements programme, focused operation, inventory management, integration and so on) in order to lower operation costs and effectively manipulate the resources (materials) within the supply chain. Strategic inventory management is one of tactics for effectively managing materials in the supply chain and reducing the potential risk of holding inventory. In addition, the inventory improvement firms may be able to facilitate financial performance. Consequently, the proposition will be developed from the situation of explicitly dealing with complexity and uncertainty. In the next section, the importance of financial performance and the research proposition will be developed.

3.2 Why Financial Performance is Important for an Enterprise

In this section, the importance of financial performance will be discussed. The main function of financial performance can be divided into two, the evaluation of firms and an indicator for stakeholders.

3.2.1 A measurement for a firm's survival

It is obvious that financial performance presents profitability and the availability of future investment of the organisation. In contrast, poor financial performance can reflect a downturn of business and become unattractive for other investors; the worst situation could lead to a closure of the business (Barton and Mercer, 2005). Latham and Braun (2009) examined 450 firms during 2001-2003 which underwent financial slack. The evidence shows that poor financial performance results in a lower credit ranking and cash turnover. Companies lose the competence of negotiating with external units and the capability of leveraging their competitiveness. Traditionally, companies have relied on their financial report to evaluate their performance. The financial report explains the strengths and weakness of the company and provides the analytical data for the company to recognise its performance (Otley, 1999). Stern et al. (1996) and Rappaport (2006) indicated that the priority strategic objective should be improving financial measures in order to align internal targets and maximise the company's value. Davila and Foster (2005) investigated the importance of accounting systems in companies. The short-term financial performance is related to the long-term growth. They concluded that the survival rate of the firms would be higher if the firms had a better financial performance and business plan. Consequently, financial performance is the priority consideration of the firms as well as the most substantial measurement. To seek out the measures in the operational activities is a task of the senior manager in order to aid the business growth and survival.

3.2.2 Stakeholders' perceptions

The financial report indicates the performance of the firm and this information will influence people willing to invest in the firm. Financial reports are concerned with collecting, analysing and communicating financial performance. The in-depth information is emerged from the financial report and utilisation of the data is dependent on users; for example, the owner is able to recognise the strengths and weaknesses of the business, the customer can evaluate whether the firm is reliable, managers can receive information on which operational activity is the weakest, investment analysts and investors can appraise whether the firm is worth investing in, governments can calculate how much tax will be paid, and so on (McLaney and Atrill, 2008). Finch (2008) has supported this point of view. The paper examines the relationship between internal and external stakeholders. Moreover, a business cannot exist without stakeholders. The company and its senior manager should, critically, recognise the needs of the stakeholder and define them as its strategic objectives. Other studies have examined the behaviour of other external finds on a business' financial performance. For example, Nagurney (2009) explains that financial performance is a substantial benchmark for the concerns of joint ventures and/or the behaviour of mergers. This is a shortcut by other finds to join in the business to acquire external advantages in gaining business opportunity. In conclusion, the financial performance does not only demonstrate internal measurements, but also provide opportunities to attract other players to join in the business.

3.3 Propositions

Lastly, a set of propositions was developed based on previous literature dealing with supply chain operation and inventory control. These propositions represent the theoretical concepts and reflect the impact of operational activities on financial performance. To investigate how the company manipulates inventory management, it is essential to consider the information on internal operations.

P1: Inventory performance can be described as activities of inter-organisational data collection and integration

The intention of supply chain activities is to improve productivity and enhance profitability by focusing the operations of the business. These measurements are evolved to outline financial performance which is regularly published in the financial report. The management of inventory is one of the vital issues in supply chain operation and financial performance. The methods for handling inventory can be categorised as vertical disintegration, supplier base reduction, focusing of operation, outsourcing, and so on. It is possible for companies to employ one or more of the strategies to manipulate the supply chain activity.

P2: Inventory performance is implemented on an explicit framework of supply chain management

In addition, the trend of globalisation leads to an increase of complexity and uncertainty both inside and outside the company. The complexity of product and supply chain relationships and marketing uncertainties make inventories more difficult to cope with. The growth of company structure also causes difficulty in

terms of inter-information exchange.

P3: Inventory performance is carried out to explicitly deal with complexity and uncertainty

Klingenberg and Geurts (2009; p428) argue that “not only do large lots create inventory, but inventory creates expenses for warehouses, warehouse personnel, depreciation, obsolescence, shrinkage. Additionally, the cash tied up in inventory is not available for use in profit making capital expenditures”. Hence, employing theoretical models such as inventory to current assets, inventory turnover, inventory days held and so on allow the examination of inventory performance, particularly in firms which operate surrounded by of lot-sized inventories.

P4: Inventory performance is implemented to facilitate financial performance

Chapter 4 Methodology

4.1 Aim of this Study

As in the preceding section, the performance of a business' strategy plays a crucial role in a business survival and success. In an era of fast information exchange, a high degree of competition and globalisation, the tactic of managing supply chain activities seem to be closely related to the company's performance. As mentioned, managing inventory is an issue that dominate supply chain discussion. The development of globalisation and the internet have driven the increase in complexity of supply chain operations, not only on the products side, but also in terms of the scope of the supply chain and the customer demand, as well as the growth of the difficulty of managing inventory. This is in spite of the fact that a number of strategies (vertical disintegration, supplier base reduction, outsourcing, just-in-time (JIT) and so on) and models (preorder, consignment and a combination of both modes) have been created to enhance supply chain performance and mitigate risk. In order to satisfy a customer's requirements, the complexity of coping with supply chain activities has been significantly growing. The aim of this study is to examine whether the method of inventory management impacts a firm's financial performance. The author will investigate the method of the production and inventory policy and the type of manipulation of supply chain activity which the observed company adopted, and discuss the difference between the effects of make-to-order and make-to-stock policy on the level of inventory. In addition, the company's inventory statement and sales report will be decoded in order to critically examine the correlation.

4.2 Research Question

This research will start with a view of inventory performance towards supply chain activities, to seek how the supply chain influences inventory performance. Next, the correlation between inventory performance and financial performance will be examined. Thus, the research question is:

- *Does the supply chain activity influence inventory performance and how?*
- *How does inventory performance influence a company's financial performance?*

4.3 Objective of this Study

The objective of this study is to research the link between inventory performance and financial performance in the manufacturing sector. The trend of globalisation has driven the supply chain network to become more complex and unpredictable, notably in the manufacturing sector (Balaji and Viswanadham, 2008; Bozarth et al., 2009). A number of firms (not originally manufacturing) have chosen to integrate their vertical and/or horizontal operations in terms of internal operation cost reduction, for example McDonalds in fast food operations. The strategy of keeping a low level of inventory is a target and aspiration in a majority of firms. Some of the main supply chain methods of operation, such as JIT, are designed for managing inventory and maintaining a minimum operational cost.

Nevertheless, some manufacturers are unable to avoid a high level of inventory due to facing severe fluctuation in the price of raw materials such as metals or

natural resources, as well as a significant increase or decrease in demanding a very short period. Thus, these manufacturers store high levels of inventory. Firstly to react to the changes in the marketplace and respond to variety of customer demands. Secondly to avoid an increase in procurement costs of the raw materials, so that the company is able to maintain profit at a stable level. Consequently, to connect to the aim of this study, a small-to-medium sized manufacturer (a small-to-medium sized manufacturer will be easier to identify and collect data about) will be chosen on which to conduct the research. This manufacturer is recognised as a component maker in the textile machine production industry with a high volume of raw materials in stock. This research will conduct interviews with its managers and staff to acquire in-depth information about the company. In addition, collecting inventory records and financial reports from the last three years will provide evidence with which to support the outcomes of the interviews.

4.4 Epistemology

This research investigated the correlation between inventory performance and financial performance underlying the supply chain. Interpretivism position was the philosophical foundation of the research as it was conducted by understanding the difference between human rather than objectives. In addition, the interpretivist perspective is one the highly appropriate in the case of business and management research (Saunders et al., 2007). The generalisability of research is not an essential factor in this research because the aim of this research is to acquire a unique understanding of a complex situation in the

business environment.

4.5 Type of Design

This mission of this research is to examine the empirical problem that a firm has confronted during its operation. The research will revise the manufacturing strategy and observe the company in order to carry out an in-depth investigation. A case study can be defined as ‘investigating a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident’ (Yin, 2009: 18). In addition, Yin (2009) argues that a case study is a method for exploring ‘how’ and ‘why’ questions in a real set of events, or if the researcher is unable to control the events. On the other hand, a case study is an empirical inquiry that examines ongoing events in real life and the researcher will be able to describe the events and phenomena that occur.

The case study is a method to provide description, to test theory and to generate theory. The research method applied in this study is an explanatory case study in which a set of propositions is developed and tested. Yin (1994) indicates that investigating crucial events may refer to a theoretical background; the researcher might decide on a single setting that provides the optimisation of the phenomenon. Benbasat et al. (1987) refer to the single case study which is dominated in the initial stage by theory explanation or generation, and in the latter stage by theory testing. Moreover, Soroor et al. (2009) conclude that a case study is the most useful theory testing method and can be conducted as follows: first, a

testing of the propositions could examine the extent to which the theory has not been investigated; second, a case study is a powerful instrument for establishing limitations on the generalisability of the theory; and last, a single case study provides a high degree of control to test a new theory.

The real-life setting of this study is a textile component factory. This factory is considered to be important due to the uniqueness of its inventory policy and its business environment. The uniqueness of its market, a niche market, has limited the development of the technology in the production process, and the specialisation of its raw materials increases the difficulty of handling and managing them. In addition, the scope of its supply chains is widely complicated and the needs of its customers are changeable and unpredictable. The manufacturer therefore has to take risks and face uncertainty in its environment.

4.6 Overview of the Company

The K Company (a fictitious name) produces components for textile machines (replacements) and has been located in a suburban area near Taipei, the capital of Taiwan, since 1984. The main business of this manufacturer is to produce the components which require replacement on textile machines every three months to one year (the life of the component is dependent on the running and operation of the machine). This company is 80% owned by the founder, hence the organisational structure appears to a simple structure and middle managers do not have authority to make key decisions.

Sales: The sales marketplace consists of East Asia, Middle East, American and Europe. Main sales area is focused on China marketplace due to the same language pattern.

Suppliers: the main input (raw material) is steel and is imported from two countries. One of the materials is made to a unique specification, the other one is a standard specification which does not need to be manufactured over a long duration.

4.7 Data collection

A combination of past records and structured interviews was adopted to collect data. To ensure the reliability of the collected data, a protocol is a major instrument in the method of a case study which provides the interviewer with procedures and general rules to follow (Yin, 2009). The questions used in the interviews centred on the improvement of the company and the changed circumstances. The questions had been tested by a member of staff of the company to ensure clarity of content and accuracy.

The first part of the data collection was conducted in the form of a structured interview to managers and staff (warehouse keepers). The questions aimed at managers consisted of:

- 1 Clarifying the business problem faced;
- 2 The motivation of changing company position;
- 3 Top management's perception of the changes;
- 4 The improvement of policy.

These questions were used to explicitly ask the senior management about their view of the company and the problems faced by it. Additionally, at this stage, the interview clarified the critical problem faced by the company and enquire how managers responded to these issues. Furthermore, the allocation of job responsibilities was identified to explain the position of interviewees in the company.

The second part of the interview developed from the first part and focused on how improvements could be implemented in the company. The interview was dominated by the staff who work in particular positions, such as warehouse keepers. The questions were focused on clarifying their job positions, the allocation of their current job, their perception of the company's policy and the method of implementing (their) current job. In other words, through interviewing these people, it was possible to understand how improvements are implemented, as well as the staff's perceptions. The side of how does this company manipulate the new inventory policy.

The second part of the data collection consisted of reviewing the documented data from the last three years, due to the new programme being started at the end of 2005. Yin (2009) argues that a lack of reliability could be incurred in the interview collection. This is because the interviews are conducted by the interviewer and interviewees. The interaction between them could lead to a completely different answer to the same questions by the interviewee. This outcome could be derived from, for example, bias due to poorly articulated questions, response bias, inaccuracies due to poor recall or the interviewee

giving the responses they believe the interviewer wants to hear. Thus, the data collected from internal company documents assisted in avoiding these factors by examining a combination of both forms of data collection. In addition, the documented data were applied as evidence of the answers interviews as well as instruments to consolidate the argument from the interviewee.

The collected data were used to describe the process of improvement in inventory management, to identify the coordination problem and to investigate the correlation between inventory management and financial performance. After the data analysis, the results were utilised to test the research proposition to see the outcome of the proposition.

4.8 Data Analysis

This research was conducted by structured interview (qualitative data) and historical inventory statement (quantitative data). The reason for chosen qualitative data: “First, the data may cover the behaviour or event that the study is trying to explain. Second, the data may be related to an embedded unit of analysis within the broader case study (Yin, 2009; p133)”. The quantitative data provides an explicit explanation or may be used to test propositions. The qualitative data (interview) will be used to test the proposition. The quantitative data (historical steel statement) will be used to support the qualitative data.

4.9 Triangulation of evidence

Multiple sources of evidences have been used in this study in order to converge

the evidence. A single source of evidence is not recommended to examine case studies. Using the multiple sources of evidence is supports the argument more than a single source of evidence (Yin, 2009). In this research the source of evidence was adopted by structured interview and historical document. The structured interview allowed the research question to be described and the historical inventory statement was able to support the evidence on the interview data.

Chapter 5 Findings

5.1 Company Overview

5.1.1 Capacity

The maximum capacity in a month is around 3 million units in a standard pattern of working hours and days. According to the requirements of customers, the production policy can be divided into two categories: make-to-order and make-to-stock; around 60% of production is make-to-order and the rest is arranged as make-to-stock policy for popular and general items. The consumption of steel is around 3,163 kilograms per month (average in the past three years; see Table 5-1) and the annual consumption is around 37,963 kilograms (average in the past three years; see Table 5-1). Raw materials, 60% are unique specifications and the average purchase price is GBP 10-14 per kilogram (the price of common specification raw materials is GBP 4-5 per kilogram). The production process adopted is traditional, i.e. not fully automated; the type of production can be considered to be labour-oriented.

	2006	2007	2008	Average used per year	Average used per month
Used per year (kgs)	33,149.8	38,090.7	42,650.4	37,963.6	3163.6

Table 5-1: The statistics of raw materials consumptions from 2006 to 2008

5.1.2 Customers

The company's customers can be categorised into two groups: machine makers and machine users. Firstly, for machine makers, the first-tier customers, the component is delivered with the machine; this accounts for around 40% the company's of sales. Machine makers appear to more cooperative due to stable demand and long-term orders. To manufacturer a textile machine takes around 25-35 working days (depending on the manufacturer and the type of the machine) and the manufacturing starts after receiving orders from customers. In other words, the machine maker has a longer period for delivery and production.

On the other hand, machine users account for around 30% of sales. They need to regularly replace useless components. The problem is that machine users always replace obsolete components at the last minute and the majority of customers do not store a set of replacements as a safety consideration. The uniqueness of the components causes difficulty with the make-to-stock policy. Hence, to react quickly to a delivery order appears to be a challenge of production allocation in the make-to-order process.

5.1.3 Suppliers

The majority and the higher costing raw materials appear to be steel and a few brass products. The reasons for holding a high volume of inventory are, first, the specialisation of the steel: the input (raw material) is categorised as a unique specification of steel which is only made in one country (the classified information). The specialisation therefore leads to a long period of delivery and

minimum order quantities. Second, there are varieties of specifications: due to the specialisation of the steel, most specifications can only produce a few classifications of products. Hence, a large variety of unique specifications need to be stocked in order to respond to a diversity of purchasing from customers. Third, the fast-changing market demand: the demand of the textile market is unpredictable and fast-changing due to the seasons and diversities of fabrics. In addition, the demand of each location (country differentiation) is not the same, even at the same time. Lastly, the owner's approach: the concept of new management styles, such as JIT, risk mitigation and so on, are difficult to be accepted by the owner due to the traditional thought. The owner used to place the order with large quantities as a representation of showing purchasing power.

On other words, some manufacturers, for instance manufacturers who produce steel or brass products, intend to hold inventory with a high volume of raw materials in order to avoid fluctuations in raw material price and the shortage of supply in the marketplace, as well as to respond to the changes of the marketplace. In conclusion, this observed manufacturer was unable to quickly react to the fast changes in customer demand and the capacity did not reflect the demand. This manufacturer therefore had to increase the volume of inventory, meaning a growth of operational cost due to the high level of inventory.

5.1.4 Sales

The collected data were recorded from the beginning of 2006 to the end of 2008. The company had started to collect the data in the middle of 2005, due to the

recognition of the implementation of the new inventory policy, and the collecting of data is ongoing. The data has recorded several main issues, such as the use of raw materials in the month (weight), the amount of raw material stock in the warehouse (weight), the value in stock (in Taiwanese dollars), and the sales figures for each month (in Taiwanese dollars) (see Table 5-6).

The data show two differences in the raw materials, which are the normal material and the specialised raw material. Both are placed in categorisation A of raw materials (the ABC categorisation) which means all required raw materials have a high value (this study focus area). The cost of the normal material is comparable to a standard steel price, whereas the cost of the specialised materials is much higher than the normal material (approximately three times higher; the unit cost of both the normal and the specialised material are not the same shown in every month due to the fluctuation of the raw material cost). The amount of inventory appeared to be gradually decreasing by 10% each year. In 2006 the average stock was 3,553 kilograms and the level of stock dropped to an average of 2,762 kilograms in 2008.

On the other hand, the sales record has shown (Figure 5-1) that the peak season is from March until July and sales gradually drop from then until October. Sales in February appeared to be low due to Chinese New Year; the factory was on leave for two weeks period with the result that sales activities stopped as well as production. According to the average sales of the year, the company seems to be facing a drop of sales each year. In 2008, sales were in the lowest position of the three years. This was because of the financial crisis that has been impacting the

world all over; the export business took up around 50% of the company's sales.

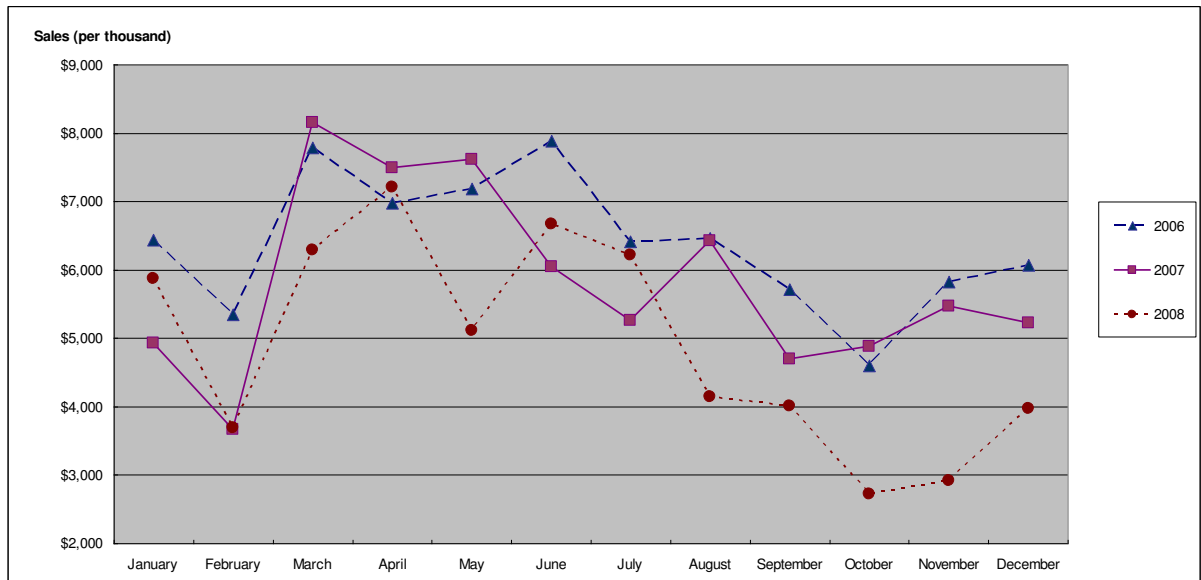


Figure 5-1: Sales statement (2006-2008)

5.2 The Company Position

K company was a power centre company (simple structure) and half functional division, the owner was the person who was in charge of the final decision making. Underlying this mixed structure, the organisational structure of this company was a horizontal division. Every middle manager was positioned at the same level (functional structure) and received commands from and reported to the owner (simple structure). Advantages of this structure were that the owner was more able to handle the business and operation process because of the supervision of the whole company. Hence, the owner assigned the initial mission to middle managers, such as marketing, operational and accounting managers and they only carried on implementing their allocated mission. In addition, the communication to suppliers was also dominated by the owner who delivered the

information from suppliers to the staff. In other words, the owner of K company owned 100 percentage of the power to control and manipulate the whole operational activities.

The style of power centre management caused some disadvantages to this company. Dess et al., (2007) pointed out the disadvantages of a simple structure. The issue of few rules and regulations is obvious to see in a simple structure company. Employees' perception is easy to neglect and the top manager cannot deliver proper motivations, as a result the top management cannot have control over the bottom staff and middle managers do not have authorisations to motivate the staff. In addition, the centralisation of management will lack professionalisation in each divisional department and the person who is in charge cannot deal with everything at the same time.

On the other hand, the specialisation of the marketplace generates problems that lead to the difficulties of raw material management, the supply chain relationship and management, and the customer relationship management. The company's market is classified as a niche market due to its unique portfolios and the supplied market is not the general market and leads to the difficulties of technological/product development as well as cooperation with suppliers.

Consequently, the problem of this company can be derived from its simple structure and market position. The next section will investigate the explicit analysis from interviews with the company's managers and staff.

5.3 Staff Performance Enhancement

Restructuring

In order to achieve higher performance from its staff and middle managers the owner accepted the suggestion from an advisor to restructure the company and devolve power to middle managers. The new organisational structure was a combination of the function structure and the divisional structure (Figure 5-2) which added a small team of corporate staff to carry on the supervision and assistance for lower level staff. The company attitude towards lower level staff is to deliver help not only by middle managers, but also from corporate staff. Hence, this was a complementary method where the top management was able to directly recognise the need of staff through the corporate team and middle managers in case any of the middle managers could not deliver the needs of staff because of conflicts.

In addition, middle managers were given the power to handle their department and take full responsibility for their decision making. Middle managers were able to focus on their job and develop the best operation and communication to subordinate staff to generate a better performance. The reward system was amended and middle managers were able to deliver rewards to subordinate staff and middle managers were rewarded by an outstanding performance of their department. Hence, the incentives motivated middle managers and their subordinate staff to move forward in their jobs, not only receives the command from their director.

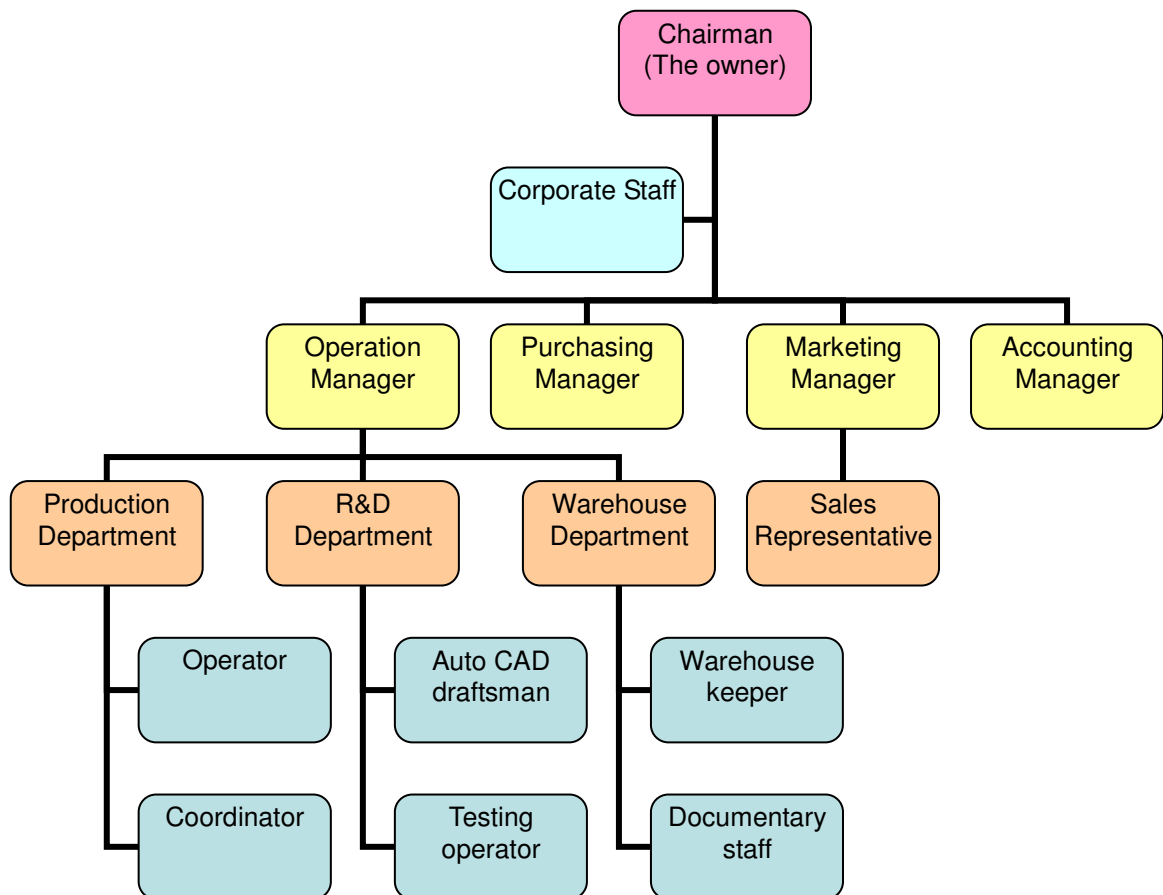


Figure 5-2: The organisational structure of the studied company

The design of the job assignment was based on the improvement of inventory management, and the task consisted of two parts. The first part concentrated on the middle managers and was designed by the owner and the advisor. The second part was focused on the subordinate staff and was drawn up by middle managers and the advisor. The objective of the middle managers was to analyse the collected data from subordinate staff and allocates the mission, such as purchasing schedule, customer demand forecasting, production arrangement, the inventory (raw materials) management, with a proper schedule. The main objective for the assignment was recognised as the operation manager due to the difficult of market position and the specialisation of raw materials.

The operation manager was given the major mission in the improvement due to his role in coordinating three subordinate processes which were production, R&D and warehouse maintenance to achieve a substantial improvement targets. The marketing manager was in charge of customers and had to forecast customer demand according to the pervious orders and transferred the order message and status (whether emergency or not) to other managers. The purchasing manager was given another major mission which was to ensure the delivery of raw material on time and to pass on the correct order information to suppliers. The objectives and mission of middle managers are shown in Table 5-2.

Position	Objective	Mission
Operation manager	Production	Arranging daily production and ensuring the production process was smooth and without defects.
	R&D	Knowing the need and arranging it into production
	Warehouse	Explicitly realising and controlling the inventory statement
Marketing manager	Customer	Forecasting the needs of customers and delivering prompt information (customer order) to the operation manager
Purchasing manager	Supplier	Placing orders on suppliers and ensuring the delivery of purchased material arrivea at a scheduled time.
Accounting manager	Financial target	Recognising the value of the inventory and maintaining it at a lower level

Table 5-2: The job allocation of managers

The job assignment of subordinate staff was focused on improving the efficiency and job classification. The mission was to set up a series of standard operation process (SOP) protocols for every single position and explain the coordination of their job. The improvement was mainly involving warehouse keepers, operators and sales representatives. For instance, warehouse keepers: their job was

involved taking responsibility for booking in and out raw materials, recording the exact amount into the database which was uploaded to the senior manager and maintain a clear area for storing materials. The standardisation document showed the movement of materials and provided clues for tracking them afterwards. The job allocation of staff is shown in Table 5-3.

	Objective	Detail
Warehouse keeper	Recording data	Ensuring the input and output of steels will be immediately and correctly documented into database
	Warehouse maintenance	Maintaining the stored position in an easy identify position
Operator	Production line	Ensuring the daily production can be completed and safety of production
	Form acquiring	The material requisite form needs to be filled in every in and out of steels.
Sales representative	Customer handling	Arranging the deliver to customer Forecasting the customer demand by visiting customers
Corporate staff	Staff supervisionu	Realising the demand of low level staff
	Job supervision	Ensuring the job is correctly completed by double check

Table 5-3: The job allocation of staff

According to the middle managers, the efficiency and performance of subordinate staff had grown due to the restructuring and the authorisation of autonomy. Nevertheless, the cost of administration had increased, because of measures such as the additional corporate staff and extra documentation work. In particular the documentation work for operators was not easy because of the work environment and their educational background. In general, managers and the owner had a positive evaluation of the performance

5.4 The Supply Chain Management Performance

Cooperation and coordination with customers and suppliers is a crucial factor in

the performance improvement. The complexity of the supply chain structure has hindered communication in the supply chain management both to suppliers and customers. The task is that the manufacturer needs to seek the best means of communication and must attempt to immediately respond to quickly figure out any problems, such as placing orders, making deliveries faster, and incorporating new technology development. Next section will demonstrate the framework of the supply chain of the studied company and describe how the staff coordinates and cooperates with the suppliers and customers.

Suppliers cooperation

Due to the specialisation of the specification of materials, the delivery and quantity of orders were extremely limited, so that delivery speed cannot be improved, the minimum order quantity was still considered as a large quantity (at least 800 kilograms). Secondly, the unpredictable marketplace has driven the forecasting harder and made it more difficult to make the right decisions. Thirdly, the steel industry is always dominated by a few huge companies and the sales price is controlled by a few wholesalers, so that the negotiation of price by order quantities is always a difficult issue. Thus, the studied company has adopted a suggestion to improve the relationship with suppliers. First, they adopted a new information technology system to improve the method of data collection (input and output of raw materials) and the recruitment of new staff that had the knowledge of using the computer system. Second, by adding a new position for analysing data the company was able to forecast the best time for placing orders.

The new position was controlled by the operation manager who was in charge of

the data analysis which was collected from the warehouse keeper. Warehouse keepers collected the input and output record every week into the database. The job of the new member of staff was to examine the data and then suggest to the operation manager when to place orders. On the other hand, the purchasing manager took the responsibility of coordinating with suppliers. The policy employed was a combination of make-to-stock and make-to-order. Basically the special steel was made by several separate procedures. The initial procedures were able to be made in advance. Hence K company has to pay for preparing the steel material for these two stages. The benefit of paying for it was to shorten the delivery and mitigate the risk of ordering final steel products. The Figure 5-3 shows the process that is followed when an order has been placed. Once the order has been placed the supplier is able to start the manufacture since procedure 3 takes two months duration to complete. In the meantime, the supplier is prepare the raw material again, so that the payment for the initial stages will spontaneously be re-manufactured (procedures 1 & 2).

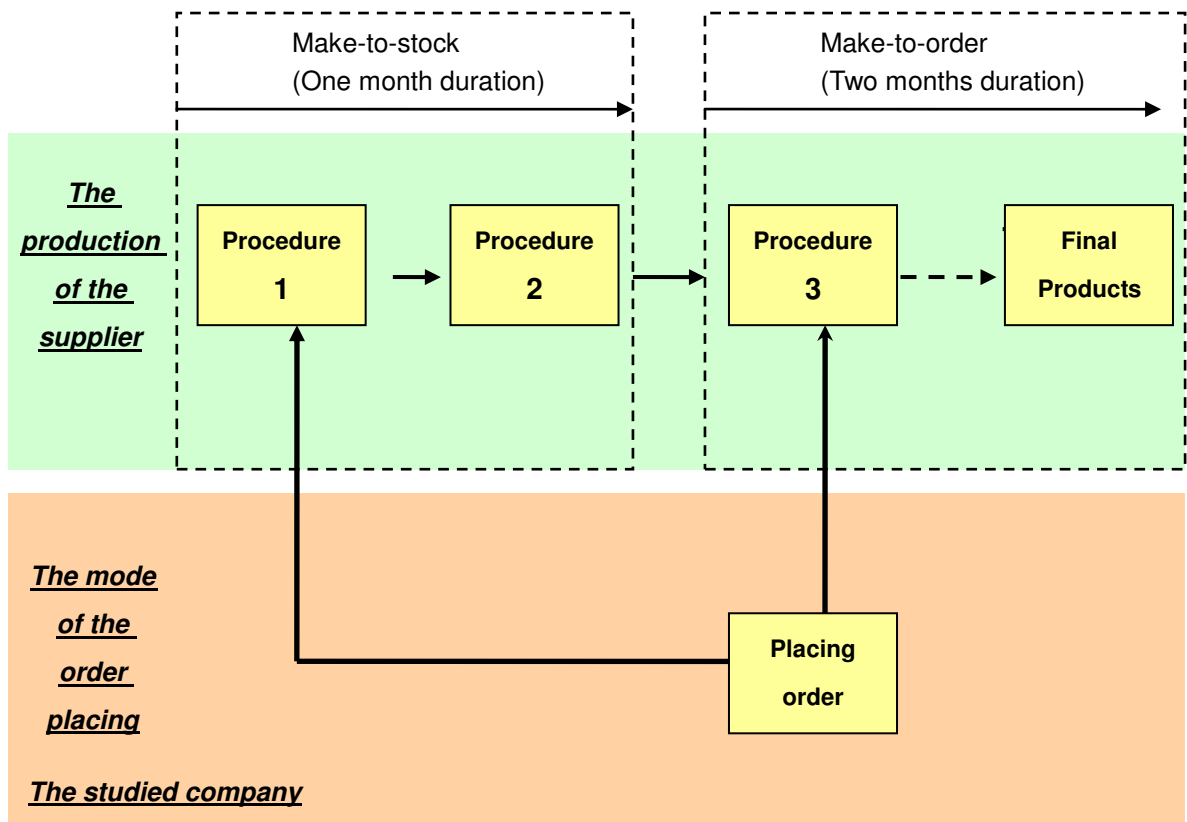


Figure 5-3: the flow of production arrangement and time to place order

Customers coordination

The goal of the company was to shorten the delivery period to the customer and then attempt to predict the demand, although the demand was extremely difficult to forecast due to the different demands of every single market and seasonal factors. A typical order placed in this industry would be for make-to-order products (around 75% are make-to-order, 25% are make-to-stock), so the manufacturer cannot produce the majority of products in advance. The customers can be divided into two groups: machine makers and wholesalers.

The strategy towards machine makers that the studied company used involved

partnership and information technology (IT). The use of information technology reduced the time for the information changing from customers (machine makers) to the manufacturer. Once the machine makers have accepted an order form their customers, it takes around 20 to 30 days (depending on the type of machine) to manufacture the machine. The concept of information changing means that the machine maker will transfer the order information while the production of the new machine has been scheduled in the factory. Thus, the studied company would simultaneously receive the order information and would arrange the production immediately (the process is shown Figure 5-4). Second, the partnership with machine makers aids the flow of information and new product development. The R&D department (machine makers) keeps a close relationship with the studied company to share and exchange any new information and technology. Hence both companies could gain benefits and grow at the same time.

For wholesalers, the studied company had established a database to track customers' orders. The database consists of two functions. First, every order was documented and there was always a chain reaction in that the same area will place the same order at one time due to the same demand. In other words, once the first order had been received, others orders gradually appear from the same area notably in China and the Middle East area. Second, the track system assists the company to forecast the next demand time, although the consumption depends on how the user uses it. This method could build a response mechanism to automatically identify the demand, so that the studied company could make a suggestion to customers whether or not to place an order.

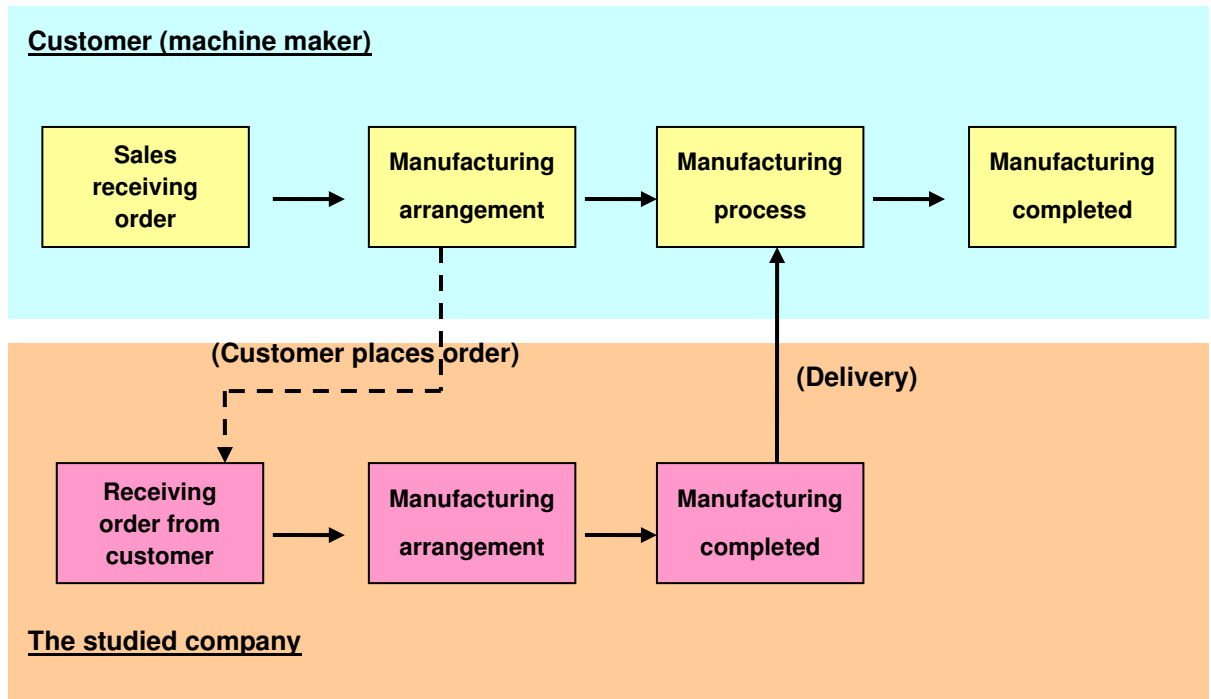


Figure 5-4: The production flow of the supplier and the company

The operation of the company

In conclusion, the studied company cannot only focus on the supplier side or the customer side, both sides are considerably important in the whole supply chain operation. To organise and set up a position in the company was a primary issue to cope with this matter. Staff needed to be able to communication both internally and externally and analyse data as an instruction according to the assigned job and their position. Hence, the company could receive the latest information from outside the company (its customers) and may make a prompt response back inter-company.

5.5 The Inventory (Materials) Performance

The measurement of the inventory performance can be categorised as turnover rate, shortage rate and the cost of management. Shortage was the main issue that the company needed very carefully to look at. This is because the shortage rate could influence the delivery and the reliability to customers. The turnover rate was an indicator of how much cost (cash) had to be stored as an inventory. A large holding inventory means that the company will lose either opportunities to invest in itself or the benefit of cash to the operation. The cost of management related to the cost incurred to handle the inventory, such as cost of people and the cost of the space.

The shortage rate

The performance of shortage rate seriously influenced the reliability of the company. The specialisation of materials was the main factor that caused the shortage to happen. First, the supplier could not guarantee that the delivered quantity would be exactly as per contract due to the specialisation and multiple specifications. For instance, an order for 1000 kilograms, whereas the final completed products was only 750 kilograms. Hence, the company received 25% less. Second, unexpected large orders were always arrived together due to the localisation of the marketplace. The same area appears to have the same demand, so that customers were always placing the same order. In general, the company manufactured a fixed amount of materials. Moreover shortages appeared if massive orders arrived. The production and materials could not support all orders and customers would have to wait for a period. Third, another situation that caused shortage of materials could be delays in the documentation

work. The problem seemed to be that the studied company could choose to pay by remittance (cash) or by the letter of credit (L/C). The difference between these two payments was the documentary work, the L/C payment is required several procedures through the bank and the supplier. On the other hand, the remittance payment just passed through the bank. Hence, the L/C payment took more time to complete and the risk of delay was higher than with remittance.

Steel turnover rate

The performance of turnover rate was poor in the company due to the factor of massive purchasing. Purchasing orders could be six months to twelve months worth of demand. Therefore the company had to store the material at least six months. The product life of steel seems able to stock for a long duration, whereas the risk of rust and obsolescence was still a problem of in storing the raw materials. Lastly, the cost of the warehouse was one of the factors. The studied company used to have a large space to store all the materials. This could cause a shortage of space and the difficulty of managing it.

To improve the turnover rate the company considered increasing the frequency of purchasing and reducing the quantity to its minimum requirement. By doing this, the company wished to reduce the quantities of the holding inventory, the cost of the holding inventory, the risk of obsolescence and rust, and enhance the capability of space utilisation. Moreover, by leveraging of the L/C payment term (six-month term to payback the bank) and establishing the minimum quantity order that the company could be able to run out materials in six months and sell to customers. In other words, the company would not need to hold the cost of the

inventory, and pay for whole purchasing. The cost of purchasing materials would be returned before paying back to the bank if the materials could be completely used and sold.

The cost of management

The cost of management was one of the issues that needed to be considered in inventory performance. The cost of administration was an inevitable cost in operating improvement. The invisible cost related to the cost of adding the new documentation work done by workshop staff and warehouse keepers. Staff always considered these documentation works as extra work which they did not even have to do. However, all collected information was crucial data for analysing and tracking the use of materials. In addition, the increase of purchasing frequency instead of a large quantity purchasing increased the operation cost with every purchase. For instance, the purchasing policy was once a year with a 6000-kilogram order, with a one time purchasing in the past. The company now divided the purchasing into six times every two months. That meant that the staff had to do all the paperwork every 2 months.

The visible cost was referred to new staff who were recruited to assist the improvement and had the necessary knowledge, such as skill in computer operation and statistics analysis. More importantly the company could motivate old staff to encourage them to be more competitive. The other cost which needs to be mentioned was the transportation cost. From a single massive purchase to several minimum purchases, the transportation cost was multiplied into several

times. This is because that the transportation cost was related to the number of deliveries instead of purchasing weight.

5.6 The Testing of Propositions

P1: Inventory performance can be described as activities of inter-organisational data collection and integration.

It is important in analysing data to identifying the crucial point from collected data as an essential factor. To do this, the cooperation of company's staff is a point. Misjudgement will happen if staff cannot correctly and quickly do things and the company cannot integrate collected data immediately. Hence management cannot understand the latest situation in the company.

In practice, the studied company focused correctly on collecting data and immediate analysis of data. To simplify the documentary work for all staff and inculcate into them the importance of data collection were the methods that the company adopted. Meanwhile, the manager took the responsibility of supervising, and ensuring that all forms could be completed correctly and immediately, so as to reduce the risk of being incorrect. In addition, managers were able to reward staff according to the overall performance of the company, so that staff realised that to enhance their capability on the job it not only aided the company, but also helped them to be rewarded from company. Secondly, to efficiently integrate and analyse the data was one of the crucial factors in being able to recognise the company's situation and to identify potential necessary items in the near future. In other words, to quickly and correctly handle data inter-company, particularly

inventory statements and related documents, are referred in the inventory performance.

P2: Inventory performance is implemented on an explicitly framework of supply chain management.

The theory of inventory management is related to the whole supply chain operation and cooperation. This does not only entail cooperation with suppliers, but also with customers. To closely cooperate with every supplier and customer is one of the most essential issues in improving the inventory management. A successful example is the application of JIT.

In practice, the studied company considered that suppliers were equally as important as customers. To clearly recognise the correct link department or person was the focused issue in the studied company. As a steel supplier, the studied company provided the monthly inventory statement every month and tracked every single order to ensure that the time of delivery and quantity matched the contract. Meanwhile, it was possible to place another order if the quantity did not match the original order. Also, the monthly inventory statement provided double warranty to suppliers and the studied company, so that the steel supplier could forecast the demand. Secondly, to customers, some of the machine makers had a close relationship with the studied company. No matter whether it was the purchasing, R&D or sales department, the studied company was able to receive the latest information from these departments, such as receiving a new order, the launch of a new series of machines, co-cooperation in developing new machines and so on. In other words, by cooperating within the

supply chain, the studied company could recognise the demands of the marketplace and could make an immediate respond to react.

P3: Inventory performance is carried out to explicitly deal with complexity and uncertainty.

The trend of globalisation has driven the organisation towards complexity and increasing new designs of products. Market demand has also become uncertain and difficult to forecast. The complexity of organisational structure breaks the job into pieces. Thus the communication between each other (suppliers to the buyer, buyers to the supplier) has become difficult. In addition, the complexity of new product development and the unpredictable market has made inventory management more difficult.

In practice, the studied company started a restructuring the organisation to improve the company. The job position had been split into several positions, such as the warehouse keeper's role had been divided into warehouse management, data collection, input and output management. Altogether the organisational structure had become more complex, the job was more focused and did not involve a variety of tasks.

Looking at factors outside the company, the uncertainty of demand is one of the crucial factors. Customers place their order at one time, because of the localisation of demand. When the company received orders with a massive quantity, the stored materials probably would not to be enough to supply all of the orders. The situation of shortage could happen. However, this shortage situation

did not often recovered due to the high level of inventory and frequency of placing the order to prevent the shortages happening.

P4: Inventory performance is implemented to facilitate the financial performance.

Several studies (Lieberman, and Demeester, 1999, Rajagopalan, and Malhotra, 2001) argue that inventory performance and financial performance only have a few correlations. They state that the cost of inventory management is related to the expense of people management. Hence, there is a small proportion of financial performance.

In practice, the cost of people management, such as for recruitment, transportation and administration, was not a big proportion in the studied company. This concept was matched to the statement of review studies. There were two significant factors to influence the financial performance on inventory management. First, the leverage of cash operation: the payment of steel materials can be arranged as cash payment or L/C payment. In the past, materials needed around six months to twelve months to run out before they generated cash. The cost of inventory must be paid in advance. The new criteria are that the payment would be paid by L/C and the condition to pay back to the bank was six months. Thus, with reduced minimum orders, materials might be consumed before paying back the bank. The company only had to pay 20% of total payment to the bank in advance.

Secondly, from the inventory statement (Table 5-6) it emerged that the amount of

holding inventory was constantly growing over the last three years. The amount of inventory in 2006 showed a huge fluctuation every month (see Figure 5-5). The curve established a stable status in 2008. It means that the company was learning the method, such as the point of purchasing, the amount of purchasing, customer taste, to manage the inventory in 2006. However, the curve showed a stable status in 2008 meaning that the company might be able to understand the optimum time to place an order, managing the inventory from collected data.

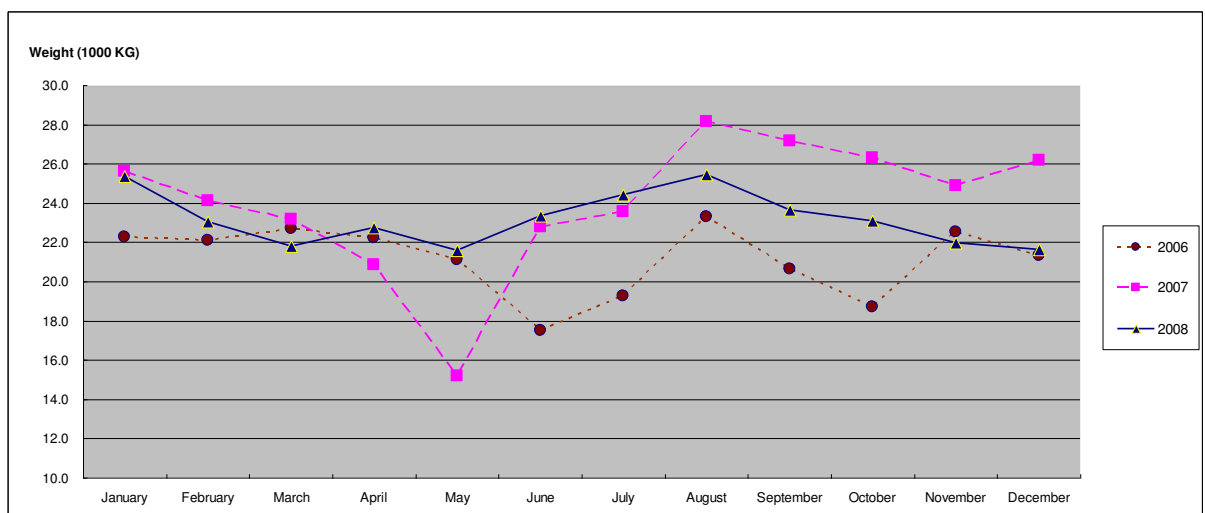


Figure 5-5: The monthly inventory curve

2006	January	February	March	April	May	June	July	August	September	October	November	December
Normal												
Used	817.9	1556.1	2388.9	2321.2	1986.7	1847.2	1272.0	2442.9	1330.8	920.8	1745.8	1214.9
In stock	10832.6	10526.5	9662.6	9771.4	8863.7	7534.5	7585.5	11127.6	9824.7	6874.4	9068.0	7853.1
Value	2388788.0	2313925.0	2112218.0	2025382.0	1919091.0	1655305.0	1667035.0	2272068.0	2047091.0	1408282.0	1743690.0	1545323.0
Specialisation												
Used	2145.2	1495.1	1607.7	2116.5	1873.1	3116.1	2040.0	1786.6	1724.5	903.4	1995.2	2001.8
In stock	11434.1	11573.0	13046.3	12480.8	12242.7	9955.6	11668.6	12197.0	10829.5	11849.1	13467.9	13474.1
Value	7038593.0	7028014.0	7922714.5	7494461.0	7383244.0	6025928.0	6947843.0	7184271.0	6388002.0	7023788.0	7903449.0	8028835.0
weight(all) / kgs	22266.7	22099.5	22708.9	22252.2	21106.4	17490.1	19254.1	23324.6	20654.2	18723.5	22535.9	21327.2
Value (all) / NT\$	\$9,427,381.0	\$9,341,939.0	\$10,034,932.5	\$9,519,843.0	\$9,302,335.0	\$7,681,233.0	\$8,614,878.0	\$9,456,339.0	\$8,435,093.0	\$8,432,070.0	\$9,647,139.0	\$9,574,158.0
sales (month) \$	\$6,432,184.2	\$5,351,953.4	\$7,781,628.8	\$6,976,888.5	\$7,191,664.0	\$7,885,537.5	\$6,410,942.0	\$6,463,410.3	\$5,709,193.2	\$4,595,201.4	\$5,826,140.1	\$6,074,785.5
2007												
Normal												
Used	1254.9	1171.0	2226.9	1922.0	1520.0	1878.5	1736.6	1365.5	886.0	1726.6	1053.0	1708.0
In stock	10317.2	10042.7	8808.3	7582.3	1595.3	6830.8	6473.7	6554.7	6473.7	6328.7	6445.7	7755.7
Value	1935596.0	1935581.0	1696469.0	1494079.0	1532069.0	1487394.0	1414668.0	1443918.0	1422873.0	1391006.0	1420231.0	1606178.0
Specialisation												
Used	1736.9	1196.8	2660.1	2761.0	1165.5	1142.0	1368.4	1685.6	1152.4	1378.4	1541.0	1853.6
In stock	15288.2	14067.4	14352.3	13289.3	13590.8	15975.8	17076.9	21580.3	20674.9	19968.5	18427.5	18406.9
Value	8897429.0	8240528.0	8355230.0	7732435.0	7961160.0	9255950.0	9868869.0	12351366.0	11867787.0	11499053.0	10679693.0	10749070.0
weight(all) / kgs	25605.4	24110.1	23160.6	20871.6	15186.1	22806.6	23550.6	28135	27148.6	26297.2	24873.2	26162.6
Value (all) / NT\$	\$10,833,025.0	\$10,176,109.0	\$10,051,699.0	\$9,226,514.0	\$9,493,229.0	\$10,743,344.0	\$11,283,537.0	\$13,795,284.0	\$13,290,660.0	\$12,890,059.0	\$12,099,924.0	\$12,355,248.0
sales (month) \$	\$4,929,490.2	\$3,666,525.3	\$8,151,469.3	\$7,490,596.4	\$7,610,948.3	\$6,042,059.8	\$5,257,229.6	\$6,421,312.9	\$4,690,994.6	\$4,882,806.1	\$5,464,574.2	\$5,228,047.2
2008												
Normal												
Used	951.7	1159.6	2067.5	2169.4	1835.8	1510.6	800.1	1224.5	1827.0	751.0	1058.0	1760.5
In stock	8634.4	7366.8	6174.3	7514.9	5679.1	7625.5	7421.9	8502.0	7804.0	8517.5	7818.5	8124.0
Value	1793048	1558930.0	1323815.0	1603850.0	1238290.0	1649749.0	1598551.0	1866300.0	1700015.0	1808100.0	1665210.0	1672290.0
Specialisation												
Used	2681.6	1047.2	1382.0	2146.4	932.0	1241.2	920.9	1677.2	1086.2	1293.0	421.4	1205.0
In stock	16741.3	15694.1	15625.1	15248.7	15922.7	15707.0	17005.6	16942.4	15856.2	14563.2	14141.8	13520.8
Value	9854473	9251164.0	9118633.0	8870595.0	9149753.0	9085481.0	9753331.0	9688559.0	9127669.0	8444255.0	8276726.0	7942999.0
weight(all) / kgs	25375.7	23060.9	21799.4	22763.6	21601.8	23332.5	24427.5	25444.4	23660.2	23080.7	21960.3	21644.8
Value (all) / NT\$	\$11,647,521.0	\$10,810,094.0	\$10,442,448.0	\$10,474,445.0	\$10,388,043.0	\$10,735,230.0	\$11,351,882.0	\$11,554,859.0	\$10,827,684.0	\$10,252,355.0	\$9,941,936.0	\$9,615,289.0
sales (month) \$	\$5,873,894.7	\$3,686,261.4	\$6,288,669.6	\$7,205,158.8	\$5,118,335.4	\$6,673,973.2	\$6,221,881.4	\$4,140,544.0	\$4,006,268.3	\$2,728,852.1	\$2,924,323.6	\$3,973,332.4

Table 5-6: The inventory statement (2006-2008)

Chapter 6 Discussion

6.1 Summaries of Conclusion

The global marketplace has changed the strategy of manufacturing. A manufacturer cannot consider its supply chain as a local chain as well as its customers become global and sooner or later international competitors will enter and share the marketplace. The best strategy to obtain market share is to constantly enhance itself in every activity, such as marketing, operation, accounting and so on. In this study, the main research was to investigate the correlation between inventory performance and financial performance. The management of the supply chain activity was a crucial factor that could influence the inventory performance. After examining the studied company and analysing collected data, some conclusions can be identified as follows.

- *Decision making based on inventory is becoming essential due to the changed marketing environment.*

Customers are always seeking suppliers who are able to provide better service. For instance, the duration of delivery, the quality of supplied products and so on. Customer loyalty as well as satisfaction appears to drop if the supplier cannot deliver products on time, so that customers tend to seek other suppliers, particularly in the manufacturing sector. Hence, holding inventory is tool that to deliver products to customers on time and in the required quantity.

Whereas, the trend of holding inventory is becoming an issue in that manufacturers are attempted to lower through reducing levels of inventory. The policy of majority manufacturers is to lower the level of inventory to avoid the high cash cost of storing inventory and the low turnover rate. This policy goes against the requirements of customers (asking manufacturers to hold inventory). Hence, the decision of whether to have a holding the inventory or not and how much to hold is important. Good decision making could enhance the capacity offered to customers. On the other hand, poor decision making could cause the manufacturer to fail in providing enough quantity of products to customers and

even may lose customers.

- *The skill and experience of analysing the collected data and market tendency will influence the decision making and inventory performance.*

The skill and experience of analysing collected data are significantly related to the shortage rate and the turnover rate. Table 6-1 identified the response from interviewees that majority of interviewees argue that shortage rate and turnover rate will be influenced by the existing skill and experience of analysing data, Figure 6-1 shows the correlation of shortage rate and turnover rate towards skill and experience. With a lower turnover rate, materials probably could not be used frequently and usually might not bring in massive orders from customers. A high turnover rate could refer to the high consumption of materials and the efficiency of placing orders. The ability to analyse collected data and experience of placing orders will influence the inventory performance. Experience is the one of the most difficult area of knowledge to impart to other people. One of the best ways to learn the skill of handling contingency is to experience the contingency, such as a shortage of materials. Some people will never learn the solution of contingency if they have not ever met it. In other words, the learning experience belongs to personal intra-knowledge sharing. People may not be willing to share their knowledge and experience due to the personal benefits or conflicts within the company. On the other hand, the managing of inventory is gradually being stable. Figure 5-5 shown the monthly inventory statement. The statement in 2006, first year of employed the new management, was sharply up and down, this is because the management team still learned how to collect and analyse data. In 2008, the inventory curve is stable could an evidence that the team had learned the method of managing inventory.

In addition, the uncertainty of the marketplace also influences personal decision making. Factors of uncertainties, such as seasons, localisation, fashion, new technology and so on, might incur different results. It is also difficult to respond to a variety of contingencies if they are based on a person's limited knowledge and experience. Thus, the impartation of experience and skills could affect the company performance, such as the decision making of holding inventory,

	Whether the skill and experience of analysis the data influences shortage rate?	Whether the skill and experience of analysis the data influences turnover rate?
Chairman	YES	NO
Operation manager	YES	YES
Purchasing manager	YES	YES
Marketing Manager	YES	YES
Accounting manager	NO	YES
Warehouse keeper (A)	NO	YES
Warehouse keeper (B)	YES	YES
Operator	NO	YES

Table 6-1: Questions of shortage rate and turnover rate towards the skill and experience

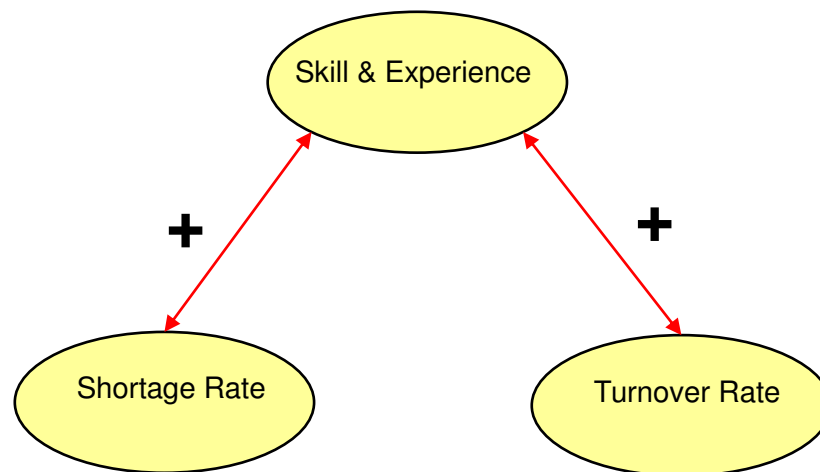


Figure 6-1: The correlation of shortage rate and turnover rate towards inventory performance

- *The method of collecting data will influence the decision making of inventory as well as its performance.*

With the complexity and uncertainty of the marketplace, it is difficult to make an accurate forecast of market demand. Data should be collected from multiple information points and diversity resources, such as customer distributions, the market tendency and so on (Table 6-2 shows the response from interviewees and their recommendations of data collection resources). In addition, an increase number of customers is one of the issues that causes forecasting difficult with every customer has had different requirements. Hence, having constantly improving data collection skills, expanding collected categorisations and scopes, and the capability for data analysis, a company should be able to efficiently control and to cope with the market demand. Figure 6-2 shows the positive correlation between data collection method and inventory performance as well as data collection method and decision making.

Furthermore, it is not only necessary to recognise the demands of the market, but also it is important to control the intra-organisational information sharing and data analysis. The market environment is quite unique in the studied company, being located in a niche market, the market size has limited the development of company technology. Thus, fully understanding of every order (quantity, time, who), the demands of the market (resources of data collection, market tendency), and the capability of data analysis could significantly influence the inventory performance.

	Whether the method of data collection influences the decision making?	Whether the method of data collection influences the inventory performance?	Recommendations of data collection resources
Chairman	NO	NO	Inventory statement Customers database
Operation manager	YES	YES	Inventory statement In and out statement (factory used)
Purchasing manager	YES	YES	Customer distribution
Marketing Manager	YES	YES	Customer distribution Market tendency
Accounting manager	NO	YES	Market tendency
Warehouse keeper (A)	YES	YES	Inventory statement
Warehouse keeper (B)	YES	YES	Inventory statement
Operator	NON	YES	Inventory statement

Table 6-2: Questions of decision making and inventory performance through data collection method

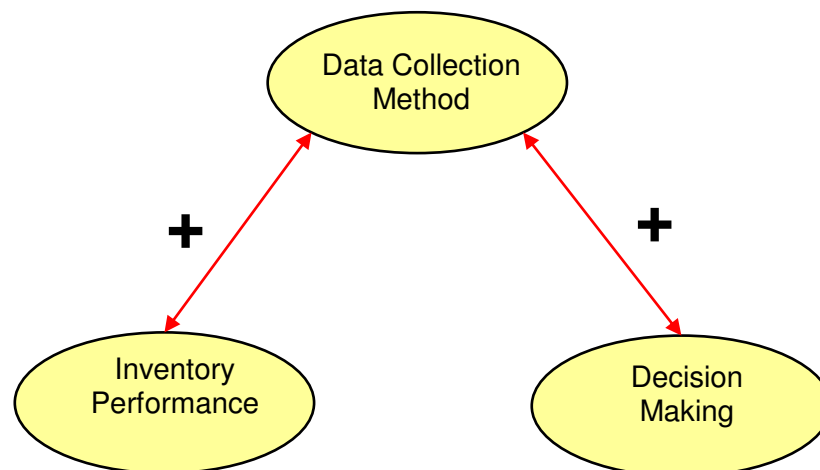


Figure 6-2: The correlation of the inventory performance and decision making towards the data collection method

- *Information sharing in the supply chain will influence the inventory performance*

It is vitally important to access fast and accurate information on inventory performance from the supply chains (customers, suppliers and intra-organisation). The methods of data collection and categorisation are various due to the differences in organisations and departments. Various purposes could cause difficulty in information sharing and handling across organisations. In addition, the policy of inventory management and information sharing need to be considered in relation to operational modes (make-to-order, make-to-stock). For instance, the studied company had two significant product types, which are produced by make-to-order or make-to-stock. The information sharing from suppliers assisted delivering reduction of materials shortage (strong positive), information shared by customers aided the preparation of materials (moderate positive), and information shared in the intra-organisation supported the operation and communication (strong positive). Table 6-3 shows the response from interviewees and Figure 6-3 shows a positive correlation between information sharing and inventory performance. Hence, the coordination of collected data could enhance the capability of scheduling orders and improve the inventory performance.

	Whether the information sharing with suppliers influences inventory performance?	Whether the information sharing with customers influences inventory performance?	Whether the information sharing within the organisation influences inventory performance?
Chairman	YES	NO	YES
Operation manager	YES	NO	YES
Purchasing manager	YES	YES	YES
Marketing Manager	NO	YES	YES
Accounting manager	NO	NON	NON
Warehouse keeper (A)	YES	YES	YES
Warehouse keeper (B)	YES	NON	YES
Operator	NON	YES	YES

Table 6-3: Questions of information sharing towards inventory performance

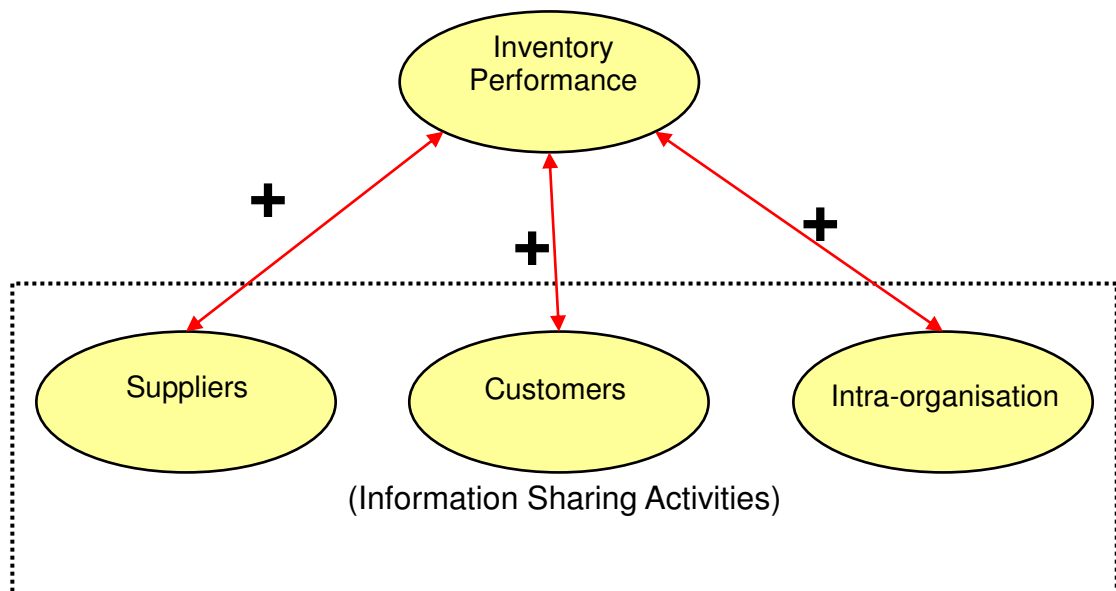


Figure 6-3: The correlation of the inventory performance and decision making towards the data collection method

- *The best technique of decision making is based on the knowledge of the management*

Although the dependence of computer data collection is on highly reliability and validity, it seems there is not enough to support the forecasting of the fast-changing market. The uncertainty of the market and the complexity of the supply chain has made decision making a difficult issue. Hence, the constant generation of experiences by knowledge management will be a crucial factor to assist in the final decision supporting computer-collected data.

The studied company was located in an uncertain and niche market. Several limitations came from the supplier, limited order quantity, long delivery time and specialised material. The same concept applied to customers where the demands of the market were varied due to different locations and time. As a result the best decision the manufacturer had to understand the customer demand, suppliers support, intra-organisational coordination and communication underlying the framework of knowledge.

- *The inventory performance is related to financial performance.*

Lastly, the supply chain activity has facilitated inventory performance in several stances, such as purchasing, the amount of inventory, turnover rate and so on. The findings demonstrated that the company had a significant improvement on these factors. The improvement of these progresses has made the reduction of operation cost, such as the payment can be postponed by L/C payment, the reduction of inventory referred to the improvement of cash flow and the increased turnover rate is related to the reduction of loss due to obsolescence. Hence, it can be concluded that the improvement of inventory performance caused the improvement of financial performance.

Chapter 7 Recommendations and Conclusion

7.1 Conclusions

This research proposed a series of four propositions that correlated inventory performance in the supply chain management and financial performance. The first proposition was that the inventory performance might consist of the intra-organisational information sharing and integration. The second and third reflect to supply chain management and activities. The last proposition related inventory performance and financial performance. Several studies argue that the inventory performance is not closely related to financial performance, it is only a small portion of administration and management expense.

This research was conducted through case study to examine the correlation between inventory performance and financial performance. The research was encompassed around the question: First, does the supply chain activity influence inventory performance and how. Secondly, how inventory performance influence a company's financial performance. According to the interviews and the historical document, the finding shows that the well-operation of inventory management is able to skilfully lever cash flow to improve the cash operation and the company is able to create more cash flow to invest in other business activities. In addition, the supply chain activity is a significant factor in impacting inventory performance. The complexity of organisations and the uncertainty of market demand causes difficult of handling supply chain activities as well as communication. Lastly, the factor of decision making by people (managers and their capability in leadership) is also one of the essential factors on which the company has to achieve.

7.2 Recommendation

Reviewing the studied company, several potential problems and threats were identified. The threat refers to the growing number of competitors (Chinese manufacturers). The fast -rowing market, China, brings in a number of customers; it also comes up with many competitors. The cost problem: cost are involved in

buying materials, administration, improving production skills and the obsolescence of the inventory. First, the specialisation of materials increases the difficulty of purchasing and cost. Second, the increasing cost of improving the staff performance and the extra cost of restructuring. Third, the specialisation of the industry causes the difficulty of forecasting demand and decision making of the inventory. Lastly, although the inventory of steel can be stored for a long time, it still can incur the rust problem because of the environment of the warehouse. Hence, several recommendations are suggested for the studied company.

- *The development of software and personal computer skill, to help data collection and data analysis*
- *Knowledge base to create own technology (the development of new formulation of inventory management)*

A significant issue of improving inventory performance could be the method of data collection and the capability for data analysis. The suggestion toward the decision making of placing orders could focus on the way that data is collected and to avoid mistakes from individuals. This is because computer data collection is just an instrument to aid organisation to collect and analyse data. People should be the last gate to placing the command. Hence the method of placing order should be highly flexible and should pay more attention to the people who made the final decision.

- *Training of middle managers, to deliver better perception to subordinate staff and the skill of preventing contingency*

Basically, the performance of staff will significantly influence the overall performance of the company as well as the inventory performance. Middle managers are people who closely work with staff everyday. Hence middle managers' attitudes towards staff will alter the performance of all staff. For instance, managers with good communication skills and leadership will build a better working environment. On the other hand, poor leadership and communication skills could cause disharmony across staff as well as poor

performance. Consequently, the findings proved the proposition that skill and experience of staff (managers) will influence the performance of inventory and decision making. Hence the company should regularly train middle managers with adequate capabilities, such as skills in communication, motivation of staff, emotion management and leadership of subordinate staff to gain better performance.

7.3 Limitation of the Research

The limitation of this study could be categorised in three parts, the company, data collection and interviewees. First, the market of the selected company was related to a niche market and speciality market which cannot provide a generalisation to all types of industry. The size of the company is small-medium enterprise and belongs to traditional industry.

Second, data collection issues: the studied company was a small-medium size enterprise and the number of employees and structure of the organisation was limited. The interviews of staff and managers cannot be applied to a number of samples, only a few staff and managers could be interviewed. Moreover, the collection of the inventory statement was started in the middle of 2005, hence the adopted statement was from 2006 to 2008 due to the need acquire three whole-year records.

Lastly, the interviewees: because interviews were carried out by telephone interview, the skill of the interviewer was a crucial factor that could affect the responses from interviewees. The skill of the interviewer to deliver different perceptions to interviewees in terms of the skill of the question, the skill in asking general questions and the attitude of asking questions. Hence, the skill of conducting an interview could significantly influence the response. In addition, the answers could also be affected due to the position of the interviewer and personal conflict. This is because even though the interview was carried out by people who do not work there and there is no beneficial conflict, the interviewer still could not influence the accuracy of the answer in their mind.

7.4 Future

Several researchers have studied inventory performance and overall performance of the company, however, there are not many studies on inventory performance and financial performance. Inventory performance was one of the essential factors in this company that needed a high turnover rate. In the case study, the research was done by a small and medium enterprise which attempted to acquire the supply chain concept. The supply chain activity facilitated the company in inventory management which provided the opportunity of financial leverage. Hence the potential risk of holding inventory was reduced and offered a method of effectively managing the cash flow.

A further study which is recommended would be to discover the inventory management in an international company. International companies have adopted several models of the supply chain management, such as JIT, outsourcing, and so on, and have achieved successful implementation in these activities. Hence, first, to deeply research the varieties of operational modes in inventory management towards the company's overall performance as well as financial performance could be a valuable research. Second, individual (personal) performance is one of crucial factors that could influence the decision making. Good decision making in inventory management could aid the company towards success. Conversely, poor decision making could destroy a company. Hence, research toward the managerial style and inventory performance could be valuable to do further research.

References

- Aitken, J., Childerhouse, P., and Towill, D. (2003) “The Impact of Product Life Cycle on Supply Chain Strategy”, *International Journal of Production Economics*, 85(2), pp127-140.
- Anderson, P. F. (1982) “Marketing, Strategic Planning and the Theory of the Firm”, *Journal of Marketing*, 46(2), pp15-26.
- Aviv, Y. (2001) “The Effect of Collaborative Forecasting on Supply Chain Performance”, *Management Science*, 47(10), pp1326-1343.
- Babich, V., Burnetas, A. N. and Ritchken, P. H. (2007) “Competition and Diversification Effects in Supply Chains with Supplier Default Risk”, *Manufacturing & Service Operations Management*, 9(2), pp123-146.
- Bakos, Y. (2001) “The Emerging Landscape for Retail E-Commerce”, *Journal of Economic Perspectives*, 15(1), pp69-80.
- Balaji, K. and Viswanadham, N. (2008) “A Tax Integrated Approach for Global Supply Chain Network Planning”, *IEEE Transactions on Automation Science & Engineering*, 5(4), pp587-596.
- Barnes-Schuster, D., Bassok, Y. and Anupindi, R. (2002) “Coordination and Flexibility in Supply Contracts with Options”, *Manufacturing & Service Operations Management*, 4(3), pp171-207.
- Barton, J. and Mercer, M. (2005) “To Blame or not to Blame: Analysts’ Reactions to External Explanations for Poor Financial Performance”, *Journal of Accounting & Economics*, 39(3), pp509-533.
- Beaumont, N. and Sohal, A. (2004) “Outsourcing in Australia”, *International Journal of Operations & Production Management*, 24(7), pp688-700.

- Benbasat, I., Goldstein, D. K., and Mead, M. (1987) “The Case Research Strategy in Studies of Information Systems”, *MIS Quarterly*, 11(3), pp369-386.
- Benefield, D. (1987) “Consignment: What the Hospital CFO Should Know”, *Hospital Material Management Quarterly*, 8(4), pp29–37.
- Boddy, D., Cahill, C., Charles, M., Fraser-Kraus, H. and Macbeth, D. (1998) “Success and Failure in Implementing Supply Chain Partnering”, *European Journal of Purchasing & Supply Management*, .3(2/3), pp143-151.
- Bourland, K. E., Powell, S. G. and Pyke, D. F. (1996) “Exploiting Timely Demand Information to Reduce Inventories”, *European Journal of Operational Research*, 92(2), pp239-253.
- Bozarth, C. C., Warsing, D. P., Flynn, B. B. and Flynn, E. J. (2009) “The Impact of Supply Chain Complexity on Manufacturing Plant Performance”, *Journal of Operations Management*, 27(1), pp78-93.
- Broekmeulen, R. and van Donselaar, K. H. (2009) “A Heuristic to Manage Perishable Inventory with Batch Ordering, Positive Lead-times, and Time-varying Demand”, *Computers & Operations Research*, 36(11), pp3013-3018.
- Burnetas, A. and Ritchken, P. (2005) “Option Pricing with Downward-Sloping Demand Curves:The Case of Supply Chain Options”, *Management Science*, 51(4), pp566-580.
- Buzacott, J. A. and Shanthikumar, J. G. (1994) “Safety Stock Versus Safety Time in MRP Controlled Production Systems”, *Management Science*, 40(12), pp1678-1689.
- Buzzell, R. D. and Ortmeyer, G. (1995) “Channel Partnerships Streamline Distribution”, *Sloan Management Review*, 36(3), pp85-96.

- Cachon, G. (2004) “The Allocation of Inventory Risk in a Supply Chain: Push, Pull, and Advance-Purchase Discount Contracts”, *Management Science*, 50(2), pp222-238.
- Cannon, A. R. (2008) “Inventory Improvement and Financial Performance”, *International Journal of Production Economics*, 115(2), pp581-593.
- Chandra, C. and Grabis, J. (2008) “Inventory Management with Variable Lead-time Dependent Procurement Cost”, *Omega*, 36(5), pp877-887.
- Chase, R. B., Jacobs, F. R. and Aquilano, N. J. (2006) “*Operations Management for Competitive Advantage*”, 11th ed., London, McGraw-Hill/Irwin.
- Chase, R. B., Jacobs, F. R. and Aquilano, N. J. (2004) “*Operations Management for Competitive Advantage*”, 10th edn, London: McGraw-Hill.
- Chen, Y. (2005) “Vertical Disintegration”, *Journal of Economics & Management Strategy*, 14(1), pp209-229.
- Chow, W. S., Madu, C. N., Kuei, C. H. and Lin, C. H. (2002) “Developing Supply Chain Strategies Based on the Survey of Supply Chain Quality and Technology Management”, *International Journal of Quality & Reliability Management*, 19(7), pp889-901.
- Chow, W. S., Madu, C. N., Kuei, C. H., Lu, M. H., Lin, C. H. and Tseng, H. J. (2008) “Supply Chain Management in the US and Taiwan: An Empirical Study”, *Omega*, 36(5), pp665-679.
- Cohen, M. A. and Agrawal, N. (1999) “An Analytical Comparison of Long and Short Term Contracts”, *IIE Transactions*, 31(8), pp783-796.
- Cottrill, K. (1997) “Reforging the Supply Chain”, *Journal of Business Strategy*, 18(6), pp35-39.

- Christensen, W. J., Germain, R. N. and Birou, L. (2007) “Variance vs Average: Supply Chain Lead-time as a Predictor of Financial Performance”, *Supply Chain Management*, 12(5), pp349-357.
- Davila, A. and Foster, G. (2005) “Management Accounting Systems Adoption Decisions: Evidence and Performance Implications from Early-Stage/Startup Companies”, *Accounting Review*, 80(4), pp1039-1068.
- Dess, G. G., Lumpkin, G. T. and Eisner, A. B. (2008) “*Strategic Management : Text and Cases*”, 4th ed., London : McGraw-Hill/Irwin.
- Dess, G. G., Rasheed, A. M. A., McLaughlin, K. J. and Priem, R. L. (1995) “The New Corporate Architecture”, *Academy of Management Executive*, 9(3), pp7-18.
- Demeter, K. (2003) “Manufacturing Strategy and Competitiveness”, *International Journal of Production Economics*, 81/82, pp205-213.
- Deming, W. E. (1975) “On Some Statistical Aids toward Economic Production”, *Interfaces*, 5(4), pp1-15.
- Disney, S.M. and Towill, D.R. (2003) “The Effect of Vendor Managed Inventory (VMI) Dynamics on the Bullwhip Effect in Supply Chains”, *International Journal of Production Economics*, 85(2), pp199-215.
- Dowlatshahi, S. (1998) “Implementing Early Supplier Involvement Implementing Early Supplier Involvement: a Conceptual Framework”, *International Journal of Operations & Production Management*, 18(1/2), pp143-167.
- Dowlatshahi, S. (2000) “Designer-Buyer-Supplier Interface: Theory versus Practice”, *International Journal of Production Economics*, 63(2), pp111-130.
- Dong, Y. and Xu, K. (2002) “A Supply Chain Model of Vendor Managed Inventory”, *Transportation Research: Part E*, 38(2), pp75-95.

- Elliott, H. (1998) “Inventory--Double-Edged Sword”, *Electronic News* (10616624), 44(2235), p46.
- Ellram, L. M. and Edis, O. R. V. (1996) “A Case Study of Successful Partnering Implementation”, *International Journal of Purchasing & Materials Management*, 32(4), pp20-28.
- Epstein, G. S. (2007) “Production, Inventory and waiting Time”, *Managerial & Decision Economics*, 28(6), pp579-589.
- Ewing, B. T. and Thompson, M. A. (2008) “Industrial Production, Volatility, and the Supply Chain”, *International Journal of Production Economics*, 115(2), pp553-558.
- Finch, D. J. (2008) “Performance through Relationships: A Case for the Integration of Strategic Stakeholder Management and Community Investment”, *Journal of Sponsorship*, 1(4), pp338-349.
- Flynn, B. B., Sakakibara, S. and Schroeder, R. G. (1995) “Relationship between JIT and TQM: Practices and Performance”, *Academy of Management Journal*, 38(5), pp1325-1360.
- Gallego, G. and Ozer, O. (2001) “Integrating Replenishment Decisions with Advance Demand Information”, *Management Science*, 47(10), pp1344-1360.
- Gavirneni, S., Kapuscinski, R. and Tayur, S. (1999) “Value of Information in Capacitated Supply Chains”, *Management Science*, 45(1), pp16-24.
- Germain, R., Claycomb, C. and Droge, C. (2008) “Supply Chain Variability, Organizational Structure, and Performance: The Moderating Effect of Demand Unpredictability”, *Journal of Operations Management*, 26(5), pp557-570.

- Gertler, M. and Gilchrist, S. (1994) “Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms”, *Quarterly Journal of Economics*, 109(2), pp309-340.
- Gunasekaran, A. and Ngai, E. W.T. (2009) “Modeling and Analysis of Build-to-order Supply Chains”, *European Journal of Operational Research*, 195(2), pp319-334.
- Gumus, M., Jewkes, E. M. and Bookbinder, J. H. (2008) “Impact of Consignment Inventory and Vendor-managed Inventory for a Two-Party Supply Chain”, *International Journal of Production Economics*, 113(2), pp502–517.
- Gupta, Y. P. (1990) “A Feasibility Study of JIT Purchasing Implementation in a Manufacturing Facility”, *International Journal of Operations & Production Management*, 10(1), pp31-41.
- Griffin, A., Gleason, G., Preiss, R. and Shevenaugh, D. (1995) “Best Practice for Customer Satisfaction in Manufacturing Firms”, *Sloan Management Review*, 36(2), pp87-98.
- Grossman, S. J. and Hart, O. D. (1986) “The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration”, *Journal of Political Economy*, 94(4), pp691-719.
- Hallihan, A., Sackett, P. and Williams, G. M. (1997) “JIT Manufacturing: the Evolution to an Implementation Model Founded in Current Practice”, *International Journal of Production Research*, 35(4), pp901-920.
- Handfield, R. B. and Ernest, L. N. (1999) “*Introduction to Supply Chain Management*”, Upper Saddle River: Prentice-Hall
- Hardy, T. (2009) “Getting your Product 'First to Market'”, *Australian Anthill*, 32, pp76-76,

- Hariharan, R. and Zipkin, P. (1995) “Customer-Order Information, Leadtimes, and Inventories”, *Management Science*, 41(10), pp1599-1608.
- Harrison, A. and Van, H. R. (2008) “*Logistics Management and Strategy: Competing Through the Supply Chain*”, 3rd ed., Harlow: Prentice Hall Financial Times, 2008.
- Hayes, R. H. and Pisano, G. P. (1994) “Beyond World-Class: The new manufacturing Strategy”, *Harvard Business Review*, 72(1), pp77-87.
- Hill, C. W. L. and Matusik, S. F. (1998) “The Utilization of Contingent Work, Knowledge Creation, and Competitive Advantage”, *Academy of Management Review*, 23(4), pp680-697.
- Jacobides, M. G. (2005) “Industry Change through Vertical Disintegration: How and Why Markets Emerged in Mortgage banking”, *Academy of Management Journal*, 48(3), pp465-498.
- Jayaraman, V., Ross, A. D. and Agarwal, A. (2008) “Role of Information Technology and Collaboration in Reverse Logistics Supply Chains”, *International Journal of Logistics: Research & Applications*, 11(6), pp409-425.
- Jeffers, P., Muhanna, W. A. and Nault, B. R. (2008) “Information Technology and Process Performance: An Empirical Investigation of the Interaction between IT and Non-IT Resources”, *Decision Sciences*, 39(4), pp703-735.
- Jones, D.T. (1995) “Supply Chain Value Streams and Lean Enterprises”, *British Academy of Management Annual Conference*
- Jones, P. and Robinson, P. (2009) “*Operations Management*”, 3rd ed., Harlow : Pearson/Custom Publishing,
- Kakabadse, A. and Kakabadse, N. (2005) “Outsourcing: Current and Future Trends”, *Thunderbird International Business Review*, 47(2), pp183-204.

- Kaminsky, P. and Kaya, O. (2009) “Combined Make-to-order/Make-to-stock Supply Chains”, *IIE Transactions*, 41(2), pp103-119.
- Kerkkanen, A. (2007) “Determining Semi-finished Products to be Stocked When Changing the MTS-MTO Policy: Case of a Steel Mill”, *International Journal of Production Economics*, 108(1/2), pp111-118.
- Klingenberg, B. and Geurts, T. G. (2009) “A Theoretical Framework for Financial Performance Measurement of Operations Management Strategies”, *Proceedings for the Northeast Region Decision Sciences Institute (NEDSI)*, pp427-430.
- Kumar, M. and Ganguli, S. (2009) “Modeling Inventory Management Improvement: Criticalities and Recommendations”, *ICFAI Journal of Supply Chain Management*, 6(1), pp36-48.
- Lai, G., Debo, L. G. and Sycara, K. (2009) “Sharing Inventory Risk in Supply Chain: The Implication of Financial Constraint”, *Omega*, 37(4), pp811-825.
- Latham, S. F. and Braun, M. R. (2009) “Assessing the Relationship between Financial Slack and Company Performance during an Economic Recession: An Empirical Study”, *International Journal of Management*, 26(1), pp33-39.
- Lee, C. C. and Chu, W. H. (2005) “Who Should Control Inventory in a Supply Chain?”, *European Journal of Operational Research*, 164(1), pp158-172.
- Lee, H. L., Padmanabhan, V. and Whang, S. (1997) “The Bullwhip Effect in Supply Chains”, *Sloan Management Review*, 38(3), p112.
- Lee, J. and Schwarz, L. B. (2009) “Leadtime Management in a Periodic-Review Inventory System: A State-dependent Base-stock Policy”, *European Journal of Operational Research*, 199(1), pp122-129.

- Lee, S. M. and Ebrahimpour, M. (1984) “Just-In-Time Production System: Some Requirements for Implementation”, *International Journal of Operations & Production Management*, 4(4), pp3-15.
- Levy, D. M. (1997) “Lean Production in an International Supply Chain”, *Sloan Management Review*, 38(2), pp94-102.
- Li, B. and Lu, Y. (2009) “Geographic Concentration and Vertical Disintegration: Evidence from China”, *Journal of Urban Economics*, 65(3), pp294-304.
- Li, S., Murat, A. and Huang, W. (2009) “Selection of Contract Suppliers under Price and Demand Uncertainty in a Dynamic Market”, *European Journal of Operational Research*, 198(3), pp830-847.
- Liberopoulos, G. (2008) “On the Tradeoff between Optimal Order-base-stock Levels and Demand Lead-times”, *European Journal of Operational Research*, 190(1), pp136-155.
- Lieberman, M. B., and Demeester, L. (1999) “Inventory Reduction and Productivity Growth: Linkages in the Japanese Automotive Industry”, *Management Science*, 45(4), pp466-485.
- Lovell, M. C. (2003) “Optimal Lot Size, Inventories, Prices and JIT under Monopolistic Competition”, *International Journal of Production Economics*, 81/82, pp59-66.
- Luo, W., Liberatore, J. L., Nydick, R. L., Chung, Q. B. and Sloane, E. (2004) “Impact of Process Change on Customer Perception of Waiting Time: A Field Study”, *Omega*, 32(1), pp77-83.
- McLaney, E. and Atrill, P. (2008) “*Accounting: An Introduction*”, 4th ed., Harlow : Financial Times Prentice Hall.

- McIvor, R. and McHugh, M. (2000) “Partnership Sourcing: An Organization Change Management Perspective”, *Journal of Supply Chain Management: A Global Review of Purchasing & Supply*, 36(3), pp12-20.
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min S., Nix, N. W., Smith, C. D. and Zacharia, Z. G. (2001) “Defining Supply Chain Management”, *Journal of Business Logistics*, 22(2), pp1-25.
- Miller, T. and de Matta, R. (2009) “Maximize Profit for Your Strategic Global Manufacturing and Distribution Planning Process”, *Outsourced Logistics*, 2(2), pp30-34.
- Moon, K. L. and Ngai, E. W. T. (2008) “The Adoption of RFID in Fashion Retailing: A Business Value-added Framework”, *Industrial Management & Data Systems*, 108(5), pp596-612.
- Nagurney, A. (2009) “A System-optimization Perspective for Supply Chain Network Integration: The Horizontal Merger Case”, *Transportation Research: Part E*, 45(1), pp1-15.
- Neely, A. (1999) “The Performance Measurement Revolution: Why now and What next?”, *International Journal of Operations & Production Management*, 19(2), pp205-228.
- Netessine, S. and Rudi, N. (2006) “Supply Chain Choice on the Internet”, *Management Science*, 52(6), pp844-864.
- Otley, D. (1999) “Performance Management: A Framework for Management Control Systems Research”, *Management Accounting Research*, 10(4), pp363-382.
- Pagell, M. (2004) “Understanding the Factors that Enable and Inhibit the

- Integration of Operations, Purchasing and Logistics”, *Journal of Operations Management*, 22(5), pp459-487.
- Quinn, J. B. and Hilmer, F. G. (1995) “Strategic Outsourcing”, *McKinsey Quarterly*, (1), pp48-70.
 - Rajagopalan, S., and Malhotra, A. (2001) “Have US Manufacturing Inventories Really Decreased? An Empirical Study”, *Manufacturing and Service Operations Management*, 3(1), pp14–24.
 - Rappaport, A. (2006) “10 Ways to Create Shareholder Value”, *Harvard Business Review*, 84(9), pp66-77.
 - Reiner, G. and Hofmann, P. (2006) “Efficiency Analysis of Supply Chain Processes”, *International Journal of Production Research*, 44(23), pp5065-5087.
 - Roy, R. and Cochrane, S. P. (1999) “Development of a Customer Focused Strategy in Speculative House Building”, *Construction Management & Economics*, 17(6), pp777-787.
 - Saunders, C., Gebelt, M. and Hu, Q. (1997) “Achieving Success in Information Systems Outsourcing”, *California Management Review*, 39(2), pp63-79.
 - Saunders, M., Lewis, P. and Thornhill, A. (2007) “Research methods for business students”, 4th ed., Harlow: FT Prentice Hall.
 - Sarkar, A. and Mohapatra, P. K. J. (2006) “Evaluation of Supplier Capability and Performance: A Method for Supply Base Reduction”, *Journal of Purchasing & Supply Management*, 12(3), pp148-163.
 - Schmenner, R. W. and Swink, M. L., (1998) “On Theory in Operations Management”, *Journal of Operations Management*, 17(1), pp97–113.
 - Schonberger, R. J. (2003) “The Right Stuff, Revisited”, *MSI*, 21(9), pp26-30.

- Sharafali, M. and Co, H. C. (2000) “Some Models for Understanding the Cooperation between the Supplier and the Buyer”, *International Journal of Production Research*, 38(15), pp3425-3449.
- Silver, E. A. (1981) “Operations Research in Inventory Management: A Review and Critique”, *Operations Research*, 29(4), pp628-645.
- Skinner, W. (1974) “The Focused Factory”, *Harvard Business Review*, 52(3), pp113-121.
- Slack, N., Chambers, S. and Johnston, R. (2007) “*Operations Management*”, 5th ed., Harlow: FT Prentice Hall.
- Slater, S. F. and Narver, J. C. (1994) “Market Orientation, Customer Value, and Superior Performance”, *Business Horizons*, 37(2), pp22-28
- Soman, C. A., van Donk, D. P. and Gaalman, G. (2004) “Combined Make-to-order and Make-to-stock in a Food Production System”, *International Journal of Production Economics*, 90(2), pp223-235.
- Soroor, J., Tarokh, M. J., and Shemshadi, A. (2009) “Theoretical and Practical Study of Supply Chain Coordination”, *Journal of Business & Industrial Marketing*, 24(2), pp131-142.
- Spekman, R. E., Kamauff Jr., J. W. and Niklas, M. (1998) “An Empirical Investigation into Supply Chain Management”, *International Journal of Physical Distribution & Logistics Management*, 28(8), pp630-650.
- Stalk, G., Evans, P., and Shulman, L. E. (1992) “Competing on Capabilities: The New Rules of Corporate Strategy”, *Harvard Business Review*, 70 (2), pp57–70.
- Stank, T. P., Keller, S. B. and Daugherty, P. J. (2001) “Supply Chain Collaboration

- and Logistical Service Performance”, *Journal of Business Logistics*, 22(1), pp29-48.
- Stern, J. M., Stewart III, G. B. and Chew Jr., D. H. (1996) “EVA: An Integrated Financial Management System”, *European Financial Management*, 2(2), pp223-245.
 - Stigler, G. (1951) “The Division of Labor is Limited by the Extent of the Market”, *Journal of Political Economy*, 59, pp185–193.
 - Swamidass, P. M. (2007) “The Effect of TPS on US Manufacturing During 1981-1998: Inventory Increased or Decreased as a Function of Plant Performance”, *International Journal of Production Research*, 45(16), pp3763-3778.
 - Swamidass, P. M. and Newell, W. T. (1987) “Manufacturing Strategy, Environmental Uncertainty and Performance: A Path Analytic Model”, *Management Science*, 33(4), pp509-524.
 - Swift, C. O. (1995) “Preferences for Single Sourcing and Supplier Selection Criteria”, *Journal of Business Research*, 32(2), pp105-111.
 - Tan, K. C. (2002) “Supply Chain Management: Practices, Concerns, and Performance Issues”, *Journal of Supply Chain Management*, 38(1), pp 42-53.
 - Tayles, M. and Walley, P. (1997) “Integrating Manufacturing and Management Accounting Strategy: Case Study Insights”, *International Journal of Production Economics*, 53(1), pp43-55.
 - Taylor, D. H. (2009) “An Application of Value Stream Management to the Improvement of a Global Supply Chain: A Case Study in the Footwear Industry”, *International Journal of Logistics: Research & Applications*, 12(1), pp45-62.
 - Timme, S. G. and Williams-Timme, C. (2003) “The Real Cost of Holding Inventory”, *Supply Chain Management Review*, 7(4), pp30-37.

- Tsai, C. Y. (2008) “On Supply Chain Cash Flow Risks”, *Decision Support Systems*, 44(4), pp1031-1042.
- Tunalv, C. (1992) “Manufacturing Strategy--Plans and Business Performance”, *International Journal of Operations & Production Management*, 12(3), pp4-24.
- Tyan, J. C., Wang, F. K. and Du, T. C. (2003) “An Evaluation of Freight Consolidation Policies in Global Third Party Logistics”, *Omega*, 31(1), pp55-62.
- Mazhar, N. (2008) “Inventory and the Bottom Line”, *Industrial Distribution*, 97(8), p16.
- Vachon, S., Halley, A. and Beaulieu, M. (2009) “Aligning Competitive Priorities in the Supply Chain: the Role of Interactions with Suppliers”, *International Journal of Operations & Production Management*, 29(4), pp322-340.
- Valentini, G. and Zavanella, L. (2003) “The Consignment Stock of Inventories: Industrial Case and Performance Analysis”, *International Journal of Production Economics*, 81/82, pp215-224.
- Van der Vaart, T. and Pieter van Dork, D. (2006) “Buyer-Focused Operations as a Supply Chain Strategy”, *International Journal of Operations & Production Management*, 26(1), pp8-23.
- Van Heerdenn, A. and Bosson, S. (2009) “Private Actors and Public Goods - A New Role for the Multinational Enterprises in the Global Supply Chain”, *Revue Management et Avenir*, 23, pp36-46.
- Vastag, G. and Whybark, D. C. (2005) “Inventory Management: Is there a Knock-on Effect?”, *International Journal of Production Economics*, 93/94, pp129-138
- Venkatraman, N. (1997) “Beyond Outsourcing: Managing IT Resources as a Value Center”, *Sloan Management Review*, 38(3), pp110-111.

- Wagner, T., Guralnik, V. and Phelps, J. (2003) “TÆMS Agents: Enabling Dynamic Distributed Supply Chain Management”, *Electronic Commerce Research & Applications*, 2(2), pp114-132.
- Wang H. (2002) “Exogenous Cash: Testing Financing Constraints on Inventory Investment Using Dynamic Panels with Additional Information from Annual Reports”, *Quarterly Review of Economics & Finance*, 42(4), pp779-802.
- Waller, M., Johnson, M. E. and Davis, T. (1999) “Vendor-managed Inventory in the Retail Supply Chain”, *Journal of Business Logistics*, 20(1), pp183–203.
- Williamson, O.E. (1979), “Transaction-cost Economic: the Governance of Contractual Relations”, *Journal of Law and Economics*, 22(2), pp3-61.
- Wijngaard, J. (2004) “The Effect of Foreknowledge of Demand in Case of a Restricted Capacity: The Single-stage, Single-product Case”, *European Journal of Operational Research*, 159(1), pp95-109.
- Wright, M. and Thompson, S. (1986) “Vertical Disintegration and the Life-cycle of Firms and Industries”, *Managerial & Decision Economics*, 7(2), pp141-144.
- Xiaodong X. and Birge, J. R. (2008) “Operational Decisions, Capital Structure, and Managerial Compensation: A News Vendor Perspective”, *Engineering Economist*, 53(3), pp173-196.
- Yao, Y., Evers, P. T. and Dresner, M. E. (2007) “Supply Chain Integration in Vendor-managed Inventory”, *Decision Support Systems*, 43(2), pp663-674.
- Yin, R. K. (2009) “Case Study Research: Design and Methods”, 4th ed., London : SAGE, 2009.

