VENDOR MANAGED INVENTORY PERFORMANCE IN MALAYSIAN MANUFACTURING COMPANIES

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ABSTRACT

The implementation of the Vendor Managed Inventory (VMI) in the Malaysian manufacturing sector can be viewed as a solution to mitigate the increment of operational costs and low performance in customer services. Many factors contributed to the performance of the VMI programme, but only a few attempts were made to determine the contribution of the VMI elements and the organizational factors on VMI performance; and the influence of the types of products in this relationship. The objectives of this study were to determine the relationship and to examine the impact of the VMI elements, the organizational factors on VMI performance, and the moderating effect of the types of products on the relationship between the VMI elements, the organizational factors and VMI performance. The study used the survey method. Data were tested from 101 manufacturing companies listed in the Federation of Malaysian Manufacturers. The findings from the Pearson Correlation test showed that inventory location, managerial commitment, decentralized decision- making, information- system capability and trust have significant and positive relationships with cost performance. Meanwhile, inventory location, demand visibility, inventory-control limits, managerial commitment, information- system capability, and trust have significant and positive relationships with service performance. In addition, the multiple regression analysis showed that demand visibility, inventory- control limits, inventory location, trust, and managerial commitment contribute to VMI performance. The hierarchical regression analyses revealed that the types of products have a significant moderating effect to warrant desirable performance from demand visibility, inventory location, inventory control limits, and inventory- ownership. Therefore, the implementation of VMI in the Malaysian manufacturing sector needs to share demand information, apply minimum and maximum limits for inventory control, locate storage locations near customer premises, establish trust, and provide sufficient managerial commitment to benefit from the VMI programme. This study also suggests that the application of inventory- control limits on innovative products would decrease the cost performance of VMI. Also, inventory- ownership by the supplier on functional products would decrease the service performance of VMI.

Keywords: VMI elements, organizational factors, VMI performance

ABSTRAK

Perlaksanaan program *Vendor Managed Inventory* (VMI) dalam sektor pembuatan di Malaysia boleh dilihat sebagai satu penyelesaian untuk mengatasi masalah peningkatan kos operasi dan prestasi yang rendah dalam perkhidmatan pelanggan. Terdapat banyak faktor yang menyumbang kepada prestasi program VMI. Namun, hanya terdapat sedikit usaha yang dibuat untuk menentukan sumbangan elemen-elemen VMI dan faktor-faktor organisasi terhadap prestasi VMI. Begitu juga apabila diteliti pengaruh jenis-jenis produk terhadap perhubungan ini. Objektifnya adalah untuk menentukan hubungan dan menyelidik kesan elemen-elemen VMI, faktor-faktor organisasi dan prestasi VMI. Kajian ini menggunakan kaedah tinjauan. Data-data yang diuji adalah daripada 101 buah syarikat pembuatan yang disenaraikan dalam Persekutuan Pengilang-Pengilang Malaysia. Data dianalisis menggunakan korelasi Pearson dan analisis regresi berganda. Dapatan kajian daripada ujian korelasi Pearson menunjukkan bahawa lokasi inventori, komitmen pengurusan, pembuatan keputusan yang tidak berpusat, keupayaan sistem maklumat dan kepercayaan mempunyai hubungan yang signifikan serta positif dengan prestasi kos. Sementara itu, lokasi inventori, permintaan yang jelas, had kawalan inventori, komitmen pengurusan, keupayaan sistem maklumat dan kepercayaan mempunyai hubungan yang signifikan dan positif dengan prestasi perkhidmatan. Sebagai tambahan, analisis regresi berganda menunjukkan bahawa permintaan yang jelas, had kawalan inventori, lokasi inventori, kepercayaan dan komitmen pengurusan menyumbang kepada prestasi VMI. Seterusnya, analisis regresi hierarki mendedahkan bahawa jenis produk mempunyai kesan penyerderhanaan yang signifikan dalam menjamin prestasi yang baik daripada kenampakan permintaan, lokasi inventori, had kawalan inventori dan pemilikan inventori. Oleh itu, perlaksanaan VMI dalam sektor pembuatan di Malaysia perlu berkongsi maklumat permintaan, menggunakan had minimum dan maksimum untuk mengawal inventori, menempatkan lokasi penyimpanan berdekatan dengan premis pelanggan, membina kepercayaan dan menyediakan komitmen pengurusan yang secukupnya bagi memperolehi manafaat daripada program VMI. Bagaimanapun, kajian ini juga mencadangkan aplikasi had kawalan inventori terhadap produk inovatif akan menurunkan prestasi kos VMI. Begitu juga, pemilikan inventori oleh pembekal terhadap produk fungsi akan menurunkan prestasi perkhidmatan VMI.

Kata kunci: elemen-elemenVMI, faktor–faktor organisasi, prestasi VMI

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ARP	Automatic Replenishment Programs
ASN	Advanced Shipping Notice
CIM	Centralised Inventory Management
CPFR	Collaborative Planning, Forecasting and Replenishment
CRP	Continuous Replenishment Programs
ECR	Efficient Consumer Response
QR	Quick Response
RR	Rapid replenishment
RBV	Resource-Based View
SCA	Sustainable competitive advantage
SCR	Synchronized Consumer Response
VMI	Vendor Managed Inventory
VRIN	Valuable, Rare, Inimitable, and Non-Substitutable Resources

CHAPTER ONE

INTRODUCTION

This chapter comprises of eight sections, which covers the background of the study, problem statements, research objectives, research questions, significance of the research, terms definition, delimitations, limitations, and organization of the structure of the research.

1.1 Background of the Study

The main challenges of supply chain is the reduction of uncertainties in demand quantity. Reduction of demand uncertainty can result in enhancement of customer service quality and cost. Realizing the benefits of SCM, many manufacturing companies choose the appropriate supply chain strategy. One of the most prevailing collaboration model focuses in reducing demand uncertainty is Vendor Managed Inventory (VMI). VMI had gained more attention from practitioners and academics compared to other collaboration models due to its efficiency in improving service and cost reduction (Chiamsiri, 2008). Lee, Chu, and Hung (2005) also stressed that VMI is becoming an effective approach for implementing the channel coordination initiative, which is critical and imperative to improve the entire chain's cost performance.

VMI was first popularized by Wall-Mart and Procter Gamble in the late 1980s in the retail industry. Successful VMI initiatives have also been trumpeted by many companies such as Whitbread Beer Company, Barilla Company, Johnson and Johnson Company, Kodak Canada International Company, and Campbell Soup Company. Presently, VMI is being implemented in various

industries with different range of products, accessories, and raw materials (Elvander, Sarpola, & Mattson, 2007). For instance, a case study conducted by Kaurema, Smaros, and Holmstrom (2009) and Vigtil (2007) have proven that VMI was also implemented in the automotive, machinery services, chemicals, packaging, and wood and furniture industries.

In VMI programs, the suppliers or vendors (mostly manufacturers) generate orders for the customers (mostly distributors or retailers) based on the demand data provided by the customers (Irungu & Wanjau, 2011). A good relationship between customer and supplier in which suppliers have access to the demand information can results in better forecast and better response to the customers' inventory needs in terms of quantities. This will enhance quick and fast replenishment of products and shipment to customers' location. Hence, the replenishment decisions made by suppliers are more accurate and the orders generated for the customers are more likely to meet the true demand in the marketplace. Thus, the VMI give lot of benefits to the supply chain.

Additionally, the literature (Kaipia, Holmström, & Tanskanen, 2002; Disney & Towill, 2003; Smaros, Lehtonen, Appelqvist, & Holmstrom, 2003) identified reduction in the uncertainty of customers' demand, reduction of inventory level, reduction of stock out number and frequency, more flexibility in production planning and distribution, and improvement of customer services as benefits of VMI implementation. According to Sui, Gosavi and Lin (2010), VMI can give benefits to both customer and suppliers including the increase of services level, inventory reduction, reduce of planning and

ordering costs, ease in coordination of the supply process, and reduced transporters.

Although many studies indicated that VMI programs significantly improved a company's performance, actual results of many VMI programs were disappointing (Muckstadt, Murray, Rappold, & Collins, 2001). One of the executives in the fields of supply chain management exposed that out of ten VMI implementations, only three or four have achieved great benefits (Aichmayr, 2000). Also, a study by Claasen, Van Weele, and van Raaij (2008) on small and large organizations in a variety of industries indicated that there were several improvements in the services when implementing VMI, but their findings on cost reduction were inconclusive. This is because some companies were found to have advantages on reduced transportation costs while others attained benefit more from the reduction of inventory costs whereas only one buyer was mentioned on the reduction in administration costs.

In another study, Kauremma et al. (2009) conducted five cases of VMI program, which involved many industries including machinery services, chemicals, packaging, grocery, and paper. Although, all customers experienced increase in material availability however there was a supplier that experienced decrease in inventory levels. One of the main reasons for weak achievement was because the supplier did not provide a specialized information system for VMI. The cases also revealed that only one supplier experienced production efficiency from the implementation of VMI. This is because the other four suppliers were unable to complement between completed and on-going inter-organizational development efforts.

Similarly, Sarpola (2006), Elvander et a.l (2008) and Zammori, Braglia, and Frosolini (2009) proposed frameworks comprise of several alternatives in designing VMI. These studies pointed out the systematic ways of implementing VMI in order to achieve efficiency in production. Whereas Claasen et al (2008), Kulp et al (2004) and Ramayah et al (2005) examined the relationship between sharing of information and VMI performance by using survey research method. These studies were found to be consistent with Claasen et al (2008) which revealed that information sharing was significantly related to the success of VMI. However, Ramayah, Imad Zbid, and Sazani Shafie, (2005) study was found not consistent with this argument. They concluded that sharing demand information is not significantly related to resource and flexibility performance. Their finding was supported by Kulp et al (2004) that information sharing is not related to immediate performance of manufacturers' out-of-stock. This led to many companies withdrawer from VMI (Lapide, 2001), especially the manufacturing companies due to hesitation about the benefits of VMI program (Dong & Xu, 2002).

In addition, another important factor associated with VMI programs is the organizational factors (Myer, Daugherty, & Autry, 2000). Past studies claimed that managerial commitment, centralization of decisions making, information system capability, and trust can bring impacts on VMI performance (Claasen et al., 2008; Sheu, Yen, & Chae, 2006; Kuk, 2004; Myer et al., 2000). However, in certain cases these factors seem to be less important. For instance, Claasen et al. (2008) found that one of the customers claimed that trust does not play any role in VMI program. While Sarpola (2006) argued that

the information system capability is less significant if the demand uncertainty or the value and turnover of the products are low.

To conclude, the main argument for conducting this research is based on the realization that literature was scarce on the effectiveness of VMI. There is an increasing awareness of VMI in other industries than retailing. Also practitioners are curious about the suitability of the concept for their companies (Vigtil 2007). Among other things, they need to know which products to be included and which VMI elements and organizational factors to adopted (Kaipia, 2007; Holmstrom, 2000). Hence, this study explored the relationships between VMI elements, organizational factors and potentials benefits. The study firstly examined the description of the VMI program and its concept of potential benefits in term of cost and services. Finally, the set of relationships that connects VMI to performance are analysed as findings for this study.

1.2 Problem Statements

Despite widespread recognition of the business potential associated with such optimizations of operational buyer-supplier interfaces, reports on VMI failure are becoming more frequent in the literature (Sheffi 2002; Sparks & Wagner 2003). The implementation of VMI has been criticized as impairing the financial performance of manufacturers (Pohlen & Goldsby 2003). Many companies have discontinued from VMI programs due to inaccurate forecasting and lack of cooperation from their supplier (Sheffi, 2002) and unable to meet manufacturer's needs (CSCMP, Quarter 4, 2011).

VMI failure also could be ascribed to suppliers' lack of supply chain philosophy adoption and understanding of VMI (Ellegaad, 2010). Waller et al. (1999) stressed that the successful of VMI implementation depends heavily on sound business processes. According to Zammori et al (2009) the empirical study on elements of VMI gained less focus. It can be argued that several elements of VMI (ownership of inventory, inventory location, level of demand visibility, information transfer mode, monitoring and ordering mode, replenishment decisions, and inventory control limits) are the major limitation factors affecting VMI performance (Zammori et al., 2009; Vigtil, 2007; Elvander, et al. 2007; Sarpola, 2006). In addition, VMI implementation fails due to inter-relationships and organizational structure (Waller et al. 1999). This claim is supported by Shen et al. (2013) that organizational factor can impede the successful VMI implementation. Past studies claimed that managerial commitment, centralization of decisions making, information system capability, and trust can impact on VMI performance (Claasen et al. 2008; Sheu et al. 2006; Kuk 2004; Myer et al. 2000).

In addition, characteristics of products also plays important role in altering the benefits accrued from VMI implementation. When demands become relatively predictable, the benefits from using VMI program decreased (Yao & Dresner 2006). Besides, if VMI was implemented for innovative products, the buyer was highly involved and willing to provide the supplier with all necessary information. More research is, however, needed in order to establish which products are best fitted for a vendor-managed inventory (Holmstrom, 2000). Based on the findings above, it is important to investigate the underlying causes of VMI programmes failure particularly within Malaysia

manufacturing companies. Hence, this study aims to examine the implementation of VMI by manufacturer. The study will also investigate the extent by which VMI elements, organizational factor and VMI performance influence by product types.

1.3 Research Questions

The purpose of this research is divided into the following research questions:

1. What are the relationship and the influence between VMI elements and VMI performance in Malaysia manufacturing companies?

2. What are the relationship and the influence between organizational factor and VMI performance in Malaysia manufacturing companies?

3. Do the types of products moderate the relationship between VMI elements dimensions, organizational factors dimensions and VMI performance in Malaysia manufacturing companies?

1.4 Research Objectives

In general, the objective of this research is to develop a framework of VMI in Malaysia manufacturing companies. More specifically the main objectives of the study are:

1. To investigate the relationship and the influence of VMI elements on VMI performance in Malaysian manufacturing companies.
2. To investigate the relationship and the influence of organizational factor on VMI performance in Malaysian manufacturing companies.

3. To examine the moderating effect of type of products on the relationship between VMI elements and organizational factors variable and VMI performance in Malaysian manufacturing companies.

1.5 Significance of the Study

Generally, this study could contribute to successful implementation of VMI in Malaysian manufacturing sector. Manufacturing sector is a significant contributor to Malaysian economy where exports of manufacturing products account for RM 719.8 billion, whereas the value of manufactured products account for RM 195.9 billion of total gross domestic product in 2013. However, the manufacturing sector, which accounts for nearly 25% of the economy expanded at a slower pace of 5.1% in the year 2013. Thus, manufacturing sector need to improve their performance to growth continuously. Malaysian manufacturing companies must ensure VMI program is successfully implemented.

In addition, supplier in manufacturing companies requires effective VMI program as a viable solution to improve their competitive advantage and attract more customers. Since, VMI program can lead to increment of sales and better customer relationship, successful implementation of VMI in Malaysia manufacturing companies can contributed to better growth of Malaysia economy.

Similarly, the study in VMI is significant not only to fulfil the gaps in the literatures, but also to promote solutions to mitigate the current problems in manufacturing companies, which included bullwhip effect on demand, increase of inventory cost, on-time delivery, and inventory shortage in

Malaysia manufacturing sector. Unsuccessful of VMI program could lead to drawback that incurs a high cost and loss of sales as termination of contract. Therefore, examining the relationship between organizational factors, VMI elements, type of products and VMI performance could contributes to better understanding the success of VMI program among supplier in manufacturing companies. Thus the study will create awareness among suppliers on the importance of the VMI elements, organizational factors, and type of products in VMI program.

Furthermore, the results of the study will benefits suppliers in manufacturing companies on policies assessment that should be included in contract agreement of VMI program. Suppliers also could focus more on important elements that bring advantages to their organization. Thus, not only avoiding failures of VMI program but also avoiding some of negative effect of the program to supplier.

This study also significant to enrich the theory of resource-based view (RBV) based on the research framework proposed. The RBV views organizational factors, VMI elements, and type of products as valuable, rare, inimitable, and non-substitutable (VRIN) resources, which seem neglected by the researchers when discussing about VMI. Both VMI elements and organizational factors are important to be considered in practicing VMI, which further help to increase the performance in managing inventory. Also, understanding the moderating effect of type of products on relationship between organizational factors and VMI elements and VMI performance can contributed to VMI performance effectiveness. Therefore, the variables of organizational factors,

VMI elements, and type of products are considered as a contribution to the general RBV theory.

1.6 Scope of Study

Despite that empirical study on VMI is considered scarce; discussion on VMI had been covered quite broad and vast. However, there are still lots of unsuccessful VMI implementation program. In the literature most of the researches focus on strategic decisions whereas VMI elements are the root causes of unsuccessful implementation of the program. Thus, this study will focus on the operating elements, which are scarce in VMI study. As the study confront with a variety of arrangement in VMI program, the basic elements of VMI in this study were identified from literature, which include ownership of inventory, inventory location, level of demand visibility, information transfer mode, monitoring and ordering mode, replenishment decisions, and inventory control limits.

Successful of VMI implementation depends on the structural and experiential capabilities of organization, which comprise of financial and human resources. Therefore, this study also focuses on managerial commitment, decentralized of decision making and information system capability, which is among uncommonly discussions in the literature. Therefore, organizational factors as stated above were tested from the perspective of suppliers.

The VMI program also involved with a wide variety type of product characteristic, which includes predictability of demand, volume of demand, product variety, profit margin, and etc. Therefore, the performance of VMI

program employed by manufacturing companies can be expected to differ in which type of product can alter the implication. This study also considers the moderating effect type of product on the relationship between VMI elements, organizational factor and VMI performance.

In addition, many past survey studies on VMI do not separate between buyer and supplier perspectives. This is a clear deficiency with the research on VMI, which abandoned the focus on supplier's perspective. Thus, in a situation where a supplier (usually manufacturer) is responsible to replenish customer's inventory, it is essential to understand what factors will affect VMI performance from supplier's perspective.

1.7 Organization of the Thesis

The four main variables of the research are presented in eight chapters. The Chapter 1-Introduction comprises eight sections, which cover the background of the study, problem statements, research objectives, research questions, significance of the research, limitations, and organization of the thesis of this research. Next, in the Chapter 2- Literature Review, the concept of Vendor Managed Inventory was discuss with review of literature on previous studies conducted on the subject. All literatures review in this study is related to variables and elements of VMI program, type of products, and VMI performance. In addition, the Resource Based Theory also was discussed in order to support the research framework development. Meanwhile, in the Chapter 3–Research framework and hypotheses development, the variables discussed in the literature review were narrowed down to illustrate the key research area of this study. An outlay of the research framework is presented

to visualize the relationships undertaken by this research together with hypothesises statement. The Chapter 4 – Research methodology elaborated the research methods utilised in conducting this study. It starts with the research design, which comprises of purpose of the study and duration, research design strategies, the units of analysis and sampling method. Next section discuss the data collection, followed by questionnaire design, which include VMI performance construct, organizational factors construct, VMI elements construct, type of product construct, and measurement scale. Further section was explained the validity, reliability, and normality. Next, the pilot study was discussed and a short description on the data cleaning and screening and test of responses bias. Further, factor analysis also was discussed. Finally, method of data analysis, which comprises of Pearson correlation test and multiple regression analysis was discussed in order to achieve the research objective. In the Chapter 5-Data Analysis and Findings, the chapter presented the analysis and statistical tests to establish the findings from all the surveys. This chapter also illustrates the use of statistical tools to test the information of the responses. Finally Chapter 6–Discussion and Conclusions, discussed the research findings and conclusions from the findings. The objectives of the study were discussed in separated sections. The implications of the study also were discussed into several division, which are included theoretical, managerial and policy implications. Next, the limitation of the study and the future research also is discussed. Finally, the recommendation of the study also is discussed.

CHAPTER TWO

LITERATURE REVIEW

The purposes of this chapter are to review the concept of supply chain management and followed by a review of literature on the previous study conducted on this subject and concepts. All literatures reviewed in this study are related to the variables and elements of VMI practices, organizational factors, type of products, and VMI performance.

2.1 Vendor Managed Inventory (VMI)

Inventory management continues to be the biggest business challenges as firms attempt to balance inventory cost and customer service demands in an increasing complex environment (Ellinger et al., 1999). In a traditional supply chain, each actor is responsible for their own inventory control and production, or distribution ordering activities (Gronalt & Rauch, 2008). Normally, customers place orders on their suppliers. Since the suppliers have no advance information of requirement they resort to make forecast, which leads to frequent changes to their production and distribution.

This order cycle, inevitably generating demand distortion called the “bullwhip effect”. The bullwhip effect occurs when the downstream unit is transmitted up on the supply chain as inventory replenishment orders move on from one unit to another and substantial information distortion may occur during this transmission that leads to the increasing variance in the orders as one move up the supply chain (Chandra & Grabis (2007). The variance in orders can cause product availability and order quantity failed to "match up", and might result in problems, including excessive inventory investment, poor customer service,

lost sales opportunities, and inefficient production scheduling (Daugherty et al., 1999). With shortening the product life cycle, the enlargement of demand uncertainty and the constant improvement of customer towards the service level as well as the traditional inventory management model have become incompatible.

Vendor-managed inventory is an alternative for the traditional order-based replenishment practices. VMI changes the approach for solving the problem of bullwhip effect. Specifically, VMI is a supply chain strategy where the vendor or supplier is given the responsibility of managing the customer's stock (Disney & Towill, 2003). The customers' company provides the suppliers with the access to their inventories and demand information. Thereafter, the supplier decides when and how much to deliver. This is a fundamental change that affects the operational mode both at the customer and at the suppliers' company. The study shows how replacing purchase orders with inventory replenishments enable the suppliers to improve services while reducing supply chain costs (Waller et al. 1999). In addition, VMI gives the supplier more time to react to its level of demand, and this way brings benefits in production planning (Kaipia et al., 2002).

2.1.1 Definition of VMI

The term VMI has been applied by many researchers and authors in the field of supply chain. However, the interpretations and association of the VMI terms are almost inconsistent in the VMI studies. Hence, this study needs to establish a clear standard of definitions and terms in

order to determine the scope of literature review and meaningful analysis.

According to Yao et al. (2007), VMI is a collaborative commerce initiative where suppliers are authorized to manage buyer's inventory of stock-keeping units, and integrate the operations between suppliers and buyers through information sharing and business process reengineering. Meanwhile, Sarpola (2006) viewed VMI as collaboration between business partners, with the help of the customer's demand and inventory level information, the supplier manages and replenishes the customer's inventory. On the other hand, Ramayah, Tan, Omar, and Dahlan (2008) defined VMI as an inventory planning and fulfilment technique in which a supplier is responsible for monitoring and restocking customer's inventory at the appropriate time to maintain predefined levels. The vendor is given access to current customer's inventory and forecast and sales order information to initiate replenishment as required.

While reviewing the definition of VMI, it comes with many terms that had been claimed as synonyms for VMI. VMI can be referred as Continuous Replenishment (CR) and Supplier-managed Inventory (SMI) (Waller et al., 1999). While Simchi-Levi et al. (2003) differentiated CR with vendor prepares shipment and waiting for customer confirmation. However, they also make a case example of CR similar to the case example of VMI used by Waller et al. (1999). Additionally, Yao and Dresner (2008) also differentiated between CR

and VMI is that with VMI the retailer no longer places order with the manufacturer, but manufacturer make ordering decision on behalf of the retailer based on the shared information received from the retailer. Confusedly, they claimed their definition is consistent with those used in the industry, but they also agreed that the term VMI is widely used when practicing CR. Meanwhile, Kuk (2004) also agreed that SMI is a similar term to VMI. Conversely, Pohlen and Goldsby (2003) argued that VMI differ from SMI where VMI is: (a) deals with independent demand; (b) customer as retailer or distributor, (c) and replenishment based on point of sales data. However, empirical studies had proven that VMI program also involves relationship between manufacturer and manufacturer, deals with dependent demand, and production schedule (Kauremma et al. 2009). Therefore, one may prefer the terms VMI or CR or SMI that embrace same basic principles in replenishing inventory.

The literature also reveals that some researchers and authors also apply umbrella terms where multiple terms are being applied to one term as a general name. Angulo et al. (2004), Sabath et al. (2001) and Ellinger et al. (1999), studied the Automatic Replenishment Programs (ARP), and they claimed that there are several types of ARPs in use, for instance VMI and CRP and more industry specific programs like ECR and QR. While Disney and Towill (2003) used VMI as an umbrella term which includes quick response (QR), synchronized consumer response (SCR), continuous replenishment program (CRP), efficient consumer response (ECR), rapid replenishment (RR), collaborative planning,

forecasting and replenishment (CPFR) and centralised inventory management (CIM). Further Simchi-Levi et al. (2003) classified VMI as one type of Retailer-Supplier Partnership (RSP) together with others program includes Quick Response (QR), and Continuous Replenishment (CR) or Rapid Replenishment (RR). Meanwhile De Toni and Zamolo (2005) argued that VMI, CR, and QR are under the ECR initiatives. Table 2.1 present the umbrella terms and terms they embrace related to VMI.

Table 2. 1
Umbrella Terms and Terms They Embrace Related to VMI

Author (s) and Year	Umbrella term and the term they encompass
Angulo et al. (2004), Sabath et al. (2001) and Ellinger et al. (1999)	Automatic Replenishment Program (ARPs) VMI, CR, QR, and ECR
Disney and Towill (2003)	Vendor Managed Inventory (VMI) QR, CR, RR, ECR, CIM, CPFR, SCR
Simchi-Levi et al. (2003)	Retailer-Supplier Partnership (RSP) QR, RR, VMI, CRP
De Toni and Zamolo (2005)	Efficient Consumer Response (ECR),VMI, CRP, QR

Although the characterizations suggested for VMI are not the same with one another, almost all of the authors emphasized that inventory replenishment responsibility was shifted from customer to vendor with the help of demand data from customer. To conclude, although different terms have been used to describe the inventory replenishment process, attention should be concentrated on the common concept that they agree. Therefore, this study refers VMI a continuous process in which the vendor or supplier (Kauremaa et al. 2009):

1. responsible for the replenishment decision based on predefined agreement with customer;

2. receives or collects the demand data needed from the customer to assist the replenishment decision.

Based on definition of VMI above, term VMI will be used to dictate the responsibility of supplier in managing customer's inventory replenishment. In addition, the term VMI will also be used as a proxy to the umbrella term used in this research to embrace broader discussion on VMI in order to explore more opportunity in enhancing its performance. In fact, several studies also had used VMI as a proxy to the umbrella term (Kauremaa et al., 2009; Vigtil, 2007; Elvander et al., 2007). Although there is a slightly different design of VMI applied by suppliers and customers, the next section presented the typical process flow of VMI.

2.1.2 Overview of VMI Process Flow

The first step in VMI process is sharing demand information. The information sent by the customer to the supplier may contains the historical data, demand forecast, point of sale, assembly plan and other important information (Vigtil, 2007; De Toni & Zamolo, 2005), which would assist the replenishment decision. However, the frequency and accuracy of data exchanged between the supplier and the customer are important factors for VMI to work effectively (Vigtil, 2007; Kaipia & Kallionpaa, 2007).

The second step is supplier responses on the demand information provided by the customer in which supplier will decide either to make inventory replenishment or not. If the demand information is already at

the hand of supplier, the arrangement of inventory replenishment, planning and organizing with the production line will be easier (Kaipia & Kallionpaa, 2007).

Next, in certain VMI practice the Advanced Shipping Notice (ASN) will be issued in advance (Vigtil, 2007; Zammori et al., 2009) to indicate when a shipment will be made and how much quantities will be shipped by the supplier. This notice will facilitate the updating of the inventory record and permit to reduce the fixed cost of receiving inventory (Zammori et al., 2009). The specific quantity and time of goods shipment is based on the agreement between the supplier and customer.

After that, the goods are shipped from the supplier to the customer. It is very important to ensure these shipments are based on accurate data to avoid over or less inventory replenishment (Gnanasekaran, 2000). When the shipment is received, the customer will update the inventory levels, and a receipt of confirmation (arrow number five) was sent to the supplier as a complete shipment. When the customer pull the goods from the storage to sell or use for production process (arrow number six), the customer will update the inventory levels based on actual consumption.

Thereafter, data will be sent to the supplier along with the consumption information and the new inventory levels (arrow number seven). After the inventory level is updated, it is time for invoicing process (arrow number eight). On the customer's side, the system must be able to

receive an EDI order confirmation and using this to create a purchase order in the supplier's system (Holmstrom, 1998). In the final step (arrow number nine), the customer will make payment to their suppliers based on the actual consumption of goods (Kuk, 2004). Figure 2.1 depicted in general, the VMI program process flow.

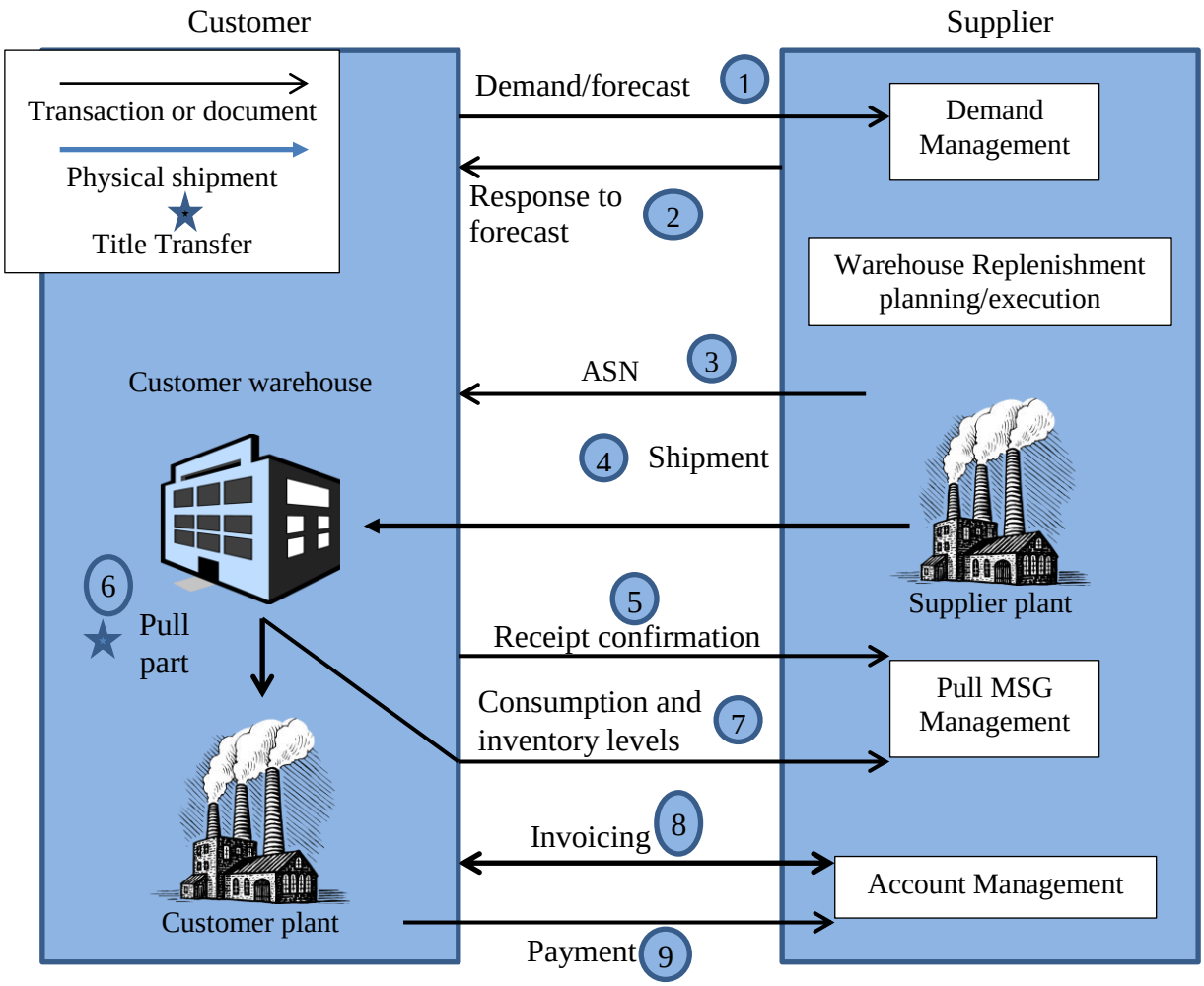

Figure 2. 1
Typical VMI Process
Source: Roberts (2005)

2.1.3 Benefits of VMI

A number of researchers have found significant benefits from VMI practices, which mostly consist of cost reductions and service improvements (Angulo et al., 2004). This section will discuss briefly on the benefits of VMI as identified in the literature. Since information about demand information is visible to the suppliers, fluctuations can be easily expected, suppliers can respond immediately. Therefore, the right product can be supplied to the customer at the right time, in which improving the service level (Kumar & Kumar, 2003). Besides,

improvement in customer service, the supplier can also reduce the inventory related costs. VMI practice was claimed to reduce the obsolescence of safety stocks, holding cost, and inventory level at the supplier side (Kumar & Kumar, 2003, Waller et. al, 1999, Daugherty et al. 1999). In addition, the supplier also can gain advantages when they are capable to conduct parallel production processes based on customer demand (Tyan & Wee, 2003). The supplier also has the opportunity to establish reliable customers and indirectly retain the sales based on a trust that exist in relationship with the customer (Xu et al., 2001).

When considering supply chain holistically, a few more benefits can be identified in VMI program. Among the important advantage is the prevention of sub-optimization, where the supplier in VMI program is allowed to make the decisions about when and how much of customer's inventory needs to be replenished. Supplier need to consider several cost when making the replenishment decisions. It includes customer's actual inventory, handling costs and transportation costs and the costs for maintaining flexible capacity by the supplier, which optimize the decisions made by supplier (Cousins & Spekman, 2003).

In fact, supplier also can access the information regarding to demand, inventory level, and supply chain costs. This would help supplier in making right decisions on behalf of customers, which in turn increase the overall margin. Further, the bullwhip effect also can be reduced, if information is shared between supplier and customer (Potter, & Gardner, 2003). The bullwhip effect occurs when there is uncertainty

of demand or members of supply chain experiences distorted the information flows. Thus, the members in supply chain tend to provide safety stock in order to mitigate the inaccuracy forecasts, which results from distorted information. Then, this safety stock creates differences between production and demand. In general, the bullwhip effect can cause member in supply chain experiences excessive inventory, increased costs, and longer lead times in the supply chain.

The customer benefits are more obvious in reducing administration costs because extensive material requirement for planning is not necessary anymore, whereas individual purchase orders are being replaced by blanket purchase orders (Aichlmayr, 2000; Kumar & Kumar, 2003). Since there will no longer backorders or returns, administration costs will decrease even more (Holmstrom, 1998). Furthermore, the customer benefits from better service levels (Kumar & Kumar, 2003; Tyan & Wee, 2003) due to a higher level of collaboration and better insight in each other's needs.

Although, the VMI program had brought many benefits to the suppliers and customers, each supplier had their own motives to engage in the VMI program. The next section explains the motive of supplier entering in VMI program.

2.1.4 VMI Motives

The purposes for bringing about a collaboration program are clearly different for the customer and the supplier. From the supplier's perspective, generally collaboration programs are believed to guarantee

a future market for the supplier's products. Kurnia and Johnston (2003) had made a study on the interests for entering VMI practice. The result of the study shows why a supplier decides to collaborate in VMI practice. Most of the suppliers rate were "pressure from trading partner (74%)", followed by "unpredictable demand issue (42%)". Also, "underutilization of assets", "poor manufacturing efficiency", and "declining competitiveness" are at 26% interest in VMI collaboration. However, "declining customer service", "inventory unbalance", and increasing product cost are on the list with only 16 percent.

Lapide (2001) supported the most common interest of suppliers which was "pressure from trading partner". Although declining customer service was only voted at low percentage, Daugherty et al (1999) stressed that offering a differentiated service to the customer was an important objective. They added that manufacturers need to be prepared to offer VMI program to implicate the customer service relationship.

While, several supplier viewed VMI practice as a value-added service that offered a long-term relationship between the companies (Varshney & Gupta, 2002). When deciding whether to adopt VMI or not, suppliers also need to consider strategic and managerial matters, such as strengthening the competitive advantage, and tightening the buyer-supplier relationships or simply surviving (Dong & Xu, 2002). To conclude, VMI practice eventually could provide benefits for supplier especially to reduce costs and to improve service to its customer.

2.2 Adoption Rate of VMI

The opportunities and possible benefits of VMI had attracted many companies to adopt VMI program. A survey including the largest US retailer and consumer goods' firms in 1998 (RIS 1999) indicated that 50 percent of the companies were involved in automatic replenishment and VMI in 1998 and it was expected to increase up to 75 percent by 2001. Meanwhile, Mattson (2002) and Olhager and Selldin (2003) indicated that the adoption rate is 16 percent and 15 percent in Sweden respectively.

Presently, Malaysian manufacturing sectors face heightened levels of competition in both domestic and international markets. Despite its spectacular achievements in the manufacturing sector, Malaysian manufacturers faced several issues. The main issues were the impact of bullwhip effect on demand, increase of inventory cost, on-time delivery, and inventory shortage (Omar, Zailani, & Sulaiman, 2008). Consequently, several Malaysian researchers had proposed VMI as an alternative to mitigate the current issues in Malaysian manufacturing companies (Shaharudin et al., 2011; Mustaffa & Potter, 2009). Although, the level of VMI program adoption in Malaysian context was unknown, there was a study of VMI program in manufacturing sector.

For instance, Ramayah et al. (2005) investigated the extent of VMI and its influence to the contract manufacturers performance, particularly, in terms of demand sharing, information sharing and strategic partnership. They used questionnaires as the survey method and obtained a return of 80 questionnaires, which represent 54 percent from Malaysia, Singapore, Philippine, and Thailand. Meanwhile, Roaimah Omar, Ramayah, Lo, Sang,

and Rusinah Siron (2010) examined the level of information sharing, information quality and usage of information technology tools among manufacturing companies located in the northern region of Malaysia. They found that VMI was ranked second as an IT tool. In previous study, Ramayah, et al. (2008) examined the impact of VMI as an IT tool on the supply chain performance in the northern region of Malaysia. They successfully collected 58 usable questionnaires.

To conclude, although there was no statistic regarding the adoption rate of VMI in Malaysia, findings from several researches in Malaysian context shows Malaysian manufacturing companies, especially, had practiced VMI concept. In fact, many manufacturing companies in Malaysia had driven to increase the number of their suppliers to engage in VMI practice (Panasonic Annual Report, 2010; ECNet, 2011).

2.3 Empirical Research on VMI

The concept of VMI program has received attention in the industrial world (Sui et al., 2010), as the model differs significantly from the traditional practice in bringing benefits to the company (Yu, Zheng, & Zhao, 2009). Thus, many studies attempted to determine factors that contribute benefits to the participated companies (Claasen et al., 2008, Kuk, 2004). Although the use of survey method in the study of VMI practice was limited, literature revealed that researchers used different terminologies to dictate the performance of VMI. For instances, Kuk (2004), Myer et al (2000), and Daugherty et al. (1999) used the term VMI effectiveness. Meanwhile, in others studies, Claasen et al. (2008) used term performance, Ellinger et al. (1999) and Stank

et al. (1999) used VMI related goals, and Stank et al. (1999) used performance related goals and operating changes.

Eventually, most of the studies sought factors that influenced the VMI performance. Such factors are organizational factors and VMI elements. Information system capability is one of the important variables that gains much attention in the VMI practices. A study by Irungu and Wanjau (2011), Claasen et al. (2008), Kuk (2004), Daugherty et al. (1999) revealed that information system capability determined the effectiveness of VMI. However, the contribution of information systems is not significant because the firm only manage a small number of inventories (Daugherty et al., 1999). Meanwhile, the effect of firm size on VMI performance was also investigated. It is indicated that firm size had a negative and significant relationship on cost reductions but the result differed on service improvement (Myer et al., 2000). Similarly, findings by Kuk (2004) had shown that large firm had low expectation and perceived on cost and service performance compared to small size companies.

Another variable of organizational factors that affect VMI effectiveness is the managerial commitment (Myer et al, 2000). Managerial commitment was found to have significant relationship on cost reductions and service improvement. Kuk (2004) also evaluated the effect of managerial commitment on VMI effectiveness, however he used the term employee involvement as a proxy to the managerial commitment. The finding showed a weak correlation between employee involvements and cost reduction was found (Kuk, 2004). In addition, a study on centralized decision making also indicated a significant

relationship on service effectiveness, but different result to cost effectiveness (Myer et al., 2000). In terms of VMI elements, the relationship between the level of demand visibility and VMI effectiveness was also tested by several researchers (Kulp et al., 2004; Ramayah et al., 2005; Claasen et al., 2008). Kulp et al. (2004) studied the effect of information sharing on wholesale price, stockouts, and profit margin. Meanwhile, Ramayah et al. (2005) studied the relationship between information sharing and contract manufacturer's performance. On the other hand, Claasen et al. (2008) studied the relationship between information sharing, success of VMI, and VMI performance. Recently, Irungu and Wanjau (2011) studied the relationship between information sharing and quality with VMI effectiveness.

Other variables studied were the standardization of VMI design, product cost volatility, competitive intensity, market oriented strategy, and profit-oriented strategy (Myer et al., 2000). However, only product cost volatility and market oriented strategy had significant relationship on VMI effectiveness. In other studies, VMI effectiveness not only treated as dependent variable, but also it could become an independent variable. In a study by Daugherty et al. (1999), VMI implementation and information system capability become antecedent to VMI effectiveness, and VMI performance as dependent variable for VMI effectiveness. While in Myer et al. (2000) study, VMI effectiveness also acted as an independent variable, whereby organizational factors, strategic factors, transaction cost as antecedent variables and firm performance as dependent variable.

A case study approach also has gained attention from researchers compared to survey approach. Recently, Niranjan, Wagner and Nguyen (2011) conducted a multiple case to enrich and validate the framework in evaluating the VMI readiness of firms. Fifteen features that determine the suitability of VMI are identified. The framework can be broadly categorized as product feature, company feature, and supplier related feature. The proposed framework was validated through the application of ten firms as case study samples. The framework can be used by other firms to support the decision of whether or not to adopt VMI. On the other hand, Zammori et al. (2009) defined the standard structure of a VMI agreement based on a case study method. The main body of agreement includes a preamble, whereas clause, scope of work, terms and conditions, service level agreement. Meanwhile, the technical aspects and relation-specific topics should be addressed in the annexes. As the VMI relationship evolves over time, changes will affect only the annexes leaving the main body of the agreement unaltered and the flexibility of the agreement can be increased (Zammori et al., 2009).

Meanwhile a multiple case study conducted by Kauremaa et al. (2008) shows a positive impact on the performance of buyer's side, but a mixed effect can be observed at the supplier's side. Further, Kauremaa et al. (2008) proposed three patterns of VMI that comprise of basic, cooperative, and synchronized. In the basic pattern supplier is given responsibility to make inventory replenishment and customer provides the necessary information to supplier. For cooperative VMI, the model requires customer and supplier to have mutual goals and working together to improve the supply chain. Meanwhile, the synchronized model, the supplier requires an increasing level of

integration of downstream information to improve the decision making process and operations.

Claasen et al. (2008) also conducted an exploration study on three suppliers and three buyers concentrated on few areas, which includes the relationship between customer and supplier, control levels, information, information systems, and the VMI performance. They argued that by imposing a tight inventory level by buyer will cause inflexibility to the supplier to replenish the inventory. Although, all customers and suppliers experience increment in controlling the supply chain, but with respect to costs, their findings were mixed. Further they found that different type of products influenced the VMI design. In the context of where innovative product involved, buyer always participated and agreed to make available the necessary information. Conversely, if there is functional product, supplier had to take the responsibility managing the entire chain with low participation of customer.

A comprehensive framework of VMI model has been developed by Elvander et al. (2008). Based on empirical evidence provides by Hines, Lamming, Jones, Cousins, and Rich (2000), the data from 15 companies were used to conceptualize the VMI model. In their framework, four dimensions of VMI design were identified namely inventory control, information, decision making, and integration level. However, they excluded the role of type of products as discussed by Hines et al. (2000).

Sarpola (2006) proposed the basic elements of VMI to differentiate VMI systems from one another, which comprise of inventory location, distribution model, inventory level monitoring and demand visibility, role of information

systems, replenishment decisions, and inventory ownership. He argued that type of products has influences on each one of the VMI elements as proposed. Further, based on a set of five case studies, Vigtil (2007) described that sales forecasts and inventory level are the most valuable information provided to the suppliers by buyers in a VMI relationship. Some information are found valuable while others are found not to be of importance. She also found that types of demand information shared differed with the type of supply chain activities being performed by the customer. De Toni and Zamolo (2005) presented a case study to demonstrate the benefits of VMI in Italian appliance company. They described the implementation of VMI by Electrolux in Italy and the improvements over the old system that it created. They also presented six key characteristics of VMI that are differentiated from traditional replenishment: order generation, exchanged data, used devices, the management and planning of production by supplier, performances and application contexts.

In another study, Tyan and Wee (2003) conducted a case study between Procter & Gamble (supplier) and Wellcome (buyer) supermarket. The case also shows the cancellation and overrode of order occurred at every phase of VMI, in which it may lead to overstock at the Procter & Gamble distribution centre. The results also illustrated, if it is implemented successfully, it may result in cost reduction, reduce inventory level, service level improvement, billing accuracy, reduce order cycle and fill rate. However, the impact of VMI practices on P&G was not studied. Meanwhile, ten Fortune 500 consumer products manufacturing companies involved in VMI was studied by Vergin and Barr (1999). The study shows that VMI customers have benefited from

the improved availability and lower stock levels, but only two of the VMI suppliers have been able to realize a better management of production and only one has achieved lower inventories. However, the study did not present a clear explanation for these negative effects; they deduce that it may have been caused by incapability of the supplier to reach the threshold volume level of 30 percent to 40 percent. The Table 2.2 summarized several empirical studies on VMI.

Table 2. 2

Summary of Selected Empirical Research of VMI

Author (Year)	Setup	Key findings
Irungu and Wanjau (2011)	Perception of 24 retail supermarket chains	The results indicate that VMI effectiveness as a system is affected by inventory flow, the quality of ICT and quality of information and sharing but is not affected by the quality of relationship.
Borade & Bansod (2010)	Perception of 131 Indian industries in adopting VMI	The results indicate that organizational objectives, strategic drivers, organizational barriers and affected operational areas in adopting VMI are different in large and small industries.
Claassen et al. (2008)	Perceptions of 64 Dutch buyers using VMI	VMI success is contributed by relationship quality, IS, and quality of information and communications system; the influenced of VMI impacts: (1) customer service (from the VMI-supplier to the VMI buyer); (2) supply chain control; (3) cost reduction
Ramayah et al. (2005)	Perception of 80 contract manufacturer using VMI	The results show that information sharing and strategic partnership do have a positive impact on CM performance. The higher the level of both factors, the higher the CM performance. While demand sharing does not has a positive impact on CM performance.
Kulp et al. (2004)	Perceptions of 54 US food and consumer goods manufacturers	Among the six supply chain collaboration models, only VMI as collaboration model that significantly with higher perceived profits
Kuk (2004)	Perceptions of 94 VMI users within 25 companies in the electronics sector, having fully implemented VMI	Organizations with high levels of employee participation and logistics integration are more likely to realize the potential values of VMI

Table 2.2 Continued

Myer et al. (2000)	Perception of 75 manufacturer and 23 retailer in member of Council of Logistic Management	Many of the posited relationships were either not sustained or results were not as predicted. Supported relationship on cost: product cost volatility, market oriented strategy, commitment. VMI performance also has impacts on strategic performance.
Ellinger et al. (1999)	Perceptions of 76 manufacturers and 23 retailers in the US retail industry	Companies with VMI share of over 20% of business considered the operational benefits higher than the other companies
Daugherty et al. (1999)	Perceptions of 76 manufacturers and 23 retailers in the US retail industry	The delivery mode within the VMI arrangement and real time data availability was perceived to have a positive influence on the operational impacts of the VMI model
Niranjan et al. (2011)	Identify and validate the framework for evaluating the VMI readiness of firms from 10 case study firms.	Propose a framework of VMI readiness of firms comprise three features: Product, company, and supplier.
Zammori et al. (2009)	Defined standard structure of VMI agreement based on application of VMI in a superconductor manufacturer	Discussed basic work of VMI include responsibility to make replenishment decisions, ownership of inventory, replenishment policies(min-max limits), share information, inventory location, conditions of storage, products, and mode of communication.
Kaipia (2009)	Study how companies can select a supply chain planning mechanism to improve the balance between material flow and information flow with data from 6 manufacturing companies	Proposes a framework for finding the balance between information flows and material flows and for applying a coordination mechanism.
Kauremaa et al. (2008)	Proposed the VMI pattern with information from 5 VMI relationship	Propose three VMI patterns and five contextual inhibitors of VMI impacts
Gronalt & Rauch (2008)	VMI implementation in solid structure timber producer.	They layout the necessities for reconfiguring the business processes which include 1) top management commitment, 2) process redesign, 3) developing inventory management systems, 4) develop a prototype, 5) test the prototype, and 6) Implementation VMI is able to reduce the overall raw material stock by more than 37% by simultaneously increasing the service level.
Claasen et al. (2008)	Investigate the enabler for success, VMI performance and design from three suppliers and three buyers	The results indicate that VMI can be applied for a variety type of product and demand patterns. The cost performance was mixed. They found that different situations lead to different VMI designs.

Table 2.2 Continued

Elvander et al. (2007)	Proposed the VMI framework based on the data from 15 firm engaged in 9 unique relationship, which had 6 different VMI design	Propose a design framework of VMI models comprise of four dimensions: Inventory control, information, decision making, and integration level.
Vigtil (2007)	Investigation of the requirement information sharing in VMI based on 5 supplier-customer relationship	Current inventory status and sales forecasts are the most important kinds of information for the suppliers in the VMI. The needs for information system depend on the operating mode of the buyer
Toni and Zamolo (2005)	VMI execution at Electrolux towards its suppliers	Presents a framework on the applicability criteria of the VMI: order generation, exchanged data, used devices, the management and planning of production by supplier, performances and application contexts.
Tyan and Wee (2003)	VMI execution between Wellcome (Taiwanese retailer) and Procter & Gamble (P&G)	Inventory levels at buyer's (Wellcome) distribution centre decreased and service level from the distribution centre to stores increased. P&G impacts not studied
Vergin and Barr (1999)	Perceptions of VMI of ten US consumer goods manufacturers	The studied ten manufacturers reported that on average they perceived their retailer customers have reduced inventory levels by 20- 50% and stock outs by 40-90%. However, only 2/10 manufacturers reported a better management of own production and 1/10 a decrease in own finished goods inventories

2.3.1 The Mixed Effect of VMI Performance

Holmström (1998) investigated the VMI practice through a case study between a vendor (supplier) and a wholesaler (customer). He stated that after the full scale introduction of VMI program did significantly reduces the delivery and administration costs for all the vendor's products. However, he did not affirm the reduction of the delivery and administration cost actually occurred among the vendor or wholesaler. The pilot implementation of VMI did significantly reduce demand variability of vendor from 75 percent to 26 percent, and the vendor's

operational efficiency resulting from full implementation of VMI program, which also showed increasing delivery frequency, reducing cycle stock at the wholesaler and reducing order cycle time from 48 hours to 10 hours. Meanwhile, new jobs have been created in the order office of the vendor, and several works and roles of the account manager and logistics managers have also changed. These changes are the results of an increase of administration cost at the vendor side to support VMI practices.

Daugherty et al. (1999) examined the implementation of VMI and capability of information systems toward the effectiveness and performance of VMI through a survey of US manufacturers and retailers. The authors claimed that it had been highly effective in terms of improving or increasing customer service levels, achieving fewer stockouts, improving reliability of deliveries, and causing faster inventory turnover. However, they also reported less effectiveness in relation to achieve a reduction in key business areas in terms of over-stocks, reduced inventory holding, returns and refusals, handling, and product damage. In addition, the capability of VMI in reducing the need to discount product shows that it is less effective.

Besides, the study indicated a positive relationship between the VMI effectiveness and VMI implementation level. The study did; not cover other important dimensions such as distribution model, inventory management, and decision making (Hines, 2000; Elvander et al., 2007), which among the important elements that would assist the VMI practice to operate more effectively. In addition, Daugherty et al.

(1999) also did not separate the effectiveness of VMI from the perspective of manufacturers and retailers, which leads to mix results of VMI effectiveness.

The Ten Fortune 500 consumer products manufacturing companies, which involved in VMI was studied by Vergin and Barr (1999). The study shows that VMI customers had benefited from improved availability and lower stock levels, but only two of the VMI suppliers had been able to realize a better management of production and only one has achieved lower inventories. Although the study did not present a clear explanation for these negative effects, they deduced that it may have been caused by incapability of the supplier to reach the threshold volume level of 30 percent to 40 percent. However, supplier and customer had benefited from VMI practice including lowering the inventory and reduces the stock out rate at the customer side. Most of the suppliers also stated that they achieved fewer rejects, fewer claims, and increase in sales.

Meanwhile, Stank et al. (1999) evaluated the levels of involvement in cross-organizational collaboration among firms utilizing VMI. The results provided moderate effectiveness in terms of operating process changes including more predictable order cycles, more receivers' friendly loads-planning, shorter production runs, and less effective in delaying final production. In terms of performance in achieving performance goals, respondents achieve increased/improved customer service, few stockouts, improved reliability of deliveries, and faster inventory turns. However, less efficiency in terms of reduced

overstocks, reduced inventory holdings, reduced handling, reduced costs, and reduced product damage was identified in their study.

Waller et al. (1999) used simulation to study the effect of demand variability, adoption rate, and limited manufacturing capability on supply chain inventories of VMI practice at Hewlett-Packard. The results on the effect of low to high demand variability presented in the inventory reductions for the VMI distribution centre were greater than 85 percent due to dramatic reductions in cycle stock that arose from frequent deliveries as well as a modest reduction in safety stock. In the case of adoption rate of VMI, the manufacturer got greater benefits when major retailers adapted the VMI to meet more demands, but retailers' additional benefits due to the increased of VMI adoption rates was minimal. Meanwhile, the relationship between manufacturing capacity and inventory requirements with a higher plant utilization only shows a slightly increase in the inventory requirements. They implied that VMI practice allowed the manufacturer to diminish the excess capacity and achieve high production efficiencies without increasing inventory. However, Waller et al. (1999) only simulated the moderate demand variability to examine the effect of adoption rate and manufacturing capacity, whereas, the different demand variability may produce a different effect on VMI performance.

The effect of VMI practice in Taiwanese grocery industry was studied by Tyan and Wee (2003), which involved a case between P&G (supplier) and Wellcome (buyer), a supermarket chain store. The results illustrated that VMI practice, if implemented successfully,

might result in reducing cost and inventory level, improving service level, increase billing accuracy, reducing order cycle and fill rate. They also found that the service level was increased more than expected, but the targeted inventory level failed to achieve 10 days of inventory due to inaccurate forecast. At the end of phase three of VMI implementation, the inventory level was slightly increased compared to previous phase, from 13 days of inventory to 16 days of inventory. On the other hand, Tyan and Wee (2003) did not discuss the effect of VMI program to P&G as to support the high service level at the Wellcome distribution service centre. Noticeably that a high service level may require P&G to stock high inventory at their distribution centre which in turn can increase the cost associated with inventory control and management. In addition, the case also shows that cancellation and overrode of order occurred at every phase of VMI that may lead to overstock at the P&G distribution centre.

Kulp et al. (2004) researched on the impact of information sharing and manufacturer and retailer collaboration on the manufacturer's profit margins. This was accomplished using a survey of 54 senior executives in the Food & Packaged Consumer Goods industry. They expected that manufacturer strives to increase the wholesale price and reduced stockout rate to bring impact on the profit margins positively. Here, it was found that participation in VMI could not be associated with stockout rate and whole sales price. However, they pointed out that if VMI had a direct effect on the profit margin, the benefit for the buyer was certain, but the effect to the supplier was unclear.

On the other hand, research carried out by Kaipia and Kallionpaa (2007) examined the types of flexibility that could be affected by information sharing in VMI. The results showed that synchronizing the production schedule according to downstream production plan reduced the inventory level and the order cycle time from 0 to 20 days with a more accurate order due to precise aggregate forecast. However, synchronizing the planning process was compensated with the rise of production cost.

Claasen et al. (2008) investigated the performance of VMI from a buyer's perspective through a survey of 64 respondents from a variety of industries. In terms of inventory cost, administration cost, flexibility, customer service level, and number of stockout, the study had shown a fairly positive effect on VMI performance. However, transportation and materials handling cost, customer responsiveness and forecasting accuracy had less impact on the performance. These results are not surprising in VMI due to most of the activities in managing inventory was burdened on the supplier and it was supplier's responsibility. Claasen et al. (2008) also conducted an exploration study. From the perspective of the buyer, VMI helped to reduce incorrect order, but only one buyer experience a decrease in administration costs. They also argued that imposing a tight inventory control by the buyer can caused inflexibility to the supplier to replenish inventory. However, most of the suppliers were able to raise their sales margin. Meanwhile, the buyers and suppliers showed that they could gain better on control on the supply chain. However, there were mixed

results in cost performance. Some had gain improvement in reducing the inventory costs, while others capable in reducing the transportation costs.

On the other hand, Liu, Lu, and Shi (2008) introduced three parameters, namely the fixed and variable transportation cost, and the service cost per unit. A model was developed to compare the performance of the supply chain between non-implementing VMI and implementing VMI. They summarized that VMI could reduce the total logistic cost of the supply chain, but the total logistic cost for the supplier was not decisive. Further, the contract purchase price between supplier and customer also led to no deception occurred under VMI practice. The results also showed an increase of buyer's profit.

Meanwhile, Yao and Dresner (2008) have developed models to value the benefits and distribution of benefits from VMI program with a two-level supply chain (supplier and customer). Results from the model revealed that frequent replenishments have reduced the cycle stocks and safety stock. However, benefits from inventory reduction are not equally distributed between the manufacturer and the retailer. They also stated that the distribution of benefits is determined by certain parameter, such as replenishment frequency and inventory holding costs. The results show that when the replenishment frequency is higher and the inventory holding cost is low, then the manufacturer will benefit more from inventory reduction.

Kaurema et al. (2009) had conducted an exploratory multiple case study with the data from five operational VMI dyads. The result

showed a mix impact in terms of inventory reduction on the buyer and supplier's side. Three buyers reported that they were able to reduce the inventory level, and the other two buyers claimed no impact. Meanwhile, two suppliers reported an increase on the inventory level, one supplier showed a decrease impact, and one supplier indicated no impact. All the three suppliers say no impact on production efficiency, except for one, stated there was an increase on the production efficiency. However, all the buyers and suppliers noted a positive impact on the material availability to the buyer and forecast accuracy of the supplier. Further, at the buyer's side shows a decrease in replenishment works. Conversely, the supplier showed an increase in replenishment works. This circumstance could be due to the shifts of responsibility to replenish inventory from buyer to supplier.

Based on the findings from various studies, the performance of VMI showed a mix result as presented in Table 2.3, specifically in terms of cost reduction and service improvement. Some of the studies indicated a positive effect and the other show conversely. Therefore, the limitations of the study are discussed in the next section.

Table 2. 3
Different Findings on VMI Performance

VMI Performance	Author(s)		
	Less/no effect	Moderate effect	High effect
Increased revenue	Liu et al. (2008)		Claasen et al. (2008)
Shorter production runs		Stank et al. (1999)	
Increased/faster inventory turn		Stank et al. (1999)	Daugherty et al. (1999)
Smaller shipments		Stank et al. (1999)	
Delayed final production (postponement)	Stank et al. (1999)		

Table 2.3 Continued

Reduced holding cost		Daugherty et al. (1999)	
Reduced Inventory cost (in general)	Claasen et al. (2008)	Daugherty et al. (1999) Claasen et al. (2008)	
Lower production cost	Kaipia & Kallionpaa (2007)		
Fewer product return due to quality or obsolescence	Vergin & Barr (1999)		Vergin & Barr (1999)
Reduced transportation cost	Claasen et al. (2008) Liu et al. (2008)		Holmstrom (1998) Claasen et al. (2008)
Reduced administration cost	Claasen et al. (2008) Kaurema et al. (2009)	Claasen et al. (2008)	Holmstrom (1998) Kaurema et al. (2009)
Reduced inventory	Stank et al. (1999) Vergin & Barr (1999) Yao & Dresner (2008) Tyan & Wee (2003) Kaurema et al. (2009)	Vergin & Barr (1999)	Holmstrom (1998) Waller et al. (1999) Kaipia & Kallionpa (2007) Yao & Dresner (2008) Kaurema et al. (2009)
Reduced over-stocks	Stank et al. (1999)	Daugherty et al. (1999)	
Reduced handling cost	Stank et al. (1999) Claasen et al. (2008)	Daugherty et al. (1999)	
Reduced ordering cost	Stank et al. (1999)		
Reduced safety stock		Waller et al. (1999)	Yao & Dresner (2008)
Reduced cycle time (processes order)			Holmstrom (1998) Kaipia & Kallionpaa (2007)
Reduced product damage	Stank et al. (1999)	Daugherty et al. (1999)	Vergin & Barr (1999)
More frequent deliveries		Stank et al. (1999)	Holmstrom (1998) Waller et al. (1999)
Increase capacity utilization			Waller et al. (1999
Friendly load		Stank et al. (1999)	
Fewer stock outs/increase availability	Kulp et al. (2004)	Stank et al. (1999) Vergin & Barr (1999) Claasen et al. (2008)	Daugherty et al. (1999) Kaurema et al. (2009)
Fewer reject shipment/order	Tyan & Wee (2003)	Daugherty et al. (1999)	Vergin & Barr (1999) Claasen et al. (2008)
Improved customer service		Stank et al. (1999) Claasen et al. (2008)	Daugherty et al. (1999) Tyan & Wee (2003)
More responsiveness	Claasen et al. (2008)		Holmstrom (1998)
Improved forecast/accuracy	Tyan & Wee (2003)		Kaurema et al. (2009)
Improve reliability of delivery		Stank et al. (1999)	Daugherty et al. (1999)
Improved manufacturing process/smooth	Kaurema et al. (2009)	Smaros et al. (2003)	Waller et al. (1999) Kaurema et al. (2009)
Better planning	Vergin & Barr (1999)		
Reduced need to discount	Daugherty et al. (1999) Liu et al. (2008)		

2.3.2 Limitations in Previous Empirical Research

The available empirical studies had proven that buyers benefit operationally in terms of lower inventories and better material availability (Kauremaa et al., 2008; Tyan & Wee, 2003), whereas suppliers seemed to not always derived operational efficiency improvements from it (Kauremaa et al., 2008; Vergin & Barr, 1999). In fact, certain studies also showed mixed results specifically in terms of cost reduction and service improvement. Some of the studies have shown a positive effect, while other studies had shown conversely (Claasen, et al., 2008; Kupl et al., 2004; Daugherty, et al., 1999; Vergin & Barr, 1999).

Notably, previous studies on VMI effectiveness either do not separate buyer and supplier's perspectives (Daugherty et al., 1999; Ellinger et al., 1999; Myer et al., 2000; Kuk, 2004) or focus on buyer's perspective (Claasen et al., 2008). If focussing only on the buyer perspective, the study may show ambiguous results or contradiction to what was expected by the researchers. Thus, in a situation where supplier is responsible to replenish customer's inventory, it is essential to understand what factors affect the VMI performance from supplier's perspective. This is a clear deficiency with the researches on VMI, which have abandoned the focus on supplier's perspective.

In addition, operating issues on how VMI works have gained less focus (Zammori et al., 2009), especially in survey method on the VMI performance (Vereecke & Muylle, 2006). Operating issues may include the VMI elements, organizational factors, and the effect of type

of products on VMI performance. Although, the empirical findings highlighted the effect of VMI elements on VMI performance, it covered only limited numbers of elements, such as information sharing related issues and distribution model.

There are numbers of other VMI elements that need to be explored. For instance, VMI elements provided by Sarpola (2006), Elvander et al. (2007) and Zammori et al. (2009), it is worthwhile to explore its impact on VMI performance. Although they list the important VMI elements, but they do not empirically examined the relationship between VMI elements and VMI performance. Therefore, there is still an inadequacy with the research on VMI, which is essential to be analysed. However, as the intention of this study is to generalize the results from various industries through quantitative approach, only basic elements of VMI will be analysed. Zammori et al. (2009) presented basic scope of VMI elements in VMI practices, which cover inventory ownership, inventory location, level of demand visibility, transfer mode, monitoring and ordering, inventory control limits, and replenishment decision.

Another important factor at the operational levels that need to be analysed is the organizational factors. Several variables have been studied, which include managerial commitment, centralization decision making, and information system capability. Although, several authors empirically analysed and proved that organizational factors were significant to VMI performance, however, their findings had shown whether a weak or strong or opposite impact to what has been expected

(Myer et al., 2000; Kuk, 2004; Vigtil, 2007). This consequence may be due to mixed perspective from different side of respondents. In addition, literature had claimed that trust has an impact on VMI performance. However, the relationship between trust and VMI performance was not tested in quantitative approach. Thus, in the contex of this study, researcher has added trust as another variable to be tested under organizational factors.

Furthermore, several researchers (Claasen et al., 2008; Sarpola, 2006; De Toni & Zamolo, 2005; Angulo et al., 2004; Daugherty et al., 1999) have noted that type of products can influence VMI practices. Type of products has been studied as a moderating variable in the study of supply chain collaboration (Redondo & Fierro, 2005). In fact, several researchers have studied the influence of characteristics of type of products on VMI performance (Waller et al., 1999; Kaipia et al. 2002). Therefore, it is expected that type of products will moderate the relationship between organizational factors, VMI elements, and VMI performance.

Hence, this study expects to close the gaps in the previous VMI studies by including the basic VMI elements. In addition, this study also adds another variable under organizational factors, which is trust. Furthermore, the moderating effect of types of products were also examined in this study. On the next section, the term of VMI performance was defined. Next, the VMI elements, organizational factors and the moderating effect of type of products are discussed in more details of its impact on VMI performance.

2.4 VMI Performance

The results of VMI program was highlighted in many research findings and articles, which used different measure but nearly similar to what others had measured. Therefore, the performance of VMI is defined as a dependent variable for this study.

2.4.1 Terms Used to Dictate VMI Performance in Previous Research

From the survey approach studies, it appears that several terms of performance were used to relate the benefits of VMI implementation, which include VMI performance (Claasen et al (2008), VMI effectiveness (Irungu & Wanjau, 2011; Kuk, 2004, Myer et al., 2000; Daugherty et al. 1999), and performance related goals (Ellinger et al. 1999). In fact, certain studies extended the impact of VMI on performance at the firm level (Ramayah et al., 2005; Myer et al., 2000, Ellinger et al., 1999). For instances, Daugherty et al. (1999) and Ellinger et al. (1999) measured the overall VMI performance, which embrace profit, market and relationship performance. Meanwhile, Myer et al. (2000) classified the firm performance only into two objectives, profit and market performance. On the other hand, Ramayah et al. (2005) adapted the supply chain performance measurement proposed by Beamon (1999) to measure the performance of contract manufacturer. Table 2.4 summarised the term used in measuring VMI performance.

Table 2. 4

Terms Used in measuring VMI Performance

Author(s)	VMI effectiveness	VMI performance	Contract manufacturer's performance	Firm performance
Irungu & Wanjau (2011)	✓			
Claasen et al. (2008)		✓		
Ramayah et al (2005)			✓	
Kuk (2004)	✓			
Myer et al (2000)	✓			✓
Daugherty et al. (1999)	✓	✓		
Ellinger et al. (1999)		✓		
No. Occurrence	4	3	1	1

Although the terms used in the study differ from each other, the dimensions of performance are quite similar. Kuk (2004), Myer et. Al (2000), Daugherty et al. (1999) used the term effectiveness, and classified it into, cost reduction and service improvement. Meanwhile, Claasen et al. (2008) use the term performance to add another dimension, supply chain control. The supply chain control dimension that measures the number of stockout and forecasts accuracy, in turn, was identical in the service improvement measurement in the Kuk (2004) study. In the other study, Ramayah et al. (2005) include the resource, output, and flexibility dimension, where several measurement items are found quite similar to what the other researchers used in measuring VMI performance and VMI effectiveness (Claasen et al., 2008; Kuk, 2004; Daugherty et al., 1999). For instances, the measurement on low inventory level, transportation cost, on time delivery, right quantity, minimal defect, short cycle time, less stockout, and less excess inventory was found in the Claasen et al. (2008), Kuk (2004), and Daugherty et al. (1999) studies.

On the other hand, studies in modelling approach also suggest that VMI has an impact on supply chain performance (Noori Housyar et al., 2010; Setamanit, 2009; Liu et al., 2008; Xie & Olson, 2006; Choi et al., 2004; Achabal et al., 2000). Similarly, most of the modelling approach studies embrace cost as performance measurement (Noori Housyar et al., 2010; Setamanit, 2009; Southard & Swinset, 2008; Liu et al., 2008; Xie & Olson, 2006; Choi et al., 2004). However, only a few authors measure the performance of VMI based on service improvement (Achabal et al., 2000; Kaipia & Kalionpaa, 2007). Table 2.5 presented the dimension of VMI performance used in survey approach study.

Table 2. 5

Dimension of VMI Performance in Survey Approach Study

Dimensions of VMI performance	Claasen et al. (2008)	Ramayah et al (2005)	Kuk (2004)	Myer et al (2000)	Daugherty et al. (1999)	Ellinger et al. (1999)	No. of Occurrence
Cost reduction	✓		✓	✓	✓		4
Services improvement	✓		✓	✓	✓		4
Supply chain control	✓						1
Flexibility		✓					1
Output (service)		✓					1
Resource (cost)		✓					1
Strategic performance				✓			1
Economic performance				✓			1
Overall Profit					✓	✓	2
Overall Market					✓		1
Overall Relationship						✓	1

According to Gunasekaran et al. (2001) and Shepherd and Günter (2006), various performance measures are being offered in the context of supply chain management. However, Stank et al. (1999) suggested

that the term performance should be viewed as a function of both efficiency (inputs) and effectiveness (goals/outputs). In more specific, Mentzer and Konrad (1991) argued that efficiency measures how well "resources" expended are utilized, while effectiveness involves the extent to which goals are accomplished. The term "efficiency" is generally associated with "cost reduction" while effectiveness usually measured the "service improvement (Robinson, 1991)." For example, Beamon (1999) proposed three dimensions in measuring supply chain performance, which include resource, output and flexibility. "Resource" dimension generally measures the "cost performance," while "output" dimension measures the "customer responsiveness." Beamon (1999) added another dimension, "flexibility," to measure the capability of the firm to respond to changes in order to provide better service to their customer.

Meanwhile, the Supply Chain Operations Reference (SCOR) model proposes a standardize model to measure SCM performance (http://www.supply-chain.org). There are five performance attributes used in the SCOR model: reliability, responsiveness, flexibility, cost, and asset utilization (Stephens, 2000). The first three criteria deal with effectiveness-related (customer-facing) performance measures, while the other two are efficiency-related (internal-facing) performance measures of a firm. Customer-facing measures are concerned with how well a supply chain delivers services to customers. Internal-facing measures are concerned with the efficiency in which a supply chain operates (Geary, 2001). We can conclude that most of the VMI

performance measurements are identical to those measured in the supply chain performance. Table 2.6 provides measurement of VMI performance, which also captured in supply chain performance.

Table 2. 6

Supply Chain Performance versus VMI Performance Measurement

Measurement item of VMI Performance (Irungu & Wanjau, 2011; Claasen et al., 2008; Kuk, 2004; Myer et al., 2000; Daugherty et al., 1999)	SCOR Model	Shepherd & Günter (2006)	Beamon (1999)
Reduced inventory holding costs	✓	✓	✓
Effect of VMI on administration costs	✓	✓	✓
Reduced materials handling costs	✓	✓	✓
Lower transportation costs due to more efficient planning.	✓	✓	✓
Less wastage as work in progress is affected when quality issue is encountered.	✓	✓	✓
Fewer product returns due to quality or obsolescence.	✓	✓	✓
Smaller shipments	✓	✓	✓
Delayed final production (postponement)	✓	✓	✓
Reduced reliance on forecasts	✓	✓	✓
Reduced overstocks	✓	✓	✓
Reduced need to discount	✓	✓	✓
Reduced product damage	✓	✓	✓
Improved customer responsiveness	✓	✓	✓
Improved ability to react to upsides/downsides.	✓	✓	✓
Overall improvement in the level of customer service.	✓	✓	✓
Timely replenishment of parts only when required.	✓	✓	✓
Fewer incidences of production line disruption/stocks outs.	✓	✓	✓
Fewer incidences of reject shipments.	✓	✓	✓
Productivity improvement should be achieved with automation of manual tasks.	✓	✓	✓
Replenishments are made in friendly loads.	✓	✓	✓
Relationship with our VMI partners should be improved.	✓	✓	✓
Improved accuracy of forecasts resulting in better planning.	✓	✓	✓
More frequent deliveries	✓	✓	✓
More predictable order cycle	✓	✓	✓

2.4.2 Term of VMI Performance Used for This Research

Based on the literature, (Irungu & Wanjau, 2011; Claasen et al., 2008; Ramayah et al., 2005; Kuk, 2004; Myer et al., 2000; Daugherty et al., 1999; Ellinger et al., 1999), VMI was mainly measured on both efficiency and effectiveness. Therefore, term of VMI performance will be used in this study, which indicates the efficiency and effectiveness

of VMI. In fact, the past study also used cost (efficiency measures) and service dimension (effectiveness measures) to measure the VMI performance (Claasen et al, 2008; Daugherty et al., 1999; Ellinger et al., 1999). Hence, this study used cost and service as the dimension of the VMI performance. In addition, as discussed in previous section, most of the measurements in VMI performance were identical as in the supply chain performance measurement. Thus, the VMI performance can be viewed as a proxy for supply chain performance.

From the organizational performance perspective, a supplier probably engages with several customers, which run specific design of VMI that can lead to different benefits (Elvander et al., 2007). Myer et al. (2000) add that the degree of customization in VMI design is common. Moreover, overall profit, market, and relationship performance are comprise of many efforts from various activities and parties. Therefore, it is quite difficult for a company to perceive the overall firm performance based on one of the single relationship of VMI engaged by a company, due to one might perform well (Ryu, 2006). Although the supplier may engage only one of the VMI program, but the overall firm performance can also be influenced by non-VMI (Noori Housyar et al., 2010).

Therefore, the term of organizational performance will not be measured in this study. As suggested by Wong and Wong (2007), the firm performance that measured the single output to input financial ratios such as return on sales (profit) and return on investment of the firm may not be adequate for use as indices to characterize the overall

supply chain efficiency. Thus overall profit, market, and relationship performance as studied by Myer et al. (2000), Daugherty et al. (1999), and Ellinger et al. (1999) would not be measured for this study. This is because, it only focuses on a single relationship of VMI from the perspective of the supplier.

2.5 VMI Elements

According to Elvander et al. (2007), a wide variety of VMI design was practiced, encompassing an ample range of products, accessories, and raw materials. This argument was also supported by Claasen et al. (2008) findings. They claimed that VMI practice can be implemented for a diverse set of products and demand patterns. The literature shows that several elements of VMI have been identified (Zammori et al., 2009; Vigtil, 2007; Elvander, et al. 2007; Sarpola, 2006), which can affect the VMI performance in terms of cost reduction and services improvement.

Unfortunately, these elements have not been empirically examined on its impact on VMI performance. Since, the basic elements of VMI, which include the inventory location, inventory ownership, level of demand visibility, transfer mode, monitoring and ordering, inventory control limits, and replenishment decisions frequently stated by numerous authors, they would not be addressed in the study. Table 2.7 presents the basic elements of VMI stated by researchers.

Table 2. 7

Basic Element of VMI Proposed by Researchers

Basic Elements of VMI	Author(s)				No. of Occurrence
	Elvander et al. (2007)	Sarpola (2007)	Vigtil (2007)	Zammori et al (2009)	
Inventory location	✓	✓		✓	3
Sourcing policy	✓				1
Inventory ownership	✓	✓		✓	3
Level of demand visibility	✓	✓	✓	✓	4
Transfer mode	✓	✓	✓	✓	4
It configuration	✓				1
Monitoring and ordering	✓	✓		✓	3
Inventory control limits	✓			✓	2
Replenishment decisions	✓	✓		✓	3
Shipment decision	✓				
Level of horizontal integration (customer)	✓				
Level of horizontal integration (Item)	✓				
Level of vertical integration	✓				
Distribution Model		✓			1

2.5.1 Inventory Location and VMI Performance

Among the important elements in VMI program is the inventory location (Zammori et al. 2009, Elvander et al., 2008, Sarpola, 2006). Elvander et al. (2007) referred inventory location as inventory physical location, which is managed by vendor in VMI practice. Inventory location can be located in both the supplier's and the customer's premises (Danielsson & Lundqvist, 2005; Sarpola, 2006; Elvander et al., 2007). This arrangement will enable the supplier to use it to buffer against short delivery cycle, unsynchronized production cycle, and respond quickly to demands or usage needs (Elvander et al. 2007, Wallin, Rungtusanatham, & Rabinovich, 2006). However, there is also incurrence of high inventory holding costs, given the need for storage, material handling and tracking, and given the threat and expense of inventory obsolescence, particularly when operating in highly volatile demand (Wallin et al., 2006).

In the VMI practice, the inventory can also be located at the customer's premises in a distributed manner, for example, directly at the manufacturer's production line or at the retailer's shop floor (Hines et al., 2000). In this alternative, the vendor replenishes the inventories at all consumption area, which includes store, production line, and machine. However, supplier will experience increment of work load in administrating inventory compared to the customer (Sarpola, 2006).

On the other hand, the supplier can deliver to a customer's central warehouse (Sarpola, 2006; Elvander et al., 2007). This approach will enable the optimization of deliveries of products or raw materials, which procured from several vendors to plants, stores, construction sites or other points of consumption (Sarpola, 2006). In general, the more centralized an operation is, the lower the safety stock levels are, then the lower the total overhead cost, transportation cost, and the higher chances to achieve economies of scale (Simchi-Levi, Kaminsky, & Simchi-Levi 2000). For instance, to ensure the inventory from several suppliers was arrived at construction site as scheduled and in a full truckload, the construction companies could choose the location of VMI's inventory that located in a terminal near the construction site. This approach can avoid interruption and interference during work progresses by minimizing the number of deliveries and vendor visits. In addition, when excessive inventories at construction site was reduced, the work progresses will run more smoothly without interferences of space acquired by store inventory and time consumed to move the inventories around the site (Sarpola, 2006).

Alternatively, the supplier can use and deliver to a third party warehouse. This option can also be an advantage when the customers do not have a physical presence in a certain market or have outsourced part or all of their logistics activities (Sarpola, 2006). Kuk (2004) added that this also provides the customer with flexibility, articularly, when supplier does not have warehouse located near to the customer factory. This solution might also be suitable if the customer does not possess the expertise or special facilities for storing the products or raw materials such as chemicals, or if the customer does not have a physical presence in a certain market, or has outsourced parts of its operations such as manufacturing, sales or distribution (Elvander et al, 2007).

The centralization of inventory locations can reduce the cost through the optimization of deliveries. In addition, if inventory location is closer to the consumption location, the supplier can be more responsive to the customer's needs. Therefore, inventory location refers to the centralization of multiple inventory locations into a single location and is generally believed that storage location is located proximity to the customer's location. Table 2.8 summarised the findings inventory location and performance.

Table 2. 8
Inventory Location Alternative and Its Effect on Performance

Inventory location alternative (Author(s))	Effect on Performance (Author(s))
Located at own premises (Danielsson & Lundqvist, 2005; Sarpola, 2006; Elvander et al., 2007)	Buffer against short delivery cycle and unsynchronized production cycle (Elvander et al., 2007); quick response to demand need (Wallin et al.2006)
Located at centralize warehouse or Third party warehouse (Sarpola, 2006; Vigtil, 2007; Kuk, 2004; Elvander et al., 2007)	Minimize number of deliveries and storage (Sarpola, 2006); reduce safety stock, lower total overhead cost, lower transportation cost, and achieve economies of scale (Simchi-Levi et al., 2000)
Customer production line or local warehouse (Sarpola, 2006; Elvander et al., 2007; Barber et al., 2004)	Increase administrative task (Sarpola, 2006); quick response to demand need (Wallin et al.2006)

2.5.2 Inventory Ownership and VMI Performance

Inventory ownership refers to the ownership of the inventory and when the invoice is being issued to the customer (Elvander et al., 2008). The literature discovered numbers of different mode of payment and transfer of inventory ownership in VMI. Owning the inventory meaning the company is accountable for the capital costs, obsolescence costs, and subject to a fluctuation in prices of inventory (Wallin et al., 2006). Though, managing the entire inventory system by one of the partners will allow the supply chain to be synchronized better according to both companies' cost characteristic (Dong and Xu, 2002). Several alternatives are available in transferring the inventory ownership. First, supplier can own the inventory at the customer's location and send invoice to the customer while the inventory were withdrawals from the storage, thereby increasing the supplier's inventory investment (Pohlen & Goldsby, 2003). However, the supplier may want to own the inventory (Sarpola, 2006; Kuk, 2004) for certain reasons, such as to increase the sales of the manufacturer's other product by pushing the new products to the market and to place

special products in the main assortment of their retailer (Sarpola, 2006).

Another alternative is customer was accountable on inventory ownership and the invoice was issued when the inventories delivered to customer. However, the payment from customer to supplier was only made when customer withdrew the inventories from the storage and was pending based on agreement of payment (Elvander et al., 2007; Sarpola, 2006, Vigtil, 2007). According to Wallin et al, (2006), this alternative may give customer the responsibility on the risk of holding the inventory such as the expense of storing, obsolescence, handling and tracking these purchased items. They added that a supplier could also be subjected to price fluctuations. Thus, risk-sharing existed in this type of inventory ownership whereby supplier received the payment for all of inventories that have been delivered (Elvander et al., 2007). However, the supplier could experience opposing effect on their cash flow when customer had extended and suspended the payment (Kuk, 2004).

In the other setting, the ownership of inventory was retained on customer upon delivery, and the customer receives the invoice from supplier once the shipment had been made (Danielsson & Lundqvist, 2005; Sarpola, 2006; Elvander et al., 2007). This approach can be referred as a standard process of in a traditional order-delivery. In this circumstance, customer is responsible to all inventory investment cost and inventory holding cost, but they can protect themselves against future price increase.

For this study, inventory ownership refers to what extent supplier owns the inventory by identifying when the supplier will be paid on the goods sold to the customer, responsibility of cost associated to hold the inventory and controlling the fluctuation of goods prices. The following table (Table 2.9) summarized the inventory ownership alternative and performance.

Table 2. 9
Inventory Ownership Alternatives and Its Effect on Performance

Inventory ownership alternative (Author(s))	Effect on performance (Author(s))
Owned by the supplier and gets paid when customer withdraw the goods (Sarpola, 2006; Pohlen &Goldsby, 2003; Kuk, 2004; Vigtil, 2007)	Increase sales (Sarpola, 2006), supplier is responsible for obsolescence cost, capital cost, handling and tracking (Wallin et al., 2006)
Owned by the customer and supplier gets paid when goods are withdrawn (Sarpola, 2006; Elvander et al., 2007)	Supplier is responsible for obsolescence cost, capital cost, handling and tracking (Sarpola, 2006;Wallin et al., 2006)
Owned by the customer and supplier gets paid when the goods are delivered (Danielsson & Lundqvist, 2005; Sarpola, 2006; Kuk, 2004; Elvander et al., 2007)	Supplier is responsible for obsolescence cost, capital cost, handling and tracking (Sarpola, 2006;Wallin et al., 2006)

2.5.3 Level of Demand Visibility and VMI Performance

These elements concern with the type of demand information shared by customer to assist the supplier in controlling their inventory. There are many types of demand information shared in VMI program. Among the demand information that were visible to the supplier comprise of sales data, stock withdrawal, production schedule, inventory level, goods in transit, back order, incoming order, and return (Vigtil, 2007; De Toni & Zamolo, 2005).With the increasing visibility of demand information the supplier will has longer timeframe for replenishment arrangement (Kaipia et al., 2002).

De Toni and Zamolo (2005) argued that sharing sales data and inventory level can improve the supplier's production planning with more stable production plan. They added that supplier can use the data to understand the seasonal changes at the factory and know when critical times will occur. However, by using this type of data, the supplier may require extra time to compare the data of the required production with his own production capacity and to come to a decision regarding his or her own investments and productions.

Alternatively, demand data contains the re-setting of forecasts based on actual market trends (Elvander et al, 2007, De Toni & Zamolo, 2005). The data related to each month was updated week by week. The suppliers can take advantage of this information and plan their own production capacity based on the customer's requests (De Toni & Zamolo, 2005). Forecasts were also used in combination with the current allocations. This data is based on real quantities of produced and sold items (POS), orders received and bills of material, which is updated every week. The data, usually transmitted by using EDI, is used for the daily check of target stock, replenishment needs, and for updating the delivery plan (De Toni & Zamolo, 2005). Therefore, the accuracy of the data must be high and the time required to update the data must be quick before supplier uses the data (Angulo et al. 2004; Raman, DeHoratius, & Ton, 2001). Meanwhile, Vigtil (2007) studied the type of data shared by customer to its supplier in VMI program. In this study, it indicates that the importance of POS data transfer is

relative to the demand uncertainty and the responsiveness of the supplier.

According to Vigtil (2007), the market interaction strategy applied by the customer can influence the value of information for the supplier. For instance, make to stock strategy, which normally applied for standardize product has quite stable demand fluctuation. Thus, the ability of supplier to minimize the opposite effects of demand uncertainty and the bull-whip effect will decrease, even if there is an increasing of demand visibility (Kulp et al., 2004).

To conclude, the more the demand data were shared between the customer and supplier the more benefits can be accrued. When suppliers have sufficient information, they can make better planning and response to customer's demand in order to replenish the customer's inventory. Therefore, for the purpose of this study, level of demand visibility refers to what extent the type of demand information is shared by customer to assist the supplier in controlling their inventory. Table 2.10 presents the impact of level of demand visibility on performance.

Table 2. 10
Level of Demand Visibility and Its Effect on Performance

Type data transferred (Authors)	Effect on Performance
Point-of-Sales or Forecast (Vergin and Barr,1999; Kulp, 2002; Mattson, 2002; Angulo et al., 2004; De Toni & Zamolo, 2005; Elvander et al., 2007; Vigtil, 2007)	*High Level of Demand Visibility*: Minimize bullwhip effect (Cachon and Fisher, 2000; Kulp et al., 2004) Give more time in planning replenishment (Kaipia et al., 2002) Low inaccuracy (Angulo et al., 2004)

Table 2.10 Continued

Stock withdrawal (Vergin and Barr, 1999; Kulp, 2002;De Toni & Zamolo, 2005; Vigtil; 2007)	Decrease out-of-stock and inventory costs, and improved sales and inventory turnover (Simchi-Levi et al. (2000)
Production schedule (Kulp, 2002; Angulo et al., 2004; De Toni & Zamolo, 2005; Sandberg, 2005; Elvander et al., 2007; Vigtil, 2007)	
Inventory level (Kulp, 2002; Mattson, 2002; Angulo et al., 2004; De Toni & Zamolo, 2005; Sandberg, 2005; Vigtil, 2007)	
Goods intransit Cachon and Fisher, 1997; Sandberg, 2005; Vigtil, 2007)	Low Level of Demand Visibility Need extra time to make decision (De Toni & Zamolo, 2005)
Back order Cachon and Fisher, 1997; Kumar and Kumar, 2003; Vigtil, 2007)	
Incoming order De Toni & Zamolo, 2005; Vigtil, 2007) Return (Kumar and Kumar, 2003)	

2.5.4 Transfer Mode and VMI Performance

Transfer mode here is referring to mode used by supplier and customer in sharing the demand information. According to Waller et al. (1999), the successful implementation of VMI systems often depends on computer platforms, communication technology, and product identification and tracking systems. For instance, the Electronic Data Interchange (EDI) also importance for enabling the customers and vendors exchange the information efficiently (Simchi-Levi et al.,

2000). However, supplier can use the modest information system support (Waller et al., 1999) such as fax, phone and email (Vigtil, 2007), and visited customer's premises to receive demand information (Sarpola, 2006; Mattson, 2002).

In the simplest mode, the supplier performs a visual examination of the inventory levels. This mode is applied in basic VMI program (Harrison & van Hoek, 2005; William, 2004). Based on this mode, the supplier visits the customer, makes an observation on inventory level and counts the stock in order to get the demand information. This alternative was preferred when there was a small number of a stock keeping units engaged in the VMI program (Daugherty et al., 1999). They assumed that the role of information system was less effective. In the two cases of Sheu et al (2006) study, they identified the salespersons visited the retailer premises and suggested the order size to the retailer on the spot. No computers were used to reach the decision; everything was done manually or by phone. This approach has shown a higher inventory level, higher return on goods, and low fill rate compared to the firm that uses information technology to transfer demand information. In fact, this approach was subjected to human errors due to much slower system (Mattson, 2002). The bad effect is more obviously to the supplier as consequence of the information delay while the further actions cannot be taken as they have to wait the shared information has been received and processed (Whipple et al., 2002).

On the other setting, the customer provides the demand information through online and the supplier can get the information whenever they needs (Elvander et al, 2007). Under the VMI program, the retailer provides the supplier with the access to its point-of-sales (POS) data (Sari, 2007). Kuk (2004) added that the direct access to the customer's demand information enables the supplier to make better forecasts and better response to the customers' inventory needs in terms of quantities to be shipped and locations to be replenished. Sheu et al. (2006) found that some of the retailers have advanced inventory system, co-managed inventory (CMI) system, and utilize information technology including EDI, electronic invoicing, and bar coding. The retailer with high degree of computerization allows its supplier to access its sales data and inventory information. Further, the study finds a positive performance in terms of inventory level, return goods, and fill rate compared to the retailers who do not utilize high degree of information technology. Meanwhile, Vigtil (2007) presented a case study to investigate the transfer mode of demand information between the customer and supplier. All cases indicate that the use of integrated communication systems play a major part in the successfulness of the VMR/VMI programs. They argued that the effect of the integrated automatic data transmission solution is said to offer positive contributions, even if the programs turn out to be unfavourable.

Based on above discussion, transfer mode here is refers to what extent the supplier depends on the information system technology in order to get access to the customer's demand information. It shows that the use

of information system technology can increase the speed of information transferred. Therefore, suppliers can receive immediate information to make decision and better planning, which in turn improving the cost performance and deliver better services to the customers. Table 2.11 present the effects of transfer mode alternatives on performance.

Table 2. 11
Transfer Mode Alternatives and Its Effect on Performance

Transfer mode (Author(s))	Effect on performance (Author(s))
Visual examination (Sarpola, 2006; Waller et al., 1999; Mattson, 2002)	Slower system and subject to human errors (Mattson, 2002); information delay (Kaipia & Taskanen, 2003); inaccuracy of information (Whipple et al., 2002)
On-line access to customer system (Housman, 2003; Sarpola, 2006; Elvander et al., 2007; Sari, 2007; Yao et al., 2007)	Reduce labour cost, less error and delay (Vigtil, 2007); better forecast and better respond (Kuk, 2004), reduce inventory level, low return goods and high fill rate (Sheu et al., 2006)

2.5.5 Monitoring and Ordering

There are several alternatives for monitoring and ordering the replenishment by supplier. According to Waller et al. (1999), most of the inventory reduction achieved with VMI can be attributed to frequent inventory reviews, order intervals, and deliveries. However findings by Vigtil (2007) shows that frequent updates reviewed by the supplier do not offer any benefits to the supplier. Meanwhile, Sezen (2006) suggested a guideline in monitoring and ordering inventory. One important consideration is the cost of each review. Costs related to the review process may include the cost of reviewing personnel, ordering and transporting.

Meanwhile, Elvander et al., (2007) added that continuous review and make ordering if needed were appropriate when the fluctuation of demand was high. The demand forecasts must be shared and updated frequent and continuously by customer (Sarpola, 2006). Then, supplier can replenish each of inventories whenever the inventory level reaches the reorder point. Continuous review allows the supplier to make ordering in constant size, which is easier to administer than variable one and supplier knows how much to send. Administration and transport can also be tailored to the specific needs perhaps a full truckload at a time. In addition, it can provide lower stock including the safety stock because the safety stock only covers for uncertainty in the lead-time (Waters, 2003). Yao and Dresner's (2008) study supported this statement. They observed that the inventory reduction for the manufacturer was increased and a firm with daily replenishment carries, on average, less stock than a firm with weekly replenishment. Meanwhile, in Sheu et al. (2006) the case study also shows the application of continuous review approach. They found in three cases where the suppliers continuously checked the inventory level and placed order information to their customer. In terms of performance, a firm with a continuous review system shows the highest performance in inventory level, return goods and fill rate compares to the firm that uses a periodic review system.

In other alternatives, the suppliers can review and place orders periodically. This alternative was also often used in combination with some kind of IT system (Elvander et al, 2007). However, in certain

VMI program, the decisions on inventory replenishment were made after the inventory level was checked by supplier during the visit at customer places (Kaipia & Tanskanen, 2003; Mattson, 2002; Williams, 2000). The main advantage of using periodic review is reducing the resources spent on monitoring inventory levels due to its simplicity and convenient to administer. Another advantage is ease in combining orders that encourage suppliers to give price discounts (Waters, 2003).

In the case study conducted by Sheu et al. (2006), two cases were found using this approach in replenishing inventory. The salesperson visited stores weekly and suggested order size to the retailers on the spot. Upon approval from the retailers' headquarters, the order was confirmed and the salespersons informed their customer service centre to arrange the delivery. These two cases had shown the lowest performance in inventory level, return goods and fill rate.

Meanwhile, Sezen (2006) investigated the impacts of changing the length of the review period on the performance of a periodic review system. The result shows that average inventories decreases as the length of the review period gets shorter. However, the total lost sales also increasing sharply when longer review periods was applied. In terms of the safety stock requirement, Sezen (2006) concluded that longer review period results in the declining of safety stock requirements.

The findings by Sezen (2006) also demonstrated that the selection of the length of a periodic review period is strongly related to the nature of the demand of a product. In terms of the product shortage duration,

the best performance is observed for the products having low variability, which yields minimal probabilities for long run shortages at all levels of review periods. Similarly, the total lost sales for the products with lower variability is relatively less than the product with high variability. Sezen (2006) concluded that products having high variable demand may need shorter review periods, and products with low fluctuating demand may require less frequent reviews. While, Waters (2003) added that periodic review is particularly useful for cheap item with high demand.

Therefore, monitoring and ordering are refered to the frequency of supplier monitoring the customer's stock levels in order to decide the inventory replenishment. It seems that frequent monitor of inventory levels can provide update information about the inventory levels. Thus, assisting the supplier to make the right decisions on inventory replenishment can reduce the cost and improve services performance. Table 2.12 present the effects of monitoring and ordering alternatives on performance.

Table 2. 12
Monitoring and Ordering Alternatives and Its Effect on Performance

Monitoring and ordering (author(s))	Effect on performance
Continuous review and ordering if needed (Elvander et al., 2007; Waller et al., 1999; Sheu et al., 2006)	Reduce inventory (Waller et al. 1999, Water, 2003, Sezen, 2006, Sheu et al., 2006; Yao & Dresner, 2008); lower safety stock and optimize transportation delivery (Water, 2003); low return goods and high fill rate (Sheu et al., 2006)
Schedule visit and periodic ordering (Vigtil, 2007; Elvander et al., 2007; Angulo, et al., 2004; Kaipia & Tanskanen, 2003; Mattson, 2002)	High inventory level, ease in combining order, and convenient to administer (Water, 2003); high inventory level, high return goods and low fill rate (Sheu et al., 2006)

2.5.6 Inventory Control Limits and VMI Performance

The inventory control limits refer to how the supplier controls the inventory (Elvander et al., 2007). Normally, in the case of VMI, the supplier is responsible for maintaining a continuous stock level within the predefined limits. The inventory control limits were calculated based on the expected demand over respective replenishment lead times. The inventory control limits can be used to avoid extremes inventory (Wild, 2002). By reducing the maximum level, average inventory levels can be reduced and thereby increase the turnover rate and reduce inventory carrying costs (Vigtil, 2007).

The minimum and maximum limits can also be used to protect product availability for the buyer (Disney & Towill, 2003; Valentini & Zavanella, 2003). In most cases of VMI practice reported the implementation of minimum and maximum limits for the inventory control are coupled with penalty costs for the suppliers who did not meet the requirement (Vigtil, 2007; Elvander et al., 2007). However, when the lower limits is high and penalty cost was applied, customer can make sure the availability of inventory through the uses of safety stock (Claasen et al., 2008). Further, Claasen et al. (2008) added that safety stock can cause slack in the supply chain which in turn increase the customer service levels, but reduced the cost performance of VMI program.

Fry, Kapuscinski, and Olsen (2001) compared the performance of traditional retailer-managed inventory (RMI) systems and vendor-managed inventory (VMI) with minimum and maximum limits.

Numerical results indicated that good maximum and minimum limits acquired 10 per cent to 15 per cent savings when moving from RMI to VMI and that savings increase with higher levels of demand variance. While, Yao and Dresner (2008) stressed that imposing penalty cost due to out-of-stock can lead to greater inventory reduction.

Gumus (2006) has also proven that setting the maximum limit is crucial to reap cost saving in production, replenishment and transportation, especially if the vendor owns the inventory. Although, there was inventory control limits, the supplier can still modified the suggested delivery plans to minimise transportation costs, give priority to the orders of customers in critical situations, or to satisfy additional orders falling in the frozen planning horizon as long as inventory level is within the limits (Danese, 2006).

Vigtil (2007) quoted that the decision to impose the inventory control limit was influenced by demand patterns, seasonal variations, lot size prices and purchase costs. Wild (2002) proposed that the two limits need to be adjusted, the identified target range should be both attainable consistently, and is acceptable for planning and coordination with other activities. Gardner (2004) added that the two limits should also be in line with the demand or there will be a shortage of inventory or there is excess inventory that takes shelf space. However, Claasen et al. (2008) argued that in a true VMI, there are no minimum and maximum limits that enable the supplier to plan its own production and decide upon the replenishment schedule as long as the agreed customer service levels are met.

To conclude, the inventory control limits here can be referred as to what extent safety stock, penalty cost, minimum and maximum limits of inventory were applied in order to ensure the availability of stock. Although setting control limits for managing inventory seems to be not a true design of VMI, the advantages of it have influenced many companies to implement it (Claasen et al., 2008). Table 2.13 present the effects of inventory control limits alternatives on performance.

Table 2. 13
Inventory Control Limits Alternative and Its Effect on Performance

Types of inventory control limits	Effect on performance
No maximum and minimum limit (Elvander et al., 2007; Danielsson & Lundqvist, 2005; Vigtil, 2007) *maximum limits* (Danielsson & Lundqvist, 2005; Housman, 2003; Danese, 2006; Disney & Towil, 2003; Claasen et al, 2008; Elvander et al., 2007) *Minimum limits* (Danielsson & Lundqvist, 2005; Housman, 2003; Danese, 2006; Disney & Towil, 2003; Claasen et al., 2008; Elvander et al., 2007) *Maximum or minimum or both limits with penalty cost* Claasen et al.(2008); Yao & Dresner (2008); Fry et al. (2001	*Without control limits* Inventory level increase (Heningsons & Linden, 2005) *With control limits* Increase availability (Disney and Towill, 2003; Valentini & Zavanella, 2003) Inventory reduction (Yao & Dresner, 2008) Increase the turnover rate and reduce inventory-carrying costs (Vigtil, 2007) Production, replenishment and transportation (Gumus, 2006) Reduce stockout (Gardner, 2004)

2.5.7 Replenishment Decisions and VMI Performance

In VMI program, replenishment decision can be made and fully determined by the supplier (Yao et al., 2007; Vigtil, 2007; Sari, 2007) where supplier has the authority to decide on both quantity, time for delivery (Elvander et al. (2007), and location (Kuk, 2004). Rationally, it provides supplier with autonomy and flexibility in managing inventory on behalf of customer. According to Yao et al. (2007), when suppliers have the autonomy to retain orders until an agreeable

dispatch time is reached, it is expected that economic consolidated dispatch quantity will accumulate before an order is dispatched.

Moreover, the replenishment decisions made by the supplier are then more likely to be accurate and the orders generated for the customers are more likely to meet the true demand in the marketplace (Kuk, 2004). Meanwhile, Kaipia et al. (2002) simulated the case study by using a time base analysis method to compare performance of VMI with traditional ordering method and JIT technique.

In VMI, manufacturer monitors daily the inventory level of the sales company and decides on inventory replenishment for every product when needed. They found that the time benefits were sufficient with VMI to allow the synchronization of production schedule to meet the demand. The inventory level was also reduced when shifting to VMI. However, when the products variety is too large, the time required is insufficient to allow the synchronization of production schedule to meet the demand (Kaipia et al., 2002). On the other hand, the customer's expenses related to the ordering process can be relieved, if supplier is responsible for replenishment decisions (Sarpola, 2006). With the supplier's authority, the manufacturing and distribution activities can be improved and optimized (Cetinkaya & Lee, 2000); and out-of-stock cost also can be reduced by prioritizing the customer orders (Waller et al., 1999).

On the other hand, a customer can confirm the replenishment orders suggested by supplier (Danese, 2006; Elvander et al., 2007; Groning & Holma, 2007). Simchi-Levi et al. (2000) have discussed this alternative

and argued that this is not the ultimate goals of VMI. However, the alternative can assumed as a first step in conversing the traditional order process to the VMI order process.

However, customer would restrict the supplier's flexibility, if customer was responsible to the inventory replenishment. When the customer had the authority in deciding the delivery time and quantity of inventory to be replenished, the sub-optimization had potentially to occur. It is due to supplier unable to maximize distribution activities through the full truckloads. Especially, if the supplier is unable to synchronize the delivery frequency parallel to the optimal production and delivery cycles (Classen et al., 2007).

Therefore, we can conclude that there are more benefits if the supplier is responsible for replenishment process compared to the customer. Suppliers are known for their capability in determining when to replenish and how much to replenish customer's inventory based on the information provided by the customer.

So, these elements can be referred as to what extent supplier is responsible to make replenishment decisions of inventory in term of when and how much. Table 2.14 present the effects of replenishment decision alternatives on performance.

Table 2. 14
Replenishment Decision Alternatives and Its Effect on Performance

Replenishment decision alternative	Effect on performance
Supplier make replenishment decision (Yao & Dresner, 2003; Disney et al., 2003; Yao et al., 2007; Vigtil, 2007; Sari, 2007; Tyan & Wee, 2003; Kaipia et al., 2002; Elvander et al., 2007); Cheung and Lee (2002)	*Consequences of Supplier make replenishment decision* Optimize delivery (Yao et al., 2007; Cetinkaya & Lee, 2000) Minimize stockout expenses (Waller et al., 1999) Better response to customer's demand, more accurate replenishment decisions (Kuk, 2004) Smooth production schedule, reduce inventory (Kaipia et al., 2002)
Customer make replenishment decision Danese (2006); Elvander et al. (2007); Groning & Holma (2007)	*Consequences of customer make replenishment decision* Less optimization in delivery (Claasen et al., 2008)

2.6 Organizational Factors

Another important factor in VMI program that related to control and resource issues is the organizational factors (Myer et al., 2000). According to the research conducted by Myer et al. (2000) organizational factors include managerial commitment, centralization of decision making, and firm size. However, only a few studies had examined these factors.

For example Kuk (2004) compared the expected and perceived VMI performance in terms of firm size. In addition, Kuk (2004) also examined the relationship between employee's involvement and cost and service performance. However, discussion on employee's involvements by Kuk (2004) was quite similar to managerial commitment as discussed by Myer et al. (2000). Meanwhile, Claasen et al. (2008) had examined the relationship quality as a proxy to both managerial commitment and trust toward the perception on the success of VMI. Similarly, Irungu and Wanjau (2011) also examined the relationship between relationship quality and VMI performance. On the other hand, the effect of information system capability towards VMI performance also received attention from Kuk (2004), Claasen et al (2008),

and Irungu and Wanjau (2011). Table 2.15 presents the identified organizational factors as the results of the studies conducted by the researchers.

Table 2. 15
Organizational Factors for VMI

Organizational factors	Myer et al. (2000)	Kuk (2004)	Claasen et al. (2008)	Irungu & Wanjau (2011)
Firm size	✓	✓		
Managerial commitment	✓		✓	✓
Centralized decision making	✓			
Relationship quality				
Information system capability		✓	✓	✓

Based on the literature review, several organizational factors were identified which include managerial commitment, centralization of decision making, firm size, information systems capability, and relationship quality as presented above. Although the studies examined the effect of firm size on VMI performance, the researcher decided to exclude the factor for reasonable reasons. A study by Myer et al. (2000) has shown that even a large company is not necessarily benefited from VMI. Further, they argued that larger companies may reluctant to increase the resources capability to replenishment programs because the top management may not realize the benefits of the program. Hence, the organization may confront with insufficient resources to ensure the program work more effectively. In fact, Kuk (2004) has also proven that even a small company can benefit more than a large company. Therefore, as long as companies can give commitment to the VMI program, they can probably achieve the objectives of the program. The relationship quality was also not a focus of this study. Since, Irungu and Wanjau (2011) and Claasen et. al (2008) had described the relationship quality as proxy to managerial

commitment and trust, the researchers decided to separate relationship quality into two meaningful factors, managerial commitment and trust. Thus, trust was added as another organizational factor for this study.

On the other hand, the other factors, centralized decision making, managerial commitment, and information system capability were retained due to the direct effect on VMI performance was inconsistent and unclear. For an example, a study by Myer et al. (2000) shown contradict and insignificant findings on the relationship between centralized decision making and VMI performance. Meanwhile, managerial commitment has shown significant relationship towards VMI performance (Myer et al., 2000). Conversely, findings by Irungu and Wanjau (2011) have shown an insignificant relationship. Similarly, Claasen et al (2008) had also examined the relationship between managerial commitment and perceived VMI success, but the direct relationship between managerial commitment and VMI performance was not examined. The effect of information system capability on perceived VMI success was studied by Claasen et. al (2008). Only quality of ICT system has positive and significant impact on perceived VMI success, but not the information quality. However, Claasen et al (2008) did not examine the direct impact of information system capability on VMI performance. On the other hand, findings by Irungu and Wanjau (2011) have shown positive and significant results on both quality of information system and information quality toward VMI performance. Again, Irungu and Wanjau (2011) did not explain the contribution of information system capability on VMI performance.

To conclude only a few examples of studies have examined organizational factors. Therefore, for this study researchers decided to focus on certain factors, which include managerial commitment, decentralization of decision-making, information systems capability, and trust. The following section will discuss in more details on the dimensions of organizational factors, which is the focus of this study.

2.6.1 Managerial Commitment and VMI Performance

The role of managerial commitment is important to ensure companies benefited from VMI program. The chances of a successful VMI program can be increase based commitment effort put by companies (Claasen et al., 2008). Since, there are changes in terms of work procedures, the employees have to reorient themselves and be prepared to deal with it (Ghannasekaran, 2000). Managerial also need to provide substantial financial and managerial resources in order to facilitate the changes (Cottrill, 1997).

Myer et al. (2000) examined the association between managerial commitment and VMI performance. The results show that managerial commitment leads to both greater perceived cost performance and enhanced customer service. However, a weak correlation between commitment and cost reduction was found in the Kuk's (2004) study. Meanwhile, Claasen et al. (2008) had examined the relationship between relationship quality and VMI success. Commitment is one of the criteria that they measured in relationship quality. The study also

reveals that quality relationship has significant relationship with VMI success, but with a weak positive correlation.

On another study, Sheu et al. (2006) investigated social and technical factors that contribute to successful supplier-retailer collaboration by examining to what extent organization commits it resources in terms of time, money, facilities, etc. in developing a long-term relation. The company practicing VMI has shown a high resource investment, top management commitment and support. This company also shows a high achievement in terms of satisfaction on relationship, inventory cycle, fill rate, and percentage of return. However, from the gathered data, they concluded that the business relationship is indeed mutually benefits and efficient even with the medium level of commitment to collaboration.

To conclude, managerial commitment for VMI program can be observed in term of sufficient employees, financial resource, and advanced planning. Even though immediate improvement in VMI program is unlikely, managers should continuously contributes sufficient aggregates of resources to attain maximum VMI related success (Myer et al., 2000). In addition, the managerial should continuously enriches the environment of commitment in long-term among supplier and customer with complying with term agreed (Redondo & Fiero, 2005) and provide employees with sufficient time for planning (Smit, 2006) to ensure VMI program are to be mutually profitable for the firm and trading partners. Table 2.16 present the effects of managerial commitment on performance.

Table 2. 16

Managerial Commitment and Its Effect on Performance

Author(s)	Effect on Performance
Myer et al. (2000)	Commitment → cost and service performance (+)
Kuk (2004)	Commitment →cost (+)
Claasen (2008)	Commitment → VMI success (+)
Sheu et al. (2006)	Commitment →satisfaction level, inventory cycle, fill rate, and goods return (+)

2.6.2 Decentralized Decision Making and VMI Performance

According to Sabaht et al. (2001), the centralization decision making is needed at the supply chain level to provide a focus and allows long-term thinking/planning. With this approach, enable managers integrating the information about cost in order to optimize the distribution activities (Myers, 1997). In fact, only top management can understand the related cost (Myer et al., 2000). However, the performance of VMI is only made possible by the increased availability of relevant information for the decision maker (Kleywegt, Nori, and Savelsbergh, 2002).

Conversely, Holmstrom (1998) argued that the implementation of VMI requires lower level managers to concentrate on reviewing potential risks, increase material flow and increase the reorder level. Therefore, by decentralizing selected areas (e.g. purchasing, logistics, inventory management) operational efficiency can be improved and be more responsive (Sabaht et al., 2001). For example, Brown, Blackmon, Cousins, and Maylor (2001) argued that when purchasing activity is managed by one major location. The head office is responsible for all the purchasing for the firm. This will allow an organization to benefit

in terms of economies of scale, expertise, easier process management, and easier to find experts.

While decentralized purchasing that was conducted at a divisional level, will have a budget and will be more focus on its own individual requirements. They can be very responsive to the customer's needs, source and manage quality levels locally. However, decentralized decision making tends to be more expensive, miss out on the global deals, less strategic and more transaction focused.

While, Sheu et al. (2006) had made a case study to understand the social and technical factor including centralization of decision making that contributes to the successful supplier-retailer collaboration. The case study examines the relationship between Johnson & Johnson in Taiwan and its retailers. Their findings reveal that the retailers using centralization decision making approach will experience low performance rating in terms of inventory level, fill rate, percentage of return goods, and level of customer satisfaction.

Recently, Rangavittal and Sohn (2008) hypothesised that a centralized organizational structure helps a company to lower the costs and decentralized structure enables the companies to respond quickly to customer's needs on a real time basis and to improve customer service. They concluded that centralization lower the unit costs for the company, while decentralized reduces the customer response time and increase the customer service level.

In the previous study, Myer et al. (2000) expected a positive correlation between centralized decision-making and cost performance.

Further, they also expected that centralized decision-making would negatively influence service performance. A finding shows that centralization of decision-making has positive relationship with cost reduction efforts, but at insignificant relationship. Meanwhile, the expectation on the service performance has shown the opposite result. The centralization of decision-making has a significant and positive relationship with service performance. The positive association between centralized decision making and service performance specifies that VMI is can work effectively, irrespective of the approach of the decision-making processes.

Further, Sabath et al. (2001) examined the influence of the degree of centralization on the performance of automatic store replenishment systems. Their basic result has shown that a decentralized organization tend to achieve better results. Decentralized firms, which used automatic store replenishment systems, tend to perform better in relation to out of stocks, reduction of overstocks, returns, handling costs and product damages.

Therefore, decentralized decision making is a better choice to ensure better service performance where lower managers can respond quickly to customer's needs on a real time basis. Although, the centralized decision-making was argued to be able to increase the cost performance, managers with decentralized decision making can also make a right decision regarding the cost if they were provided with sufficient information. For this study, decentralized decision making is referred as to the degree to which certain area or functions makes firm-

related important decisions regarding cost reduction activities and service improvement activities. Table 2.17 present the effects of decentralized decision making approach on performance.

Table 2. 17
Decentralized Decision-Making and Its Effect on Performance

Author(s)	Effect on Performance
Myer et al. (2000)	Centralization of decision making➔cost and service performance (+)
Sabath et al. (2001)	Decentralization of decision making➔ out of stocks, reduction of overstocks, returns, handling costs and product damages (+)
Brown et al. (2001)	Decentralization of decision making➔cost performance (+) and service performance (+)
Sheu et al. (2006)	Centralization of decision making➔ satisfaction level, inventory cycle, fill rate, and goods return (-)
Kim (2007)	Centralization decision making➔technical performance and administrative performance (+)
Rangavittal & Sohn (2008)	Centralization decision making➔costs (+), services (-)

2.6.3 Information System Capability and VMI Performance

It has been argued that the successful implementation of VMI program often depends on computer platforms, communication technology, and product identification and tracking systems (Waller et al., 1999). Some authors (Simchi-Levi et al., 2000; Lee, Clark, and Tam, 1999) also remarked that customer and supplier requires advanced information systems including Electronic Data Interchange (EDI) as a precondition to implement VMI program. Though, Waller et al. (1999) maintained that information systems should be viewed as an enabler, not as a necessity for VMI program.

According to Kuk (2004) investment in technical capability and technological know-how is essential to attract and maintain business with the right partner. He studied the connection between the

technology capabilities that enhancing the quality of information and the performance of VMI. The results show that the technology capability in enhancing information quality can improve the services and reduce costs supply chain members. He concluded that VMI programs require the manufacturers to invest in IT infrastructure to make the production level activity and inventory more visible to their suppliers.

However, if the decision was poorly made, stockouts and production line disruption can occur (Kuk, 2004) due to the operating changes including frequent reorder decisions with smaller quantities, particularly for high volume products (Kaipia et al., 2002). Further, Kuk (2004) argued this situation can be avoided through technology that ensured information was exchanged among supply chain members. A study by Claasen et al. (2008) exposed that buyer and supplier often made investments in an additional customized ICT tool in order to exchange information more effectively. Most suppliers use SAP system as the main ERP systems to process information internally, while customers use it as an application to collect the information. Their survey also found that perceived VMI success was positive and significantly impacted by quality of IT systems. Further, the perceived VMI success has a positive and significantly impact on all three types of benefits, including costs reduction, customer services and supply chain control.

Danese (2005) conducted a case study on how VMI can be extended to both upstream and downstream in the supply network to co-ordinate

the material and information flows among a number of different suppliers, manufacturing and distribution plants. The results from the interview highlighted the success of extended VMI program depended on the adoption of a central information system. The capability that encompassed in the central information systems allows the supplier to decide on how much and when to deliver based on the information concerning the different supply network members to support the production planning and order cycle processes.

Sheu et al. (2006) discovered that IT capability was one of the supply chain architecture that influence the level and amount of supplier-retailer collaboration, especially in VMI practice. They argued that IT capability can provide a more effective platform for both parties to engage in coordination, participation, and problem solving activities. Consequently, these would increase the supply chain performance in terms of satisfaction level, inventory cycle, fill rate, and goods return.

The effect of relationship between IT capability in terms of quality and collaborative planning also had been investigated by Petersen, Ragatz, and Monczka (2005). In their study, information quality comprises of accuracy, timely, completeness, consistency and ease of access. The findings show that information quality had a positive impact on the planning process. Further, they observed that collaborative planning can be more effective, if linked information systems were used in sharing information compared to information shared in traditional mode.

To conclude, information system capability is important to facilitate the VMI program implementation. Claasen et al. (2008) also concluded that lack of adequate information technology that results in the sharing of out-dated or inaccurate sales and inventory data can lead to the failure of VMI program. Thus, the capability of information systems refers to what extent information system capability has been used to smooth the VMI program between the customer and the supplier. Table 2.18 present the effects of information system capability on performance.

Table 2. 18
Information Systems Capability and Its Effect on Performance

Author	Effect on Performance
Kuk (2004)	IT capability➔Service quality and cost reduction (partially, +)
Danese (2005)	IT capabilities ➔ better production planning and order cycle process (+)
Sheu et al. (2006)	IT capabilities ➔Level of collaboration➔supply chain performance (+)
Petersen et al. (2005)	IT capabilities ➔ planning process (+)
Claasen et al. (2008)	IT capabilities ➔ Perceived VMI success ➔ cost reductions, customer service, supply chain control (+)

2.6.4 Trust and VMI Performance

As VMI program requires member to share information, confidential information must be entrusted, unfortunately, some companies may also be unwilling to share information and lack of trust often exists (Fraza, 1998). Therefore, the absence of trust can be a major barrier to the success of VMI (Kuk, 2004).

Childe (1998) refers to three types of trust in business partnerships;

- Goodwill trust

Honesty, a partner is trusted to take decisions without unfairly exploiting the other party

- Contractual trust,

  Keeping promises, maintaining confidentiality and intend to act as agreed

- Competence trust,

  Believing that the other party is capable of performing as agreed

He argues that arm's length contractual agreements only depend on contractual and competence trust, while long term relationships build on goodwill trust. Therefore, trust here is defined as the willingness to rely on a partner in whom one has confidence (Ganesan, 1994; Spekman et al., 1998).

Gandhi (2003) proposed that in order to establish trust, a company need to demonstrate to the trading partner the benefits of shifting to VMI. Stank et al. (1999) also gave an example on how trust should be developed. They stated that Wal-Mart could trust the manufacturer would ship and deliver the product on time as requested. While Warner Lambert depends on the fact that the retailer would accept the product in the quantities and at the time they agreed on.

In the Beccerra and Gupta (1999) study, the negative aspects from lack of trust was resulted in higher transaction costs and agency costs. For example, a manager's time and energy spent on dealing with low-trust relationships are higher than those spent in dealing with high-trust relationships. Meanwhile, a partnership with high-trust would enjoy

open communication and willingness to take risks. They also indicated that the overall performance would be enhanced if the problems of distrust were reduced (Beccerra and Gupta, 1999).

Riddalls, Icasati-Johanson, Axtell, and Clegg (2002) quantified the effects of trust in supply chains during promotional periods. They found that trust has great influence on supply chains in terms of inventory costs and production costs and in certain circumstances, low levels of trust can increase total supply chain costs considerably. They also stated that trust is one of the determinants of supply chain performance.

Meanwhile, a study conducted by Handfield and Bechtel (2002) stated that trust positively improving supply chain responsiveness, including on time delivery and lead time. They also argued that even in cases when the buyers do not have a great deal of control over their suppliers, works in building the trust within the relationship could improve supplier responsiveness. Conversely, a low level of trust can make the supplier less responsive in logistics services such as order cycle time and delivery reliability.

Sheu et al. (2006) investigated social and technical variables contributing to the successful supplier-retailer collaboration. They evaluated the relationships between Johnson & Johnson (distributor) in Taiwan and its five retailers. The case study revealed that there are positive relationships between trust and long term orientation. They argued that high-trust encouraged the retailer to share information and uses IT applications. Subsequently, retailers with a high level of trust

have shown a slightly high positive effect on satisfaction level, inventory cycle, fill rate, and goods return compared to the retailers with a low level of trust.

An exploration study was conducted by Claasen et al. (2008) found that all participants, except for one, have mentioned trust was extremely important in achieving VMI performance. However, they also have not disclosed on how trust affect VMI performance. Further, they investigated the performance of VMI program from a buyer's perspective in the variety of industries. They used relationship quality as proxy to describe a trust. The study shows that a significant and positive impact of quality relationship on perceived VMI success.

Sari (2008) explored the performance increase achieved by VMI under different levels of outside supply capacity, demand uncertainty, and lead-time. He concluded that failures of many VMI programs were due to the lack of mutual trust as well as a lack of adequate information technology that results in sharing of out-dated or inaccurate sales and inventory data. Table 2.19 present the effects of trust on performance.

Table 2. 19

Trust and Its Effect on Performance

Author (s)	Effect on Performance
Beccerra and Gupta, 1999)	Trust ➔ Transaction costs (+)
Riddalls et al. (2002)	Trust➔supply chain performance (+)
Handfield and Bechtel (2002)	Buyer trust➔ supplier responsiveness
Petersen et al. (2005)	Trust ➔Planning process (+)
Vigtil (2007)	Trust➔affect VMI (+)
Claasen et al. (2008)	Trust➔Perceived VMI success ➔ cost reductions, customer service, supply chain control (+)

2.7 Type of Products and VMI Performance

Initially VMI was created for the grocery sector in the late 80s, but has been extended to other sectors, e.g. household electronics, packaging products, and cars (De Toni, 2005). In general, empirical studies have captured a number of VMI practices in the various industries. Table 2.20 listed the industries that engaged in VMI.

Table 2. 20
VMI Practices in Industries

Industry	Author (s) and Year
Electronic	Claasen et al. (2008) Dong et al. (2007), Blackhurst et al. (2006),
Pharmaceutical and healthcare	Danese (2005)
Food	Dorling et al (2005), Kulp et al. (2004)
Wood processing	Gronalt & Rauch (2008)
Grocery	Claasen et al. (2008), Kaipia (2007), Tyan & Wee (2003), Vergin & Barr (1999), Kaurema (2009)
Chemical	Kaurema et al.(2009), Claasen et al. (2008)
Electric Appliance	Dong et al. (2007), De Toni & Zamolo (2005)
Paper based	Kaurema et al. (2009)
Transportation elements.	Dong et al. (2007)
Industry Machinery and equipment	Dong et al. (2007)
metalwork	Claasen et al. (2008)
Construction	Claasen et al. (2008)

During the literature review several characteristics of product which were considered to be important for VMI performance were found. Products can be either functional or innovative, depending primarily on its characteristics presented in Table 2.21. According to Fisher (1997), functional products required indeed an effective supply chain, where the focus is the optimization of the physical flow of products that is the reduction of costs. Innovative products on the other hand, required a reactive supply chain, characterized with elevated flexibility and careful marketing activity, because the elevated uncertainty of market and low life cycle increment the risk of obsolescence

and therefore, should be managed by responsiveness and agility. Fisher (1997) suggested that an effective supply chain should be designed based on the types of products.

Table 2. 21
Characteristic of Functional Versus Innovative Products (Fisher, 1997)

	Functional product	Innovative product
Aspect of demand	Predictable demand	Unpredictable demand
Product life cycle	More than 2 years	3 month to 1 year
Contribution margin	5% to 20%	20% to 60%
Product variety	Low (10 to 20 variants per category)	High (often millions of category)
Average margin of error in the forecast at the time production is committed	10%	40% to 100%
Average stockout rate	1% to 2%	10% to 40%
Average forced end of season markdown as percentage of full price	0%	10% to 25%
Lead time required for made-to-order products	6 months to 12 months	1 day to 14 days weeks

De Toni and Zamolo (2005) argued that standard products with a steady demand and long life cycle, referred to functional products by Fisher (1997) are the most suitable products for VMI practice. Kuk (2004) also urged that VMI practice typically was implemented for repetitive production situations involving standard products rather than custom, continuous flow, or project situations. Meanwhile, Stank et al. (1999) also added that most of the acclaimed benefits of VMI program were applied to a few selected high volumes, profitable products with stable demand patterns. However, De Toni and Zamolo (2005) argued that the replenishment of innovative products in which should be based on actual needs and not by warped forecasts can also gained benefits from the VMI practice.

Waller et al. (1999) examined how variability of demands affects the benefits achieved with VMI practice. Their findings showed that demand pattern does not play an important role to determine the benefits of VMI practice. The inventory reductions were very large, which is greater than 85 per cent for all three levels (low, medium, and high) of demand variability. They argued that this benefit was achieved through reductions in cycle stock arising from more frequent deliveries as well as a modest reduction in safety stock. However, they find that shortening the order review period accounts for most of the benefits of VMI program whilst the relative benefits are slightly larger with lower compared to with high demand variability. Recently, Claasen et al. (2008) also confirmed that VMI program can be implemented for a diverse set of products and demand patterns. They also found that different situations lead to different VMI designs. The result of interviews also disclosed that if VMI was implemented for innovative products, the buyer was highly involved and willing to provide the supplier with all necessary information. Conversely, if VMI was implemented for functional products, the buyer expected the supplier to take responsibility of the entire chain without a lot of buyer involvement.

On the other hand, Kaipia et al. (2002) had analysed on the time supplier has for planning. They assumed that the longer the times the better it can optimize services and operations to the customer. The result showed that VMI program with low product variety had enough time to synchronize the weekly production scheduled to meet the demand. However, in the second case when the product variety was too large, the time benefit was too small to synchronize the production schedule with the demand. Furthermore, Kaipia et

al. (2002) also revealed that low volume item was much more efficient than high volume items under the VMI practice. The low volume item tends to reflect fewer orders than high volume items. Therefore, the more time the supplier has for planning, the better it can serve customers and optimize operations (Kaipia et al., 2002).

Gronalt and Rauch (2008) studied the VMI practice in controlling the stock at SST-production that was characterised by large variability of demand and long lead time to fulfil the customer's orders. They evaluated the VMI practice implementations against the actual inventory management for three different market scenarios. The result showed that VMI program, as an inventory control system can reduce the overall raw material stock by more than 37 percent by simultaneously increasing the SST service level.

Yao and Dresner (2006) analysed the benefits realized by the manufacturer and retailer under the VMI practice. Their analysis showed that VMI brought varying benefits in terms of inventory cost savings to firms. The results suggested that when demands become relatively predictable, the benefits from using VMI program decreased. They also argued that different types of products possessed different patterns of demand. Thus, by carefully choosing the types of products to be managed in VMI practice; managers may be able to increase the program's success rate.

To conclude, no general guidelines regarding suitable products for VMI practice were found in the literature. However, it has been clearly discussed that product characteristics can influence the performance of VMI. Therefore, types of products, innovative and functional product, which were highlighted

by Fisher (1997) were included in order to understand the influence of product characteristic on VMI elements, organizational factors, and VMI performance. For this study functional product here is referring to the features of product that have predictable demand, long product life cycle, low profit margin, low product variety, low average margin of forecast error, low average stockout rate, short replenish lead time, and low average end-of-season markdown as percentage of full price. Meanwhile, innovative product is referring to product characteristics that have unpredictable demand, short product life cycle, high profit margin, high product variety, high average margin of forecast error, high average stockout rate; long replenish lead time, and high average end-of-season markdown as percentage of full price. Table 2.22 present the researcher opinions on suitability type of product for VMI performance.

Table 2. 22
Mixed Opinions on Suitability Types of Product for VMI Performance

Typical product characteristics	Commodities/functional	Fashion goods/innovative
Demand	Predictable Waller et al., 1999; Stank et al., 1999; Hemila et al.,2006;	Volatile Waller et al., 1999; Gronalt and Rauch, 2008; Yao & Dresner, 2006;
Volume	High De Toni & Zamolo 2005, Waller et al. 1999, Stank et al.,1999)	Low Kaipia et al., 2002; Vigtil 2003;
Product variety	Low Waller et al. 1999	High Kaipia et al., 2002
Customize	Low De Toni & Zamolo 2005, Kuk , 2004)	High Hemilia et al. 2006, Angulo et al., 2004,
Profit margin (profitable)	Low Ryu, 2006, Nolan, 1997,	High Stank et al.,1999; Ryu 2006, Ellinger et al. 1999)
Replenish Lead-time	Short Vigtil 2003;	Long Gronalt and Rauch, 2008; Vigtil 2003
Product life cycle	Long Wang, 1998,	Short Angulo et al., 2004

2.8 Resource Based-View Theory and VMI

One of the main objectives of the Resource-Based View (RBV) theory is to achieve sustainable competitive advantage (SCA). The SCA is being realized through the possession of key resources with certain characteristics. The RBV argued that a firm's resources can contribute to its growth and performance (Barney, 1991). In the context of this study, the performance of VMI can be viewed as SCA, in which participating company would acquire. Meanwhile, the resources referred in the RBV include tangible and intangible assets, such as management skills, organizational processes, firm attributes, information and knowledge it controls (Barney, Wright, & Ketchen, Jr., 2001). Further, the firm's resources with characteristics, which were rare, valuable, inimitable and non- substitutable resources (VRIN) were capable to attain a SCA (Barney, 1991).

The resource-based view provides a relevant basis for studying the VMI practices. VMI elements, organizational factors, and type of products can be valuable resources in which they improve the efficiency or effectiveness of the firm in terms of reducing cost and increasing services to customer (Claasen et al., 2008; Redondo & Fiero, 2005; Daugherthy et al., 1999). This in turn will provide competitive advantage to the firm. In VMI practices, supplier is responsible for the inventory replenishment decisions and embedded with the agreement with their customer. Thus the VMI elements are considered rare in that by exercising control over it, the firm can exploit it to the disadvantage of its competitors. Equally, organizational factors belong to the firm and cannot be easily accessible to either current or future competitor. The RBV also argued that the production and marketing of special product features requires

rare, or perhaps even unique, resources (Barney, 1997). Thus, products being held by a company as an asset to fulfil the customer's demand can also be viewed as a rare resource.

On the other hand, the VMI elements, organizational factors, and type of products are also imperfectly imitable in which competitors cannot easily develop it in-house. For instance, it can be argued that VMI can be practiced at other company but not all of them are successful (Simchi-Levi et al., 2004). Indeed, if VMI was successfully practiced, the performance of the program differed from one company to another (Sarpola, 2006). Similarly, organizational factors that encompass social complexity include interpersonal relations among manager, firm's culture and a firm's reputation among customers, making them difficult to imitate (Barney, 19991). Meanwhile, imitable of product can be impeded through the legal restrictions on imitation include patents, copyrights, and trademarks (Montgomery).

The VMI elements and organizational factors also not easily substitutable; otherwise, competitors would be able to identify different, but strategically equivalent resources to be used to achieve similar competitive advantage. Although it may be possible for a firm to develop its own unique VMI elements, organizational factors, and product, but most of the firms are unable to achieve exactly the same implications as other companies do. In addition, they are heterogeneous in nature and cannot be transferred from one firm to another without cost to achieve sustainable competitive advantage (Barney, 1991; Priem & Butler, 2001) and can bring in above-average returns.

2.9 Operational Definition

a) Inventory location

Refer to the centralization of multiple inventory locations into a single location and is generally believed located proximity to customer's location.

b) Inventory ownership

It refers to what extent supplier owns the inventory by identifying when the supplier is paid on goods sold to the customer, responsibility of cost associates to hold inventory and controlling the fluctuation of goods prices.

c) Level of demand visibility

Refer to what extent the type of demand information provided to the supplier in order to assist replenishment of customer's inventory.

d) Transfer mode

Refers to what extent supplier depends on information system technology in order to get access to the customer's demand information.

e) Monitoring and ordering

Refer to how often the supplier monitors the customer's inventory levels in order to place a replenishment order or a production order.

f) Inventory control limits

Refer to what extent safety stock, penalty cost, minimum and maximum limits of inventory were applied in VMI program in order to ensure availability of stock.

g) Replenishment decisions

Refers to what extent of the supplier is authorized to make replenishment decisions about quantity and delivery time.

h) Managerial commitment

Refer to the degree to which management dedicates manpower and other resources to its VMI program, as well as the advanced planning, which takes place within the firm for the system.

i) Decentralization of decision making

Refer to the degree to which lower-level management makes firm-related important decisions regarding to cost reduction activities and service improvement activities.

j) Information system capability

Refer to what extent information system capability has used to facilitate the VMI program between the customer and the supplier.

k) Trust

Refer to the willingness to rely on a trading partner in whom one has confidence.

l) Functional product

Refer to the features of product that demand is a predictable demand, long product life cycle, low profit margin, low product variety, low average margin of forecast error, low average stockout rate, short replenish lead time, and low average end-of-season markdown as percentage of full price.

m) Innovative product

Refer to the features of product that demand is an unpredictable demand, short product life cycle, high profit margin, high product variety, high average margin of forecast error, high average stockout rate; long replenish lead time, and high average end-of-season markdown as percentage of full price.

n) Cost performance

Refer to the degree to which VMI program is efficiency in reducing cost.

o) Service performance

Refer to the degree to which VMI program is efficient in improving services.

2.10 Summary

This chapter has presented the theoretical background for this thesis. Some basic elements of VMI associated to logistics and inventory management practice were presented because they form a fundamental to the discussions and findings of this work. While understanding the generality of inventory management in logistics, the emphasized was argued on how the described can be applied in a VMI discussion. It has been argued that collaboration has become more and more important for sustained competitiveness and several organizational factors were identified which can affect VMI performance. Moreover, the type of products held by a company as a stock to fulfil the customers' demand can influence the VMI, organization factors, and VMI performance. These aspects can have an impact on the successfulness of the VMI, which was applied in the manufacturing company. Furthermore, this chapter has clarified on the variables used for describing different models for sharing of responsibilities in supply chain collaboration. This was done to outline the definition of VMI applied in this thesis and to compare the characteristics of VMI to other collaboration models.

CHAPTER THREE

RESEARCH FRAMEWORK AND HYPHOTHESES DEVELOPMENT

This chapter narrowed down from literature review to illustrate the key research area of this study. An outlay of the research framework is presented to visualize the relationships undertaken by this research.

3.1 Research Framework and Development of Hypotheses

The previous empirical studies showed studies on VMI elements were few. In fact, some of the studies were on conceptual basis that require empirical study (Zammori et al., 2009; Sarpola, 2006). On top of that, VMI elements were argued to affect VMI performance. According to Sarpola (2006), in their conceptual paper, the VMI elements were significant to the VMI practice. He also stated that an improper choice of VMI elements would affect the VMI performance. Although, an empirical study by Elvander et al. (2007) had identified several VMI elements, but its association on VMI performance was not empirically tested. Based on previous researches (Claasen et al., 2008; Ramayah, et al., 2005; Kulp et al., 2004), basic elements of VMI had not been covered broadly. Therefore, a study on this relationship is essential. This study also had determined the basic VMI elements based on works by Elvander et al. (2007), Sarpola (2007), Vigtil (2007), and Zammori et al. (2009). The basic VMI elements which examined in this study include inventory location, inventory ownership, level of demand visibility, transfer mode, monitoring and ordering, inventory control limits, and replenishment decisions.

The entire network or path of relationships that has been discussed this far can be schematically diagrammed as in the Figure 3.1. It illustrates the relationship between organizational factors and VMI elements function as the independent variables, which have a relationship with VMI performance as the dependent variable. In addition, the type of products functions as moderator on organizational factors and VMI elements.

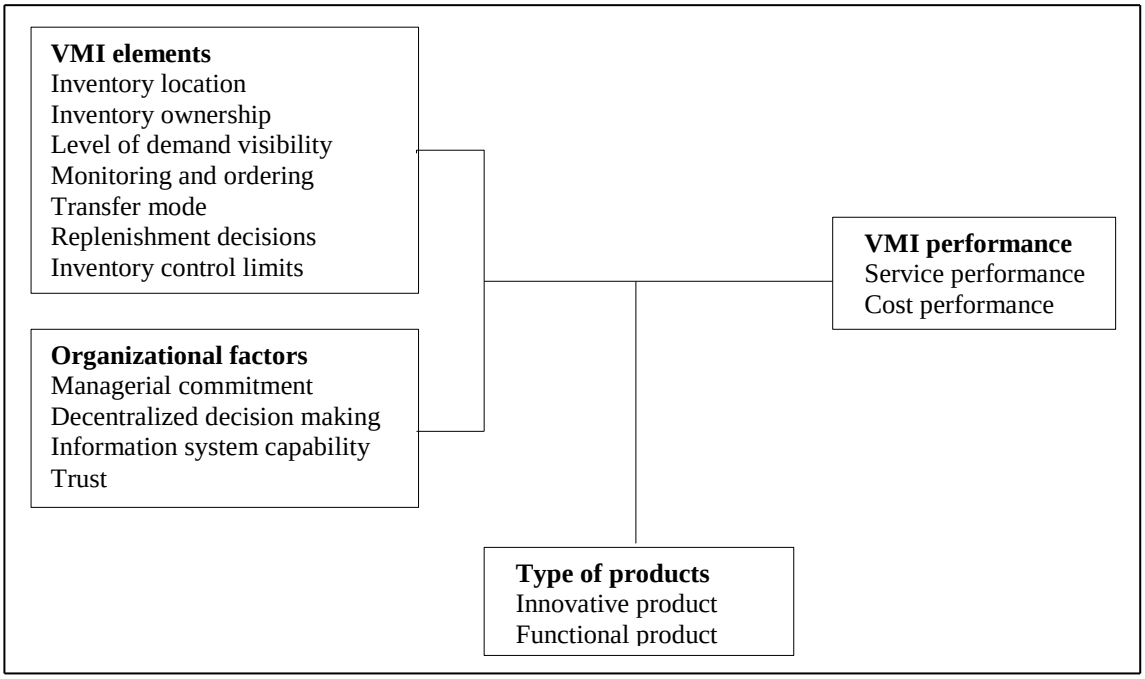

Figure 3. 1

A Research Framework of the Relationships among Organizational Factors, VMI Elements, Type of Products, and VMI Performance

Literature shows that inventory locations element can reduce the cost through optimization of deliveries. In addition, if inventory location is closer to the consumption location, the suppliers can be more responsive to their customer's needs. Ownership of inventory also can bring benefits to the supplier in term of cost reduction and better customer services. Sarpola (2007)

argued that this approach would increase sales and has better opportunity to introduce new product. In fact, inventory ownership also reduces the overall cost in the supply chain (Dong and Xu, 2002).

In term of demand visibility, literature shows that the more the demand data were shared between the customer and supplier the more benefits can be accrued. Supplier can use the demand information to make better planning and response to customer's demand. Meanwhile, a frequent review and monitoring inventory status also would give advantage to supplier. Supplier can update information of inventory level, which assists them to take further action in determining quantity ordered or expediting the shipment to customer. Besides, transfer mode also plays a significant role to successful VMI program. It has been argued that speed of information transferred can be increase using information system technology. Therefore, suppliers can receive immediate information to make decision and better planning, which in turn improve the cost performance and delivered better services to the customers.

The next VMI element in this study is replenishment decisions. If supplier has the right to make the replenishment decision, it is believed that the right quantity will be replenished at the right time to meet the actual market demand. In addition, the manufacturing and distribution activities can be improved and optimized (Cetinkaya & Lee, 2000); and out-of-stock cost also can be reduced by prioritizing the customer orders (Waller et al., 1999). Finally yet importantly, the VMI element is inventory control limits. The application of min-max limits and safety stock can ensure the high customer services. Although it can create additional cost to supplier, but with appropriate min-max limits and safety stock level can avoid incurring others

cost such as shortage cost, penalty cost, and handling cost for excessive inventory.

In order to achieve the objective one of the research, the study proposes the hypotheses for VMI elements as follows:

H1: The VMI element has a significant and positive relationship with VMI performance.

H2: The VMI elements has significantly explained the variance of VMI performance.

The literature also suggests that organizational factors is essential as it contribute to company' performance. It allows companies to gain benefits of VMI through cost reduction and improving service to the customer. Studies done in organizational factors are deemed necessary as the success of VMI practice will be influenced by the structural and experiential capabilities available to manage this system, encompassing both financial and human resources (Myer et al., 2000). Findings from previous research show that the organizational factors were related to the VMI program (Myer et al., 2000; Kuk, 2004; Sheu et al., 2006) and specifically the organizational factors is related to VMI performance (Claasen et al., 2008; Kuk, 2004; Myer et al., 2000). For instance, the hypotheses proposed by Myer et al. (2000) were support partially on the association between organizational factors and VMI performance (Myer et al., 2000). However, Myer et al. (2000) concluded that there is a need to match the organizational factors with the VMI program in order to attain better performance. For examples, managerial commitment is significant to VMI program in which supplier needs sufficient information

from customer in order to make replenishment decision on behalf of their customer. In order to be successful in VMI program, managerial must allocate sufficient allocation of time, finance, and personnel. In addition, managerial commitment also needed in complying with the term agreed. The more managerial commitment is the VMI program, the better the VMI performance. Meanwhile, de-centralized decision-making approaches also can impacts on VMI performance. Although, managers who adopted de-centralized decision-making approach is argued to be less understanding on the underlying costs, with sharing information as required in VMI program, it is believed to reduce the cost associated to inventory management. As de-centralized approach cuts down the hierarchical decision-making, it allows manager to response quickly on customers' issues. Thus, the more de-centralized decision making in the organization, the greater VMI performance.

Beside, information system capability is important to facilitate the VMI program implementation. As sharing demand information is important, the need of better information system infrastructure is crucial. The information system facilities must be ready to receive and accessing information. Researcher had outline the major criteria need to be addressed, which includes quality of information and compatibility of the system. Hence, better capability of information systems improves the VMI performance. Pertaining to organizational factor, trust is also important. The presence of trust reduces the inventory cost, in which the need of accurate and sufficient information of inventory data is important. Conversely, a low level of trust can make the supplier less responsive in logistics services such as order cycle time and

delivery reliability. Therefore, trust has positively related to VMI performance.

Hence, the study proposes the hypotheses for organizational factor to achieve the research objective two as follows:

H3: Organizational factor has a significant and positive relationship with VMI performance.

H4: Organizational factor has significantly explained the variance of VMI performance.

In addition, this study is intended to use type of products as a moderator variable, which specifies when or under what conditions predictor variable influences VMI elements, organizational factors, and VMI performance. A moderator variable is considered when the relationship between an independent variable and a dependent variable is strong, but often it is considered when there is an unexpectedly weak or inconsistent relationship between an independent and a dependent variable (Baron & Kenny, 1986; Lindley & Walker, 1993). The type of products as a moderator was studied in supply chain collaboration, which involves buyer-supplier relationship (Redondo & Fierro, 2005). They had proven that the type of products affects the firm's commitment and trust. Though, their effect on organizational interaction and processes, consequences on their influence on a specific collaboration program like VMI remain inconclusive. Type of products could also influence the VMI elements. For instance, Claasen et al. (2008) discovered that a highly innovative product could increase willingness of the buyer to share all information necessary for inventory replenishment with the

supplier. Without sharing information, VMI cannot be successfully practiced and that most probably would affect a VMI performance.

The hypothesis five was developed as follow in order to answer the objective three.

H5: Type of products significantly moderates the relationship between VMI elements, organizational factor and VMI performance.

CHAPTER FOUR

RESEARCH METHODOLOGY

This chapter discussed on the research methodology used in performing this study. Section 4.1 elaborates on research design, which contains of research design, purpose of the study and duration, research design strategies, the units of analysis, sampling method and data collection. Section 4.2 discusses the questionnaire design, which includes VMI performance construct, organizational factors construct, and VMI elements construct, type of product construct, measurement scale. Followed by Section 4.3, explains the validity and Section 4.4 discusses the pilot study and reliability test. Then Section 4.5 informs the data cleaning and screening and non-response bias test. The factor analysis was briefly discussed under Section 4.6. A brief description also on the method of analysis is on section 4.7 which comprise of Pearson correlation test, multiple regression, and hierarchical regression. A short description on the test for linearity, homoscedasticity, autocorrelation and multicollinearity is also being discussed under Section 4.7. Next, the flow of hypothesis testing was showed in Section 4.8. Finally, the Section 4.9 summarized the chapter of research methodology.

4.1 Research Design

A quantitative approach was used to imply the search for knowledge that will measure, describe, and explain the phenomena and reality (Patel & Davidson, 1994). This also underlies the deductive model, which shows hypothesized relationship. Pertaining to this approach, the proposed relationship are obvious (Aaker et al.,2001; Davis 2000) and seek to quantify an observable consequence through running a statistical experiment thereby getting results

whether the hypothesized relationships hold or not (Aaker et al, 2001). This research is concerned with measurement of numbers such as the degree at which people agree on the relationship between VMI elements and organizational factors or the satisfaction levels of VMI performance. Thus, quantitative method provides a concrete answer to the research question scientifically which is defined in an objective way and measure through statistical tools and techniques (Rosner 1990).

Compared to the qualitative research method that emphasizes the exploration of real interest of a complex situation, which cannot be always be easily quantified. The subjective approach is to find an answer to the research questions (Beedles, 2002). In fact, this approach additionally can provide the intricate detail of phenomena that are sometime impossible to compose and derive from quantitative methods (Strauss and Corbin, 1990). The limitation of this research techniques are: this method is not a formal research approach to quantify data (Miles and Huberman, 1984); having rich and complex data, it is often difficult to build parsimonious theory and theoretical specification (Einshenhart, 1989). As a result, generalizability of the findings is most difficult aspect of this research approach.

As the research framework seeks to quantify the data for explaining the hypothetical relationships, quantitative method has better potential to be used in this study. The objective of the research is to determine the relationship between VMI elements, organizational factor, and performance in Malaysian manufacturing companies. In relation to quantitative method, a survey approach was used to collect the data, since, it can encompasses broader population of studies with large sample size, so relatively easy to administrate

and incurs moderate cost. Pinnsonneult and Kraemer (1993) suggested that survey research is best suited for answering question on what, how much, how many, and to a lesser extend how and why. Furthermore, based on the literature reviews, survey is appropriate for this study, which examines four major variables and the need of higher sample size to cover the field in different location in Malaysia. Survey method is suitable as it is cost efficient. It does not involved significant amount of time to close previous research gaps identified from other researchers. Lastly, based on the preliminary interview with experienced industry practitioners, the likelihood of obtaining commitment from organization to participate in case studies is relatively low, making this option not favorable. Based on the literature reviews and problem statement illustrated, there are not many research instruments to identify determinants of VMI performance. Most previous studies rely on case study to interpret and generalized events. Hence, specially crafted test instrument through structured questionnaire are used to study the research framework. Based on this justification, survey method is more appropriate.

4.1.1 Purposes of Study and Duration

The purpose of this study is to test empirically the relationship between VMI elements and organizational factors with VMI performance. It includes VMI elements and organizational factors as the independent variables while type of products is the moderator variable. The objective of this study is to ascertain the relationship between VMI elements organizational factors, VMI performance and the moderating effect of the type of products on both relationships. Thus, descriptive

and explanatory studies were employed for this study as it tries to explain the component of VMI elements, organizational factors, and VMI performance. This study also used correlational study to determine the relationship between these variables.

There are two alternatives concerning time-frame to conduct a research, which is longitudinal study and cross-sectional study. According to Cooper and Schindler (2006), the data in longitudinal study were collected at different point of time, while the data in cross-sectional study were collected at one point of time to study the issue at a specific time. Since, most of the studies in the context of VMI used cross-sectional studies (Dong, Xu, and Dresner, 2007; Wu et al., 2004), this study also used a cross-sectional study.

4.1.2 Research Design Strategies

A survey method was used due to its ability to explain the phenomena or to learn the reasons for any particular activity (Zikmund, 1994). According to Neuman (1997), data can be collected from many respondents in order to test multiple hypotheses and to measure many variables. The survey method is also commonly used and not so expensive. Hence, the questionnaires were mailed and delivered to the companies in order to gather the data. Section 4.1.5 discusses the further detail on data collection.

4.1.3 Unit of Analysis and Targeted Respondent

According to Neuman (1997), unit of analysis refers as the type of unit in measuring variables by researcher. In general, the study sought the level of VMI elements, organizational factors, and type of products engaged by supplier in supporting VMI program. This study focused on manufacturing industries where Malaysia companies were chosen as the unit of analysis. This study involve variety of industries in manufacturing sector, which include electronics, food related, automotive, chemicals/plastics, building materials, appliance, pharmaceutical, metal/metal working, textile/clothing, paper and packaging, and petroleum. Based on previous study on VMI program (Dong et al. 2007; Kuk, 2004; Daugherty et al., 1999), the target respondent for this study is key manager level, which usually represented by its General Manager, Customer Service Manager, Purchasing manager, Logistics Manager, Operation Manager, or higher-level officer (e.g. Planner and scheduler) who involved in decision making and providing direction of inventory replenishment strategy.

4.1.4 Population and Sampling Method

According to Sekaran (2005), the population refers to a whole group of people or organization that is of interest to the researcher. The Federation of Malaysian Manufacturers (FMM) directory 2010 become source of the population of the study, which comprise of medium to large Malaysian manufacturing firms. The FMM directory was used as the source of the population and sampling due to the

comprehensiveness of the directory. Classification of the firms was done in accordance with the definition of small and medium firms provided by Small and Medium Industries Development Corporation (www.smidec.gov.com).

As in the FMM directory there are about 2227 medium and large manufacturing firms registered as a member. There are few conditions when choosing sample size, which are the accuracy is required, the heterogeneity of the sample, the number of variables in the study and the statistical tools that are appropriate can influence the size of sample (Hussey & Hussey, 1997; Neuman, 1997). Following Krejcie and Morgan (1970) and Sekaran (2003), the recommended sample size is 330 (for the population size of about 2200 firms). Based on recent research by Islam and Karim (2011), the response rate on supply chain practice in Malaysia can be as low as 14.2 per cent. Salkind (1997) recommended that sample size should be increased by 40 percent-50 percent to account for lost mail and uncooperative subjects. Based on the recommendation made by Salkind (1997), the sample size was increased to 50 percent from total of sample size with 495 companies (330 sample size x 1.5) was selected from the entire population. A simple random sampling procedure was applied where respondents had equal opportunity of being chosen by drawing their names from a container. The 2227 of manufacturing companies were assigned a number to facilitate the selection and identification. As a result of sampling, Table 4.1 presents the distribution of chosen manufacturing companies for this study.

Table 4. 1
Distribution of chosen companies for sampling

Type of Industries	No. companies
Electronics	68
Food related	65
Automotive	55
Chemicals/Plastics	43
Building materials	36
Appliance	56
Pharmaceutical	39
Petroleum	18
Metal/Metal working	41
Textile/Clothing	32
Paper & Packaging	42
Total	495

4.1.5 Data Collection

In collecting data from respondents, this study uses a survey method as the main approach because it offers quite high reliability however generally low in validity (Babbie, 1990). In this study, the self-administered questionnaires were used. According to Zikmund 1(994), this approach enables the researcher to conduct a survey at wide geographic area with a relatively low in cost. In addition, it is convenient for the respondents where respondents are kept anonymous, and the questions are measured in standard measurement.

In order to mitigate the tendency for low response and bias in mail questionnaires, Sekaran (2005) suggested looking details in term of wording of the questions, questionnaires appearance, and the consolidation of variables. Moreover, when using mail questionnaires the respondents have sufficient time to look for the information and to reflect before responding the tough questions. It also allowed for a high contact rate at a lower cost (Reagan, 2003).

To increase the response rate, a set of questionnaire was sent to the respondents together with a cover letter and a self-addressed stamped envelope. The purpose of this study and the importance of the respondents' feedback were explained in the cover letter. After the questionnaires were sent to the respondents, a telephone call was made to follow-up the feedback from respondent. The stamped envelope was provided to encourage higher response. This survey instrument package was in accordance to the suggestion by Hussey and Hussey (1997) where it includes cover letter, questionnaires and a self-addressed stamped envelope.

4.2 Questionnaire Design

The primary data was collected through the use of survey questionnaire as shown in Appendix A. The questionnaire consists of 7 sections to measure respondents' and company background, type of products, organizational factors, elements of VMI, and performance of VMI that are associated to VMI program.

Section A

The first section (section A) of the questionnaire was used as a filter question whether the respondents truly practice the VMI at their company based on the definition of terms used in this study. The first set of questions requires respondent to state the inventory replenishment program they are involved. Next set of questions asked whether supplier was given authority to make inventory replenishment on behalf of their customer. The third set of questions

is pertaining to sharing of demand information to assist the inventory replenishment.

Section B

Section B focused on the items of VMI adoption, which include motive identification of improve product availability, improve market access, customer demand it, enhance strategic growth, adding technological strengthen, strengthen operations, ensure customer retention, building financial strength and enhancing organizational skills. The next set of questions measures product characteristics which comprise of predictability of demand, product life cycle, contribution margin, product variety, average forecast error, average stock-out rate, average price discount, and production lead time.

Section C

Section C highlighted the measurement of the organizational factors variables that consist of centralization of decision making, managerial commitment, information systems capability, and trust.

Section D

Meanwhile, section D is intended to assess the VMI elements, which include inventory location, inventory ownership, level of demand visibility, transfer mode, monitoring and ordering, inventory control limits, and replenishment decisions.

Section E

Next, in section E, the question was intended to measure VMI performance in terms of cost and service.

Section F

In section F, the duration of VMI program and demographic information were asked. In addition, to ensure all useable data come from manufacturing company, the respondents were asked on their primary business whether they involved in manufacturing or trading or merchandising company. They also were asked about type of industries they involved, annual sales turnover, numbers of employees, and type of companies.

Section H

Finally, in section H, demographic questions were asked to enable the researcher to build respondent's profile. A space for respondents' information was provided.

4.2.1 VMI Performance Constructs and Dimensions

As previously discussed, two primary performance dimensions underlie the VMI program, that of (1) costs and of (2) service. In the study of VMI, when the performance of a specific collaboration was evaluated, economic measures such as costs (Aviv 2002; Dong & Xu 2002) and service (Stank et al., 1999; Myer et al., 2000; Angulo et al., 2004; Claasen et al.; 2008) were mostly used to measure VMI performance in the quantitative approach.

Thus, to understand the performance of VMI program, the investigation on cost and service performance is a key point of this study. There were 11 questions or items used to measure the cost performance construct and 14 questions or items were used to measure the service performance construct. The measurement items were

adapted from various authors that dictate the impact of VMI program to supplier, which were listed in Table 4.2 below.

Table 4. 2
Source of Cost and Service Performance of VMI Measurement

Variable	Items	Literature
Cost	1. Reduce the inventory holding cost. 2. Reduce the transportation cost. 3. Fewer product returns due to quality or obsolescence. 4. Fewer wastage as work in progress is affected when the quality issue is encountered.	Adapted from Kuk (2004)
	5. Reduce the administration cost. 6. Reduce the materials handling cost.	Adapted from Claasen et al. (2008)
	7. Reduce product damage. 8. Reduce the need to discount. 9. Reduce over stock	Adapted from Daugherty (1999)
	10. Reduced reliance on forecasts. 11. Shorter the production run	Adapted from Myer et al. (2000
Service	1. More frequent deliveries 2. More predictable order cycle	Adapted from Myer et al. (2000)
	3. Improve the relationship with customer 4. Improve the accuracy of forecast resulting in better planning. 5. Improved ability to react to upsides/downsides. 6. Productivity improvement should be achieved with automation of manual tasks. 7. Fewer incidences of production line disruption/stockout. 8. Fewer incidences of reject of shipments. 9. Reduce the order fulfilment time/ cycle time. 10. Delivery is made in exact quantity needed/meet the customer requirements. 11. Achieve overall improvement in the level of customer service.	Adapted from Kuk (2004)
	12. Delay the final production (postponement)	Adapted from Myer et al. (2000)
	13. Increase the customer responsiveness.	Adapted from Claasen et al. (2008)
	14. Improve the reliability of delivery.	Adapted from Daugherty et al. (1999)

4.2.2 Organizational Factors Construct and Dimensions

There are five variables to measure the organizational factors; managerial commitment, information system capability, decentralization of decision making, and trust. There were five measurement items of managerial commitment, which were adapted from Myer et al. (2000), Redondo and Fierro (2005) and Smit (2006). Although, Myer et al. (2000) had provided a set of questions of managerial management construct, but a clear mean is needed. Therefore, as discussed by Redondo and Fierro (2005), supplier's compliance to the term agreed was also included. In addition, question developed by Myer et al, (2000) in term of resource commitment is quite general. Hence, measurement item in terms of resource commitment was adapted from Smit (2006), which includes allocation of time, financial, and personnel. Further, the measurement item of advance planning was adapted from Myer et al. (2000).

Beside quality of information system, compatibility of information system also was frequently measured by researcher (Claasen, et al., 2008; Kuk, 2004; Daugherty et al., 1999). Compatible technology is more likely to foster mutual understanding and lead to a greater satisfaction, since the exchange cost is lower while incompatible technology is more likely to lead to an increase in conflict. Thus, technology that improves information flow and connectivity is more likely to win supply chain members' approval (Kuk, 2004). Therefore eight questions regarding the information system capability were adapted from Claasen et al. (2008) and Kuk, (2004).

Meanwhile, de-centralization of decision making measures the degree to which lower-level management makes firm-related decisions versus those managers upper-level. As discussed by Rangavittal and Sohn (2008), Myer et al. (2000), and Sabath et al (2000) decentralized decision making can affect cost reduction and service improvement. Therefore, based on this argument, the four constructs of decentralization of decision-making were adapted from Myer et al. (2000) with the clarity of its effect on cost reduction and service improvement decisions.

Finally, level of customer's trust towards the supplier to manage the inventory replenishment on behalf of the customer also was measured. Childe (1998) and Doney and Cannon (1997) had developed the trust measurement construct, which involved buyer-supplier relationship. Further, a quite similar meaning of measurement item of trust was developed by Claasen et al. (2005) in the study of VMI practice. However, they did not separate the perception of trust between the buyer and the supplier. Since, this study is intended to measure the VMI practice based on supplier's perspective, the trust construct were adapted from Claasen et al. (2005). Table 4.3 presents the items measured for each of organizational factor dimension and sources of measurement.

Table 4. 3
Source of Organizational Factors Measurement

Variable	Items	Literature
Managerial commitment	1. We have thorough advance planning for the inventory replenishment program.	Adapted from Myer et al. (2000)
	2. We are complying with the terms agreed with the inventory replenishment program's policy.	Adapted from Redondo & Fierro (2005)
	3. Our managerial gives us sufficient time to support the inventory replenishment program. 4. Our managerial provide us with necessary financial resources to support the inventory replenishment program. 5. Our managerial makes an adequate amount of personnel available to us for the inventory replenishment program.	Adapted from Smit (2006)
Information system Capability	1. Our information system can improve the accuracy of information received. 2. Our information system can improve timeliness of information. 3. Our information system is able to capture real-time information. 4. Our information system can achieve daily download of information.	Adapted from Kuk (2004)
	5. Our information system is compatible with existing IT systems. 6. Our information system is compatible with customer's IT systems. 7. Our information system is readily to enter in the customer's system 8. Our information system is formatted to facilitate the usage.	Adapated from Claasen et al. (2008)
Centralization of Decision Making	1. Our decision-making process is centralized. 2. Our division makes all the important, firm wide managerial decisions. 3. Our division makes all decision regarding the cost reduction activities 4. Our division makes all decision regarding the service improvement activities	Adapted from Myer et al. (2000)
Trust	1. We rely on the customer handling critical information on our company confidentially. 2. When we have an important requirement, we can depend on customer's support. 3. We are convinced that this customer performs its task professionally. 4. The customer is always honest with us. 5. We can count on the customer's promises made to our firm	Adapt Claasen et al. (2005)

4.2.3 VMI Elements Construct and Dimensions

VMI design consists of seven elements including inventory location, inventory ownership, level of demand visibility, transfer mode, monitoring and ordering, inventory control, and replenishment decision. As discussed in the literature review, inventory location can affect VMI performance. The discussion was focused on the closeness of inventory location, and centralization of inventory location. The centralization of inventory location can reduce the cost through the optimization of deliveries (Kuk, 2004; Simchi-Levi et al., 2000). Meanwhile, if inventory location is closer to the consumption location, the supplier can provide better services to their customer (Sarpola, 2006). Thus, inventory location construct was developed from Kuk (2004) and Sarpola (2006) review, which measured the centralization of inventory location, closeness of location to the consumption area, optimization of deliveries and responsiveness to the demands.

Meanwhile, inventory ownership measure the degree to what extent the replenishment of inventory owned by supplier and when the invoice was issued to the customer (Sarpola, 2006; Elvander et al.; 2008). However literature also suggested that inventory ownership should also be viewed based on who is responsible on the cost and risks of holding inventory (Wallin et al, 2006). Therefore, this construct was developed from Sarpola (2006), Elvander et al. (2008) and Wallin et al. (2006) review.

Next, the level of demand visibility is concerned with the amount of demand information provided by the buyer to the supplier. Based on

the literature, the historical data, point-of-sales data, demand forecast, purchase order, production/assembly planning, inventory level, goods in transit, incoming order, backorder, and return (Elvander et al., 2007; Vigtil, 2007; De Toni & Zamolo, 2005; Kumar & Kumar, 2003) are among the type of data transferred in the VMI practice. Thus, all the possibilities type of data transferred were measured in this study.

The VMI practice can be implemented by visiting customer's premises to collect demand information (Sarpola, 2006; Waller et al., 1999; Mattson, 2002) and with modest information system support (Waller et al., 1999) such as fax, phone and email (Vigtil, 2007). However, the successful implementation of VMI was argued often depended on computer platforms, communication technology, and product identification and tracking systems (Waller et al., 1999). The direct access to the customer's demand information will enable the supplier to make better forecasts and better response to the customer's inventory needs in terms of quantities to ship and locations to replenish. In this study, transfer mode was measured in what way the supplier gets access to the customer's demand data. The discussion on transfer mode was provided by Elvander et al. (2008), which covers on how the supplier gets the information regarding the demand information. In addition, Harrison & van Hoek, (2005) discussed the activity performed when supplier visited the customer's premises. Thus, the transfer mode in this study was developed based on the discussion made by Elvander et al. (2008) and Harrison and van Hoek, (2005).

On the other hand, Waller et al. (1999) argued that most of the inventory reduction achieved with VMI program can be attributed to more frequent inventory reviews, order intervals, and deliveries. Vigtil (2007) stressed that frequent review would not provide any benefits to the supplier. However, Elvander et al. (2008) argued that continuously review and make ordering if needed was appropriate when the fluctuation of demand is high. Meanwhile, Sheu et al. (2006) added that the short of review period offered high performance in managing inventory. The monitoring and ordering construct was developed based on Elvander et al. (2007) and Sezen et al. (2006) review, which discussing the frequent of inventory review, order replenishment, and period of review that affect VMI performance.

Meanwhile, in order to protect product availability for the buyer, VMI is often implemented with minimum and maximum limits of stock levels (Disney & Towill, 2003; Valentini & Zavanella, 2003). However, imposing a minimum and maximum limit together with the penalty cost to ensure the availability of safety stocks is causing slack in the supply chain, which in turn increases the customer service levels, nevertheless limited on cost performance of VMI practice (Claasen et al. (2008). Since, Elvander et al. (2007) and Claasen et al. (2008) had provided a clear definition on inventory control limits application; the developed question was based on their study.

The replenishment decisions elements were concerning the extent to which the supplier was authorized to make replenishment decisions about the quantity and delivery time. In VMI program, replenishment

decision can be fully determined by supplier (Yao et al., 2007; Vigtil, 2007; Sari, 2007). Although, several authors had discussed the responsibility of supplier to make inventory replenishment decision on behalf of customer, they did not comprehensively examine the aspect of decision as Elvander et al. (2007) did. Therefore, the measurement for replenishment decision level was adapted from by Elvander et al.'s (2007) study, which included decision on quantity and time. Table 4.4 presents the items measured for each of VMI elements dimension and sources of measurement.

Table 4. 4
Source of VMI elements measurement

Variable	Items	Author (s) and Year
Inventory location	1. Our finish inventory storage is located in centralize manner. 2. Our finish inventory storage location is close to customer's location/consumption area.	Adapted from (Kuk, 2004)
	3. We can optimize deliveries through centralization of inventory storage. 4. Our customers can at any time withdraw our inventory quickly from the storage location when needed.	Adapted from (Sarpola, 2006)
Inventory Ownership	1. We still own the inventory even it has been delivered to customer. 2. We only get paid when customer withdraws goods from storage. 3. The invoice only will be issued to the customer when the customer withdraws goods from storage.	Adapted from Sarpola (2006) Elvander et al. (2008)
	4. We are still responsible for the holding cost of inventory even it has been delivered to the customer. 5. We are exposed to price fluctuation in inventory even it has been delivered to the customer.	Adapted from Wallin et al. (2006)
Level of Demand Visibility	1. Our customer provides us with the historical data to assist inventory replenishment. 2. Our customer provides us with the point-of-sales data to assist inventory replenishment. 3. Our customer provides us with the demand forecast to assist inventory replenishment. 4. Our customer provides us with the purchase order to assist inventory replenishment.	Elvander et al. (2007)

Table 4.4 Continued

	5.	Our customer provides us with the production/assembly plan to assist inventory replenishment.	Vigtil (2007)
	6.	Our customer provides us with the inventory level to assist inventory replenishment.	
	7.	Our customer provides us with the goods in-transit to assist inventory replenishment.	
	8.	Our customer provides us with the backorder to assist inventory replenishment.	
	9.	Our customer provides us with the return order to assist inventory replenishment.	
Transfer Mode	1.	We do not conduct the stock count at customer's premises.	Adapted from Harrison & van Hoek, (2005)
	2.	We do not need to visit customer's premises to get inventory related information.	Adapted from Elvander et al. (2007)
	3.	We receive in batching inventory related information from the customer's system.	
	4.	We can get inventory related information through online access to the customer's system/ from our system.	
Monitoring and ordering	1.	We review the customer's stock continuously.	Adapted from Elvander et al. (2007)
	2.	We place the replenishment order when needed.	
	3.	We do not review of customer's stock periodically.	
	4.	We have shorter review periods.	Adapted from Sezen et al. (2006)
Inventory Control Limits	1.	Our customer used minimum limit to control the inventory level.	Adapted from Elvander et al. (2007)
	2.	Our customer used maximum limit to control the inventory level.	
	3.	We can be incurred penalty cost if do not meet the inventory control limits.	Adapted from Claasen et al. (2008)
	4.	We provide safety stock in order to meet customer need.	
Replenishment Decisions	1.	Our customer does not propose the replenishment order to us.	Adapted from Elvander et al. (2007)
	2.	We make replenishment order decisions.	
	3.	We do not need confirmation of replenishment order from customer.	
	4.	We have the authority to decide the quantity to be replenished.	
	5.	We have the authority to decide the time of delivery.	

4.2.4 Type of Product Construct and Dimensions

In previous studies of VMI, the type of products was argued as the VMI performance (De Toni & Zamolo, 2005; Kuk, 2004; Waller et al, 1999). The measurement items used for type of products were

developed by using the characteristics of functional and innovative products offered by Fisher (1997). There are eight characteristics of product that differentiated the innovative and functional products were measured. They are volatility of demand, product variant, product life cycle, forecasting error, product stock-outs or late deliveries, production lead-time, product's contribution margin, and product volume. Table 4.5 presents the items measured for type of products and sources of measurement.

Table 4. 5
Source of Type of Products Measurement

	Functional Product (Fisher, 1997)	Innovative Product (Fisher, 1997)
Aspect of demand	Predictable demand	Unpredictable demand
Product life cycle	More than 2 years	3 month to 1 year
Contribution margin	5% to 20%	20% to 60%
Product variety	Low (10 to 20 variants per category)	High (often millions of category)
Average margin of error in the forecast at the time production is committed	10%	40% to 100%
Average stockout rate	1% to 2%	10% to 40%
Average forced end of season markdown as percentage of full price	0%	10% to 25%
Lead time required for made-to-order products	6 months to 12 months	1 day to 14 days weeks

4.2.5 Measurement Scale

This section deals with issues related to the measurement of concepts, which include the operational definitions, the scales used, and the development of instruments to measure the previously described concepts. The survey was developed largely based on scales that have been used previously in the literature. Respondents answered all questions with respect to a particular product line in their company,

which they were asked to identify. Respondents were also asked to choose the product line that contributes the most sales volume for their company or division. Demographic information about the company or division and the respondents were also collected.

The 6-point Likert scale questions were used to measure the organizational factors, VMI elements, type of products, and VMI performance. The researcher decided to use the 6-point Likert scale for plausible reasons. First, data became significantly less accurate when the numbers of scale points drop to less than 5, and there was little increase in reliability when the categories move up to more than 7 points (Paul, 2010). Second, 6-points scale without neutral rating is preferred when respondents are expected to be familiar with VMI (Paul, 2010). Third, social desirability bias can be minimized by eliminating the mid-point that exists in the odd point scale (Garland, 1991).

The questions asked respondents "to what extent do you agree to each of the following statements in respect of your inventory replenishment program performance and organizational factors and inventory replenishment elements and type of product?" The Likert scale was ranged from 1 = strongly disagree; 2 = disagree; 3 =somewhat disagree; 4 =somewhat agree; 5 = agree; and 6 = strongly agree. However, as suggested by Olhager and Selldin (2007) the statement of the characteristics of the type of product should include the numerical examples provided by Fisher (1997) at the end of the range for each

construct to assist the respondents to answer the questions. The set of questionnaires can be found in the Appendix A.

4.3 Validity

To ensure the various concepts and theories related to VMI were measured correctly, validity tests was conducted. The questions taken from previous studies were considered to have face validity. According to Sekaran (2005), face validity is the extent to which the questions cover the concept it purpose to measure. Besides, content validity is also essential to ensure the measurement is sufficient and characterize the concept to be tested. This content validity can be achieved through the suitability of the questions on the concept (Sekaran, 2005). The determination of content validity is judgmental and can be approach in several ways. This research employed a panel of reviewers to judge how well the instrument meets the standard. Two academicians and three practitioners were chosen to evaluate the instrument. These panels were asked to evaluate by giving suggestions and critiques in order to improve the questionnaires. They were asked to highlight any ambiguity in the questions and also to remove those irrelevant questions. As a result, several items were added, modified, and deleted based on the information gathered at these steps. The reviewers also argued on the ambiguity of the term "friendly load" meaning, which was adapted in Myer et al. (2000) to measure the service performance of VMI. Therefore, based on the definition provided in the literature, the term "friendly load" was changed to "exact quantity needed/meet the customer requirements" (Myer, et al, 2000). Another item that was modified was "our managerial gives us sufficient time

and financial resources to give shape for the inventory replenishment practice" which also adapted from Myer et al. (2000) to measure the managerial commitment. The reviewers argued that the item had measured two dimensions in a single question. Therefore, the item was being separated into two items, the first one is referring to "sufficient time", and another one on "financial resources". The majority items for survey questions responded that were appropriate. Therefore, the instruments can be considered as having validity as it is indeed evaluated by a group of expert reviewers (Kidder & Judd, 1986).

4.4 Pilot Study and Reliability Test

To determine whether all items contained well understood questions by the respondents prior to adoption, the questionnaires was pilot tested on 30 manufacturing firms. According to Neuman (1997) pilot test can improve the quality of the questionnaire. Among benefits for conducting pilot test are weaknesses in design and instrumentation can be detected and provide proxy data for selection of a probability sample (Cooper & Schindler, 2001). The range from 25 to 100 of respondents is suitable for the purposes of pilot study (Cooper & Schindler, 2006). To determine whether all items contained therein were well understood by respondents prior to adoption, the questionnaire was pilot tested on 35 manufacturing firms. The respondents were given two weeks to answer the questionnaires.

To ensure the consistency of measurement with regard to time and to the various items in the instrument, Coefficient alpha or better known as Cronbach Alpha was used. Cronbach Alpha's measure of internal consistency was

computed for each scale. As shown in Table 4.6, all the dimensions scored above 0.60, which ranged from 0.620 to 0.890. The overall Cronbach's Alpha scored for all the 22 items to test the organizational factors was 0.887. All the dimensions scored were ranged from 0.677 to 0.868. Meanwhile, for the 35 items of VMI elements that measure on the inventory ownership, inventory location, level of demand visibility, transfer means, ordering and monitoring, as well as recommend the replenishment decisions and inventory control limits, the overall Cronbach's Alpha score was 0.858. Next, the overall 8 items of moderating variable, type of products, show coefficient reliability at 0.623. While, the overall score of Cronbach Alpha for VMI performance was 0.912, with each dimension score at 0.890 and 0.879. Nunnally (1978) suggested the threshold value is at 0.7, although, values between 0.7 and 0.6 can also be considered still acceptable if the research is exploratory in nature (Hair, Black, Babin, Anderson, & Tatham, 2006). This study has some element of exploratory in the sense that there are few empirical studies available in literature and there is hardly any similar study in this country. Therefore, data collected from the pilot study are reliable and obtained acceptable level of internal consistency.

Table 4. 6
Cronbach's Alpha reliability test results for dimensions of organizational factors, VMI elements, type of product, and VMI perforamance

Dimensions	Cronbach's Alpha
Organizational factors:	0.887
Managerial commitment	0.868
Information system capability	0.866
Trust	0.677
Centralization of decision making	0.832
VMI elements:	0.858
Inventory ownership	0.801

Table 4.6 Continued

Inventory location	0.620
Level of demand visibility	0.837
Transfer means	0.688
Ordering and monitoring	0.736
Replenishment decision	0.697
Inventory control limits	0.655
Type of product:	0.623
VMI performance	0.912
Service performance	0.890
Cost performance	0.879

4.5 Data Cleaning and Scanning and Test of Non-Response Bias

Before further analyses were conducted, the data were subjected from error-free in coding. The frequency test can be applied to identify errors in data entry. The indication of error can be detected if the mean was outside the specified range. In addition, the error values also should not exceed minimum or maximum value. However, the data only will be deleted when the error reaches 15 per cent (Meyers, Gamst & Guarino, 2006). In term of linearity between variable, a scatter plot was applied on the major variables. The scatter plot should be oval shaped which indicates the linearity between two variables. Meanwhile, the T-test was used to identify any differences between early and late respondents. The data was considered have response bias if the T-test shows significant results.

4.6 Factor Analysis

The construct of the questionnaires was subjected to validity and reliability tests. One of alternative in testing the constructs is through factor analysis. The objective is to examine the underlying patterns or relationships for a large number of variables and to determine whether the information can be condensed or summarized in a smaller set of factors or components (Hair, et

al., 2007). A group of item in needed to explain every item, which represents part of construct. In addition, factor analysis also assists the researcher to select appropriate items to ensure the construct validity existed. The correlations that exist between items in factor analysis, explains which item is in which dimension.

According to Hair et al. (2006), each variable requires a minimum of five cases when running factor analysis. However, Gorsuch (1983) suggested that the minimum sample size should be at least 100. The first step in factor analysis is extracting process where the items that represent to measure a variable forming the component. Meanwhile, the second step is rotation process that assist researcher to interpret by simplifying and recognizing more meaningful factor.

All related constructs, i.e. type of products, VMI elements; organizational factors, and VMI performance will be simultaneously entered into Principle Axis Factoring (PAF) with Varimax rotation. In order to determine the dimension is factorable, the Principle Axis Factoring (PAF) with Varimax rotation should be significant and the Kaiser-Meyer-Olkin (KMO) threshold value is as in the guidelines for identifying significant factor loadings based on the sample size provided by Hair et al. (2006).

4.7 Method of Data Analysis

The data collected through questionnaire were coded and analysed by using the Statistical Package for the Social Science (SPSS) version 19.0. Preliminary test was undertaken to determine the response rate, descriptive statistics, validity, and reliability of the study constructs. Response rate was determined

by calculating the frequency and percentage of response based on the feedback received. Descriptive statistical analysis including frequencies and percentage were used to present the main characteristics of sample.

Factor analysis and reliability analysis were used to assess the construct validity and reliability of the independent variables and dependent variables. Inferential analysis techniques were employed in this study to find the answers for the various research questions posted earlier. The statistical methods, such as correlation analysis, multiple regression analysis, and hierarchical multiple regression analysis were used to answer the research questions.

4.7.1 Pearson Correlation

Pearson correlation was utilised to investigate the relationships between VMI performance and the variables under the organizational factors and VMI elements. Correlation coefficient revealed the magnitude and direction of the relationships. The magnitude is the degree to which variables moved in unison or opposition (Sekaran, 2003). Therefore, Pearson correlation was used to test hypothesis 1 and 3. The strength of the relationships between the variables can be determined based on correlation value, where correlation value of 0 is demonstrates as no relationship, whereas correlation value of ±1.0 stated as to have a perfect positive or negative relationship (Pallant, 2005). Cohen (1998) had proposed details interpretation on the strength of relationship, where weak relationship has the correlation value of ±0.1 to ±0.29, the moderate relationship has the correlation

value of ±0.30 to ±0.49, and the strong relationship has the correlation value of ±0.50 and above.

4.7.2 Multiple Regression Analysis

Multiple regression analysis was used to examine the relationship between a single dependent variable and a set of independent variables. This application was used to examine the hypothesis 2 and 4 in order to explain the variance of the independent variables, organizational factors and VMI elements, on a single dependent variable, VMI performance. There are four important statistical assumptions for multivariate technique to represent the requirement of the underlying statistical theory. They are normality, linearity, homoscedasticity, and multicollinearity (Hair et al. 2006).

4.7.2.1 Sample Size

In order to perform multiple regressions, Hair et al. (1998) indicated the ratio of observation to independent variable should not be less than 5:1, with a desired level of 15-20 observations for each independent variable. As this study contains two independent variables, the desired level is between 30-40 observations. However, a more detailed recommendation was advanced by Green (1991) where he suggested that the desired power level, alpha level, number of predictors and expected effect size should be taken into consideration. He came up with the following formula of $N \geq 50$

+ 8m (where m= number of independent variables) whereby the power of test for such multiple regression with a medium effect size of approximately 0.8 or greater. Since, this study consists of 495 respondents, preliminary expectation was met the suggestion made by Hair et al. (1998) and Green (1991).

4.7.2.2 Linearity and Homoscedasticity

The linearity of the relationship between dependent and independent variables represent the degree to which the change in dependent variable is associated with independent variables. A scatter plot is a good test for judging how well a straight line fits the data. While homoscedasticity refers to the assumption that the dependent variable being explained in the dependent relationship should not concentrate in only a limited range of independent value. Homoscedasticity will be used to verify through the scatter plot of the regression standardized residual versus regression standardized predicted values.

4.7.2.3 Autocorrelation

The Durbin-Watson coefficient, (d) was conducted to test the autocorrelation of the model (Cohen & Cohen, 1983). The role of thumb defined that the values of d range from 0 to 4. Values close to 0 indicate extreme positive autocorrelation; close to 4 indicate extreme negative autocorrelation; and close to 2 indicate no serial autocorrelation. As a rule of thumb, d should

be between 1.5 and 2.5 to indicate independence of observations (Cohen & Cohen, 1983).

4.7.2.4 Multicollinearity

According to Coakes (2005), multicollinearity refers to high correlation among the independent variables, whereas singularity occurs when perfect correlation among independent variables exist. The simplest technique to identify collinearity is an examination of the correlation matrix for the independent variables. The high correlation generally of 0.90 and above is the first indication of substantial collinearity (Hair et al., 2006). In addition, the tolerance and variance inflation factor (VIF) value was also calculated for each independent variable by selecting collinearity diagnostics. Tolerance test was carried out for each independent variable. According to Hair et al (2006), a common cut-off threshold is a tolerance value of 0.10, which corresponds to a VIF value above 10.

4.7.3 Hierarchical Multiple Regression Analysis

A moderating effect occurs when a third variable or construct changes the relationship between two related variables/constructs (Hair et al 2006). A moderator mode that the relationship involving two constructs changes with the level of another construct. Moderator variables can be at the interval, continuous, or ratio level, and they can also be categorical (Baron & Kenny, 1986; Lindley & Walker, 1993).

In the case of metric moderators cluster analysis may be useful to form groups, or where the moderator variable shows bimodality (i.e., frequency distribution shows two clear peaks) logical groups may be created around each peak (Hair et al. 2006); in this study a moderator is type of products in VMI program.

For the moderating hypothesis, a hierarchical regression as recommended by Aiken and West (1991) and Baron and Kenny (1986) were adopted to test hypothesis 5. To reduce the multicolinearity, variables were mean-centred. Separated regressions were performed for the moderating effect of type of products, respectively. At step 1, the main effects of VMI performance will be entered. At step 2, type of products as a moderator variable was entered into the equation. Finally, the two way interaction terms was obtained by multiplying the moderator variable and organizational factors variables. For each dependent variable, eight hierarchical multiple regression analysis will run separately for the two criteria of VMI performance, cost and service performance; and two criteria of type of products, innovative and functional. A moderation effect will be detected if the explained variance (R^2) was significantly increased by the interaction term ($P < 0.05$).

4.8 Flow of Hypothesis Testing

The hypotheses of this study were tested based on a sequence of statistical analyses described in Figure 4.1. During hypotheses testing, the assumptions of linear regression analyses were met to acknowledge the validity of variables

that are being analysed as independent variable and dependent variable of VMI program.

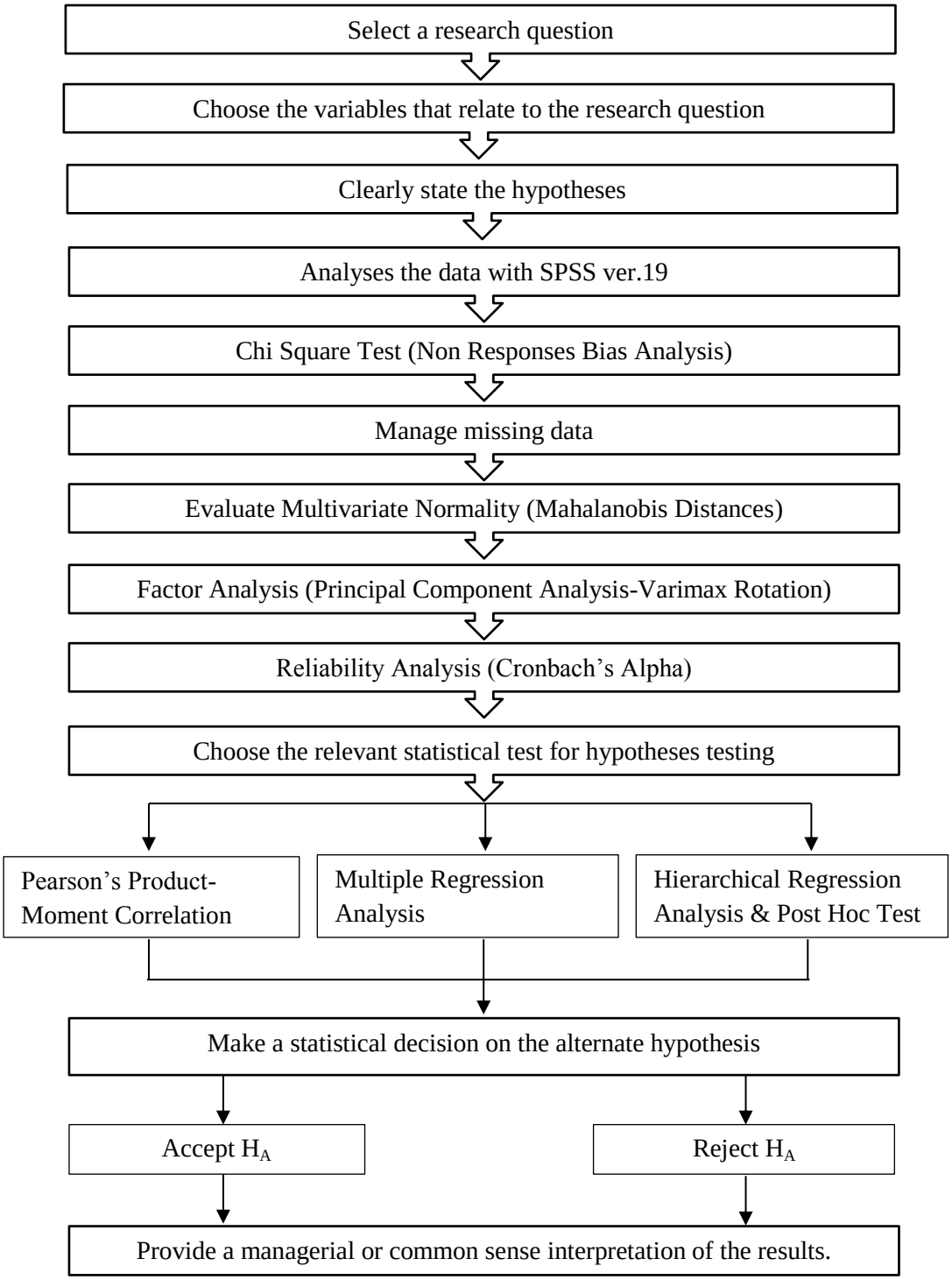

Figure 4. 1
Flow Chart for hypothesis testing

4.9 Summary

This chapter elaborates on the detail aspects of the approach that was undertaken by this thesis. Three important aspects of the research design, the measurements, and the tools of analysis have been discussed at length throughout the chapter.

CHAPTER FIVE

DATA ANALYSIS AND FINDINGS

This chapter aims to present the result of analysis and to clarify the findings of this study. Section 5.1 elaborates the sample of this study followed by Section 5.2 with the profile of the respondents, which includes the motives of VMI, the type of industries they involved, the firms' size, and the firm ownership. Meanwhile, the Section 5.3 discussed the result of factor analysis. While running the factor analysis, a different group of the dimensions revealed under this study. Therefore, the Section 5.4 restated the hypotheses according to dimensions captured through the factor analysis. In Section 5.5, model evaluation was discussed, which included test of non-response bias, normality test, multivariate outlier, linearity test, and homoscedasticity. The descriptive statistics was discussed in section 5.6. Meanwhile, the result of Pearson correlation, multiple regressions, and hierarchical regression analysis are being covered under section 5.7, 5.8, and 5.9 respectively.

5.1 Sample of the Study

The FMM directory was used as the resource for sampling. The total number of sample size required was 330 out of 2227 manufacturing companies. However, a total of 495 companies were included in the sample size in order to increase the response rate. Then, the questionnaires were mailed to the respondent based on the addresses stated in the FMM directory. Besides, the questionnaires were also distributed and collected personally at 23 factories in Kedah and Penang in order to increase the response rate. Eventually, a total of 114 questionnaires were returned. However, only 101 questionnaires were usable. The others 13 respondents were excluded due to incomplete

questionnaires (4 questionnaires) , not engage with the VMI program (6 questionnaires), and reluctant to answer (3 questionnaires). Thus, this study had achieved 20 percent response rate from the total number distributed and 31 percent from the sample size required. Although the feedback of this study was not so favourable, the response rate was quite similar to previous study by Borade and Bansod (2010). The Table 5.1 below shows the response rate of related VMI research.

Table 5. 1
Respond Rate of Selected Studies in VMI-Relates

Author(s)	Topic studied	Response rate
Borade and Bansod (2010)	Study of vendor-managed inventory practices in Indian industries	17.6 % from 500 sample size of large companies, 12.6 % from 500 sample size of SMEs companies
Claasen et al. (2008)	Performance outcomes and success factors of vendor managed inventory (VMI)	Response rate 64 from 629 firms (10.2 %).
Dong et al. (2007)	Environmental determinants of VMI adoption: An exploratory analysis	Response rate 137 from 2305 firms (7.0 %).

5.2 Profile of the Respondents

This section provide descriptive information of respondent profile which include inventory replenishment program implemented in Malaysia manufacturing companies, motives for VMI involvement position of respondent, type of industries, firm size and firm ownership.

5.2.1 Inventory replenishment program in Malaysian Manufacturing companies

As mentioned in the section 5.1, only 114 questionnaires were returned and 101 were usable to be analysed. The table 5.3 shows the inventory replenishment program in Malaysia manufacturing companies for

usable questionnaires. Based on the information gathered, the manufacturing companies' uses different term of collaborating program include Vendor Managed Inventory, Efficient Customer Response, Continuous Replenishment, Quick Response, and Just-in-Time. Although, different term collaborating program has been used, most of the respondents stated that they were authorized by customer to replenish customer's inventory and sharing demand information to assist the replenishment decision process. Thus, align with definition used in this study that VMI program requires supplier to make the replenishment decision of customer's inventory and received or collect demand information to support the replenishment decision process. This finding also aligns with Disney and Towill (2003) that included Efficient Customer Response, Continuous Replenishment, and Quick Response as program similar to VMI program. Table 5.2 presents responses from usable questionnaire on inventory replenishment program they adopt.

Table 5. 2
Inventory replenishment program

Name Inventory Replenishment Program	Number of Companies	Replenishment decisions	Sharing of demand information
VMI	95	Supplier	Yes
ECR	2	Supplier	Yes
CR	3	Supplier	Yes
QR	1	Supplier	Yes
Total	101		

5.2.2 Motives for VMI involvement

The results indicate that 63.4 percent (64 firms) were intended to improve product availability, 54.5 percent (55 firms) wanted to improve market access and 52.5 percent (53) firms involved with VMI due to customer demand it. Meanwhile, 44.6 percent (45 firms) intend to enhance strategic growth, 40.6 percent (41 firms) were adding technological strengthen, and 38.9 percent (37 firms) apply VMI to strength their operations. Only 34.7 percent (35 firms) employ to ensure customer retention. From all the responses received, only 28.7 percent (29 firms) were building financial strength and enhancing organizational skills. In summary, Table 5.3 present the motives of Malaysian manufacturing companies involvement in VMI program.

Table 5. 3
The Respondents to Motives

Variable: Motives	Frequency (n=)	Percent (Total 100 percent)
Improve product availability	64	63.4
Improving market access	55	54.5
Customer demand it	53	52.5
Enhancing strategic growth	45	44.6
Adding technological Strength	41	40.6
Strengthening operations	39	38.6
Assure customer retention Building Financial	35	34.7
strength	29	28.7
Enhancing organizational skills	29	28.7

5.2.3 Respondents' position

In terms of position held by respondent, 41.6 percent are executives, 36 percent are senior managers, 13 percent are manager and 13 percent are assistant managers. Only 9.9 percent among the respondents are

directors of the firms. The respondents' position was summarized in table 5.4.

Table 5. 4
Respondents' position

Position	Frequency (n=)	Percent (Total 100%)
Director	10	9.9
Senior Manager	36	35.6
Assistant Manager	13	12.9
Executive	42	41.6

5.2.4 Type of Industry

In this study, most of the respondents were involved in the electronic industry. The Table 5.5 showed that electronic industry consisted of 22.8 percent of the number of respondents. Meanwhile food related industry represent at 18.8 percent of respondent, and followed by automotive (15.8%), chemicals and plastics (13.9%), building materials (7.9%), appliance (6.9%), pharmaceutical (6.9%), petroleum (3%), metal (3%), textile (1%) and paper and packaging (1%). Obviously, most of VMI program were practiced in the electronic industries. This data also proved that probably VMI relationship also existed between manufacturer and manufacturer, not only manufacturer and wholesaler or retailer. In addition, VMI practiced are well known in electronics industries.

Table 5. 5
Distribution of Respondent by Industry

Sector	Frequency (n)	Percentage
Electronics	22	21.8
Food related	19	18.8

Table 5.5 Continued

Automotive	16	15.8
Chemicals/Plastics	14	13.9
Building materials	8	7.9
Appliance	7	6.9
Pharmaceutical	7	6.9
Petroleum	3	3.0
Metal/Metal working	3	3.0
Textile/Clothing	1	1.0
Paper & Packaging	1	1.0

5.2.5 Firm Size

In terms of firm size, the representative of respondents are quite balance between large and medium size of companies. In this study respondent for medium size companies represent 50.5 percent of respondent and large companies represent 49.5 percent of respondent. The high participation of small and medium size companies in VMI program may due to the target respondents were supplier in manufacturing companies. Thus, as a supplier in small and medium size companies, they had to follow the customer demand for VMI program. Figure 5.1 shows the break-down of firm size of respondents for this study.

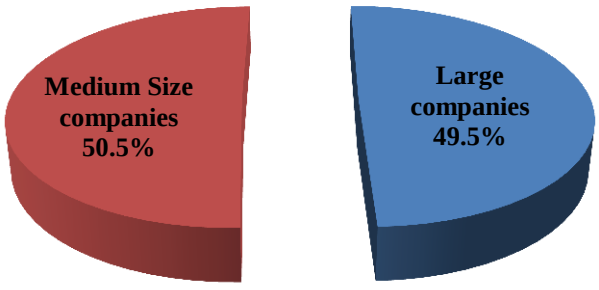

Figure 5. 1
Firm Size Based on Employee Number

5.2.6 Firm Ownership

The local company represent 55.4 percent of responses; followed by Multinational Corporations of 42.6 percent. Those firms that had a joint venture ownership were only at 2.0 percent. This finding also aligned with the current statement by Panasonic (2010), as they stressed to continuously increase the engagement of their supplier in VMI program as a strategy to improve their supply chain performance and most of the suppliers involved were from local companies. Figure 5.2 shows the details.

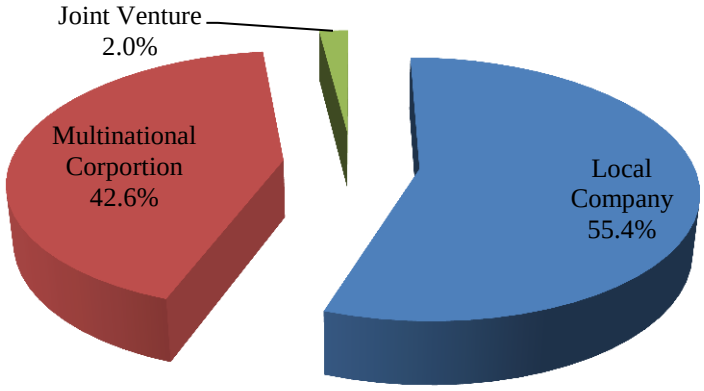

Figure 5. 2
Type of Company Ownership

5.3 Factor Analysis

The construct of the questionnaires was subjected to validity and reliability tests. One of alternative in testing the constructs is through factor analysis. The objective is to examine the underlying patterns or relationships for a large number of variables and to determine whether the information can be condensed or summarized in a smaller set of factors or components (Hair, et

al., 2007). The following results are pertaining to factor analysis results for VMI performance, VMI elements, organizational factor, and type of products.

5.3.1 Factor Analysis of VMI Performance

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy at 0.810 indicates that factor analysis can be conducted on the VMI performance data. Moreover, with a significant Bartlett's test, there is a sufficient correlation among the analyzed items (range from 0.542-0.912- anti image). The communalities among the items were also fairly high, in the range of 0.558 to 0.793. The Cronbach's coefficient alpha is 0.873 (service) and 0.897 (cost) which indicate good reliability. After factoring and rotating the VMI performance, it produced six components. However, only two components are retained. The four components were excluded from analysis due to number of items less than three or item load on other components or unacceptable loading. The summary of the table is produced in Table 5.6.

Table 5. 6
Result of Factor Analysis for VMI Performance
(Only Factor Loadings above 0.55 Were Shown)

Dimensions and Measurement Items	Loading	Communalities	Reliability
Service Performance:			.873
S2. More predictable order cycle.	.664	.793	
S3. Improve the reliability of delivery.	.672	.698	
S4. Improve the relationship with customers.	.719	.767	
S5. Improve the accuracy of forecast resulting in better planning.	.799	.714	
S6. Improved ability to react to upsides/downsides			

Table 5.6 Continued

of customer demand.	.577	.705	
S7. Productivity improvement should be achieved	.772	.712	
with automation of manual tasks.	.556	.558	
S8. Fewer incidences of production line disruption/ stockout.			
Cost Performance:			.897
C5. Reduce the overstocks.	.727	.600	
C6. Reduce product damage.	.661	.680	
C7. Reduce the holding cost.	.812	.751	
C8. Lower the transportation cost due to more efficient planning.	.726	.757	
C9. Reduce the administration cost.	.836	.736	
C10.Reduce the material handling cost.	.852	.752	
C11.Reduce the need to discount.	.713	.645	

5.3.2 Factor Analysis of VMI Elements

A similar step was preceded on the dimensions of VMI element. First of all, seven dimensions of VMI elements, namely inventory ownership, inventory location, level of demand visibility, monitoring and ordering, transfer mode, replenishment decisions, and inventory control limits, which were discussed by Zammori et al. (2009), Elvander et al. (2008), and Sarpola, (2007).

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.717 with the Bartlett's test being significant. Hence, factor analysis can be conducted on the items. The communality for VMI elements ranged between 0.526 and 0.829 where correlation among the analyzed items range from 0.533- 0.827 (anti-image). The factor analysis had formed eight components. However, only five components had three or more acceptable loading of items. The first component focused more on level of demand visibility in assisting inventory replenishment by supplier, the second component focused on closeness of inventory storage location, the third component more on level of inventory

replenishment decision by supplier, the fourth component focused on the ownership of inventory, and the fifth component focused on method applied in controlling the level of inventory. These five components which consists of level of demand visibility (0.892), inventory location (0.641), replenishment decisions (0.777), inventory ownership (0.800), and inventory control limits (0.663) shows an acceptable reliability between 0.648 -0.894. The factor analysis and reliability test results were summarized in Table 5.7.

Table 5. 7
Result of Factor Analysis for VMI Elements
(Only Factor Loadings above 0.55 Were Shown)

Dimensions and Measurement Items	Loading	Communalities	Reliability
Level of Demand Visibility:			.892
DV1. Our customer provides us with the historical data to assist the inventory replenishment decision.	.749	.654	
DV2. Our customer provides us with the point-of-sales data to assist the inventory replenishment decision.	.675	.526	
DV3. Our customer provides us with the forecast information to assist the inventory replenishment decision.	.581	.638	
DV5. Our customer provides us with the production/assembly plan to assist the inventory replenishment decision.	.647	.662	
DV6. Our customer provides us with the inventory level information to assist the inventory replenishment decision.	.769	.775	
DV7. Our customer provides us with the goods in-transit information to assist the inventory replenishment decision.	.775	690	
DV8. Our customer provides us with the backorder information to assist the inventory replenishment.	.812	.703	
DV9. Our customer provides us with the return order	.741	.741	
Inventory Location:			.641
IL2. Our storage location of finish inventory is close to the customer location/consumption area.	.642	.700	
IL3. Our transportation lead time is short in fulfilling customer order.	.717	.645	
IL4. Our customers can at any time can withdrawal the inventory from storage location when needed.	.755	.726	

Table 5.7 Continued

Replenishment Decisions:				.777
RD1. Our customer does not propose the quantity of inventory to be replenished.	.635	.695		
RD3. We do not need a confirmation from customer to replenish the inventory.	.787	.780		
RD4. We can decide the quantity of inventory to be replenished.	.759	.708		
RD5. We can decide when the inventory should be delivered.	.657	.734		
Inventory Ownership:				.800
IO1. We still own the inventory even it has been delivered to customer.	.626	.693		
IO2. We are exposed to price fluctuation in inventory even it has been delivered to customer.	.809	.762		
IO4. We are still responsible for holding cost of inventory even it has been delivered to customer.	.777	.692		
Inventory Control Limits:				.663
CL1. Our customer uses "minimum limit" to control the inventory replenishment level.	.640	.644		
CL2. Our customer uses "maximum limit" to control the inventory replenishment level.	.732	.636		
CL3. We can be incurred penalty cost if do not meet the inventory replenishment control limits.	.601	.541		
CL4. We provide safety stock in order to meet customer demand.	.668	.580		

5.3.3 Factor Analysis of Organizational Factors

The dimension of organizational factor also was factored. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.858 with the Bartlett's test being significant. Hence, factor analysis can be conducted on the items. The communality for organizational factors ranged from 0.563 until 0.817 with correlation among the analysed items ranging from 0.738- 0.933 (anti-image).

After factoring and rotating the organizational factor component, it produced five components. However, the fifth component load with less than three items was dropped to ensure the best fit to data. The

first component focused more on information system capability, the second component focused on managerial commitment, the third component focused more on level of decentralized decision making, the fourth component focused on level of trust in VMI program. These four components showed a high reliability between 0.814 -0.905. The result is shown in Table 5.8.

Table 5. 8
Result of Factor Analysis for Organizational Factors (Only Factor Loadings above 0.55 Were Shown)

Dimensions	Loading	Communalities	Reliability
Information System capability:			.905
IC1. Our information system can improve the accuracy of information received.	.612	.637	
IC2. Our information system is formatted to facilitate the usage.	.707	.740	
IC3. Our information system can improve the timeliness of information.	.742	.675	
IC4. Our information system able to capture the real-time information.	.734	.672	
IC5. Our information system can achieve daily download of information.	.785	.734	
IC6. Our information system is compatible with the existing IT systems.	.704	.634	
IC7. Our information system is compatible with the customer's IT systems.	.729	.774	
IC8. Our information system is ready to access customer's information system.	.588	.627	
Managerial Commitment:			.867
MC1.Our managerial provide us with necessary financial resources to support the inventory replenishment program.	.785	.738	
MC2.Our managerial gives us sufficient time to support the inventory replenishment program.	.834	.748	
MC3.We has thorough advance planning for the inventory replenishment program.	.638	.713	
MC4.We is complying with the terms agreed in the inventory replenishment program's policy.	.659	.644	
MC5.Our managerial makes an adequate amount of personnel available to us for the inventory replenishment program	.665	.689	
Decentralized decision Making:			.868
CD2.Our division makes all the important firm managerial decisions.	.829	.775	
CD3.Our division makes all decisions regarding to cost reduction activities.	.818	.761	

Table 5.8 Continued

CD4.Our division makes all decisions regarding to service improvement activities.	.872	.817	
Trust:			.814
TR3. We are convinced that this customer performs its task professionally.	.577	.697	
TR4. The customer is always honest with us.	.766	.727	
TR5. We can count on the customer's promises made to our firm.	.809	.697	

5.3.4 Factor Analysis on Type of Products

Type of product dimensions was also run through the factor analysis (Table 4.8). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for type of products was showed at acceptable level (0.685) and correlation among the analysed items range from 0.569- 0.802 (anti-image). The communalities results were also fairly high; from 0.505 to 0.737. The rotated component produced three useful components. However, the third component was only loads with one item. Thus, only component 1 and 2 were used to represent the type of product. The third component was removed due insufficient number of item. The first component captured on functional product of the firm while the second component focused on the innovative product. Table 5.9 shows the result.

Table 5. 9
Result of Factor Analysis for Type of Products
(Only Factor Loadings above 0.55 Were Shown)

Dimensions	Loading	Communalities	Reliability
Functional product:			.793
TP1. Our product demand is unpredictable.	.849	.838	
TP4. Our product has a high forecasting errors/forecasting problems.	.851	.856	
TP5. Our product has a high stock-outs or late deliveries.	.696	.790	

Table 4.8 Continued

Dimensions	Loading	Communalities	Reliability
Innovative product:			.613
TP2. Our product variant is high.	.742	.696	
TP7. Our product has a high contribution margin.	.776	.832	
TP8. Our product has a high average end-of-season markdown.	.689	.679	

5.4 Modified Research Framework and Restatement of Hypotheses

Based on the results of factor analysis, few dimensions were excluded from the study. Among the excluded dimensions were monitoring and ordering, and transfer mode. The monitoring and ordering dimension was removed due to low anti-image correlation (1 item), load on other component (2 items), and low factor loading (2 item). Meanwhile, the transfer mode was dropped due to low anti-image correlation (1 item), load as single item on a component (1 items), and low factor loading (2 item). Table 5.10 summarized the dimensions derived after factor analysis.

Table 5. 10
The Dimensions Discovered Before and After Factor Analysis

Before factor analysis	After factor analysis
VMI elements:	VMI elements:
Inventory ownership	Inventory ownership
Inventory location	Level of demand visibility
Level of demand visibility	Inventory location
Monitoring and ordering	Replenishment decisions
Transfer mode	Inventory control limits
Replenishment decisions	
Inventory control limits	
Organizational factors:	Organizational factors:
Managerial commitment	Managerial commitment
Information system capability	Information system capability
Decentralized decision making	Decentralized decision making
Trust	Trust
VMI performance:	VMI performance:
Cost reduction	Cost reduction
Service improvement	Service improvement
Type of product:	Type of product:
Innovative product	Innovative product
Functional product	Functional product

Since, factor analysis had reduced the number of dimension; the hypotheses need to be restated. The Figure 5.3 presents the theoretical framework of the relationships among organizational factors, type of products, VMI elements and VMI performance after factor analysis.

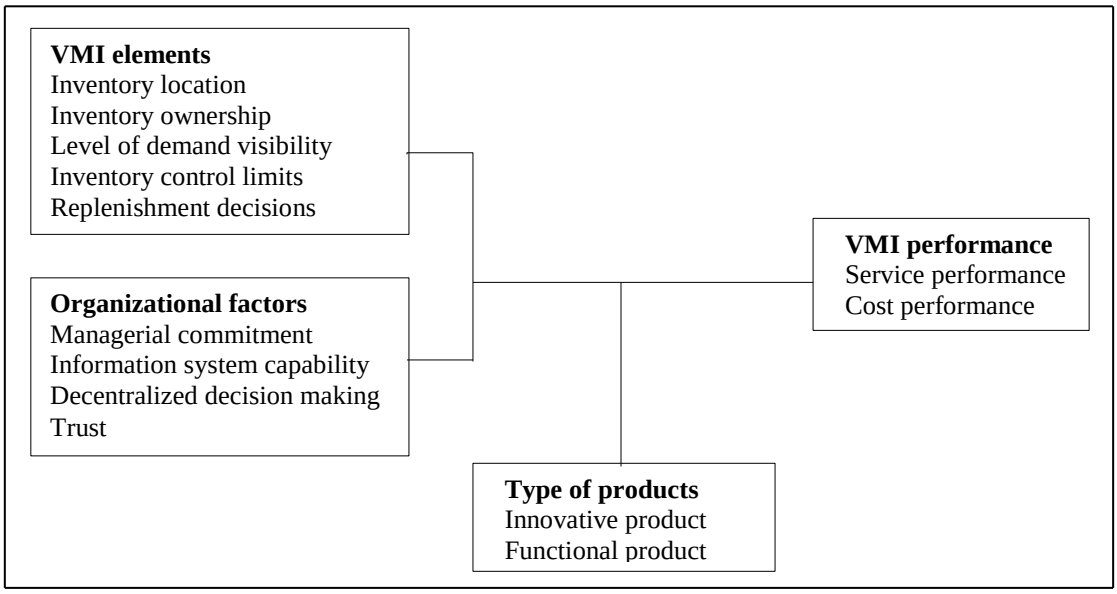

Figure 5. 3
A Theoretical Framework of the Relationships among Organizational Factors, Type of Products, VMI Elements and VMI Performance after Factor Analysis

Pertaining to Figure 5.3 above, the following hypotheses are developed for this study.

Hypothesis 1

VMI elements have a significant and positive relationship with VMI performance.

Hypothesis 1A ($H1A_A$)
Inventory location has a significant and positive relationship with cost performance.

Hypothesis 1B ($H1B_A$)
Inventory location has a significant and positive relationship with service performance.

Hypothesis 1C ($H1C_A$)
Supplier owned inventory has a significant and positive relationship with cost performance.

Hypothesis 1D($H1D_A$)
Supplier owned inventory has a significant and positive relationship with service performance.

Hypothesis 1C($H1C_A$)
Level of demand visibility has a significant and positive relationship with cost performance.

Hypothesis 1F($H1F_A$)
Level of demand visibility has a significant and positive relationship with service performance.

Hypothesis 1G ($H1G_A$)
Inventory control limits has a significant and positive relationship with cost performance.

Hypothesis 1H ($H1H_A$)
Inventory control limits has a significant and positive relationship with service performance.

Hypothesis 1I ($H1I_A$)
Supplier's replenishment decision has a significant and positive relationship with cost performance.

Hypothesis 1J ($H1J_A$)
Supplier's replenishment decision has a significant and positive relationship with service performance.

Hypothesis 2

The VMI elements have significantly explained the variance of VMI performance.

Hypothesis 2A ($H2A_A$)
The VMI element dimensions significantly explain the variance of service performance.

Hypothesis 2B ($H2B_A$)
The VMI element dimensions significantly explain the variance of cost performance.

Hypothesis 3

Organizational factor has a significant and positive relationship with VMI performance.

Hypothesis 3A ($H3A_A$)
Managerial commitment has a significant and positive relationship with cost performance.

Hypothesis 3B ($H3B_A$)
Managerial commitment has a positive and positive relationship with service performance.

Hypothesis 3C ($H3C_A$)
Decentralized decision-making has a significant and positive relationship with cost performance.

Hypothesis 3D ($H3D_A$)
Decentralized decision-making has a significant and positive relationship with service performance.

Hypothesis 3E ($H3E_A$)
Information system capability has a significant and positive relationship with cost performance.

Hypothesis 3F ($H3F_A$)
Information system capability has a significant and positive relationship with service performance.

Hypothesis 3G ($H3G_A$)
Trust has a significant and positive relationship with cost performance.

Hypothesis 3H ($H3H_A$)
Trust has a significant and positive relationship with service performance

Hypothesis 4

The organizational factor have significantly explained the variance of VMI performance.

Hypothesis 4A ($H4A_A$)
The organizational factor dimensions significantly explain the variance of service performance.

Hypothesis 4B ($H4B_A$)
The organizational factor dimensions significantly explain the variance of cost performance.

Hypothesis 5

Type of products significantly moderates the relationship between VMI

elements, organizational factor and VMI performance.

Hypothesis 5A ($H5A_A$)
Innovative products significantly moderate the relationship between inventory location and the service performance.

Hypothesis 5B ($H5B_A$)
Innovative products significantly moderate the relationship between inventory ownership and the service performance.

Hypothesis 5C ($H5C_A$)
Innovative products significantly moderate the relationship between visibility of demand and the service performance.

Hypothesis 5D ($H5D_A$)
Innovative products significantly moderate the relationship between inventory control limits and the service performance.

Hypothesis 5E ($H5E_A$)
Innovative products significantly moderate the relationship between replenishment decision and the service performance.

Hypothesis 5F ($H5F_A$)
Functional products significantly moderate the relationship between inventory location and the service performance.

Hypothesis 5G ($H5G_A$)
Functional products significantly moderate the relationship between inventory ownership and the service performance.

Hypothesis 5H ($H5H_A$)
Functional products significantly moderate the relationship between visibility of demand and the service performance.

Hypothesis 5I ($H5I_A$)
Functional products significantly moderate the relationship between inventory control limits and the service performance.

Hypothesis 5J ($H5J_A$)
Functional products significantly moderate the relationship between replenishment decision and the service performance.

Hypothesis 5J ($H5J_A$)
Innovative products significantly moderate the relationship between inventory location and the cost performance.

Hypothesis 5J ($H5J_A$)
Innovative products significantly moderate the relationship between inventory ownership and the cost performance.

Hypothesis 5K ($H5K_A$)
Innovative products significantly moderate the relationship between visibility of demand and the cost performance.

Hypothesis 5L ($H5L_A$)
Innovative products significantly moderate the relationship between inventory control limits and the cost performance.

Hypothesis 5M ($H5M_A$)
Innovative products significantly moderate the relationship between replenishment decision and the cost performance.

Hypothesis 5N ($H5N_A$)
Functional products significantly moderate the relationship between inventory location and the cost performance.

Hypothesis 5O ($H5O_A$)
Functional products significantly moderate the relationship between inventory ownership and the cost performance.

Hypothesis 5P ($H5P_A$)
Functional products significantly moderate the relationship between visibility of demand and the cost performance.
Hypothesis 5Q ($H5Q_A$)
Functional products significantly moderate the relationship between inventory control limits and the cost performance.

Hypothesis 5R ($H5R_A$)
Functional products significantly moderate the relationship between replenishment decision and the cost performance.

Hypothesis 5S ($H5S_A$)
Innovative products significantly moderate the relationship between managerial commitment and the service performance.

Hypothesis 5T ($H5T_A$)
Innovative products significantly moderate the relationship between decentralized decision making and the service performance.

Hypothesis 5U ($H5U_A$)
Innovative products significantly moderate the relationship between capability of information system and the service performance.

Hypothesis 5V ($H5V_A$)
Innovative products significantly moderate the relationship between trust and the service performance.

Hypothesis 5W ($H5W_A$)
Functional products significantly moderate the relationship between managerial commitment and the service performance.

Hypothesis 5X ($H5X_A$)
Functional products significantly moderate the relationship between decentralized decision making and the service performance.

Hypothesis 5Y ($H5Y_A$)
Functional products significantly moderate the relationship between capability of information system and the service performance.

Hypothesis 5Z ($H5Z_A$)
Functional products significantly moderate the relationship between trust and the service performance.

Hypothesis 5AA ($H5AA_A$)
Innovative products significantly moderate the relationship between managerial commitment and the cost performance.

Hypothesis 5AB ($H5AB_A$)
Innovative products significantly moderate the relationship between decentralized decision making and the cost performance.

Hypothesis 5AC ($H5AC_A$)
Innovative products significantly moderate the relationship between capability of information system and the cost performance.

Hypothesis 5AD($H5AD_A$)
Innovative products significantly moderate the relationship between trust and the cost performance.

Hypothesis 5AE ($H5AE_A$)
Functional products significantly moderate the relationship between managerial commitment and the cost performance.

Hypothesis 5AF ($H5AF_A$)
Functional products significantly moderate the relationship between decentralized decision making and the cost performance.

Hypothesis 5AG ($H5AG_A$)
Functional products significantly moderate the relationship between capability of information system and the cost performance.

Hypothesis 5AH ($H5AH_A$)
Functional products significantly moderate the relationship between trust and the cost performance.

Hypothesis 5Y ($H5Y_A$)
Functional products significantly moderate the relationship between capability of information system and the service performance.

Hypothesis 5Z ($H5Z_A$)
Functional products significantly moderate the relationship between trust and the service performance.
Hypothesis 5AA ($H5AA_A$)
Innovative products significantly moderate the relationship between managerial commitment and the cost performance.

Hypothesis 5AB ($H5AB_A$)
Innovative products significantly moderate the relationship between decentralized decision making and the cost performance.

Hypothesis 5AC ($H5AC_A$)
Innovative products significantly moderate the relationship between capability of information system and the cost performance.

Hypothesis 5AD($H5AD_A$)
Innovative products significantly moderate the relationship between trust and the cost performance.

Hypothesis 5AE ($H5AE_A$)
Functional products significantly moderate the relationship between managerial commitment and the cost performance.

Hypothesis 5AF ($H5AF_A$)
Functional products significantly moderate the relationship between decentralized decision making and the cost performance.

Hypothesis 5AG ($H5AG_A$)
Functional products significantly moderate the relationship between capability of information system and the cost performance.

Hypothesis 5AH ($H5AH_A$)
Functional products significantly moderate the relationship between trust and the cost performance.

5.5 Model Evaluation

Before testing the hypotheses, the data must be evaluated in terms of non-response bias, normality, multivariate outlier, linearity, and homoscedasticity test. The following topics discussed the findings of the test.

5.5.1 Test of Non-Response Bias

The returned questionnaires were divided into two categories, which are early respondents and late respondents. The 31 questionnaires were categorised as early respondents and 70 of the questionnaires as late respondents. The T-test was used to identify any differences between early and late respondents in order to clarify the existent of non-response bias. Therefore, all the dimensions comprise in this study was tested using T-Test. The test shows that only inventory ownership dimension had significant result. Since, there is only a significant result for one dimensions of 13 dimensions, the non-response bias is not a major bias. Thus, the differences between early and late samples were not a serious issue here. Table 5.11 present the result of T-test on early respondent and late respondent.

Table 5. 11
Result of T-Test for Non-response Bias Analysis

Variable	T-value	Significant
Service performance	1.882	0.814
Cost performance	1.084	0.228
Level of demand visibility	0.380	0.870
Inventory ownership	-1.637	0.000**
Replenishment decisions	-1.945	0.235
Inventory location	-0.789	0.428
Inventory control limits	1.679	0.309
Capability of information system	1.397	0.345
Managerial commitment	1.355	0.760
Centralization of decision-making	0.617	0.692
Trust	1.138	0.179
Functional product	-1.535	0.685
Innovative product	-1.526	0.076

5.5.2 Normality Test

Normality can be assessed to some extent by obtaining skewness and kurtosis value of the variables (Pallant, 2001). The variable was

considered normally distributed, if the skewness value was below 2.0 and kurtosis value less than 7.0 (Cohen & Cohen, 1983). Based on the performance of normality assessment tables, the researcher concluded that all constructs in the research variables have a skewness value lower than 2.0 and kurtosis value smaller than 7.0. Overall, all the variable were distributed under the normal data. Table 5.12 summarised the normality assessment results.

Table 5. 12
Normality Assessment

	N				
	Valid	Missing	Mean	Median	Std. Deviation
service	101	0	4.6891	4.7143	.62131
cost	101	0	4.5903	4.7143	.79419
Innovative	101	0	3.6106	3.6667	1.02748
Functional	101	0	4.0363	4.0000	1.15653
DVisibility	101	0	4.0529	4.0000	.81698
Ilocation	101	0	4.3069	4.3333	.86882
Rdecision	100	1	3.5050	3.7500	1.06005
Climits	101	0	3.9901	4.0000	.81771
Iownership	101	0	3.6997	4.0000	1.24767
IsystemCap	101	0	4.4901	4.6250	.82608
Mcommit	101	0	4.5366	4.6000	.79344
CenterDc	101	0	4.5083	4.6667	.89888
Trust	101	0	4.3960	4.3333	.76987

	N			Std. Error		Std. Error
	Valid	Missing	Skewness	of Skewness	Kurtosis	of Kurtosis
service	101	0	-.279	.240	-.068	.476
cost	101	0	-.222	.240	-.730	.476
Innovative	101	0	-.428	.240	-.395	.476
Functional	101	0	-.127	.240	-.823	.476
DVisibility	101	0	-.761	.240	.605	.476
Ilocation	101	0	-.655	.240	.628	.476
Rdecision	100	1	-.526	.241	.058	.478
Climits	101	0	-.106	.240	-.295	.476
Iownership	101	0	-.818	.240	-.122	.476
IsystemCap	101	0	-.584	.240	.240	.476
Mcommit	101	0	-.248	.240	-.445	.476
CenterDc	101	0	-.738	.240	.648	.476
Trust	101	0	-.398	.240	.295	.476

5.5.3 Multivariate Outlier

Mahalanobis distance has also been used to confirm the normality of outlier. As the rule of thumb, the maximum Mahalanobis distance should not exceed the critical chi-squared value with degrees of freedom equal to number of predictors and alpha = .001, or else outliers may be a problem in the data (Parlant, 2007). Table 5.13 below showed that Mahalanobis Distance have the minimum value = 2.025 and maximum value = 30.097, Chi-square value = $\chi 2$ (11 independent data variable, 0.001) = 31.3. Thus, it confirms the normality of the outlier.

Table 5. 13
Mahalanobis Distance Results

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.5995	5.4926	4.5906	.38815	100
Std. Predicted Value	-2.565	2.335	.001	1.005	100
Std. E. of Predict. Value	.140	.412	.247	.066	100
Ad. Predicted Value	3.3961	5.5618	4.5794	.40997	100
Residual	-1.71008	1.64633	.01396	.68300	100
Std. Residual	-2.324	2.237	.019	.928	100
Stud. Residual	-2.562	2.651	.026	1.008	100
Deleted Residual	-2.07858	2.31265	.02515	.80849	100
Stud. Deleted Residual	-2.648	2.748	.026	1.020	100
Mahal. Distance	2.605	30.097	10.930	6.467	100
Cook's Distance	.000	.237	.016	.033	100
Centred Leverage Value	.026	.304	.110	.065	100

Dependent Variable: Mean_cost

5.5.4 Linearity Test and Homoscedasticity

In order to confirm the linearity and homoscedasticity, a scatter plot was run on the major variables. The result in Figure 5.4 showed an

oval shape as an indicator to linearity and homoscedasticity of variables. The result was shown on the following figure.

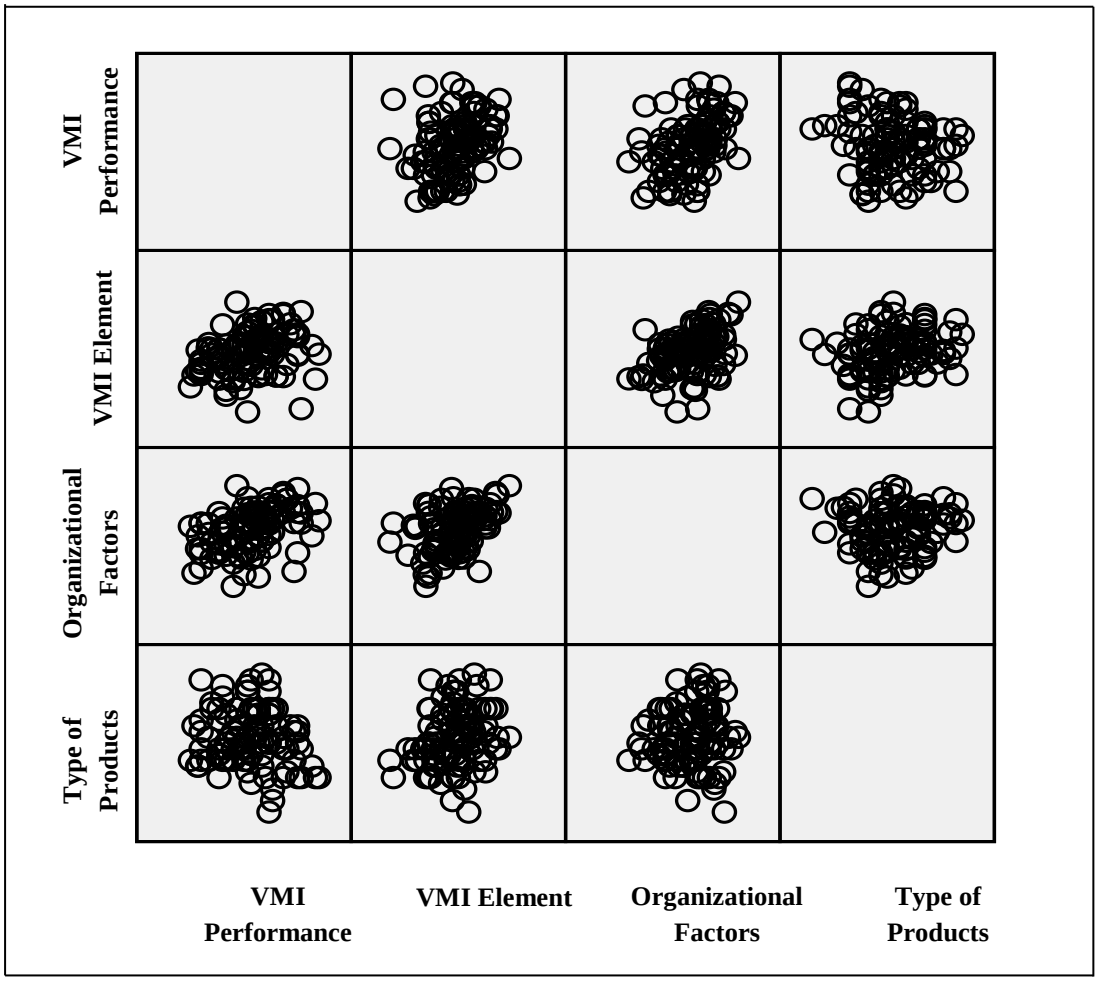

Figure 5. 4
Scatter Plots of Independent and Dependent Variables

5.6 Descriptive Statistics of the Variables

An overall, the respondents agreed on the VMI performance with a mean of 4.60. In general, the implementation of VMI program provides benefit to supplier. In details, service performance and cost performance scored a mean of 4.64 and 4.70, respectively. This shows that supplier in manufacturing

companies had gained benefits from VMI in term of cost reduction and increase the service performance.

For VMI elements, the overall mean was 3.91, which indicated that VMI elements were performed at fairly high. Specifically, customer was actively shared the demand information with their supplier at fairly high level (μ=4.05). The possession of customer's inventory by supplier was also fairly high (μ=3.70). This indicate that supplier are exposed to price fluctuation and responsible for holding costs. For replenishment decision (μ=3.51), the mean was slightly lower compared to inventory location (μ=4.31) and inventory control limits (μ=4.00). Although, literature suggested that supplier should be given authority to make replenishment decisions, the findings suggested that supplier was only given a fairly high level of replenishment decision. While, the finding suggested that supplier provide inventory storage location near to consumption areas or customer premises in order to facilitate the customer withdrawal the inventory immediately and reduce the delivery time. In term of inventory control limits, manufacturing companies applied min-max limit conjunction with safety stock and penalty cost from customer.

However, the organizational dimensions scored at slightly higher than VMI elements dimensions. The supplier in manufacturing companies provide high managerial commitment (μ=4.54) on VMI program. The supplier also willing to provide a high level of information system capability (μ=4.49). Meanwhile, the mean for decentralized decision making and trust, respectively was at 4.51 and 4.40, which indicate supplier applied a highly decentralized decision making approach and highly established trust with their customer. In addition, the level of innovative (μ=3.61) and functional products (4.04) was fairly

high, respectively. Table 5.14 shows the mean and standard deviation of all variables.

Table 5. 14
Descriptive Statistics of the Variables

Factors and Dimensions	Mean	Std. deviation
VMI performance:	4.60	.60
Service performance	4.64	.62
Cost performance	4.70	.79
VMI elements:	3.91	.62
Level of demand visibility	4.05	.82
Inventory ownership	3.70	1.25
Replenishment decisions	3.51	1.06
Inventory location	4.31	0.87
Inventory control limits	4.00	0.82
Organizational factors:	4.48	.63
Capability of information system	4.49	.83
Managerial commitment	4.54	.79
Centralization of decision-making	4.51	.90
Trust	4.40	.77
Type of product:	3.82	.63
Functional product	3.61	1.03
Innovative product	4.04	1.16

5.7 Level of VMI Element, Organizational Factor, and VMI performance Based on Type of Industries

The mean showed that most of the companies the industries like appliance (μ=4.22), textile (μ=3.75), petroleum (μ=3.83), metal (μ=3.58), chemicals (μ=3.96), electronics (μ=3.88), and pharmaceutical share demand information with their partners. Industries in automotive (μ=4.38) and food related (μ=4.38) shares more information compares to others, but, in general, industries in paper and packaging (μ=3.25) and buildings materials (μ=3.48) did not share information with their suppliers. Meanwhile, most of all industries (mean range from 3.67 to 4.71) place their storage nearest to their customer except textile industry (μ=2.00). In term of replenishment decisions, merely halve of industries do not have authorities to make replenishment

decisions on behalf of their customer. The industries that do not authorize their supplier to make the replenishment decisions are include textile (μ=2.75), automotive (μ=2.80), electronics (μ=3.45), and metal (μ=2.67) industries. Pertaining to the inventory control limits, industries like appliance (μ=4.07), petroleum (μ=4.00), automotive (μ=4.25), chemicals (μ=3.84), food related (μ=4.11), electronics (μ=4.06), and pharmaceutical (μ=4.43) applied it as to prevent the inventory from shortages. Only industries in metal (μ=3.42), paper and packaging (μ=3.00), building materials (μ=3.19) and textile (μ=3.50) give flexibility to their supplier to maintain the inventory levels. In term of inventory ownership, almost all of industries transfer the ownership of inventory to theirs suppliers (mean range from 3.62 to 4.22), except for electronics (μ=3.24), metal (μ=3.22), and paper packaging industries (μ=3.00).

The result also showed that the industries like appliance (μ=4.82), petroleum (μ=4.38), automotive (μ=4.80), chemicals (μ=4.70), food related (μ=4.45), electronics (μ=4.38), metal (μ=3.67), pharmaceutical (μ=4.43), and building materials (μ=4.39) install their company with high level of information system capability. However, industries in textile (μ=3.00), paper and packaging (μ=3.13) did not have better information system capability facilities in their companies. Most of the companies had put high managerial commitment toward VMI program, while, industries in petroleum (μ=4.13), and building materials (μ=4.30) just have fairly high of managerial commitment on VMI program. The table also showed that companies in textile (μ=3.40), paper and packaging textile (μ=3.00) industry are fairly low in positioning managerial commitment on VMI program. In term of decision making approach, all of

industries applied decentralized decisions making in their organization (mean range from 3.67 to 5.33). Refers to the trust element, most of the industries (mean range from 3.67 to 4.65) believe that their customer trust on them, except for companies in textile (μ=2.33) industry.

For service performance, the results showed that paper and packaging industry experienced fairly low performance (μ=3.29). Others industries, which include appliance, textile, petroleum, automotive, chemicals, plastics, electronics, metal, building materials, and pharmaceutical achieved a positive results with a high level performance (range from μ=4.38 to μ=4.91). A fairly high level of service performance found in food related industry (μ=4.30). Meanwhile for cost performance, all the industries reported a high performance range from μ=4.34 to μ=5.00. In general, all industries in manufacturing sector showed positive results in VMI program.

Table 5.15 presented the comparison of mean of level of VMI element, organizational factor, and VMI performance based on type of industries.

Table 5. 15
Level of VMI Element, Organizational Factor, and VMI performance Based on Type of Industries

	VMI elements					Organizational Factor				VMI performance	
Type of Industries	Visibility of demand	Inventory location	Replenish. decisions	Inventory control limits	Inventory Ownership	Information system capability	Managerial commitment	Decentralized decision making	Trust	Service	Cost
Appliance	4.22	4.24	3.71	4.07	3.95	4.82	4.66	4.86	4.24	4.67	4.63
Textile/ Clothing	3.75	2.00	2.75	3.50	4.00	3.00	3.40	3.67	2.33	4.57	5.00
Petroleum	3.83	4.22	4.67	4.00	4.22	4.38	4.13	4.89	4.00	4.38	4.67
Automotive	4.38	4.65	2.80	4.25	3.52	4.80	4.81	4.71	4.60	4.71	4.86
Chemicals/ Plastics	3.96	4.14	3.57	3.84	3.62	4.70	4.69	4.26	4.48	4.63	4.80
Food related	4.38	4.37	3.85	4.11	4.07	4.45	4.48	4.46	4.39	4.30	4.62
Electronics	3.88	4.09	3.45	4.06	3.24	4.38	4.56	4.27	4.65	4.59	4.70
Metal/Metal working	3.58	3.89	2.67	3.42	3.22	3.67	4.60	4.67	3.67	5.00	4.33
Pharmaceutical	4.09	4.71	3.75	4.43	4.00	4.43	4.34	4.90	4.43	4.67	4.82
Paper & Packaging	3.25	3.67	3.75	3.00	3.00	3.13	3.00	5.33	4.00	3.29	4.71
Building materials	3.48	4.63	3.65	3.19	4.13	4.39	4.30	4.46	4.00	4.91	4.34

5.8 Level of VMI Element, Organizational Factor, and VMI performance Based on Firm Size

Based on mean analysis, supplier in large companies (μ=4.09) and small and medium companies (μ=4.00) share demand information with their partners at fairly high level. In term of inventories storage location, large companies located their storage premises more proximity (μ=4.37) to their customer compared to small and medium companies (μ=4.25). Surprisingly, customers in VMI program did not allowed large companies to make inventory replenishment decision (μ=3.43), but authorised slightly for small and medium companies to decide inventories replenishment (μ=3.58). Meanwhile, both of large (μ=4.05) and small and medium (μ=3.96) size companies applied slightly inventory control limits element in their VMI program. In term of inventory ownership, both of company's size was given limited ownership of inventories.

The result also showed that large (μ=4.65) and small and medium (μ=4.39) size of companies install their company with high level of information system capability. In term of managerial commitment, both of companies size had instil high managerial commitment toward their VMI program, with mean μ=4.60 (large) and μ=4.47 (small and medium), respectively. The results also showed that both of companies size used decentralized decision making approach at high level with mean μ=4.46 (large) and μ=4.56 (small and medium), respectively. For trust element, large companies denoted high level of trust (μ=4.51). While small and medium size companies also believe that their customer trust (μ=4.29) on them at high level.

For service performance, the mean showed that large companies experienced higher performance (μ=4.80) compared to small and medium companies (μ=4.59). Meanwhile for cost performance, nevertheless size of companies reported a high performance with mean μ=4.66 (large companies) and μ=4.52 (small and medium companies), respectively. Table 5.16 presented the comparison of mean of level of VMI element, organizational factor, and VMI performance based on firm size.

Table 5. 16
Level of VMI Element, Organizational Factor, and VMI performance Based on Firm Size

Variables		Size of company	
		Large	Small and medium
VMI elements	Visibility of demand	4.09	4.00
	Inventory location	4.37	4.25
	Replenish. decisions	3.43	3.58
	Inventory control limits	4.02	3.96
	Inventory Ownership	3.51	3.89
Organizational Factor	Information system capability	4.65	4.39
	Managerial commitment	4.60	4.47
	Decentralized decision making	4.46	4.56
	Trust	4.51	4.29
VMI performance	Service	4.80	4.59
	Cost	4.66	4.52

5.9 Results of Pearson Correlation Test

The Pearson Correlation test was used in order to test the hypotheses 1 and 3. The objective is to determine the associations among the VMI elements dimensions, organizational factors dimensions and VMI performance dimension. According to Pallant (2005), the result shows no relationship, if the value of correlation is 0, while a perfect positive or negative relationship has been achieved, if the value of correlation is ±1.0. Cohen (1988) suggested a more detail interpretation on strength of correlation value. According to Cohen

(1988), a small strength is in the range of r = ±0.1 to ±0.29; a medium strength is in the range of r = ±0.30 to ±0.49, while a large strength is in the range r = ±0.50 to ±1.0.

For VMI elements dimensions, only inventory location, level of demand visibility, and inventory control limits had significant and positive relationships with VMI performance. Level of demand visibility and inventory control limit showed a significant and positive relationship with service improvement with a correlation of r =0.483 and r =0.464, respectively at $p<0.001$. However, inventory location only had a significant and positive relationship with service performance, at r =.222 ($p < 0.05$). In general, the strength of VMI elements dimensions and service performance was from small to moderate level. Meanwhile, only inventory location had a significant and positive relationship with cost performance at r =.319 (p=0.001).

On the other hand, all of the organizational factors dimensions had significant relationships with service and cost performance at different level of significance. Among the organizational factors dimensions, at a 99 percent confidence interval, only information system capability, managerial commitment and trust had shown a significant and positive correlation of r =0.354, r =0.382, and 0.426, respectively with service performance. Meanwhile, decentralization decision-making was not significantly correlated with service performance at r=.183. However, all of the organizational factors dimensions had significant and positive relationships with cost performance, but only managerial commitment had shown at 99 percent interval level with r= .326. The others, information system capability, decentralization decision-making and trust only showed the value of r =0.229, r =0.206, and 0.235,

respectively at 95 percent interval level. Hence, the strength between organizational factors dimensions and VMI performance was from small to moderate. The Table 5.17 has shown the results of the relationships between the independent variables and the dependent variables.

Table 5. 17
Pearson Correlation Result on the Relationships between the VMI elements, Organizational Factors and the VMI Performance (2 Tailed Tests)

Variable(s)	Cost performance	Service performance
VMI elements:		
Inventory location	.319**	.222*
Inventory ownership	.085	-.002
Level of demand visibility	.183	.483**
Inventory control limits	.156	.464**
Replenishment decisions	-.053	-.013
Organizational factors:		
Managerial commitment	.326**	.382**
Decentralized decision-making	.206*	.183
Capability of information system	.229*	.354**
Trust	.235*	.426**

** correlation is significant at the 0.01 level
* correlation is significant at the 0.05 level

Among all the variables, the replenishment decision and managerial commitment showed significant relationships with functional product. The strength of the relationship is, however, small with $r = -0.265$ ($p < 0.01$) and $r = -0.207$ ($p < 0.05$), respectively. Meanwhile, at a 99 percent confidence interval, the VMI elements dimensions of inventory location, replenishment decisions, and inventory ownership had significant and positive relationships with innovative product with $r = 0.290$, $r = 0.356$, and $r = 0.339$, respectively. At a 95 percent confidence interval, level of demand visibility and inventory control limits also had significant and positive relationships with innovative product with r equal to 0.249 and 0.218, respectively. On the other hand, organizational factors dimensions showed significant relationships at a

confidence level of 99 percent, between information system capability, centralization of decision making and innovative product with r = 0.259, and r = 0.354, respectively. The results of Pearson Correlation on the relationship between the type of products, VMI elements, and organizational factors were presented in table 5.18.

Table 5. 18
Pearson Correlation Result on the Relationship between the Type of Products VMI Elements, and Organizational Factors (2 Tailed Tests)

Variable(s)	Functional product	Innovative product
VMI elements:		
Level of demand visibility	.171	.249 *
Inventory location	.073	.290 **
Replenishment decisions	-.265 **	.356 **
Inventory control limits	.040	.218 *
Inventory ownership	-.186	.339 **
Organizational factors:		
Capability of information system	.189 *	.259 **
Managerial commitment	.207	.084
Centralization of decision-making	.077	.354 **
Trust	.066	.009

** correlation is significant at the 0.01 level
* correlation is significant at the 0.05 level

5.10 Results of Multiple Regressions Analysis

Next, multiple regressions were performed to test the hypotheses 2 and 4. The objective is to examine the predictive power of the VMI elements and organizational factors (as independent variables) toward the VMI performance (as dependent variable). Therefore, the dimension that has more influence on VMI performance can be identified. Multiple regressions were also chosen because of its capability to evaluate simultaneous the predictive power of independent variables.

The ratio should not be less than 5:1, with a desired level of 15-20 observations for each independent variable when conducting a multiple

regressions. As this study encompasses maximum of five dimensions for each test, so the minimum desired level is between 75-100 observations. However, the desired power level, alpha level, number of predictors and expected effect size should take into account when determining the number of observation required. He proposed a multiple regressions with a medium effect size of approximately 0.8 or greater can use the formula; $N \geq 50 + 8m$ (where m= number of independent variables). Thus, this study requires a minimum of sample size of 90 in order to conduct multiple regressions analysis.

Others test such as multicolinearity, linearity and homoscedasticity were also performed in order to comply with the assumptions under multiple regressions. To assess multivariate multicollinearity, this study used tolerance or VIF (variance influence factor), which build in the regressing of each independent on all the others. In order to ensure that the independent variables were not highly correlated with each other; the VIF must be less than 10 while tolerance value should not be 0.01 or less. The scatter plot was used as indicator of linearity and a normal distribution. In addition, Mahalanobis Distance was also used to confirm any outliers. To test the autocorrelation of the model, the Durbin-Watson coefficient results should be within the acceptable range of 1.5-2.5, while the condition index should not be more than or equal to 30. The above assumptions were checked and proper action was taken to reduce multicolinearity by deleting the outliers.

5.10.1 VMI Elements and Service Performance

A multiple regression analysis was conducted to examine the relative impact of VMI elements on service performance. The result of data

analysis showed that two predictor variables, which were level of demand visibility and control limits (with the population of study size =101) were the predictors to the service performance of VMI. Meanwhile, the other three dimensions which were inventory location, replenishment decision, and inventory ownership were not factored to service performance of VMI. Significantly, level of demand visibility [F (1, 98) = 29.852, p<0.01] contributed 22.6 percent of variants (adjusted R^2= 0.226) in service performance. The result showed that level of demand visibility was a primary indicator to the service performance. The combination of level of demand (β=0.346, p< 0.01) visibility and control limits [β=0.312, p< 0.01] contributed to 29.8 per cent or adding 7.9 per cent (29.8-22.6) to the variants (adjusted R^2 0.298) in variable criterion of service performance [F (1, 97) = 11.075, p<0.01]. Based on the results, the researcher reported that level of demand visibility and control limits were the predictors to the service performance of VMI. The following table presents the model summary of VMI elements and service performance (Table 5.19) and coefficients of VMI elements and service performance (Table 5.20).

Table 5. 19
Model Summary of VMI Elements and Service Performance

				Change Statistics					
Model	R	R Square	Adjusted R Square	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.483[a]	.233	.226	.233	29.852	1	98	.000	
2	.559[b]	.312	.298	.079	11.075	1	97	.001	1.813

Table 5. 20
Coefficients of VMI Elements and Service Performance

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	4.689	.055		85.766	.000		
	centre_LD	.367	.067	.483	5.464	.000	1.000	1.000
2	(Constant)	4.689	.052		90.066	.000		
	centre_LD	.263	.071	.346	3.692	.000	.807	1.239
	centre_CL	.237	.071	.312	3.328	.001	.807	1.239

5.10.2 VMI Elements and Cost Performance

Multiple regression analysis was also conducted to examine the relative impact of VMI elements on cost performance. The result of data analysis showed that only inventory location (with the population of study size =101) was the predictor to the cost performance of VMI. However, the inventory location (β=0.319, $p< 0.01$) [$F (1, 98) = 11.11$, $p<0.01$] had lower contribution to the cost performance at 9.3 percent of variants (adjusted R^2 0.093). The result also indicated that VMI elements do not provide plentiful of benefit in reducing cost as only inventory location contributes to cost performance at lower percentage. The following table showed the results of model summary of VMI elements and cost performance (Table 5.21) and coefficients of VMI elements and cost performance (Table 5.22).

Table 5. 21
Model Summary of VMI Elements and Cost Performance

Model	R	R Square	Adjusted R Square	Change Statistics R Square Change	Change Statistics F Change	Change Statistics df1	Change Statistics df2	Change Statistics Sig. F Change	Durbin-Watson
1	.319[a]	.102	.093	.102	11.110	1	98	.001	2.099

Table 5. 22
Coefficients of VMI Elements and Cost Performance

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	4.590	.076		60.678	.000		
	centre_IL	.292	.088	.319	3.333	.001	1.000	1.000

5.10.3 Organizational Factors and Service Performance

The results of multiple regression analysis showed that organizational dimensions, which were trust and managerial commitment (with the population of study size =101) were the predictors to the service performance of VMI. Other two dimensions, which were information system capability and decentralized decision making were not factored for the service performance of VMI. The trust dimension [F (1, 99) = 22.00, $p<0.01$] contributed 17.4 per cent of variants (adjusted R^2 0.174) in service performance. The result showed that trust ($\beta=0.327$, $p< 0.05$) was a primary indicator to the service performance. The combination of trust and managerial commitment [$\beta=0.253$, $p< 0.05$] contributed to 22.1 percent to the variants (adjusted R^2 =0.221) or adding 5.4 per cent (21.1-17.4) in variable criterion of service performance [F (1, 98) = 6.961, $p<0.05$]. Based on the results, the researcher reported that trust and managerial commitment were the predictor variable for service performance of VMI. The table below showed the model summary of organizational factors and service performance (Table 5.23) and coefficients of organizational factors and service performance (Table 5.24).

Table 5. 23
Model Summary of Organizational Factors and Service Performance

Model	R	R Square	Adjusted R Square	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.426[a]	.182	.174	.182	22.005	1	99	.000	
2	.486[b]	.236	.221	.054	6.961	1	98	.010	1.828

Table 5. 24
Coefficients of Organizational Factors and Service Performance

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	T	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	4.689	.056		83.433	.000		
	centre_Trust	.344	.073	.426	4.691	.000	1.000	1.000
2	(Constant)	4.689	.055		85.908	.000		
	centre_Trust	.264	.077	.327	3.405	.001	.846	1.183
	centre_Commit	.198	.075	.253	2.638	.010	.846	1.183

5.10.4 Organizational Factors and Cost Performance

Meanwhile, the multiple regression analysis was also conducted to examine the relative impact of organizational factors on cost performance. The result of data analysis showed that only managerial commitment (with the population of study size =101) was the predictor to the cost performance of VMI. The managerial commitment variable (β=0.326, $p< 0.05$) [$F (1, 99) = 11.81$, $p<0.01$] had contributed to the cost performance only at 9.8 per cent of variants (adjusted R^2 =0.098). The model summary of organizational factors and cost performance and coefficients of organizational factors and service performance was presented in Table 5.25 and Table 5.26, respectively.

Table 5. 25
Model Summary of Organizational Factors and Cost Performance

Model	R	R Square	Adjusted R Square	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.326[a]	.107	.098	.107	11.812	1	99	.001	2.219

Table 5. 26

Coefficients of Organizational Factors and Service Performance

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	4.590	.075		61.146	.000		
	centre_Commit	.327	.095	.326	3.437	.001	1.000	1.000

5.11 Results of Hierarchical Regression Analysis

For the moderating hypothesis (Hypothesis 5), a hierarchical regression as recommended by Aiken and West (1991) and Baron and Kenny (1986) were adopted. To reduce the multicolinearity, variables were mean-centered. Separated regressions were performed for the moderating effect of type of products, respectively. In Step 1, the main effects of VMI performance will be entered. In Step 2, type of products as a moderator variable was entered into the equation. Finally, the two way interaction terms were obtained by multiplying the moderator variable and organizational factors variables. A moderation effect will be detected if the explained variance ($R2$) was significantly increased by the interaction terms.

5.11.1 The Moderating Effect of Type of Products on VMI Element Dimensions and Service Performance

First step, the independent variable of VMI elements was included. There were five dimensions of VMI elements namely level of demand visibility, inventory location, replenishment decision, inventory ownership, and inventory control limits. These variables were entered into the first block. In Step 2, the moderator variable, innovative product and functional product were entered in the second block. The

third block includes the interaction of moderator variables and VMI element dimensions.

Step 1 show 35.0 percent (adjusted R^2= 0.350) of the variance in the service performance of VMI (dependent variable) was jointly explained by the level of demand visibility, inventory location, replenishment decision, inventory ownership, and inventory control limits (independent variables). In this step, both level of demand visibility and inventory control limits show a significant level at 0.001. The beta value is 0.316 and 0.429 for level of demand visibility and inventory control limits, respectively. Meanwhile, inventory ownership has shown a significant value at 0.089 with beta value of -0.163. Others variables were not significant to the service performance of VMI.

In the second step, when the moderator variables were introduced, a significant F change indicates there is an effect from the moderator variables in the relationship between the predictors and criterion variables was significant at value of 0.16. The inventory control limits remained significant at level of 0.001 (β = 0.430). While, the level of demand visibility was significant at p=0.01 (β = 0.299) In addition moderating variable, functional product also shows significant value at p=0.05 with beta value of -0.191. Meanwhile the adjusted R^2 is 0.393. Hence, the predictive power to explain the criterion by the predictors is 39.3 percent.

In Step 3, the interaction between the predictor variables and the moderators found that there was a significant F change of 0.006

(adjusted R^2= 0.491). Among all the variables, there were three interactions that produced a significant relationship. The level of demand visibility and innovative product, and inventory location and innovative product were significant at 0.10 confidence level. Meanwhile, the relationship between inventory ownership and functional product was significant at 0.05 confidence level. The beta value for the interactions between level of demand visibility and innovative product, inventory location and innovative product, inventory ownership and functional product were at β =0.203, β =0.194, and β =-0.295, respectively. Table 5.27 shows the multiple regressions result of the moderating effect of type of products on VMI elements and service performance.

Table 5. 27
The Moderating Effect of Type of Products on the Relationship between VMI Element Dimensions and the Service Performance of VMI

Variable(s)	Step 1 Independent variables	Step 2 Moderating variables	Step 3 With interaction
Level of demand visibility	0.316***	0.299**	0.299**
Inventory location	-0.001	-0.004	0.051
Replenishment decisions	-0.044	0.027	0.071
Inventory control limits	0.429***	0.430***	0.423***
Inventory ownership	-0.163*	-0.116	-0.068
Innovative product		-0.111	-0.105
Functional product		0.191**	0.174
Level of demand visibility x Innovative product			0.203*
Inventory location x Innovative product			0.194*
Replenishment decisions x Innovative product			0.122
Inventory control limits x Innovative product			-0.156
Inventory ownership x Innovative product			0.002
Level of demand visibility x Functional product			-0.019
Inventory location x Functional product			0.107
Replenishment decisions x Functional product			0.018
Inventory control limits x Functional product			-0.003
Inventory ownership x Functional product			-0.295**
R^2	0.383	0.437	0.579
Adjusted R^2	0.350	0.393	0.491
R^2 Change	0.383	0.053	0.142
Significant F change	0.000	0.016	0.006

In order to investigate the effects of continuous moderating variable, a dichotomous variable is created for regulatory pressure by using median as the cut-off point to categorise groups with low and high scores. Thereafter, how the association between predictor and criterion variables differs across groups becomes evident. Figure 5.5 (i) showed that innovative product positively moderates the level of demand visibility to service performance relationship. The graph also suggested the product that has less characteristic of innovative tends to have lower service performance on highly sharing demand information. Consider the X axis, when the level of demand visibility is high, the gap for service performance was smaller while the gap was larger for low level of demand visibility. Therefore, the interaction effect of innovative product was higher when the level of demand visibility is high.

According to Figure 5.5 (ii), when innovative product was high, a positive relationship between close inventory locations and service performance were presented. However, for low innovative product, there is a negative relationship between inventory locations and service performance. Figure 5.5 (iii) also showed that service performance is characterized by positive effects for low and high levels of the moderator. At high functional product (moderator variable), increasing ownership of inventory is associated with the decrease of service performance. By contrast, at low levels of functional product, an increase of ownership of inventory is associated with increased service

performance. Therefore, inventory ownership was giving apparent effect on service performance for functional product.

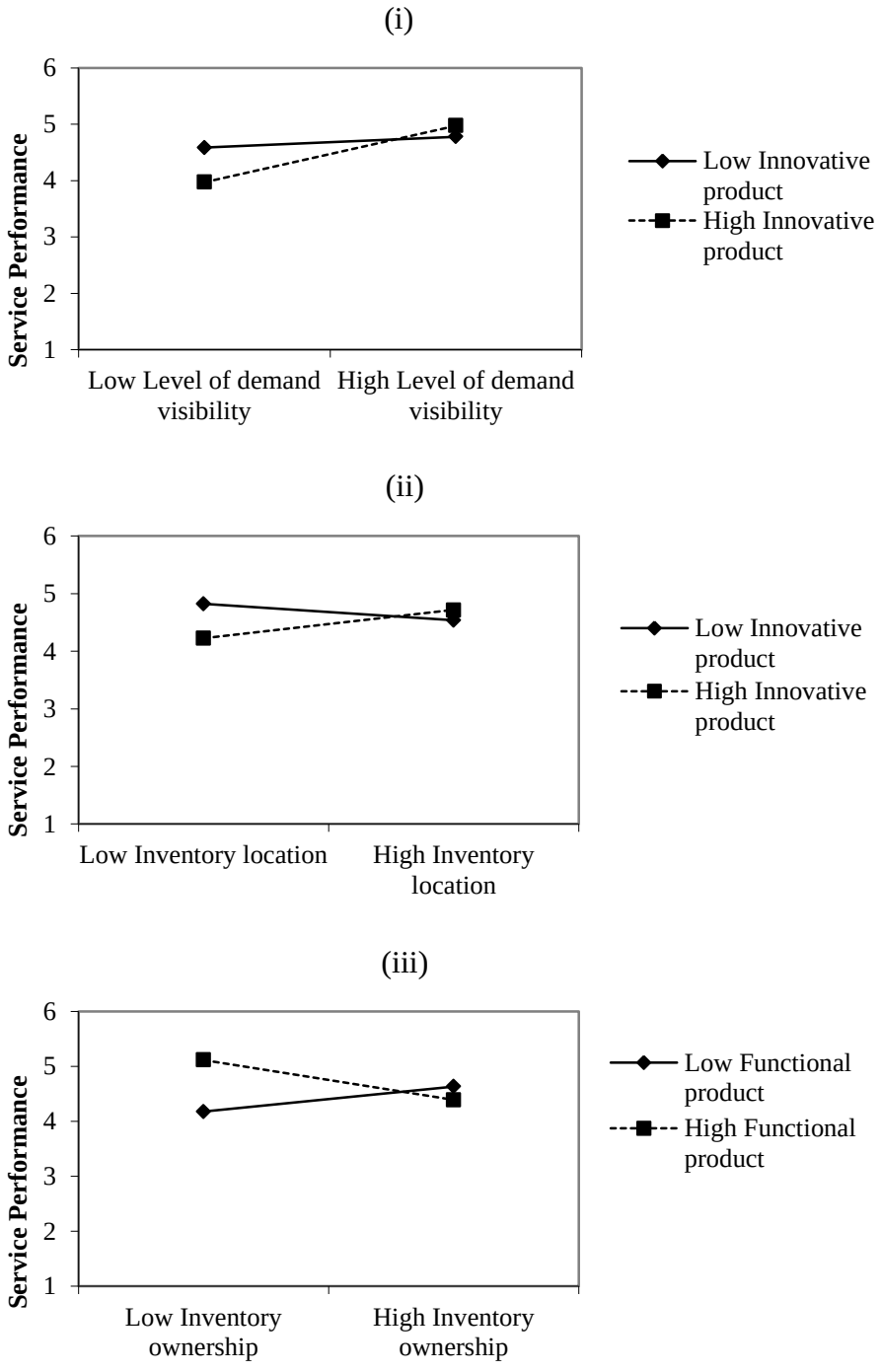

Figure 5. 5
The Relationship between Level of Demand Visibility (i), Inventory Location (ii), Inventory Ownership (iii) and Service Performance with Moderating Variable

To identify the type of moderator involved, a correlation test was conducted between the service performance and innovative product characteristics. There was not significant relationship (Pearson correlation - 0.043, significant at 0.669) between them indicating that innovative product characteristics only interact with the predictors making it a pure moderator. The correlation test between the service performance and functional product was significant with r=0.312 and significant at 0.001. Hence functional product acts as a quasi-moderator in this relationship as it interacts with both the predictor and the criterion.

5.11.2 The Moderating Effect of Type of Products on VMI Element Dimensions and Cost Performance

In Step 1, the independent variable of VMI elements was included. There were five dimensions of VMI elements namely level of demand visibility, inventory location, replenishment decision, inventory ownership, and inventory control limits. These variables were entered into the first block. Step 1 shows only 7.6 percent of the variance in the service performance of VMI (dependent variable) was explained jointly by level of demand visibility, inventory location, replenishment decision, inventory ownership, and inventory control limits (independent variables). In this step, only inventory location shows a significant value at 0.05 with the beta value is 0.303.

In Step 2, the moderator variables, innovative product and functional product were entered in the second block. In the Step 2, where the moderator variables were introduced, a significant F change indicates there is no interaction effect from the moderator variables in the relationship between the predictors and criterion variables.

The third block includes the interaction of innovative product and productive product and VMI element dimensions. The interaction between the predictor variables and the moderator found that there was a significant F change. The F change shows a significant value at 0.014. Similarly, there are also three interactions that produced a significant relationship. There were two interactions of independent variables and innovative product, level of demand visibility and inventory location and innovative product were significant at value 0.013 and 0.054, respectively. Meanwhile, the relationship between inventory control limits and functional product was significant at value of 0.006. The β value for the interactions between level of demand visibility and innovative product, inventory control limits and innovative product, and level of demand visibility and functional product were at 0.374, -0.279, and 0.413, respectively. Table 5.28 shows the multiple regressions result of the moderating effect of innovative product on VMI elements and cost performance.

Table 5. 28

The Moderating Effect of Type of Products on the Relationship between VMI Element Dimensions and the Cost Performance of VMI

Variable(s)	Step 1 Independent variables	Step 2 Moderating Variables	Step 3 With interaction
Level of demand visibility	0.058	0.081	0.223
Inventory location	0.303**	0.326**	0.178**
Replenishment decisions	-0.138	-0.087	-0.043
Inventory control limits	0.032	0.038	0.042
Inventory ownership	0.042	0.072	0.165
Innovative product		-0.182	-0.115
Functional product		0.018	-0.016
Level of demand visibility x Innovative product			0.374**
Inventory location x Innovative product			0.199
Replenishment decisions x Innovative product			0.008
Inventory control limits x Innovative product			-0.279*
Inventory ownership x Innovative product			0.039
Level of demand visibility x Functional product			0.413**
Inventory location x Functional product			-0.028
Replenishment decisions x Functional product			-0.139
Inventory control limits x Functional product			-0.076
Inventory ownership x Functional product			-0.135
R^2	0.123	0.151	0.344
Adjusted R^2	0.076	0.086	0.208
R^2 Change	0.123	0.028	0.193
Significant F change	0.028	0.226	0.014

The Figure 5.6 (i) indicates a mix direction to the relationship between the level of demand visibility and cost performance for innovative product. The firm with high innovative product characteristic had positively influenced cost performance with the increase in level of demand visibility. Meanwhile, the firm that had low innovative product characteristic had shown negative direction on cost performance with the increase in level of demand visibility. Therefore, a high level of demand visibility was required for innovative product to increase the cost performance of VMI. Figure 5.6 (ii) presents the moderating effect of innovative product characteristic on the relationship between inventory control limits and cost performance. The graph indicates that high control limits of inventory significantly

lead to the highest score of cost performance when the product encompasses low characteristic of innovative compared to high innovative product. Meanwhile, if a high inventory control limits was applied for high innovative product, the cost performance of VMI is gradually decreased. As shown in Figure 5.6 (iii), is characterized by the opposing effects for low and high levels of the moderator. At high levels of the functional product (moderator variable), increasing level of demand visibility is associated with increased cost performance. By contrast, increasing level of demand visibility is associated with the decrease of cost performance at low levels of the functional product.

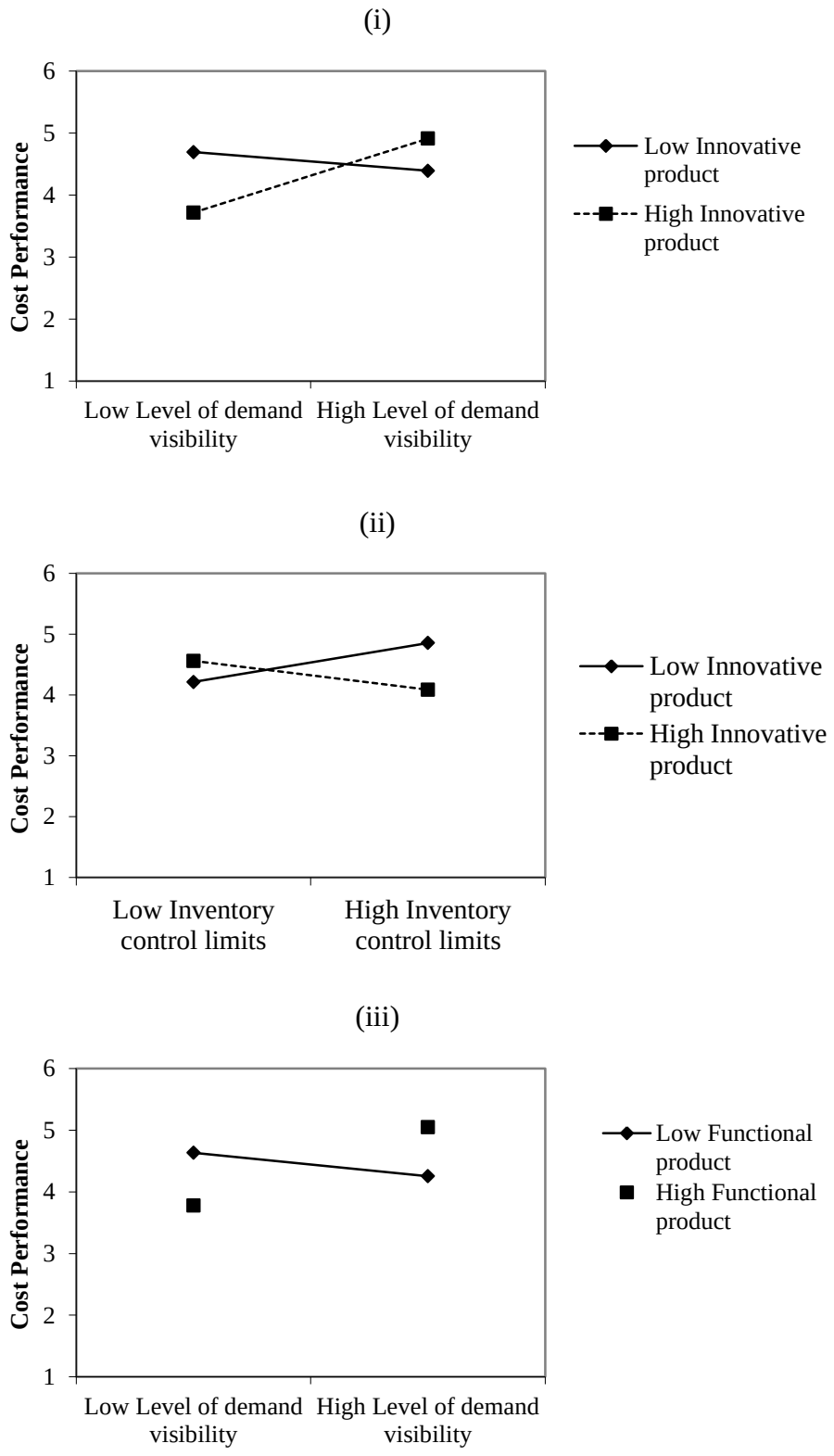

Figure 5. 6

The Relationship between Level of Demand Visibility (i), Inventory Control Limit (ii), and Cost Performance with Moderating Variable

To identify the type of moderator involved, a correlation test was conducted between the cost performance and functional product characteristics. There was not significant relationship (Pearson correlation 0.129, significant at 0.200) between them indicating that functional product characteristics only interact with the predictors making it a pure moderator.

To identify the type of moderator involved, a correlation test was conducted between the cost performance and innovative product characteristics. There was not significant relationship (Pearson correlation - 0.072, significant at 0.474) between them indicating that innovative product characteristics only interact with the predictors making it a pure moderator.

5.11.3 The Moderating Effect of Type of Products on Organizational Factors Dimensions and Service Performance

In Step 1, the independent variable of organizational factors was included. There were four dimensions of organizational factors namely information system capability, managerial commitment, decentralized decision-making, and trust. These variables were entered into the first block. In Step 2, the moderator variables, innovative product and functional product were entered in the second block. The third block includes the interaction of innovative product, functional product and organizational factors dimensions.

Step 1 showed 20.8 percent of the variance in the service performance of VMI (dependent variable) was jointly explained by information

system capability, managerial commitment, decentralized decision-making, and trust (independent variables). In this step, only trust shows a significant value at 0.002 with beta value of 0.319. The moderator variable (innovative product) was introduced in Step 2. However, there is not significant F change that indicates there is no major effect from the innovative product in the relationship between the predictors and criterion variables. In Step 3, the interaction between the predictor variables and the moderators also found that there was not significant F change (p=0.484). Hence, there was no moderating effect influencing the relationship of organizational factors and service performance. The multiple regressions result of the moderating effect of innovative product on organizational factors and service performance was shown in the Table 5.29.

Table 5. 29
The Moderating Effect of Innovative Product on the Relationship between Organizational Factors Dimensions and the Service Performance of VMI

Variable(s)	Step 1 Independent variables	Step 2 Moderating Variables	Step 3 With interaction
Information system capability	0.087	0.051	0.127
Managerial commitment	0.210	0.175	0.169
Decentralized decision-making	-0.037	-0.044	0.003
Trust	0.319**	0.333**	0.337**
Innovative product		0.030	-0.040
Functional product		0.258	0.178
Information system capability x Innovative product			0.078
Managerial commitment x Innovative product			-0.066
Decentralized decision-making x Innovative product			0.170
Trust x Innovative product			-0.109
Information system capability x Functional product			0.095
Managerial commitment x Functional product			-0.209
Decentralized decision-making x Functional product			0.209
Trust x Functional product			-0.059
R^2	0.240	0.298	0.355
Adjusted R^2	0.208	0.253	0.250
R^2 Change	0.240	0.058	0.057
Significant F change	0.000	0.024	0.484

5.11.4 The Moderating Effect of Type of Products on Organizational Factors Dimensions and Cost Performance

In Step 1, the independent variable of organizational factors was included. There were four dimensions of organizational factors namely information system capability, managerial commitment, decentralized decision-making, and trust. These variables were entered into the first block. In Step 2, the moderator variables, innovative product and functional product were entered in the second block. The third block includes the interaction of innovative product, functional product and organizational factors dimensions.

Step 1 showed 9.1 percent of the variance in the service performance of VMI (dependent variable) was jointly explained by information system capability, managerial commitment, decentralized decision-making, and trust (independent variables). In this step, only managerial commitment shows a significant value at 0.0310 with beta value of 0.292. The moderator variable (innovative product) was introduced in Step 2. However, there is not significant F change that indicates there is no major effect from the innovative product in the relationship between the predictors and criterion variables. In Step 3, the interaction between the predictor variables and the moderators also found that there was not significant F change ($p=0.666$). Hence, there was no moderating effect influencing the relationship of organizational factors and service performance.

Based on the above results, it can be seen that few variables act as moderators in both service and cost performance of VMI. However,

the type of products only interacts significantly with VMI elements but not with organizational factors. In addition, the interaction between innovative product (moderator variable) and service performance were more apparent compared to the functional product. In fact, innovative product emerges as pure moderator to both service and cost performance. Conversely, functional product only acts as pure moderator to cost performance not service performance. This indicates that the VMI performances will be more salient with innovative product characteristics.

To conclude, the hypotheses 3 were partially supported with six interactions between moderating variables and VMI elements. However, all the hypotheses 6 that measured the interaction between moderating variables and organizational factors were rejected. The multiple regressions result of the moderating effect of innovative product on organizational factors and service performance was shown in the Table 5.30.

Table 5. 30
The Moderating Effect of Type of Products on the Relationship between Organizational Factors Dimensions and The Cost Performance Of VMI

Variable(s)	Step 1 Independent variables	Step 2 Moderating variables	Step 3 With interaction
Information system capability	-0.063	-0.024	0.078
Managerial commitment	0.292	0.265	0.126
Decentralized decision-making	0.091	0.136	0.174
Trust	0.117	0.095	0.035
Innovative product		-0.132	-0.125
Functional product		0.016	-0.077
Information system capability x Innovative product			0.188
Managerial commitment x Innovative product			-0.162
Decentralized decision-making x Innovative product			0.001
Trust x Innovative product			0.006
Information system capability x Functional product			0.186
Managerial commitment x Functional product			0.013
Decentralized decision-making x Functional product			-0.043

Trust x Functional product			0.072
R^2	0.127	0.143	0.197
Adjusted R^2	0.091	0.088	0.067
R^2 Change	0.127	0.016	0.054
Significant F change	0.010	0.419	0.666

5.12 Validation of Research Findings

The empirical findings of this research are validated by respondents who volunteered to contribute their opinions on the results. Four managers of manufacturing company from medium-sized and large-sized indicated that their firms involved with VMI program and addressed that they managed customer's inventory. Their customers were not only end-users and they may comprise of assemblers and distributors. The company is a supplier to manufacturer that used their product in the assembling processes.

In term of the VMI elements effect on VMI performance in the manufacturing companies, the major findings in all cases appear to suggest that visibility of demand is a factor improving service performance in VMI program. Among the shared information includes: historical data; point of sales data; forecast from customer; production planning; inventory level; backorder; and goods in-transit. Although, in the case B shows that the information shared were less than other cases, they suggested that if more information were shared between customers, the service performance could be increased. Company in case B experienced more issue in availability of inventory at customers storage. Sometime, they confront with shortage and excessive in supplying inventories to their customers.

In the other hands, inventory control limits also plays a significant role to ensure the availability of customer inventories. Case A and C reported that they applied minimum and maximum limits for inventory control, except for

case B. Most of company argued that the application of inventory control limits is policy bonded in the VMI contract. In term of inventory ownership and replenishment decisions element, most cases reported a limited impact on VMI performance.

Although, they have the possession of inventory, but the decision regarding to replenishment of customer's inventory requires confirmation from their customers. These situations can impede the opportunities of supplier to take advantage of VMI through ownership of inventory and replenishment decision. Meanwhile, the proximity of storage location to customer location contributes to VMI performance only a limited extend. For an example in the case A, they have an abroad VMI customer, but still capable to reduce the cost and improving services through the third party logistics and warehouses provider. However, the administration of inventories will be easier for the local customers due to less of business procedures compared to doing business abroad, which need to comply with procedure and government policy.

In term of the effect of organizational factor, this dimension was divided into four sub-dimensions, which include information system capability, managerial commitment, decentralized decision-making, and trust. Based on the interview results conclude that managerial commitment and trust are the most important factors to better performance of VMI program. A manager from case C argued that since VMI is a collaboration program that move away from traditional approach in managing inventories in the supply chain. Therefore, it required large amount of commitment to pursue the procedure and the absent of a high level of trust to ensure all the policy bounded in the contract been complied by both parties.

In addition, case A and B also show that the role of information system is less compatible with their customers. In case A, the company is incapable in investing good information and communication system. As for the future needs, they recommended that government should facilitate SMEs companies to acquire information and communication infrastructure by providing better fund scheme. However, for time being they are capable to communicate effectively using existing information system facilities. Meanwhile, the company in case B monitors and updates their customer inventory level status on periodically basis by visited their customer premises. They have limited access on their customer information system in order to acquire demand information. Therefore, the less compatibility of information system is not an obstacle to them to share information. Almost all the cases had applied different approach and level of decision-making. All the cases suggested that a different level of decision-making approach is not a factor in the VMI performance. The inference from the cases indicate that the chosen decision-making approach is not due to VMI program that had been implemented, but more for facilitating the decision-making process based on the amount of workload.

As these cases explicitly suggest type of products plays significant moderating role in promoting better performance. Both, innovative and functional product have significant role in promoting better performance of VMI program. In term of relationship between visibility of demand and VMI performance, both type of product shows important role but at the different level. For an example, the visibility of demand in case B helps them to manage the variety of product that offered to their customer more effectively. However, the

advantage of sharing demand information is more obvious for functional product as in case A. The more predictable demand and low forecast error assist the company to optimize the transportation cost and ordering cost. On the other hand, the moderating effect of type of products shows minimal impact on relationship between inventory ownership by supplier, inventory location, inventory control limits, and replenishment decisions and VMI performance.

The type of product also was conceptualized to be moderating effect on relationship between organizational factor and VMI performance. However, there is no perceptual evidence of possible high impact on the relationship. As the cases indicate that the important of managerial commitment and trust is important nevertheless type of product involve in the VMI program. Among the reasons are to secure the sales volume; avoids penalty, which result from breaking the contract; and to maintain company reputations. All the cases perceived same conclusion on the moderating effect of type of product on the relationship between information system capabilities and VMI performance. They suggest that type of product did not alter the impact of information system capabilities on VMI performance because the existing information system infrastructure had met the minimal requirement of VMI program. As well as the level of decentralized decision-making approach, the cases suggest that type of product did not adjust the impact on VMI performance. Both, innovative and functional product requires the right decisions to ensure effective and efficient flow of inventories. But, with limited replenishment decisions provided to supplier hinder them to be more flexible in supplying inventories to their customers.

To conclude, the respondents validated that VMI elements and organizational factors contributes to VMI performance and confirmed the influence of type of product characteristic onto VMI performance only to a limited extent. Table 5.31 summarizes respondents' qualitative information on VMI program at their organization.

Table 5. 31
Summary of Cases Finding

	Case A	Case B	Case C
Type of Industry	Electronics	Appliance	Automotive
VMI implementation	Yes	Yes	Yes
Level of demand visibility	Historical data; point of sales data; forecast from customer; production planning; inventory level; backorder; and goods in-transit	Historical data; point of sales data; forecast from customer; inventory level; and goods in-transit	Historical data; point of sales data; forecast from customer; production planning; inventory level; backorder; and goods in-transit
Inventory control Limits	Applied minimum-maximum limits and provide safety stock	No minimum-maximum limits; do not provide safety stock	Applied minimum-maximum limits and provide safety stock
Inventory Location	Storage location close to customer location, transportation lead time short	Storage location moderately close to customer location, transportation lead time moderately short	Storage location close to customer location, transportation lead time short
Inventory Ownership	Own customer inventory, responsible to holding cost, exposed to price fluctuation	Own customer inventory, and responsible to holding cost, not exposed to price fluctuation	Own customer inventory, and responsible to holding cost, moderately exposed to price fluctuation
Replenishment Decisions	Supplier make replenishment decisions but subjected to customer confirmation in term of time delivery	Supplier make replenishment decisions in term of quantity and time to deliver	Customer propose in term of quantity and time to deliver
Managerial Commitment	Comply with VMI policy; provide adequate personnel to manage VMI program	Highly committed to VMI program especially in term of allocation of sufficient time; critically assess the VMI planning, and comply with VMI policy.	Highly committed to VMI program especially in term of allocation of sufficient time; critically assess the VMI planning, and comply with VMI policy.
Decision-making approach (DD)	Centralizes	Decentralizes the decisions pertaining to services and cost performance	Decentralizes

Table 5.31 Continued

Information system capability (ISC)	Moderately provide accuracy information; real-time information and timeliness but less compatible with customer's IS	Moderately provide accuracy information; real-time information and timeliness but less compatible with customer's IS	Moderate to high in providing accuracy information; real-time information; timeliness and compatible with customer's IS
Trust	Rarely breaks contractual agreement; establish mutual trust	Customer is moderately reliable in performing their task	Rarely breaks contractual agreement; establish mutual trust; customer is competent
Type of product	Functional: Demand moderately predictable, low forecast error; low stockout	Innovative: Product variant and price discount is moderately high; contribution margin (profit) moderately low	Innovative: Product variant and price discount is moderately high; contribution margin (profit) moderately low
Does VMI elements and organizational factor impact on VMI performance?	Yes, at limited extent. - Highly improve reliability of deliveries; responsiveness; few stockout. - reduce transportation cost and ordering cost	Yes, at limited extent. - Moderate to high in improving reliability of deliveries; responsiveness; few stockout. - Highly improve overall inventory management related cost	Yes, at limited extent. - Highly improve reliability of deliveries; responsiveness; few stockout - Highly improve overall inventory management related cost except materials handling cost
Does type of product moderate the relationship between VMI elements and organizational factor on VMI performance?	Yes, at minimal impact. - improve reliability of deliveries; responsiveness; reduce and transportation cost	Yes, at minimal impact. - improve reliability of deliveries; responsiveness; slightly improve overall inventory management related cost	Yes, at minimal impact. - improve reliability of deliveries; improve overall inventory management related cost except materials handling cost

5.13 Summary of Hypotheses Testing

H1: VMI elements have a significant and positive relationship with VMI performance.

Hypothesis 1 was developed and tested using the Pearson correlation. The significant and positive variables that associated with service performance were inventory location (H1B), level of demand visibility (H1F), inventory control limits (H1H). Meanwhile, only inventory location (H1A) was significant and positively related to cost performance. Thus, hypotheses 1 was partially supported.

H2: The VMI elements have significantly explained the variance of VMI performance.

The multiple regression analysis was conducted to test the hypotheses above. Combination of level demand visibility and inventory control limits significantly explain the service performance (H2A). However, finding indicates that only inventory location significantly explains the cost performance (H2B).

H3: Organizational factor have a significant and positive relationship with VMI performance.

Hypothesis 3 was developed and tested using the Pearson correlation. The variable that significant and positively associated with service performance were managerial commitment (H3B), information system capability (H3F), and trust (H3H). Meanwhile, managerial commitment (H3A), decentralize decision making (H3C), information system capability (H3E), and trust (H3G) were significant and positively related to cost performance. Thus, hypotheses 3 was partially supported

H4: Organizational factor have significantly explained the variance of VMI performance.

Multiple regression analysis was also used to test the hypotheses above. Finding indicates that a combination of trust and managerial commitment significantly explain the service performance (H4A). However, only managerial commitment significantly explains the cost performance (H4B). Based on results identified in multiple regression analysis, the hypothesis 4 is partially supported.

H5: Type of products significantly moderates the relationship between VMI elements, organizational factor and VMI performance.

In order to answer the research question 3, the moderating effect of type of products on the relationship between VMI elements and VMI performance was tested. For both the service performance and cost performance, type of products to VMI performance has significant interaction with VMI elements dimensions. Thus, type of products is a moderator to the relationship of VMI elements dimensions in both VMI performances dimensions. However, for service performance the significant relationships were supported by hypotheses H5A, H5C, and H5G. Meanwhile, for cost performance only few of the relationships had significant interaction, which are H5K, H5L, and H5P. Unexpectedly, type of products to VMI performance did not have any significant interaction with any of the organizational factors dimensions. Thus, type of products is not a moderator to the relationship of organizational factors dimensions with both VMI performances. To conclude, the H3 were slightly supported.

CHAPTER SIX

DISCUSSIONS AND CONCLUSION

This chapter is divided into many sections. In Section 6.1, objectives and purpose of this study is reiterated. Next, each of the research questions was discussed based on the findings, which is enclosed under Section 6.2 until Section 6.6. The discussion on the findings was concluded in Section 6.7. The implications of the study were discussed in Section 6.1 and the section encompassed several division such as the theoretical, managerial and policy implications. Also, the limitation of the study was covered in Section 6.2 while, future research and recommendation were discussed in Section 6.3 and 6.4 respectively. The chapter summarize was given in Section 6.5.

6.1 Overview of the Study

The relationship and the impact of VMI elements and organizational factors on VMI performance was examined in this study. The moderating effect of innovative product and functional product characteristics on VMI elements, organizational factors, and VMI performance also was determined. The first objective is to find out the association and influence of VMI elements on VMI performance. Similarly, the second objective was to find out the association and influence of organizational factors on VMI performance. Lastly, the final objective of this study was to determine the moderating effect of type of products which are innovative product and functional product on the relationship between VMI elements, organizational factors, and VMI performance.

The FMM directory was used as resources for the purpose of sampling. The target respondent is key manager, which represent the firm as unit of analysis.

Although, the required sample size was 330 respondents, a total of 495 set of questionnaire were mailed in order to increase the response rate. However, only 101 of questionnaires were usable for the purpose of analysis, which made the response rate at 20.4 percent of the sample size. Regarding to early-late response bias, the t-test result showed no major issues on the data. Besides, the other test such as normality, linearity, homoscedasticity, and Mahalanobis Distance also was conducted. Similarly, there is no major issue on the data. Therefore, a further analysis using Pearson correlation and multiple hierarchical regressions was run to attain the study objectives.

The VMI elements, organizational factors, type of products, and VMI performance were performed the factor analysis. With the acceptable loading, the factor analysis had captured difference dimensions under each of factors. For instance, the basic elements adapted from Zammori et al (2009) include seven elements, yet result of factor analysis only produced the acceptable loadings on five elements. However, these five elements discussed by Zammori et al. (2009), Elvander et al. (2008), and Sarpola (2007) who studied VMI. These elements are level of demand visibility, inventory location, inventory ownership, replenishment decisions, and inventory control limits. Meanwhile, under type of products, Fisher (1997) proposed that innovative product and functional products based on eight products characterises by unpredictable demand, short product life cycle, high contribution margin, high product variety, high average of forecast error, high average stockout rate, high average of price discount, and long production lead time. While functional products have predictable demand, long product life cycle, low contribution margin, low product variety, low average of forecast error, low

average stockout rate, low average of price discount, and short production lead time (Fisher, 1997). Selldin and Olhager (2007) used the proposed framework of type of products made by Fisher (1997) in their study. They successfully identified the innovative product, which characterized by high product variant, high forecasting error, and high product stockout, while functional product were characterized by long product life cycle and high lead time of production. However, the characteristics of type of products captured in this study are quite different from what had been studied by Fisher (1997) and Selldin and Olhager (2007). In this study, innovative product were characterized by high product variant, high profit margin, and high average price discount, while functional product were characterized by predictable demand, less forecasting error, less product stockout. In addition, the result of factor analysis for organizational factors and VMI performance also captured the discussed dimensions.

The different results of factor analysis compared to the expected dimension are related to small sample size. The higher loading is required to diminish the problems of large variances in the small sample size. A few statisticians (MacCallum et al. 2001 and Tabachnick & Fidell 2007) argued that lower factor loading is acceptable for the larger the sample size. Therefore, with lower factor loading, the probability to capture few more dimensions than this study recognized is increased.

In order to discuss the results of the findings, the research objectives are reiterated as the following:

1. To investigate the relationship and the influence between VMI elements and VMI performance in manufacturing companies.

2. To investigate the relationship and the influence of organizational factors on VMI performance.
3. To examine the moderating effect of type of products on the relationship between VMI elements and organizational factors variable and VMI performance.

The research objectives were discussed based on the hypotheses with the theoretical support and justification from previous research. Factors influencing the evidences are being discussed with suggestions are being made. Non-significant and contradictory findings are commented on the possible reasons.

6.2 The Relationship and the Influence of VMI Elements on VMI Performance

The correlation test and multiple regression analysis were used to achieve the first objective. The relationships and the influence of VMI elements on VMI performance were investigated.

The result show that significant relationship exists between level of demand visibility, inventory control limits, inventory location, and service performance. In details, the service performance of VMI was jointly explained by level of demand visibility and inventory control limits at 29.8 percent (r^2= 0.298). The level of demand visibility is the main contribution to service performance of VMI with 22.6 percent of total variance. Meanwhile, inventory control limits only explain 7.2 percent from the total variance (29.8 %). For cost performance, the result showed that inventory location

correlated and contributed significantly to the explanation of cost performance at only 9.3 percent.

The relationship and the influence of level of demand visibility and service performance was positively and significant. This study provides findings on level of demand visibility in VMI and complements the previous research that sharing of information can increase VMI performance (Irungu & Wanjau, 2011; Claasen et. al, 2008; Ramayah et. al, 2005). The implications by providing information on demand in time are faster replenishments can be achieved, slow and fast moving goods can be identified, accurate demand forecasts can be made to match the inventory flow, and high level customer service through product availability (Irungu and Wanjau 2011). Meanwhile for cost performance, its relationship was insignificant. Although sharing of information can improve the performance of supply chain (Simchi-levi & Zhao, 2003; Zhang & Zhang, 2007), sharing out-dated information can extensively decrease the performance (Vigtil, 2007, Elvander, et al. 2007). In this case, it is not significant to cost performance nor is it able to play the role as a cost reduction strategy to the firms.

The relationship between inventory control limits and service performance was also significant, which align with the argument made by Disney and Towill, (2003) and Valentini and Zavanella (2003) who stated that there are relationship between inventory control limits and stock availability. According to Claasen et al. (2008), imposing a high lower limit and penalty cost can ensure the availability of stocks which in turn increase customer service levels. However, a small contribution of inventory control limits on service performance is due to fairly tight in inventory control limits imposed by

buyers (μ=4.00). Normally, setting a tight inventory control limits were due to the insufficient buyer's trust (μ=4.40) in the supplier's capabilities to replenish just-in-time. Kaipia et al (2002) stated that this action can limit the flexibility of supplier to make optimum replenishment decisions. However, the study found an insignificant positive relationship between inventory control limits and cost performance of VMI. As mentioned by Claasen et al. (2008), VMI programs have applied different approaches of inventory control limits that vary by presence of trust. Though, Wild (2002) reminded that inventory control limits need to be adjusted, the identified target range should be both attainable consistently (Wild, 2002), and in line with the demand (Kuk, 2004). The consequences of not meeting this prerequisite are difficulty to plan and coordinate with other activities (Wild, 2002), a shortage of inventory or there is excess inventory (Gardner, 2004).

Although, there was significant relationship between inventory location and service performance, contribution to service performance was not significant. According to Sarpola (2007), when the storage location was in centralized manner, the role of vendor representative is normally low. Whereas, the vendor representative must ensure the right quantity and timing of shipment should be made to their customer. Thus, this circumstance limited the advantage of proximity of storage location to increase the opportunity to deliver inventories in time. Conversely, the study found a significant positive relationship between inventory location and cost performance of VMI. The result supported previous arguments, where centralized and closer inventory location can minimize number of deliveries and storage (Sarpola, 2006); reduce safety stock, lower total overhead cost, lower transportation cost, and

achieve economies of scale (Simchi-Levi et al., 2000). Although, most VMI program requires frequent delivery, the cost associated were not affected due to short distance of supplier and buyers' facilities.

The study also showed that inventory ownership not significantly correlated and contributed to VMI performance. Though managing the entire inventory system by supplier can enhance the service performance for its customer (Mishra and Raghunathan, 2004) and allow the supply chain to be synchronized better according to both companies' cost characteristic (Dong and Xu, 2002), this relationship was found not significant. Elvander et al. (2007) argue that when the supplier is incapable to absorb inventory cost; they sought an alternative to share the cost with their customer. This strategy was found to be a way of sharing risks, whereby the customer is also responsible on the risks of holding inventory such as the expense of storing, obsolescence, handling and tracking of the purchased items (Wallin et. al, 2006). Meanwhile, supplier would eventually be paid for all products that have been delivered (Elvander et al., 2007). These conditions can consequently lead to an unimportance of inventory ownership by partners.

The relationship between replenishment decisions and VMI performance for both service and cost has shown a negative correlation. However, this relationship was found not significant even though several researchers argued that the supplier may acquire major benefits by being able to optimize distribution through full truckloads strategy and the authority to decide when and how much to deliver each time, as long as the inventory remains within the agreed limits (Angulo et al., 2004; Cetinkaya & Lee, 2000; Disney et al., 2003). The suppliers were not given enough authority to decide on inventory

replenishment (μ=3.51), thus, the replenishment decisions are made mutually with their customers and failed to increase the performance of VMI. Normally, the mutual decision approach was used in a transition period going over from the traditional order process to the VMI order process (Simchi-Levi et al., 2000). Therefore, the replenishment decisions did not relate to VMI performance nor did it able to play role as a performance factor to VMI.

6.3 The Relationship and the Influence of Organizational Factor on VMI Performance

The test shows that all organizational factors dimension had significant and positive relationships with VMI performance except for the relationship between decentralized decision making and service performance of VMI. However, only trust and managerial commitment explains the variance in the service performance of VMI at 22.1 percent. For cost performance of VMI, only managerial commitment contributed at 9.8 percent.

Trust had played a positive role in achieving service performance, which contributed at 17.4 percent of total variance in service performance. This finding strengthens the case explained by Claasen et. al (2008) that trust was extremely important in achieving VMI performance. Trust encourages members in VMI program to share information (μ=4.05). Thus, provides to supplier with important information in decision making process. A study conducted by Handfield and Bechtel (2002) stated that trust was positively improving supply chain responsiveness, including on time delivery and lead time. However, trust was not significantly contributed to cost performance of VMI. Although, this study showed that level of trust is generally high

(μ=4.40), most of industries only had fairly high level of trust (appliance, automotive, petroleum, metal working, paper and packaging, and building materials). As VMI program requires member to share information, confidential information must be entrusted, unfortunately, some companies may also be unwilling to share information and lack of trust often exists (Fraza, 1998). Thus, the absence of trust can be a major barrier to the success of VMI (Kuk, 2004).

Meanwhile, managerial commitment significantly contributed to service and cost performance. Previous research had indicated a positive relationship between commitment and with both performance measurement, service and cost (Myer et al., 2000; Kuk, 2004). Therefore, the managerial commitment is critical to the success of VMI and the employees have to reorient themselves (Myer et. al, 2000) and are prepared to deal with changes (Ghannasekaran, 2000). However, from the gathered data by Sheu et al. (2006) concluded that the business relationship is indeed mutually benefits and efficient even with the medium level of commitment to collaboration. Myer et al (2000) argued that managers need to allocate optimal amounts of assets to the replenishment programs, even though immediate improvement in performance is unlikely.

One of the dimensions under organizational factors, information system capability had shown a positive relationship with service and cost performance. The findings indicate that firm's ability to increase VMI performance is inclined by the information system capability. This was supported by conclusion made by Kuk (2004) and Claasen et al. (2008) that capability of information system can ensure the information was exchanged among the supply chain members more effectively and indirectly increase the

firm's performance. However, the presence of better information system capability did not contributed to VMI performance. Aligned to Waller et al. (1999) stated that information systems should be viewed as an enabler, not as a necessity for successful VMI program. This study showed that industries had different level of information system capability, from fairly low (textile, paper and packaging) to high level (appliance, petroleum, automotive, chemicals, food related, electronics, pharmaceutical, and building materials).

The study found that decentralized decision-making is not significant to service performance. The argument behind this is the decision regarding the customer service is bounded with the policy included in the agreement. Even though the decision was decentralized, supplier still needs to comply with the agreement with their customer. For example, this study showed that suppliers were allocated with minimal authority in making decision pertaining to inventory replenishment (μ=3.51). In addition, the customer service policy might be different from one customer to another. This study showed that application of min-max limit of inventory level was different from one industry to others. Thus, it failed to show a significant result. However, a significant and positive relationship between decentralized decision-making and cost performance was aligned with the statements made by Sabath et al. (2001) and Mayor et al. (2001). With adequate information, it will enable the lower manager of decentralized decision-making approach to reduce the cost associated to inventory management. Unfortunately, decentralized decision making approach also not contributed to cost performance. As lower manager need information to make decision, insufficient information (μ=4.05) may hinder lower manager to make better decision related to cost reduction.

6.4 The Moderating Effect of Type of Products on VMI Elements, Organizational Factors and VMI Performance

In order to achieve the third objective, the moderator effect must be determined. The moderating effect of type of products was determined using a multiple hierarchical regression. For the relationships between VMI elements and service performance of VMI, the adjusted R^2 is increasing from 39.3 percent to 49.1 percent with the inclusion of the moderator variables. While for the relationships between VMI elements and cost performance of VMI the adjusted R^2 is increasing moderately from 8.6 percent to 20.8 percent with the inclusion of the moderator variables. Thus, the prediction of the service and cost performance became more strength with the introduction the moderators.

As expected, innovative product moderated the relationship between level of demand visibility and service performance. In addition, the relationship between inventory location and service performance was also moderated by innovative product. However, the relationship between inventory ownership and service performance was moderated by functional product. On the other hand, the relationship between level of demand visibility and cost performance was moderated by both type of products, innovative product and functional product. Innovative product also moderated the relationship between inventory control limits and cost performance.

Among the type of products dimensions, only innovative product acts as a pure moderator to affect the relationship with some of the dimensions of VMI elements and VMI performance. The functional product only acts as pure moderator to affect the relationship between level of demand visibility and cost performance and conversely acts as quasi moderator to affect the

relationship between inventory ownership and service performance. Many of them were pure moderators except for functional product for service performance where it was a quasi-moderator.

6.4.1 The Moderating Effect of Type of Products on the Relationship between Visibility of Demand and VMI Performance

Generally, the type of products has shown a significant role as a moderating variable on the relationship visibility of demand and VMI performance except for moderating effect of functional product on the relationship between visibility of demand and service performance. The role of innovative product in the relationship between levels of demand visibility – service performance indicated that when innovative product was high, with high level of demand visibility, service performance was slightly higher than low innovative product. The result means that when the characteristics of innovative product are high, the more information regarding the demand information is required to assist in decision-making process. Thus, at low visibility of demand, the low innovative product is still capable to provide better service performance compared to high innovative product.

A similar result was also found in the moderating effect of innovative product on the relationship between level of demand visibility and cost performance. Although, a high characteristic of innovative product and high level of demand visibility results in less cost performance compared to low innovative product, both high and low innovative products influence a positive relationship on demand visibility and cost

performance. Obviously, in the situation in which innovative product is involved in VMI program, the role of demand visibility to achieve a high cost performance become important.

The high innovative product had many variant that requires supplier to have more specific information regarding the demand trend of each product. With highly shared information on the innovative product, supplier can predict the order cycle much better; predict the next delivery time, and availability of the stock. In addition, a high contribution margin for innovative product also needs a careful monitor to avoid huge loss to the supplier due to out of stock, unreliable delivery and unpredictable order cycle of the products. With the help of sufficient information of future demand, supplier can make better production planning to fulfil the customer's needs. As proven in the result of this study, it is found that this particular finding corroborates with earlier assertions that stated greater demand visibility can induce greater VMI performance.

Conversely, an insignificant moderating effect of functional product on the relationship between level of demand visibility and service performance has shown the probability of make to stock strategy was used. This strategy is normally applied for functional product that has standardized product with quite stable demand fluctuation. Therefore, for certain supplier the benefits for the improvement of demand visibility were decreased, in the form of minimizing the bull-whip effect and the adverse effects of demand uncertainty (Cachon & Fisher, 2000; Kulp et al., 2004). Thus, the benefits of visibility of demand are

not important while being involved with make to stock strategy for functional product.

In addition, the different performance may arise from different forecasting methods applied between the supplier and customer. For example, Kmarts often claimed that its supplier was not compliance with the agreement to keep two weeks of stock on hand due to different methods of forecasting employed by the two companies (Simchi-levi et al, 2000). The bad effect is more obviously to the supplier as consequence of the information delay while the further actions cannot be taken as they have to wait the shared information has been received and processed (Whipple et al., 2002).

However, the functional product had moderated the relationship between demand visibility and cost performance. Aligned with Raghunathan and Yeh (2001) arguments that information sharing is more likely to be more effective at reducing costs for mature products with stable demand. When the product is more predictable and had low forecasting errors, benefits of sharing information would help supplier to continuously maintain only necessary inventory at predetermine level. Thus, inventory cost can be reduced when the level of inventory was reduced.

6.4.2 The Moderating Effect of Type of Products on the Relationship between Inventory Location and VMI Performance

Based on hierarchical regression results, all the hypotheses regarding the moderating effect of type of products on relationship between

inventory location and VMI performance was rejected except for the moderating effect of innovative product on relationship between inventory location and VMI performance. More specifically, the significant interaction of inventory location and innovative product has shown a positive direction of service performance associated with an increase of proximity of inventory location for high levels of innovative product. Conversely, a negative direction of service performance is associated with high inventory location for low innovative product. The result also showed that, when the inventory location is closer, with high innovative product the gap for service performance was slightly increase. However, when inventory location is low, a better service performance can be achieved with low innovative product. Therefore, the more the product was innovative the closer the inventory location to customer's location needs to be. This arrangement would enable the supplier to use its supply of the inventory with short delivery cycle and response quickly to the demand or usage needs (Elvander et al. 2007, Wallin, Rungtusanatham, & Rabinovich, 2006).

On the other hand, the finding implicated that inventory location does not influence cost performance. Although the innovative product characteristic shows a positive direction, inventory location's influence on their cost performance is still insignificant. Therefore, it is argued that supplier in manufacturing company with innovative product characteristic; do not consider inventory location as an important VMI element that can increase their cost performance of VMI. In other

words, innovative product does not play any significant role as a moderator in manufacturing companies that locate the inventory closer to their VMI customer and therefore, its influence on cost performance is non-existence.

The insignificance of moderating effect is most probably true when supplier was not given enough authority to replenish the customer's inventory. Thus, when the customer controls the process especially the replenishment decision making, there is an evident risk of sub-optimization if the transportation frequency is not aligned with the supplier's optimal production and delivery cycles (Claasen et al., 2008). The finding also implicated insignificant moderating effect of functional product between inventory location and VMI performance. Although the functional product characteristic shows a positive direction, inventory location's influence on their VMI performance is still insignificant. Therefore, it is argued that supplier in manufacturing company with functional product characteristic; do not consider inventory location as an important VMI element that can increase their VMI performance. In other words, functional product does not play any significant role as a moderator in manufacturing companies that locate the inventory closer to their VMI customer and therefore, its influence on service performance is non-existence.

The insignificance of moderating effect is also true when inventory is also located in a centralized manner or at the vendor or third party premises. When supplier appointed a third party services to conduct their distribution activities as it becomes economically viable for them.

It could be a priority alternative for vendor to appoint third party to manage their distribution activities, if there is an absent of interaction between customer and vendor representatives and accessing the customer's demand information do not give any advantages to the vendor (Sarpola, 2006). However, the incapability of third party services to provide better service to suppliers' customer had violated the strength of functional product to provide better VMI performance.

6.4.3 The Moderating Effect of Type of Products on the Relationship between Replenishment Decision and VMI Performance.

In general, all the findings on moderating effect of type of products on the relationship between replenishment decision and VMI performance were not supported. Therefore, it is argued that supplier in manufacturing company, regardless of type of products involved in VMI program do not consider replenishment decision as an important VMI element that can increase their service performance of VMI. In other words, type of products does not play any significant role as a moderator in manufacturing company that have implemented VMI and therefore, its influence on service performance is non-existence.

Managing inventories becoming more challenging when VMI program is involved with innovative product, which included high product variant, profit margin, and high seasonal marked-down of price. Thus, certain customers may feel reluctant or may resist allocating full authority of replenishment decision to the supplier which they believe can disrupt their product supply. Although VMI requires supplier to

make the replenishment decision, customer tends to intervene the decision made by supplier because they doubt on what the effect of the decision will be. Moreover, the replenishment decisions made by the customer are then less accurate and the orders generated from the customers represent less of true demand in the marketplace (Kuk, 2004).

The findings further indicated that replenishment decisions made by supplier do not consider innovative product as an important moderating effect that can trigger them to perform better in cost performance. When supplier was also responsible for inventory ownership (μ=3.70), the supplier may want to increase the sales by pushing the new products to the market (Sarpola, 2006) and increase the availability of the product to the end users by holding a large inventory (Mishra and Ragunathan, 2004). Thus, may cause the overstock, high in holding, transportation, administration and handling cost. If supplier is the owner of the inventory, they are responsible for the capital costs, including the obsolescence costs, accumulated by the inventory (Wallin et al, 2006). Since the supplier owns the inventory, they will be concerned with managing it as effectively as possible to lower the inventory cost.

Supposedly, the characteristics of functional product will assist supplier to replenish customer's inventory at the right quantity and time. However, the insignificant result of moderating effect of functional product describes several reasons. First, supplier was not given high authority to decide how much and when to replenish the

customer's inventory (μ=3.51). For example, the frequency of delivery will be increased especially when the customer requested the supplier to deliver small shipment. The extra costs may have been created for the supplier because the supplier has not always been able to make their shipments as ordered.

The supplier may also be incapable to consolidate the shipment especially when they only have small customer based in specific regions. Coupled with low replenishment decision, supplier also unable to retain orders until an agreeable dispatch time is reached, when they expected that economic consolidated dispatch quantity will accumulate before an order is dispatched. Thus, restrict the supplier to minimize the cost of stockout by possibility to prioritize the customer orders (Waller et al., 1999) and improve the optimization of its manufacturing and distribution (Cetinkaya and Lee, 2000).

In fact, the high level of replenishment decision allocated to the supplier would not provide any significant benefits if also guarded with tight inventory control limits. The suppliers may receive less freedom and flexibility in the inventory control process. They have to maintain specific level of inventory levels to be consumed by their customer. An application of maximum and minimum levels of inventory control indirectly enforced supplier to deliver frequently in small batch (μ=4.00). Thus, incapability of suppliers to consolidate better shipment can lower their performance in terms of reducing cost and improving services.

6.4.4 The Moderating Effect of Type of Products on the Relationship between Inventory Ownership and VMI Performance.

As mentioned earlier, by owning the inventory supplier can provide better service to their customer. Based on the first step hierarchical regression has shown that inventory ownership alone cannot be considered as important VMI elements that can be used to improve VMI performance. However, the result of interaction variables in the third step implied that only functional product was significant as the moderator on the relationship between inventory ownership and service performance.

The insignificant results of this study may be triggered by several reasons. Firstly, since innovative product comprise of many variants, the supplier may not have extra time to plan in order to deliver better service to their customer (Kaipia et al., 2002). In addition, due to the lack of knowledge or inventory management skill, innovative product may not be able to foresee the importance of owning the inventory on their service performance. The innovative product will not improve their service performance because the incapability of supplier to hold customer inventory with innovative characteristic of product.

The characteristic of the innovative product also is associated with many products variant and high contribution margin. Thus, too many variants in product can create difficulty for the supplier to manage their customer's inventory plus with other customer's inventory. This circumstance can create disorder in managing inventory if supplier does not have a good store management. Furthermore, a slightly fault

in managing inventory can increase the cost markedly because the innovative product represent high price. Obviously, all the cost associated with owning the inventory will be increased if the supplier is incapable to manage it effectively.

On the other hand, when functional product characteristic is involved, only then they realize the importance of inventory ownership to their VMI performance, specifically service performance. In addition, the finding implies that the suppliers with high inventory ownership tend to have higher service performance than those with low inventory ownership. Although an organization confronts with fluctuation of product price and responsible for holding cost of delivered product, a high functional product which is more predictable of demand, low in forecast error and less stockout facilitating supplier to control their customer's inventory and thus assisting them to provide better services. Although, the characteristic of the functional product is associated with predictable demand, low forecast error, and low stockout probability can help supplier to manage customer's inventory better, the production factor of functional product may contribute to insignificant result of moderating relationship. Normally, functional product was produced in large batch and applied a make- to -stock strategy in order to reduce the cost (Sun, et al., 2010). These approaches would push the supplier to dump a large quantity of inventory in the storage, which increase the cost associated to inventory management.

6.4.5 The Moderating Effect of Type of Products on the Relationship between Inventory Control Limits and VMI Performance.

The finding of the study suggests that type of products does not act as a moderator to most of the relationships between the studied variables. Only innovative product moderated the relationship between inventory control limits and cost performance. The role of innovative product in the relationship between inventory control limits – cost performance indicated that when innovative product was low, with high inventory control limits, cost performance increase. However, when innovative product was high, the cost performance with high inventory control limits decrease. The results indicated that when the characteristic of innovative product is high, the inventory control limits employed by the customer restrict the ability of supplier in reducing cost. Supplier may require additional resources to manage the highly innovative products which comprise of high product variant compared to low innovative product. When supplier maintaining inventory at a specific minimum and maximum level for each of product category, the amount of inventory also accumulate based on the numbers of product categories. In addition, if the inventory was not consumed or sold in a long period, obsolescence and product damage also can incur a high cost to supplier. In fact, supplier may have to reduce the price per unit as the value of the innovative product will drop significantly at the end of seasons. Thus, at low innovative product, the inventory control limits approach can work conversely and provide better cost

performance with a low variant of product, low profit margin, and low price markdown at the end of seasons.

Meanwhile, there are several reasons why type of products failed to show significant effect on the relationship between inventory control limits and VMI performance. Certain customers are not really confident with the capability of supplier to make replenishment decisions with a right quantity and delivery time (μ=3.51). Despite having acknowledged the benefits of allocating replenishment decision to the supplier, they tend to be doubtful with this approach. Thus, certain customers may put a fairly tight inventory control limits (μ=4.00) to their supplier to ensure availability of inventory and without excessive inventory. For supplier, this approach may limit their production flexibility and need to plan the production schedule carefully especially when dealing with different customer's requirement. Therefore, the inventory control limits need to be adjusted, the identified target range should be both attainable consistently, and is acceptable for planning and coordination with other activities. Findings by Claasen et al. (2008) showed that almost all customers provided their supplier with unexpectedly tight upper and lower limits for the inventory level. This is at odds with the theory of VMI, and significantly reduces the level of replenishment flexibility for the supplier. The distance between those limits differed between cases as did the penalty costs should those limits be exceeded.

6.4.6 The Moderating Effect of Type of Products on the Relationship between Capability of Information System and VMI Performance

Previous study revealed that the importance of capability of information system on service performance as one of the VMI success particularly in handling the different product characteristics. However, the findings of the present study have proven otherwise. The insignificant results of hierarchical analysis further indicated that the performance of supplier with high neither innovative product nor functional product does not improved as anticipated when it were included as the moderator for the relationship between information system capability and VMI performance. As revealed, both low and high for both innovative product and functional product are not different in their performance levels. Even though their level of type of products may differ, their perceptions on the importance of information system capability however are not.

The insignificant results of this study may be triggered by several reasons. Firstly, most of VMI programs require the manufacturers to invest in IT infrastructure to make the production level activity and inventory more visible to their suppliers; by giving the suppliers more control, manufacturers might expect higher returns (Kuk, 2004). Unfortunately, this study revealed that supplier was not given enough authority to make replenishment decisions. Thus restrict the supplier's capability to use the benefit of information system capability to provide better service performance to their customer.

Secondly, although supplier has high information system capability, the information systems would be more important if supplier is in need for timely monitoring of customer's inventory levels and to gain visibility to customer's demand (Sarpola, 2006). Conversely, the role of information systems can be anticipated to be less significant, if there is less need for timely visibility to the customer's inventory levels and to future demand (Sarpola, 2006).

In addition, the role of information systems may also be less significant, if only a small number of stock keeping units are managed in the VMI system (Daugherty et al., 1999). Thus, in the case of low product turnover and uncertainty in demand, a big investment in information systems was not good decision to achieve better operation of a VMI system.

As has been emphasized in the literature that the adoption of information systems to facilitate information exchange between companies should be merged with the redesign of inter-firm processes (e.g. Clark and Stoddard, 1996; Davenport and Short, 1990) and specifically that the implementation of VMI and adoption of information systems together provide significant and greater improvements than either of these implemented independently (Clark and Hammond, 1997; Kulp et al., 2004; Lee et al., 1999). So, there is a possibility that both supplier and customer do not integrate their information system.

Therefore, information systems should be considered as an enabler, not as a requirement, for VMI. Particularly in pilot projects it may be

beneficial to postpone investments in information systems until their cost-effectiveness has been demonstrated, as VMI systems can also be implemented with rather modest information systems support (Holmström, 1998; Waller et al., 1999; Yang et al., 2003).

6.4.7 The Moderating Effect of Type of Products on the Relationship between Managerial Commitment and VMI Performance

Though earlier step of hierarchical regression suggested that the relationship between managerial commitment and VMI performance was significant, when the moderating variable was introduced the study has found insignificant result. Consequently, type of products (innovative and functional) is not being regarded as a potential moderating effect in manufacturing industry.

Among the reasons for this finding are; first, the supplier may have the resources and be able to deliver a development program, but the customer organisation may not be committed to the process. The root cause here is most likely, a failure at the early stages of engagement with senior management, and a partnership relationship has commenced when the relationship is not strong enough. Thus customer must create an atmosphere that can drive long-term commitment with their suppliers, including the release of sensitive firm's information, if the VMI are to be mutually profitable for the firm and the trading partners (Myer et al. 2000).

As stated by Claassen et al. (2008) VMI needs commitment, and not only commitment from the management, but also from other tiers of

the organisation as well. Managerial and employee's commitment were defined as enablers of any procurement development projects (Iloranta & Pajunen-Muhonen, 2008). The managerial may have already shown commitment for VMI but it is not entirely in their hands how VMI will be implemented. Strategic moves and contract negotiations are most often led by category managers within their respective purchasing categories. Therefore it is going to need internal marketing skills to get VMI accepted as an idea and to get the most out of it in all the suitable components. Potential employees' resistance has to be managed well especially in purchasing and in the sales departments of the suppliers (Bendoly & Jacobs 2005).

Furthermore, if a supplier/manufacturer is involved with several VMI's customers, conflicts may arise where the priority of resources (expertise, spare parts, etc.) may be critical. One of the challenges will be to be able to meet multiple needs for several customers and to make the best necessary trade-offs to satisfy all the customers simultaneously. Thus, supplier was unable to maximize its service performance for each customer.

The operations for large organizations are more likely to involve multi-tier supply chains. This inevitably requires unprecedented collaboration between manufacturers and suppliers. Within the VMI arrangement, the prime responsibility of managing suppliers of lower tiers usually falls upon the first tier supplier. This arrangement will not only increase the level of details required for planning but also imposed much strain on the first tier supplier (Kuk, 2004). Although

there are sufficient commitment in suppliers organization, but failure to influence other stakeholders to be involved in, or embrace, and to support the changes will not give any effect to VMI performance.

6.4.8 The Moderating Effect of Type of Products on the Relationship between Decentralized Decision-Making and VMI Performance

The insignificant moderating effect of type of products in the manufacturing sector implies that an increase level of type of products (innovative and functional) does not affect decentralized decision making influences on VMI performance. That is, as a whole, the effect from decentralized decision making on VMI performance is not contingent on the level of type of products. It may be possible that the positive moderating effect and the negative moderating effect offset each other, leading to the insignificance, on average.

Although decentralized decision making allows an organization to benefit the economics of scale, centralized expertise, easier management of the process, and easier to find experts (Myer et al., 2000). They may have capable people in place, but with insufficient experiences of working in a collaborative relationship, or in the management skills to implement continuous improvement program. The decisions may be poorly made, which result in stockouts and production line disruption (Kuk, 2004). The consequent of poor decision can be more apparent in VMI program due to the operating changes including frequent reorder decisions with smaller quantities, particularly for high volume products (Kaipia et al., 2002).

A low allocation of replenishment decision authority, which is making available to the supplier, was also the reason of insignificant moderating effect type of products. Although suppliers have the capability to make better decision regarding the inventory management but the customer has the right to reject the proposed inventory replenishment. Thus, the possibility for supplier to optimize its manufacturing and distribution activities (Cetinkaya and Lee, 2000); and reduce the stock-out expenses by prioritizing the customer's orders (Waller et al., 1999).

6.4.9 The Moderating Effect of Type of Products on the Relationship between Trust and VMI Performance

Findings of the study have proven that suppliers in manufacturing company do not regard type of products as a moderating variable in the relationship between trust and VMI performance. In other words, they are not treating type of products as one important factor that can influence the impact of trust on VMI performance.

The surprising insignificant results of this study may be triggered by several reasons. Firstly, customers tend to treat trust as an unimportant role when they did not allocated sufficient amount of authority to supplier to make replenishment decision (μ=3.51). In order to ensure continuous supply of inventories, they also replaced the role of trust with fairly tight inventory control limits (μ=4.00). As consequences, irrespective of type of products did not influence the impact of trust on VMI performance.

Secondly, trust can be enhanced through the sharing of information in VMI program (Chandra & Kumar, 2001). However, simple information sharing may not be enough to overcome barriers and suspicions inherent in the information sharing process (Kwon & Suh, 2004). Each of the partners must be willingly providing critical information needed for an effective management of VMI. Besides sharing the demand data, other critical data may be included but not be limited to, operational data (utilization rate, productivity goals, production and distribution systems), financial data (activity cost, cost of goods sold per unit, return on capital, carrier cost, and profit structure), forecasting data (market strategy) and supply chain data (cost and value added propositions) (Henderson, 2002).

6.5 Contribution of the Study

The result of this study had implicated to theoretical, managerial and policy perspectives. For this study, the theoretical implication tries to answer on what are the resources that are new to the RBV theory and how it related. Meanwhile, the managerial implication section discusses on what managerial should do when engaging in VMI program. Next, the policy implication discusses on who should play a role and how to enhance the VMI performance.

6.5.1 Theoretical Implications

Several studies on collaborative program have used RBV as a base of research framework. However, empirical study associated to VMI

practices was scarce from the perspective of RBV. Specifically, this study considers organizational factors, VMI elements and type of products as VRINN resources. Thus, this study contributes to the knowledge in RVB theory, which includes organizational factor, VMI elements, and type of products as VRINN resources to organization in the context of VMI program. RBV had also explained that resource and capability can be used as a weapon for competitive advantage. According to Wernerfelt (1984) the firm can create an entry barrier if possess resources that are imperfectly available to all firms, which is enabling the firm to achieve high achievement for a long period of time. Based on the multiple regression tests, the results confirm that both organizational factors and VMI elements are significant to the VMI performance. Thus, it supports the research framework, which is based on RBV theory that to achieve high performance, firm would depend on their resources which are visibility of demand, inventory control limits, trust, and commitment.

In addition, this research also makes a contribution to our knowledge of the resource-based view of the firm on how resources synergizing resources to achieve competitive advantage. Precisely, it contributes to our knowledge of the effects of tangible assets on firm performance and specifically how resources, such as type of products, moderate the relationship between VMI elements and firm performance. The result has proven that characteristics of innovative product and functional product can be a source of competitive advantage when interacted with other firm resources. By having the right operating strategies that suit

their product characteristics, firms can always sustain their capabilities and competencies that prohibit competitors from replicated its VMI program. For example, supplier needs to share more information for innovative product to achieve better performance. For functional products, sharing more information can assist supplier to reduce cost. Supplier also should not possess the inventory of functional product to avoid negative effect on service performance. Supplier also should remove the application of penalty cost and min-max limits of inventory control for innovative product because it can hinder the company to reduce related cost of managing inventory.

6.5.2 Practical Implications

The results have shown the importance of both VMI elements and organizational factors in ensuring VMI performances are attained. In addition, the moderating effect of type of product also plays an important role in VMI practices. Therefore, supplier and customer supposed to consider characteristics of product supplied when designing VMI program and incorporated it in their strategic planning. Additionally, the finding also shows there is low achievement in cost performance. Without a better cost performance, it would be difficult to attract firms engage in VMI program. To ensure the VMI system is capable to convey sustainable benefits, manufacturing companies should consider several elements while setting the VMI design.

Sharing information, especially demand information is one of important element in setting VMI design. If customer willing to share the demand information, supplier can provide better service performance to their customer. The need of sharing information is more crucial when dealing with innovative products in order to attain better service and cost performance of VMI. Although findings showed that sharing information for functional product does not contributed to service performance, sharing information is needed for functional products as an effort to reduce cost. Thus manufacturing companies must share demand information not only for innovative products but also for functional product.

Since, application of inventory control limits also contributed to VMI performance, manufacturing companies should consider this element while setting VMI design. Findings showed that inventory control limits can ensure VMI program delivered better service performance. However, the application of min-max limits and penalty cost for innovative product can decrease the capability of supplier to reduce the inventory cost. Therefore, appropriate inventory control limits should be adjusted, the identified target range should be both attainable consistently as to gain benefits in term of reduce cost and improve service.

While manufacturing companies' setup the inventory storage location, they must ensure that inventory location is proximate to their customer location. The proximity of inventory location to customer location definitely can reduce the cost associates to inventory management. In

addition, to ensure better service for innovative product, proximity of inventory location to customer location also plays a significant role.

Although, literatures urged that ownership of inventory by supplier can provide better services and performance, this study showed conversely. Ownership of inventory by supplier not contributed significant and positively to VMI performance. In fact, supplier should not be given possession of inventory, especially when dealing with functional product otherwise it will reduce the service performance.

The successful implementation of VMI program is not only depending on processing method of inventory management but also requires managerial commitment as a success factor. Findings showed that managerial commitment is important to achieve better cost performance. Managerial should provide necessary financial resources to ensure the readiness of VMI implementation which include investment on ICT system. Managerial also should provide sufficient time for inventory planning. Since, the management of customer's inventory was on supplier responsibility, they were an increase of administrative work. In relation to increment of administrative work, adequate amount of personnel also need to consider. Managerial also must ensure that they are complying the term agreed in VMI policy; otherwise penalty cost might be incurred as consequence of incompliance.

Last but not least, trust also should be established between both parties to ensure successful implementation of VMI especially in delivering better services to customer. Among important element of trust are

supplier must believe that customer is capable of performing as agreed, customer is trusted to take decisions without unfairly exploiting the supplier, and customer is keeping promises, maintaining confidentiality and intend to act as agreed.

6.6 Recommendation

Although the result of multiple regressions does not support the significant of capability of information system on VMI performance, VMI requires sharing of information between customer and supplier to allow the product supply responses to actual demand rather than 'pushing' the products into the inventories, investment in ICT facilities becomes necessity. Therefore, at least existed ICT facilities are capable to track the demand requirements in order to maximize their service level to the customers. Standards ICT system such as EDI or RosettaNet, are a critical enabler of the required system-to-system infrastructure and other process improvements. The manufacturing companies should develop, support, and adopt VMI standards for data exchange, operational processes, planning processes, metrics, contracts, and terminology. In fact, the use of ICT tools – e.g. Bar-coding/RFID can help manufacturing companies to collect demand data throughout the VMI processes in more efficient and automatically for instant updates of inventory movements.

Besides providing good ICT infrastructure, government also should provide government grant to subsidize the purchase or upgrade integrated ERP solution such as SAP, ORACLE or SYTRLINE to meet the fast changing customer demands at local as well as international level. SAP or ORACLE is proven full integrated ERP solution and scalable with but costly to purchase

and maintain on yearly basis. This support would help readiness for SME to share information with their customer via ICT system.

The important role of inventory location that is proximity to the customer should not be ignored as to reduce the transportation cost. Proximity of inventory storage location to customer facilities also is important for innovative product. Thus, government should provide infrastructure for VMI-hub near the manufacturing zone (customer) especially at high-tech industrial park to serve better service performance for innovative product.

Management commitment is an important factor in VMI success. High managerial commitment found to be associated with cost effectiveness. Management commitment can spur organisation to ensure success or, at least can prevent disagreement or instantly sabotage the VMI implementation. So, it is important to ensure managerial commitment is instil at early development of VMI program. Trust

6.7 Limitations and Suggestion for Future Research

Although this research discovers exciting findings on the contributor factor for VMI performance, this study is not without its limitations. Since, this study only focus on respondent in manufacturing sector, research should carry on specific industry as each industry encompassed heterogeneous characteristics. Then, the findings on VMI design will be more specific based on particular industry. In addition, the findings of this study cannot be generalised to others sectors such as: (1) construction, (2) services, and (3) public sector. However, future research on factors affecting VMI performance can be revised to suit the above mentioned sectors.

This study manufacturing companies operating in Malaysia and the number of responses collected is satisfactory after undertaking a series of follow-ups. Due to the cross-sectional nature of this study, this research can be duplicated to include non-VMI companies to improve the quality of data and inherently enhance the generalizability of findings. Bringing customers into the VMI program can improves the supply chain for customers who have not adopted the approach (Waller et al. (1999). For this study, pilot test was conducted to minimise errors attributed to misinterpretation of ambiguous wordings as well as to ensure that no questions overlap across variables. In future, a longitudinal study is recommended, as it would be practical to assess the antecedent and outcome of VMI performance after a period.

A case study research design such as use of semi-structured interview questions and focus group could obtain in-depth information on the issues that challenge successful implementation and management of VMI program for manufacturing companies. In addition, research should also emphasize on critical success factors to ascertain the contribution of VMI program on supply chain performance. Finally, this study on VMI performance is limited to two independent variables and one dependentt variable, i.e., VMI elements, organizational factors, VMI performance and one moderating variable, i.e., type of products. The values of R^2 in regression models did not exceed 0.5 and this showed that future study should be expanded to analyse the influence other predictors such as sourcing policy (Hines, 2000), level of horizontal integration (Elvander et al. 2007), distribution model (Sarpola, 2007), in developing VMI capabilities. Other outcome variables that can be considered in extending the current framework are supply chain control (Claasen et al.

2008), flexibility (Ramayah et al., 2005) and economic performance (Myer et al., 2000).

6.8 Conclusion

The objective of this study is to recognize the relationship and contribution of VMI elements and organizational factor in predicting VMI performance within manufacturing sector. Level of demand visibility, inventory control limits, and inventory location are three components of VMI elements. Regression analyses revealed that design that abovementioned dimension are significantly influence the VMI performance. Sharing information and application of inventory control limits are crucial for service performance. While proximity of inventory storage location is requires for reducing associated to inventory management. Findings also reveals that organizational factor which includes managerial commitment, information system capability, and trust are related to VMI performance, except for decentralized decision making that only related to cost performance. Regression analysis also explains that trust and managerial commitment significantly contribute to service performance, and only managerial commitment significantly explains the cost performance.

The third objective is to consider the moderating effect of type of products on VMI performance in manufacturing companies. The findings showed that the innovative product moderate significant and positively in the relationship between level of demand visibility and VMI performance. Meanwhile, sharing information for functional product only can reduce the associated to inventory management. Although inventory control limits is important contributor to

service performance, application for innovative product can negatively affect the cost performance. In addition, innovative product also requires inventory storage located near to customer premises to attain service performance. However, ownership of inventory can negatively affect the service performance for functional product.

Therefore supplier need to evaluate its VMI elements, organization factors, and characteristics of products supplied to the customer. This assessment also would assist supplier and customer in designing VMI, specifically on how it will operate to achieve firms' competitiveness. By continuously assessing their VMI program, VMI as firms' resources cannot be imitated; this in turn sustains their performance. Besides, efforts to continuously improving resources should be aligned with the characteristics of products offered to their customer. As every product will experience different stage of product life cycle, the characteristics of products may also change. Therefore, changing in product life cycle should be accompanied with change in VMI elements as well as organizational factors.

Although, the moderating effect of type of products was not significant on the relationship between organizational factors dimensions and VMI performance, it is still vital to ensure the readiness of the organization. The organizational factors would much assist throughout the early stage of VMI program. Other important finding in this study was the capability of information technology which always associated with high capital investment. Empirically, this study demonstrated that high capability of information system is not important in order to benefit from VMI system. Thus, high end information system is not

necessary when engaged in VMI program. The most important is the appropriateness of information technology used to support VMI system.

In term of theoretical perspective, the study had suggested that the research framework was supported by RBV theory. It had shown that VMI elements and organizational factors can be used as organizational resources to enhance VMI performance. In addition, synergizing the other organizational resources, which is type of product also can increase the VMI performance. In relation to this research finding, managers should caution on the changing of their product characteristics that can affect VMI performance. Moreover, the managers are also being advised not to directly invest on high end information technology system without considering the appropriateness to their VMI system.

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