MEDIATING EFFECT OF MANAGEMENT INFORMATION SYSTEM ON THE RELATIONSHIP OF WAREHOUSE ATTRIBUTES AND ITS EFFICIENCY IN MALAYSIA'S SMALL AND MEDIUM ENTERPRISES

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By

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ABSTRACT

This dissertation studies the relationship between the influential warehouse efficiency and warehousing attributes (operations, Human Capital Management or HCM, and layout), applied by the Small-Medium Enterprises (SMEs) manufacturing firms in Malaysia. These perspective research objectives are to determine whether there is any relationship between the warehousing attributes, warehouse efficiency, and warehousing Management Information System (MIS). It also examines the mediating effect of warehousing MIS in the relationship between warehousing attributes and warehouse efficiency. A quantitative method approach is applied in this research methodology. Nine hypotheses have been proposed for the research with data collected from the survey of 182 SME manufacturing firm owners in Malaysia as listed in the SME Directory 2009. The findings indicate that the warehousing MIS significantly mediates and has an effect on the warehousing attributes and their relationship with warehouse efficiency in the SME manufacturing firms. Theoretically, the research contributes to the growth development of the warehouse efficiency theories. Practically it could facilitate the owners or warehouse managers of the manufacturing firms in making the right management decisions regarding warehousing. For future research, the study recommends further exploration into the areas of security, environment, safety and health, waste management, and integrated system (International Standards Organisation or better known as ISO 9000, ISO 14000, and ISO 18000). As a conclusion, this study provides new knowledge and important insights of warehousing attributes that will benefit manufacturing firms and other related industries, particularly for SMEs in Malaysia.

Keywords: Warehouse Efficiency**,** Warehousing Attributes, Management Information System (MIS) and Manufacturing SMEs.

ABSTRAK

Disertasi ini mengkaji mengenai hubungan antara keberkesanan pergudangan yang berpengaruh dan atribusi pergudangan (operasi, Pengurusan Modal Insan atau PMI dan susun atur), yang digunakan oleh Perusahaan Kecil dan Sederhana (PKS) di Malaysia. Perspektif penyelidikan objektif ini adalah untuk menentukan adanya sebarang hubungan antara atribusi pergudangan, keberkesanan pergudangan dan Pengurusan Sistem Maklumat (PSI) pergudangan. Penyelidikan ini juga meneliti kesan pengantara PSI pergudangan antara hubungannya dengan atribusi pergudangan dan keberkesanan pergudangan. Kaedah kuantitatif disampaikan dalam kaedah penyelidikan ini.Sembilan hipotesis dicadangkan untuk penyelidikan ini dengan data dikutip daripada kajian ke atas tuan punya 182 syarikat pengilangan PKS di Malaysia yang disenaraikan dalam Direktori PKS 2009. Hasil kajian menunjukkan keputusan yang signifikan dalam mengantara kesan PSI pergudangan kepada atribusi pergudangan dan hubungan keberkesanan pergudangan dalam syarikat pengilangan PKS. Secara teorinya, sumbangan penyelidikan ini adalah perkembangan dalam pembangunan teori keberkesanan pergudangan. Secara praktik, ia memudahkan pemilik atau pengurus pergudangan syarikat pengilangan membuat keputusan yang betul dalam pengurusan. Bagi penyelidikan akan datang, kajian mendalam boleh dibuat dalam bidang keselamatan, alam sekitar, keselamatan dan kesihatan, pengurusan sisa, dan sistem integrasi (Pertubuhan Penstandardan Antarabangsa atau PPA, yang lebih dikenali sebagai ISO 9000, ISO 14000, dan ISO 18000). Kesimpulannya, kajian ini membekalkan pengetahuan baru dan penting pengertiannya yang akan memberikan faedah kepada syarikat pengilangan dan industri lain yang berkaitan, terutamanya untuk PKS di Malaysia.

Katakunci: Keberkesanan Pergudangan, Atribusi Pergudangan, Perusahaan Kecil dan Sederhana (PKS) dan Pengilangan PKS.

DEDICATION

Aisyah.

Thank you for your patience,

kind understanding,

unwavering love and devotion

during my difficult times.

Atiqah & Aleea.

Remember.

The deeds of your mother

are immeasurable.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS

ABC	Activity Based Costing
AI	Artificial Intelligence
AWE	Warehouse Efficiency
AHCM	Warehousing HCM
AL	Warehousing Layout
AMIS	Warehousing MIS
AWO	Warehousing Operations
EDI	Electronic Data Interchange
GDP	Gross Domestic Product
HCM	Human Capital Management
IT	Information Technology
ISO	International Standard Organisation
JIT	Just-In-Time
KMO	Kaiser Meyer Olkin
MIS	Management Information System
MLR	Multiple Linear Regression
MNCs	Multinational Corporations
OL	Organisational Learning
SCM	Supply Chain Management
SKU	Stock Keeping Unit
SME	Small Medium Enterprises
SMI	Small Medium Industries
SMA	Sampling Measure Adequacy
SMIDEC	Small and Medium Industries Development Corporation
SPSS	Statistical Package for the Social Sciences
TQM	Total Quality Management
UNDP	United Nation Development Programme
WMS	Warehouse Management System
WWW	World Wide Web

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND OF THE STUDY

Issues on warehouse efficiency (general logistics management) are specifically but not comprehensively studied until after the business globalisation process takes place (Rosena, Harlina Suzana, & Sabariah, 2008; Osman & Hariri, 2009; Ismail, Hashim, Ghani, Zulkifli, Kamilah, & Rahman, 2009). The problems keep on developing and continuing with the evolution of logistics roles that became more complex, which took place actively after the 1990s (Bardi, Coyle, & Novack, 2006; Gundlach, Bolumole, Eltanway, & Frankel, 2006). This especially became critical within the last two decades in the supply chain networks, in which warehouse has become an integral part of the major logistics service providers (Sink, Langley, & Gibson, 1996; Lambert, Stock, & Ellram, 1998; Coyle, Bardi, & Langley, 2003; Koster, Le Duc, & Roodbergen, 2007).

Tompkins and Smith (1998) described that warehouse efficiency has now become a core competency or a strategic weapon that many companies use to enhance their positions in the market. At the same time, warehouse efficiency is undergoing unbelievable challenges that make its practice to strive for excellence become harder to achieve. Warehousing before this has been viewed as a supportive industry to other functional areas, but it is now regarded as a strategic industry on its own (Gundlach *et al.*, 2006; Sum, Teo, & Ng, 2001).

1.1 WAREHOUSING BY COMPETITIVENESS

With the current condition of global competitiveness and supply chain concepts, it has greatly changed the direction of warehouse efficiency perspective to supplement the firm operational activities (Harmon, 1993). Hamel and Pralahad (1994) regarded that this development occurred when the business activities become more complex, thus competition for the future is considerably an opportunity sharing exercise rather than market sharing. Due to the enormous challenges being faced by warehouse efficiency, it requires much more professional approaches than the previously adopted operations in planning, managing, and improving today's warehouse operations (Tompkins & Smith, 1998).

Warehousing contributed to about 20 percent of the surveyed companies' logistics costs in 2003, with other activities being distinguished included value added services, administration, inventory costs, transportation, and transport packaging (Koster *et al.*, 2007). Meanwhile Baker and Canessa (2006) reported that the logistics capital and operating costs of warehouses in United States (US) represented about 22 percent, while this figure was 25 percent in Europe. Baker (2004) mentioned that a United Kingdom (UK) study showed that the number of new large warehouses had steadily increased during the period from 1995 to 2002. It was claimed that this trend involves significant investments for companies even though it is often considered highly complex in nature. Baker and Canessa (2006) revealed that expenditure on warehouse automation has increased steadily in Europe and also showed the sales of manufacturing products increased by an average of 5 percent per annum for the period 2003-2005.

As a result of global competition and supply chain concepts, Koster (1998) analysed that warehouse efficiency has become a critical activity in the supply chain to outperform competitors on customer service, lead-time, and costs. He stressed that in order to remain competitive in the global market, firms must work hard to maximise both their warehousing production and their warehousing operations quality.

Tompkins and Smith (1998) highlighted that among the issues and challenges in the warehouse operations efficiencies that need to be tackled seriously are large numbers of stock keeping units (SKUs); increased customer service requirements; demands to reduce inventory; demands to increase warehouse operating efficiency and space utilisation; and demands for increased product customisation. Other issues that followed are the need to increase integration of the warehouse within the total logistics system. This is to increase demands for responsiveness in addressing quick response, cross docking, Just-In-Time (JIT), and Efficient Customer Response (ECR) efforts. Thus this created changes in logistics operation environment from "push" to "pull" condition (Tompkins & Smith, 1998).

Lambert, Cooper, and Pagh (1998) described that firms formed networks with their suppliers and customers in order to compete against other networks, rather than as individual firms. These require continuous improvement in their warehousing design and operation of production-distribution networks. Thus in turn, these firms require higher performances from their warehouses activities.

Meanwhile, Frazelle (2002) elaborated that warehousing minimises the effect of supply chain inefficiencies, improves logistics accuracy and inventory management,

and allows product accumulation, consolidation, and customisation. The cost of warehousing activities should be commensurate with the contribution of warehousing to overall logistics performance – typically between 2 percent and 5 percent of firm revenue. To be categorised as world class warehousing, costs should be minimised in lieu of customer service improvement with renewed firm emphasis on return-on-asset (Frazelle, 2002).

1.1.1 Warehousing as a Dedicated Function

Ling, Edum-Fotwe, and Ng (2008) added that warehouse efficiency served as a very essential function in many organisations. It is deployed for storage, distribution, consolidation, and transition of different types of cargoes. Therefore, from the aspect of firms' operational functions, it is almost impossible to contemplate any efficient mass production or commercial distribution without careful consideration of the role of warehousing.

Connolly (2008) explained that to manage a warehouse efficiently, one needs to know what is to be in store and where exactly each item is stored. That is commonly known as inventory and later established by stocktaking, which involves reading the labels on different items, recording, and counting data on a clipboard for later analysis.

For improvement, Gu, Goetschalckx, and McGinnis (2007) suggested that the adoption of new management philosophies, such as Just-In-Time (JIT) or lean production (Womack, Jones, & Roos, 1990; Saud, 2005) in warehousing also brings

new challenges for warehousing systems efficiently. These include tighter inventory control, shorter response time, and provision of better product service.

One method for addressing these challenges is the practice of 5S (refers to *Seiri* or Sort, *Seiton* or Straighten, *Seiso* or Shine, *Seiketsu* or Standardise, and *Shitsuke* or Sustain), which integrates the values of organisation, neatness, cleaning, standardisation, and discipline into the workplace to reduce waste and optimise productivity as well as to apply quality. This is achieved by maintaining an orderly workplace environment which is implemented mostly in all manufacturing firms (Bayo-Moriones, Bello-Pintando, & Merino-Diaz de Cario, 2010), including warehouses to achieve more consistent operational results.

With the current condition of global competitiveness and active supply chain implementation, Malaysian firms should continually increase their capabilities in the logistics services in the near future by effectively implementing warehouse activities. This might include efficient warehousing management, inventory replenishment, and order fulfilment (Sohail & Sohail, 2003). In today's competitive business environment in which many firms are strategising their warehousing activities in order to gain a share in the global markets, the firms should actively take advantage of higher production capability and sourcing information efficiency. Keys to the success of warehousing activities should be determined by the role of the logistics function (which warehouse is one of the major service providers). This is to ensure the smooth flow of materials, products, and information throughout a company's supply chain (Sum *et al.*, 2001).

This has contributed to the changes of warehouse business perspectives which require warehousing to be more efficient in their operations, human capital management (HCM), layout, and management information system (MIS). Due to the increasing importance of the logistics industry and warehouse efficiency, it has resulted in the expansion of international trade as well as an active endorsement of the company's and business' globalisation strategy (Rosena *et al*., 2008).

1.1.2 Operations Management and Warehousing Processes

Heizer and Render (2006) defined operations management as the set of activities that creates value in the form of goods and services by transforming inputs into outputs. It is also known as a transformation process by transforming inputs such as materials, machines, labour, management, and capital into outputs like goods and services (Russell & Taylor, 2011). Thus the requirements and feedback from customers are used to regulate the transformation process, which in turn changes the inputs.

Russell and Taylor (2011) added that the operations management designs, operates, and improves the productive system. The activities included organising work, selecting processes, arranging layouts, locating facilities, designing jobs, measuring performance, controlling quality, scheduling work, managing inventory, and planning production. This classifies operations management into 10 major decisions, which includes (a) service and product design, (b) quality management, (c) process and capacity design, (d) location, (e) layout design, (f) human resource and job design, (g) supply chain management, (h) inventory, material requirements planning,

and Just-In-Time (JIT), (i) intermediate and short-term scheduling, and (j) maintenance (Heizer & Render, 2006).

Based on these explanations, the firm operations management is very much related to the warehousing management operations process in total. Emmett (2005) mentioned that practically, warehouse is a planned space to store and handle of goods and materials; and relates to its business purpose (Tompkins & Smith, 1998). Stock and Lambert (2001) described that warehousing has three basic functions; movement, storage, and information transfer that the movement function has been receiving. The organisation focuses on improving the efficiency in the inventory turns and spending orders from manufacturing to final delivery.

Issues and challenges affecting warehouse efficiency processes and management perspectives are becoming seriously focused upon in managing the logistics industry, in which warehousing is part of the major logistics activities in the service providers (Sink *et al*., 1996; Lambert *et al*., 1998; Coyle *et al*., 2003; Koster *et al.*, 2007), which is summarised in Table 1.1. Among major related activities are transportation, inventory management, order processing, information system, and packaging. However, warehousing has been a neglected area of business activity in Malaysia (Rosena *et al.*, 2008).

It becomes worst as the business environments are becoming more challenging; wider and global markets have contributed to producing a large scale of products by any manufacturing organisations, especially the multi-national companies (MNCs). This creates the increase of inventory volumes in order to meet these demands of

company operations and customer satisfaction (Ismail *et al*., 2009). This development has increased the importance and relevance of warehouse functions that positively contribute to a better warehouse efficiency.

Table 1.1.
Activities of Logistics Service Providers

Function	Activities
Transportation	Shipping, forwarding, (de)consolidation, contract delivery, freight bill payment/audit, household good, relocation, load tendering, brokering
Warehousing	Storing, receiving, assembling, returning goods, marking/labelling, knitting
Inventory management	Forecasting, location analysis, network consulting, slotting/layout design
Order processing	Order entry fulfilment, Electronic Data
Information system	Interchange (EDI), World Wide Web (WWW), e-commerce, internet, routing/scheduling, Artificial Intelligence (AI), and expert systems
Packaging	Designing, recycling

Source: Adapted from Sink *et al*. (1996)

Tompkins and Smith (1998) concluded that logistics warehouses need to overcome various challenges so as to improve warehouse efficiencies. Among the challenges are to reduce the number of levels in the logistics network and the corresponding changes in order profiles, resulting in more direct-to-customer shipments. This is to enhance the availability of reliable, responsive, efficient, and effective third party warehouse providers and when to utilise them. This would significantly increase the number of equipment and system options to be considered in planning a warehouse operation (Tompkins & Smith, 1998).

The focus issues are mainly concerned with whether there are clear management directions in managing the warehouse costs, operations, space optimisation and

utilisation, layout, inventories, HCM, and MIS within the organisations or firms. To overcome these problems, most companies source out their major warehousing activities to third party logistics (3PL) as the main service providers. 3PL is an external firm (supplier) that performs all or part of a company's logistics functions, encompassing suppliers of services such as transportation, warehousing, distribution, and financial services (Coyle *et al*., 2003).

Additionally, Chow, Heaver, and Henricksson (1994) described that 3PL is a major contributor to performance development in large corporations, which is commonly known as "logistics efficiency". The firm becomes efficient with its partners and customers by reducing the cost of logistics activities: suppliers, warehousing, production, transportation, and delivery.

However, this has not provided the total solution toward the problem since not all their inventories could be stored at 3PL locations, as it is concerned with high cost, security, systems set-up, transportation, communication, training, and manpower, thus affecting warehouse management efficiency (Chow *et al.*, 1994; Coyle *et al*., 2003; Osman & Hariri, 2009). This is not surprising since the current business conditions are moving toward contract manufacturing and heavy customer demand, which are known to be very competitive and volatile.

Osman and Hariri (2009) regarded that in corporate logistics (as warehousing is part of the major activities), the problems are more into delaying and inaccurate information, incomplete services, slow and inefficient operations, and high product damage rates. The possible consequences are inability to provide inter-linked

services, high operating costs, high rates of inaccuracy, and lack of flexibility in responding to changing demand requirements by the related parties.

For this study the operational definition for the warehouse efficiency consists of warehousing operations, HCM, and layout even though other literature suggested other variables. Therefore warehousing operations in this research will look into, among others, the financial allocations in operations to warehouse efficiency. This is to observe whether there is any operating audit being done periodically or otherwise. It also includes the aspects of material handling equipment in order to operate the warehouse operation. Lastly, it appropriately accesses the ins-and-outs of materials movement in the warehouse.

In warehousing HCM, the researcher emphasises more on the employee and personnel academic and professional qualifications, experiences, skills, training, and manpower management.

Meanwhile, in terms of warehousing layout, the researcher emphasises more on systematic layout planning, the practice of 5S concept, movement of materials and handling equipment in line with the warehousing layout, and space optimisation and utilisation of the space provided.

Therefore, warehouse efficiency will be mediated by warehousing MIS. The researcher looks into the usage of computerised systems in the operations, telecommunication networking, training of computer skills involving warehouse

staff, storage of data in the computer, latest version of computer software, and document preparation, just to name a few.

1.1.3 Rationale of Study

Not many researchers have conducted studies on logistics operations management (including warehouse efficiency) in Malaysia (Rosena *et al.*, 2008; Osman & Hariri, 2009), particularly related to Small Medium Enterprises (SMEs). This does not only provide bigger gaps in such research, but also creates difficulties in getting logistics activity data (Rosena *et al*., 2008) even though warehousing is part of major logistics activities service providers. Osman and Hariri (2009) confirmed that no firm records in terms of the numbers in the freight logistics industry (especially to warehousing) and other critical details about their sizes, range of services, or status of operation, whether it is local or foreign, when required by interested parties.

Rosena *et al.* (2008) analysed that despite a remarkable expansion of the industry in the country, there have been very little published research materials in the area of logistics (including warehousing) and supply chain. This resulted in a very limited dissemination of information for the purpose of coordination, learning, and advancement in supply chain management. For example, supply chain performance management cycle needs plenty of information in order to identify problems. This is to understand the root causes and to respond to these problems with immediate corrective actions. Therefore, lack of the flow of information would influence the inability of top management to retrieve and disseminate relevant data: aggregate or disaggregate data accordingly (Rosena *et al.*, 2008).

Gunasekaran, Marri, and Menci (1999) concluded that the improvement of warehouse operations could be realised by using software and automatic data collection, particularly barcodes in conjunction with software. They added that this is to provide a better view of warehouse operations by collecting accurate data on (a) the space utilisation; (b) return on investment; (c) material handling equipment use; (d) labour cost; (f) order picking; (g) and customer service.

Relatively, warehouse conditions are lacking in retrieving statistical data and information which are parts of the major activities in the supply chain management (Langley, Coyle, Gibson, Novack, & Bardi, 2008). Therefore, warehouse efficiency needs to be competitive enough and exhibit high levels of achievement in order to be inducted as a part of the integral team in the global supply chain (Council of Logistics Management, 1995).

Therefore, this research primarily focuses on the influence of firm management over the implementation of warehousing activities in Small and Medium Enterprises (SMEs) in the Malaysian manufacturing sector.

1.1.4 Warehousing in Malaysian SMEs

Saleh and Ndubisi (2006a) established that SMEs have accounted for more than 80 percent of the total manufacturing establishment in Malaysia, where 88 percent are considered as small scale enterprises. The remaining 12 percent are classified as medium scale enterprises. It has been observed that the SMEs in Malaysia have continued to undergo intensive product specifications, design and engineering

activities, and improvement in marketing and distribution. This is to further enhance their prosperity especially in preparing for the global market (Saud, 2005). Efforts are being taken by SMEs to improve their technology accumulation and enhancement by improving the quality of labour force through hiring qualified, experienced, and higher skilled workers, and optimising the benefits and incentives offered by the Malaysian Government (Saleh & Ndubisi, 2006b).

Additionally, the Annual SME Report (2008) highlighted that despite the economic slowdown, SMEs in the manufacturing sector continued to maintain high productivity in 2008, led mainly by the export-oriented industries. Similarly, productivity in the service and agriculture sectors continued to increase with the former supported by efficient transport services, and increasing trade and finance services in subsectors. The latter is encouraged by high commodity prices that resulted in revitalising of idle lands.

The importance of SMEs is prominently highlighted in the 2010 Budget proposal with Ringgit Malaysia (RM) 538 million being allocated. This is for the implementation of various development programmes such as granting funds and grants totalling RM8.8 billion through various Malaysian government agencies based on agency's expertise (e.g. MIDA, SME Corporation, and MIDF). To further simplify access to SME financing, the government is taking steps to consolidate these funds in a more supervised way and controlled by the SME Corporation (SME Business Directory, 2009).

The report also emphasised that the budget is focused on advancing the role of the private sector as the main driver of economic growth in order to drive the country toward a high income economy. These initiatives are in line with the government's long-term vision to integrate SMEs into the New Economic Model (NEM) that will primarily be based on innovation, creativity, and high value-added services as well as human capital development. This approach is essential as Malaysia wishes to transform itself from an agriculture based product industry into a high-income nation, leveraging on high technology and highly skilled workforce (SME Business Directory, 2009).

With favourable environmental factors, the SMEs in Malaysia are expected to transcend from their present state to undertake a more important role in order to support the achievements of Malaysia's industrialisation process. The importance of SMEs would become more significant as the country expands its industrial base to achieve the challenges of the new millennium (Saleh & Ndubisi, 2006b). However, Osman and Hariri (2009) cautioned that in order to survive, the SMEs must be able to reduce costs, improve quality, and provide rapid response to the customer's needs and requirements, especially regarding warehousing activities.

One of the ways to achieve competitive edge is through the implementation of logistics best practices (Osman & Hariri, 2009) and design and lean production (Saud, 2005). Thus warehouse efficiency performance should be balanced between the internal and external activities (Tompkins, 1996) and measured in line with organisational strategies, objectives, and competitive demands (Gu *et al.*, 2007). Tompkins and Smith (1998) concluded that the warehousing MIS role could play

important functions in easing the global business issues in SME manufacturing. Among the important functions identified are (a) the demand for integrated communications and electronic data interchange (EDI), (b) automatic identification and compatible information systems, (c) the role of partnership and the virtual integration of partner inventories, (d) the increase of management needs for enhanced measurements and operational accountability, and (e) the increase emphasis on the global marketplace and challenges that result from the diversity of shipping requirements (Tompkins & Smith, 1998).

Therefore, based on the above introduction, this study has examined the relationships of management responsiveness of SMEs toward potential influence on the warehouse process and efficiency of SMEs, especially in manufacturing firms in Malaysia. The study also examined the relationships of mediating effects in the warehouse operation, HCM, layout, and MIS activities on the warehouse management. In addition, the study also helped uncover the relationship between warehouse management, actions, and directions in managing the efficiency of warehouse process activities. Finally, this study also identified factors that influence warehouse efficiency.

In conclusion, this study would give opportunities for other researchers to explore other potential gaps such as data gathering in the SME warehousing functional improvement process and its processes relating to SME manufacturing firms. Other issues such as security, environment, safety, and health are areas which have not been explored in total. These could also contribute to other research directions related to warehouse efficiency of SME manufacturing firms.

1.2 PROBLEM STATEMENT

Companies are not aware of the advantage of having an effective distribution system and thus have not given sufficient priority to the development of effective distribution strategies (Rosena *et al*., 2008), which in this case is the warehouse efficiency conditions. In general, among the problematic cases that arose include the RM47 million worth of hijacked microchips from Malaysia Airlines (MAS) cargo complex in Batu Maung Free Trade Zone, Penang ("A very well planned job", 2006; "Two charged over theft of jet engines", 2006; "Chan: Stop the finger-pointing and beef up the security", 2006), and RM50 million missing and theft of two Malaysian Air Force F5E jet engines from its military base warehouse (Bendahara, 2009). These cases have been brought to the highest levels of attention by the top Malaysian officials, such as the Prime Minister and Minister concerned, that prompted immediate police investigations and counter measures by relevant authorities (Bendahara, 2010; Bendahara & Gomez, 2010).

These two incidents reflected the seriousness of how well the warehouses have been managed and the consequences if they are not managed effectively and efficiently in their operations that involve tight security or subject to inventory audit by the Auditor General's office. Gunasekaran *et al.* (1999) regarded that the management should ensure all items within the warehouses to be accurate, cost efficient, economical, and efficient in terms of used capacity and being well organised. Failure to look into such perspective whilst managing a warehouse over these factors could contribute to mismanagement of warehousing activities.

Gunasekaran *et al.* (1999) revealed that a number of researchers and practitioners have studied the actual warehousing operations from different perspectives, but not many have addressed the improvements in their daily operations. A conceptual framework is lacking in taking into account the concept of Just-In-Time (JIT) and Total Quality Management (TQM) together with Information Technology (IT). This results in the inefficiency of warehouse management activities and thus SMEs would face major problems during their firms' operations. This would also particularly affect the output production, storing, and issuing of materials for shipment from their premises.

Koster (1998) concluded in his research that the changes are inclusive of integral inventory control focus. This shows that warehouse operations have become a critical activity in the supply chain to outperform competitors on customer service, lead-times, and operations cost. Therefore, warehouses are now required to re-design their warehouse layout carefully and change their flow-through to sustain the warehousing operations activities. This is in line with the current development of business globalisation. Gunasekaran *et al.* (1999) also concluded that warehouses are significant in view of cost as it is very much related to the management efficiency in terms of not wasting money in operational activities. Malaysia SMEs should consider and study on focusing the importance of enhancing warehousing layout efficiency to accommodate the receiving, storing, and issuing of materials and goods due to the increase of global business demand.

Virtually, there is no empirical research on the HRM aspects of warehousing (Murphy & Poist, 1992) that relates to HCM. Min (2007b) mentioned that no prior

studies explore key occupational (experienced), organisational (firm size, family-friendly, and atmosphere), and individual (pay scale, fringe benefit, bonus, job security, and advancement opportunity variables) for their potential influence on warehouse employee turnover. Other popular warehousing employee retention strategies include referral bonuses, longevity bonuses, paid time-off, company picnics, and career counselling. Although all of these have potential merits, the effectiveness of these strategies has not been verified by the existing literature (Min, 2007a). Thus, this causes a major lack of references. Practically, it also causes major problems in engaging competence, honest, and sincere personnel to commit full responsibilities in their daily working conditions which are practically related to HCM. Murphy and Poist (2003) argued that warehousing involves the most costly activities in logistics because a major part of the operations is labour intensive. One of the challenges faced by warehousing management is to improve their firm operational and organisational performances, which are directly related to HCM.

Gunasekaran *et al.* (1999) described warehouse layout as the perfect example of fundamentals, but it is often being neglected. It is mostly treated as a place where the product is stored until it needs to be shipped to the customer. It often results in the shutdown of warehouses due to the inefficiency that is caused by major problems during the warehouse foundation set-up. With the current customer demand and trend of global business demand, warehouses which are not designed accordingly to meet the current business environment. Also, potential future business trends would face more problems in its set-up to cater for the storing and complying demand from more sophisticated customers. Faber, De Koster, and Van de Velde (2002) analysed that with the current trend, warehouse layouts are often re-designed for high speed

automation, high throughput rate, and high productivity in order to reduce the order processing costs, thus increasing the process efficiency. Harmon (1993) concluded that such processes, products, or materials that remain in the warehouse would only be stored for a short period of time, which most warehouses could not sustain the high standard of requirements.

Gu *et al.* (2007) described that despite the interest in the valuable information, little research to date has examined at the system level of smart technologies or those that process data into a usable format for decision making in logistics management (specifically, warehousing). Thus, without the MIS related operations being up-dated with latest technologies, it would not only slow down the operations process but would also operate less efficient in the daily working process. Christopher (1992) argued that the real competition nowadays is not company against company, but rather supply chain against supply chain, which directly affects the logistics industries (as warehousing is a major part of logistics service providers) as a whole.

In conclusion, there is still lacking of investigations from a more holistic and comprehensive process of the warehousing attributes (operations, HCM, and layout). In this study the researcher looked in depth at the relationship among the variables of warehousing operations, HCM, layout, MIS, and warehouse efficiency from the Malaysian SME perspective. This especially needs to be addressed among the Malaysian SMEs that own or operate a warehouse of their own or rent a warehouse. In addition, it is hoped that the findings would benefit the stakeholders, especially the operators of these warehouses.

1.3 RESEARCH QUESTIONS

With reference to the above mentioned problems statement in Section 1.2, this study takes into consideration the warehousing attributes or the independent variables of operations, HCM, and layout; and the dependent variable of warehouse efficiency). The study examined the effect of these independent variables mediated by MIS. This study would also add to the existing body of knowledge in terms of the efficiency of the warehouse and Malaysian SMEs of the manufacturing sector. Thus, the following research questions were established at the beginning of the research:

(a) Is there any relationship between warehousing attributes and warehouse efficiency?

(b) Is there any relationship between warehousing attributes and warehousing MIS?

(c) Is there any mediating effect of warehousing MIS in the relationship between warehousing attributes and warehouse efficiency?

1.4 RESEARCH OBJECTIVES

In general, this study aimed to investigate the warehousing attributes of operations, HCM, and layout and their effect on warehouse efficiency. More specifically, the objectives of the research are:

(a) to determine whether there is any relationship between the warehousing attributes and warehouse efficiency,

(b) to determine whether there is any relationship between the warehousing attributes and warehousing MIS, and

(c) to examine any mediating effect of warehousing MIS in the relationship between warehousing attributes and warehouse efficiency.

1.5 OVERVIEW OF THEORETICAL FRAMEWORK

Based on the research gaps identified in the literature review in Chapter 2, the main purpose of this study was to determine the constructs in the context of warehouse efficiency among the Malaysian SMEs of manufacturing firms. Figure 1.1, depicts the theoretical framework and hypothetical relations (Hypothesis 1a [H1(a)]; Hypothesis 1b [H1(b)]; Hypothesis 1c [H1(c)]; Hypothesis 2a [H2(a)]; Hypothesis 2b [H2(b)]; Hypothesis 2c [H2(c)]; Hypothesis 3a [H3(a)]; Hypothesis 3b [H3(b)]; and Hypothesis 3c [H3(c)]) in an attempt to achieve the objectives of this research. Details of the theoretical framework and hypotheses are explained in greater detail in Chapter 2 (Section 2.9.1).

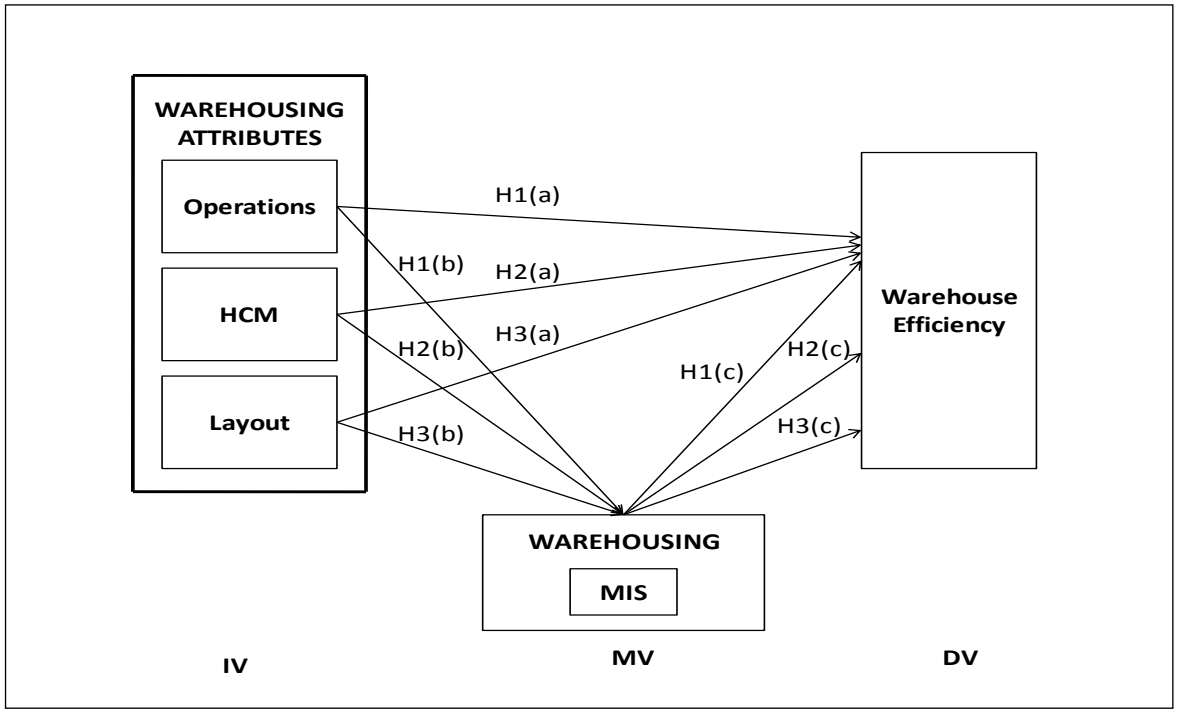

Figure 1.1. Theoretical Framework.

1.6 SIGNIFICANCE OF THE STUDY

Faber *et al*. (2002) regarded that as the world of warehousing is changing rapidly under the increased pressure to improve overall supply chain performance, this study would recognise that warehouse management, in relation to its operations, HCM, layout, and MIS, would play a crucial role in achieving the desired warehouse efficiency and performance. Specifically, it could be divided into two major perspectives: practical and theoretical significance. This is explained below on how the findings of this study are able to contribute to the existing body of knowledge and thus assist in the management decision-making process, in particular, warehousing management activities.

Practical Significance: In general this research would help facilitate warehouse managers of manufacturing firms in making decisions on establishing a more

efficient workplace environment. This study could be used as a point of reference in providing guidelines for managing complications due to the complexity of management decisions regarding warehousing. Variable attribute factors and the relationships involved in this study would help warehouse managers make *au fait* decisions in enhancing the efficiency of the warehousing operations and improving the overall productivity of the firms in general.

Theoretical Significance: This research would contribute to the growth development of warehouse efficiency theory in developing and providing more inputs for an informed and improved decision-making process in warehousing management, particularly in SME manufacturing firms. The outcome of this research, such as framework, model, matrix or guidelines proposed, would be able to assist warehouses or SME manufacturing managers to establish a more effective and efficient warehouse environment.

1.7 SCOPE AND LIMITATION OF THE STUDY

This research would focus only on Small and Medium Enterprises (SMEs) from the manufacturing sector in Peninsular Malaysia that had registered under the Small and Medium Enterprise Corporation (SME CORP). Definitions of SMEs are defined differently according to the perspective of their backgrounds, countries, variables, and other related factors. The study samples are based on the SME firms listed from the SME Business Directory (2009).

However, from the Malaysian perspective, the research adopted the definition made by the National Small and Medium Enterprise Development Council (the highest policy making body to chart the direction and strategies for SME development), which has categorised what constitutes SMEs in Malaysia (SMIDEC, 2004). According to this council, business sizes are defined as in Table 1.2, according to various sectors and based on annual sales turnover or number of full-time employees. However in more detail, SMEs are defined as follows (Hashim 2000; Saud, 2005):

(a) a small and medium enterprise in primary agriculture is an enterprise with full time employees not exceeding 50 or with annual sales turnover not exceeding RM 5 million;

(b) a small and medium enterprise in manufacturing (including agro-based manufacturing) and manufacturing related services is an enterprise with full-time employees not exceeding 150 or with annual sales turnover not exceeding RM 25 million; or

(c) a small and medium enterprise in services is an enterprise with full time employees not exceeding 50 or with annual sales turnover not exceeding RM 5 million.

Hashim (2000) concluded that there should be a more precise and appropriate definition that reflects the size, the nature, and the needs of the SMEs. This is essential and advantageous not only for a particular SME, but also for policy makers

and supporting agencies that plan and nurture the proper growth and development of the SME sectors in Malaysia as a whole.

Table 1.2.
Definitions of SMEs in Malaysia

Size	**Primary Agriculture**	**Manufacturing (including agro-based) and Manufacturing Related Services**	**Services Sector (including Information Communication Technology – ICT)**
(A)	**Annual Sales Turnover**		
Micro	Less than RM 200,000	Less than RM 250,000	Less than RM 200,00
Small	Between RM 200,000 and less than RM 1 million.	Between RM 250,000 and less than RM 10 million.	Between RM 200,000 and less than RM 1 million.
Medium	Between RM 1 million and less than RM 5 million.	Between 10 million and less than RM 25 million.	Between RM 1 million and less than RM 5 million.
SME	Not exceeding RM 5 million.	Not exceeding RM 25 million.	Not exceeding RM 5 million.
(B)	**Full Time Employees**		
Micro	Less than 5 employees	Less than 5 employees	Less than 5 employees.
Small	Between 5 and 19 employees.	Between 5 and 50 employees	Between 5 and 19 employees.
Medium	Between 20 and 50 employees	Between 51 and 150 employees.	Between 20 and 50 employees.
SME	Not exceeding 50 employees	Not exceeding 50 employees	Not exceeding 50 employees

Source: UNDP (2007)

However, this study is limited to a few factors such as the respondents' responsiveness and cooperation that may have been influenced by the manufacturing industry environment. Another limitation is that the participants of this study are confined to owners, managers, or heads of the SME warehouse only. Potential bias

might have occurred as more optimistic owners could have exaggerated their business performances or the managers or head of the warehouse could have negative perceptions of top management support over their operations.

1.8 ORGANISATION OF THE DISSERTATION

There are five chapters that have been identified in this dissertation. Chapter 1 presents the background of the study, problem statement, objectives, contribution and significance of the study. Next, Chapter 2 presents the discussion on a literature review of the various issues and variables related to the study, which includes the concepts and framework of warehousing, operations, HCM, layout, and MIS. It also presents the theoretical framework of the research and hypotheses of the study. Chapter 3 elaborates on the sampling procedure, location, and analytical tools used in this study, while Chapter 4 presents the output and findings of the study, the hypotheses testing results, and discussion. Last but not least, Chapter 5 concludes the summary of the findings, contribution to the body of knowledge, and recommendations for future research.

In conclusion, this chapter has outlined the background of the study, problem statement, research questions, and objectives. The significance of the study is summarised as: firstly it contributes to knowledge development in SMEs and warehousing activities. Secondly the study expands the literature in the area of warehousing process and management in assisting to enhance its efficiency. The scope of the study is limited to SME firms in the country.

CHAPTER TWO

LITERATURE REVIEW, THEORETICAL FRAMEWORK, AND HYPOTHESES

2.0 INTRODUCTION

The purpose of this chapter is to review the literature, identify previous conceptual and empirical works that could provide solid basis to undertake the study. Cresswell (2002) stated that conducting a literature review for a study is essential as the researcher could tell if there is a need to research or if there is any existing research that has been done on the same topic. It also demonstrates the ability of researcher to identify, select, and scrutinise information relevant to the chosen topic in order to apply it correctly to explore and address the topic for achieving a better understanding.

The literature review would assist the researcher to formulate the hypotheses of the research and to support the theoretical framework in the development of the research model. Thus, it would provide support to the methodology in examining, investigating, and determining empirically the inter-relationships among variables involved in this study. It would include an overview of warehouse efficiency and its related operations, HCM, layout, and MIS. Theories that underpin the theoretical framework are also deliberated upon in this chapter.

Finally, based on the literature, the research framework is developed and presented, and the hypotheses are derived and established accordingly.

2.1 BACKGROUND OF MALAYSIAN SMEs

According to UNDP (2007), there are a total of 16,515 SME business sector operators in Malaysia (Table 2.1). Manufacturing dominates the sector with 5,947 SMEs (including agro-based manufacturing) or 36.01 percent, and 1,428 or 8.65 percent consists of manufacturing related services.

Table 2.1.
Malaysia SMEs by Business Sector

SMEs Business Sectors	Numbers of Companies	Percentage (%)
Manufacturing including agro-based	5,947	36.01
Manufacturing related services	1,428	8.65
Mining and quarrying	37	0.23
Services including ICT	5,292	32.04
Construction	1,591	9.63
Primary agriculture	319	1.93
Others	1,901	11.51
Total	**16,515**	**100.00**

Source: UNDP (2007)

SMEs in the manufacturing sector are involved in activities such as the processing of raw materials, including food, beverages, textiles, petroleum, wood, and rubber, and the assembly as well as manufacturing of electrical and electronics appliances and components. According to the latest figure issued by Ministry of International Trade and Industry Malaysia (MITI) (2006), as shown in Table 2.2, the largest concentration of SMEs in the year 2003 are in the textile and apparel sector (23.20 percent), followed by food and beverages (15.00 percent), metal and metal products (12.40 percent), and paper printing and publishing (9.20 percent).

Table 2.2.
Distribution of SMEs in the Manufacturing Sector in 2003

Sub-Sector	Total Number of Establishments	SMEs	
		Number	Share (%)
Textile & Apparel	8,855	8,779	23.20
Food & Beverages	5,804	5,664	15.00
Metal & Metal Products	4,809	4,686	12.40
Paper, Printing, & Publication	3,549	3,483	9.20
Furniture	2,352	2,286	6.00
Rubber & Plastics Products	2,343	2,166	5.70
Wood & Wood Products	2,149	2,052	5.40
Non-Metallic Mineral Products	1,708	1,650	4.40
Machinery & Equipment	1,435	1,390	3.70
Electrical & Electronics	1,362	1,077	2.80
Chemical and Chemical Products	1,115	1,047	2.80
Transport Equipment	769	699	1.80
*General Manufacturing	2,969	2,887	7.60
Total	39,219	37,866	100.00

*Includes jewellery; leather products; tobacco products; medical, precision, and optical instruments; and recycled and petroleum products.
Source: MITI (2006)

According to Saleh and Ndubisi (2006a), in terms of geographical location, the majority of manufacturing companies in Malaysia are located in the West Coast of Malaysia, which is more industrialised and have more ports facilities. Out of all the states, Johor has the largest concentration of manufacturing firms with 17.50 percent, followed by Selangor (16.70 percent), Perak (9.40 percent), and Penang (8.7 percent). SMEs in Selangor are predominantly in the transport equipment and electrical sectors, while in Johor there is a large concentration of the textiles and apparel, and wood based product sectors. The majority of other sectors such as food and food related manufacturers are concentrated in the states of Perak and Johor (Saleh & Ndubisi, 2006a).

2.1.1 SME Manufacturing Performance

The Annual SME Report (2008) reported that Malaysia's target is to increase the contribution by SMEs to the Gross Domestic Product (GDP) from the 32.00 percent charted in 2005 to 37.00 percent; exports from 19.00 percent to 22.00 percent; and employment from 56.00 percent to 57.00 percent by 2010. Hashim (2011) mentioned that the SME contribution to exports is valued at RM38 billion. These SMEs have contributed about RM100 billion or 19.00 percent of the country's total export in 2009. The Annual SME Report (2008) also emphasised on the instrumental role of ICT such as the Internet, e-payments, and e-commerce in enhancing efficiency, productivity, and performance of SMEs.

2.1.2 SME Employment Performance

Normah (2006) mentioned that in 2003, employment opportunities created by Malaysian SMEs are approximately 3.0 million jobs or 65.10 percent. This is the total employment of 4.60 million workers engaged in the three main sectors namely manufacturing, services, and agriculture. The services sector employed the largest number of full time workers/employees (2.20 million); followed by manufacturing (740,000), and agriculture (131,000). Based on these figures, 2.30 million (76.50 percent) are full time employees while 771,000 (16.70 percent) are self-employed workers. The SME distribution locations are mainly concentrated in the Central Region (Federal Territory of Kuala Lumpur and Selangor) with 37.10 percent of SMEs, followed by Johor (10.40 percent), and the other states (less than 10 percent) (Normah, 2006).

Furthermore, the SMI Business Directory (2009) reported that SMEs, which represent 99.20 percent of total establishments in Malaysia and provide employment opportunities for about 56 percent of the total workforce, are important sources of growth for the nation. It added that they would play a major role in Malaysia's New Economic Model (NEM) which envisions transforming Malaysia from a middle-income economy to a high-income economy.

2.1.3 Malaysia SMEs Current and Future Challenges

Despite the contribution of Malaysian SMEs in the export, employment, and economic growth of the nation, Saleh and Ndubisi (2006b) cited that it faces many challenges. These barriers have been highlighted by the 1994 Asia Pacific Economic Cooperation survey (APEC, 1994), SMI Development Plan 2001-2005 (SMIDEC, 2002), Ting (2004), and United Parcel Service (UPS, 2005). According to the APEC (1994) study on Malaysian SMEs, among the macro-level challenges include inadequate data and information on the development of Malaysian SMEs. Such inability in the mainstream of industrial development is due to lack of skilled and talented workers, which would finally affect the quality of their production as well as efficiency and productivity (Saleh & Ndubisi, 2006b).

Furthermore according to Ting (2004), there are five key micro-level challenges, in particular: lack of access to finance; human resource constraints; limited or inability to adopt technology; lack of information on potential markets and customers; and global competition. He argued that there is a high risk of SMEs being wiped out if they do not increase their competitiveness in the new rapidly developing world of

globalisation. The UPS (2005) survey indicated that the results of the survey to investigate competitive issues faced by SMEs in 12 selected countries (including Malaysia) are labour cost, innovation, and access to funding and work capital. These are the main challenges faced by the countries including Malaysia.

In summing up both the macro- and micro-levels of the challenges in Malaysian SMEs, it can be concluded that these challenges are actually reflecting the actual performance of SME manufacturing and warehousing efficiency. Rosena *et al*. (2008) mentioned that in the electronic and semiconductor industries, a lot of product defects occurred due to the delivery process resulting from the lack of necessary precaution taken by the logistics services providers (which warehousing is one of the major activities). They also pointed out that many cases occurred where the components did not reach in time as agreed upon in the initial contract. It is important to regard that warehouse efficiencies are very much related to the performance of the SME manufacturing sector. The warehouse role in ensuring the excellent performance of the SME manufacturing is related to its total performance in productivity, operations, HCM, layout, and MIS. Poor warehousing efficiency would affect the performance of the SMEs, especially in relation to the operations, inventory accuracy, space utilisation, manpower and training, cost reductions, and many other factors related to the functions of SME manufacturing.

2.2 OVERVIEW ON WAREHOUSING

Warehousing or *Godown* (used to be mentioned in India and Malaysia) is considered as a large building where goods are stored, catalogued, shipped, or received (Jenkins,

1990). Gunasekaran *et al.* (1999) mentioned that warehousing activities are concerned with the physical storage and retrieval of materials, and also the processing of information needed about the goods stored. They examined that typically, warehousing comprises six major throughput activities, which are (a) receiving, (b) transfer, (c) handling, (d) storage, (e) packing, and (f) expediting. Gunasekaran *et al.* (1999) also suggested that items having the highest turnover should be located nearest the shipping area while the slow moving items should be kept at the other end of the store. This is done to provide a clear and accurate view of the items before quantification and retrieval in the warehouse.

Jenkins (1990) defined warehousing as a time honoured function of issuing a receipt for wares that are still in storage and be accountable for them until relieved of that responsibility. In practice, a warehouse is defined as a planned space for the storage and handling of goods and materials (Emmett, 2005), within a large building, that plays an important part in the organisation related to its business purpose (Tompkins & Smith 1998; Frazelle, 2002).

In addition, Jenkins (1990) regarded that the manufacturing era is already actively operational even before its transformation into the globalised networking arena. In addition, most of the factories are attached to a warehouse and it is generally regarded that those manufactured goods are able to be stored until its shipment date. Thus it is concluded that “warehousing” is a common term and far more complex than most observers would think.

More specifically, Stock and Lambert (2001) referred to warehousing as part of a firm's logistics system that stores products (raw materials, parts, goods-in-process, and finished goods) at and between point-of-origin and point-of-consumption. It also provides information to the management on the status, condition, and disposition of items being stored. Frazelle (2002) further elaborated that "warehouses are a storage location for storing large amount of products for many purposes and are keys aspects of modern supply chains and play a vital role in the success, or failure, of businesses today".

Meanwhile Stock and Lambert (2001) mentioned that when a firm decides to store its product, it typically must choose whether to rent space (called public warehousing), or to own or lease space (called private warehousing). Public warehousing could be further classified as:

(a) *General merchandise warehouse*: This is probably the most common form and is designed to be used by manufacturers, distributors, and customers for storing practically any kind of products.

(b) *Refrigerated or cold storage warehouse*: It provides a temperature-controlled storage environment. It is usually used for preserving perishable items such as fruits and vegetables. Among other items include frozen products, pharmaceuticals, photographic paper and film, and fur.

(c) *Bonded warehouse*: It undertakes the surety and authority from the Finance Ministry and places their premises under the custody of an agent of the Ministry (for example Customs and Excise Malaysia Department). Although

the government retains control of the goods until they are distributed to the marketplace, all controlled imported goods such as liquor and cigarettes are stored in this warehouse. At that time, the importer must pay customs duties to the internal revenue services. The advantage of the bonded warehouse is that import duties and excise taxes can only be paid once the merchandise is sold.

(d) *Household goods warehouse*: It is used to store personal property rather than commercial merchandise. The property is typically stored for an extended period of time as a temporary layover option. For example, the opened storage concept is where the goods are stored in a cubic meter basis per month on the open floor of the warehouse. Meanwhile, private and secured goods storage is when users are provided with a private room or vault to lock and secure their goods. In addition, container storage provides a container into which they can pack their goods.

(e) *Special commodity warehouse*: It is used for particular agricultural products, such as grains, wool, and cotton. Each of these warehouses handles only one kind of product and offers special services related to that product.

(f) *Bulk storage warehouse*: It provides tank storage of liquids and opened or sheltered storage of dry products such as coal, sand, and chemicals. Other services provided might include filling drums from bulk or mixing various types of chemicals with others to produce new compounds or mixtures.

Jenkins (1990) concluded that it is not surprising that the warehousing conditions are becoming more complex. The industries are seriously looking into the best or

optimal way to conduct business based on the results of new hosts and opportunities. These need to be grasped and problems need to be solved effectively when needs arise. Thus, it is described that "the art and science of warehousing become a vital part of business and the future greater than any other segments of modern industry" (Jenkins, 1990).

2.2.1 Warehouse Relationships with Efficiency

The warehouse relationships with efficiency play a pivotal role especially in the manufacturing industries (Bartlett & Ghoshal, 1995; Hout & Carter, 1995). Lambert *et al.* (1998) described that warehouse activities are more focused on the core competencies of the operations. This could satisfy customer expectation on the shorter delivery time and more accurate as well as reliable services. There is an important connection between the end user and the manufacturer that have gone through the warehouse activities.

In addition, Stock and Lambert (2001) encouraged that the firms need to focus on the improvement of warehousing efficiency in the inventory turnovers and spending orders from manufacturing to final delivery. This is the most important role in the firm relating to the warehousing functions for material movement, storage, and information transfer.

As a conclusion, the relationship between the warehouse and its efficiency is considered as one of the most critical activities in logistics and supply chain management by businessmen as it could generate cost reduction schemes (Lambert *et*

al., 1998). They regarded that these are the activities with enormous potential to give impact on customer satisfaction and sales generation, and an effective marketing weapon that could be used to gain competitive advantage over competitors.

2.2.2 Warehousing Evolution

Encyclopaedia of Business (2011) established that warehousing roots went back to the creation of granaries to store food, which is available for purchase during times of famine (since 16 centuries ago). It started with the European explorers who began to create shipping-trade routes with other nations, where warehouses grew in importance for the storage of products and commodities from afar. Ports are the major locations for warehouses. As railroads began to expand travel and transportation, the creation of rail depots for the storage of materials became necessary. Commercial and housing began to grow after the government placed more restrictions on railroads. During the World War II (1940-1944), it impacted warehousing in several ways. These transformations include the need to increase the size of warehouses and the need for more mechanised methods of storing and retrieving products and materials (Encyclopaedia of Business, 2011).

The growth of warehousing functions run parallel with the extension of logistics roles since the 1980s in support of its roles to marketing and manufacturing (Coyle *et al.*, 2003; Bardi *et al*., 2006). Bardi *et al*. (2006) regarded it as "changing the profile of logistics in the 1980s, particularly because growing number of companies recognised the role that logistics could play at the margin in their strategic effort to gain or regain a sustainable competitive edge".

Figure 2.1 shows that warehousing is considered to be one of the main activities of logistics through its long evolution (Coyle *et al*., 2003; Bardi *et al*., 2006). Warehousing initially is under the activity integration of material management and physical distribution, which are directly under logistics control. In addition, throughout the evolution process, the logistics roles are also expanding and becoming among the major activities in supply chain management, besides the strategic planning, information technology, marketing/sales, and finance. These changes happened in 2000 onwards, due to active business globalisation; thus, it could be concluded that warehousing is one of the major key components of the overall business supply chain.

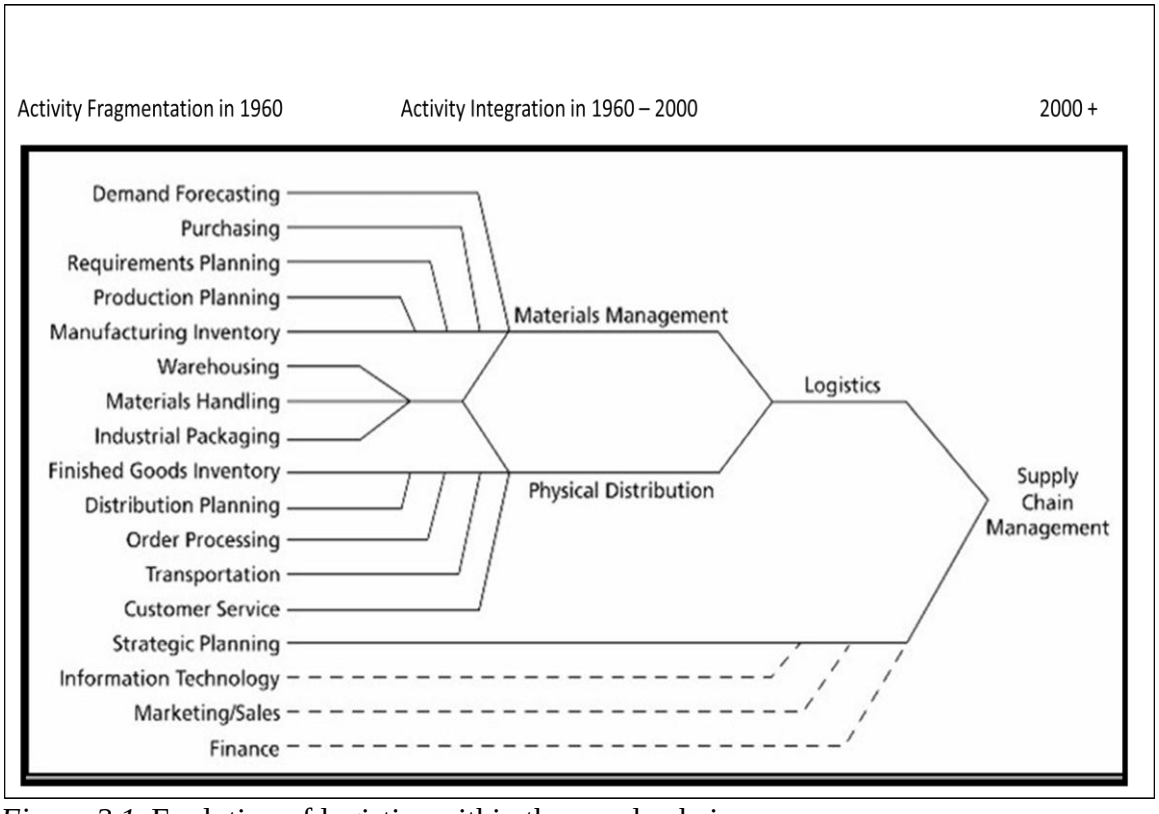

Figure 2.1. Evolution of logistics within the supply chain.
Source: Adapted from Coyle *et al*. (2003) and Bardi *et al.* (2006)

According to Bardi *et al*. (2006), the 21st Century actually saw the continuation of the evolution of warehousing and logistics that began during the decades following

World War II (1940-1944). However, since then several variables have introduced new challenges by creating supply chain management processes such as:

(a) the Internet and e-business,
(b) continued globalisation,
(c) business alliances, and
(d) rapidly changing technology.

Such variables have created the existence of supply chain networking, consisting of the facilities and distribution options for the procurement of materials from the manufacturer to customer, and all points in between. It includes the production of materials into components and finished products, and then the distribution to customers (Bardi *et al.*, 2006; Abdullah, 2010). These challenges have provided the opportunities for warehousing, logistics, and transportation to add value to product movement throughout the globe (Bardi *et al*., 2006).

Encyclopaedia of Business (2011) concluded that as mass production grew throughout manufacturing, the needs of efficient and effective warehousing capabilities grew since globalised businesses come into the picture. The warehouse industry found itself recovering from a recession at the start of the 21st Century, partially brought on by Internet savvy operation and excess production. It also coped with new methods of distribution, such as just-in-time (JIT) manufacturing, where warehousing is unnecessary because products are shipped directly to customers. Due to that, warehousing companies are now striving to become storage facilities. The warehousing businesses are transforming into "third-party logistics providers" or 3PLs that provide a wide array of services and functions. In addition to packing and

staging pallets, contemporary warehousing facilities offer light manufacturing, call centres, labelling, and other non-storage options (Encyclopaedia of Business, 2011).

2.2.3 Theories Supporting Warehousing

Stock (1997) argued that in logistics research and theory development, in this case, warehousing as one of the major logistics service providers, could benefit from borrowing and applying existing theories from other disciplines. This is because it does not have a rich heritage of theory development and empirical research. Thus, it is not surprising that all major logistics service providers have its root theories borrowed from the more established disciplines. It is considered as a primarily outgrowth from the business disciplines of marketing and management, with some input from engineering disciplines (Stock, 1997).

In fact, numerous calls have been suggested to describe the need of greater use of theory in logistics (especially warehousing) and supply chain management (Defee, Williams, & Randall, 2010; Mentzer & Kahn, 1995; Stock, 1997). However, Frankel, Naslund, and Bolumale (2005) argued that more theory-driven empirical research has occurred after the call for greater use of the logistics theory. In addition, Mentzer and Kahn (1995) concluded that the logistics research, that include warehousing as one of its major services providers, have been influenced by economic and behavioural approaches as opposed to scientific inquiry theories.

Novack, Rinehart, and Wells (1992) elaborated that the linkages of logistics and its major services providers (warehousing and other functional areas) of the organisation

cam be surmised in a developed “model of integrated logistics foundations”. In this model, they included and identified a number of constructs that comprises logistics (including warehousing) as follows:

(a) *strategy* (cost minimisation, valued added components, and control/adaptability enhancement),
(b) *structure* (inter-organisational functional integration),
(c) *capacity* (node design, node inventory location, node inventory levels, channel system configuration, and channel system inventory location requirements planning),
(d) *movement* (material movement and handling, information flow, physical movement flow, and channel system information integration),
(e) *facilities* (operations processes and operations integration),
(f) *people* (functional interaction, and inter-organisational transactions and interaction), and
(g) *financial elements* (capital assets, and market transactions).

In conclusion, this model constructs the theories and concept disciplines from economics (e.g., cost minimisation and valued added components); marketing (e.g., channels of distribution and market transactions); finance/accounting (e.g., capital assets); and management perspectives (e.g., information flow, operations process, and operations integration). Therefore, these perspectives provide the input into the authors’ model of integrated logistics foundations and extend to warehousing developments constructs. Stock (1997) added that theories and concepts of other

disciplines which have been applied in the logistics include accounting, business, computing, mathematics, philosophy, political science, psychology, and sociology.

2.3 WAREHOUSING OPERATIONS

Gu *et al.* (2007) suggested that the basic requirements in warehousing operations flow (Figure 2.2) are to receive the Stock-Keeping-Units (SKUs) from suppliers, store the SKUs, receive orders from customers, retrieve SKUs and assemble them for shipment, and ship the completed orders to customers. However, there are many issues involved in designing and operating a warehouse to meet these requirements. Resources such as space, labour, and equipment need to be allocated efficiently among the different warehouse functions. Each function needs to be carefully implemented, operated, and coordinated in order to fulfil the system requirements in terms of capacity, throughput, and service at the minimum resource cost.

Figure 2.2 also shows that in warehouse design, it involves:

(a) overall structure (material flow, department of identification, and relative location of departments);

(b) sizing and dimensioning (size and dimension of the warehouse);

(c) department layout (pallet block-stacking pattern or for pallet storage; aisle orientation; number, length, and width of aisles; and door locations);

(d) equipment selection (level of automation, storage equipment of selection, and material handling equipment of selection or order picking or sorting); and

(e) operation strategy (storage strategy selection e.g., random versus dedicated and order picking method selection).

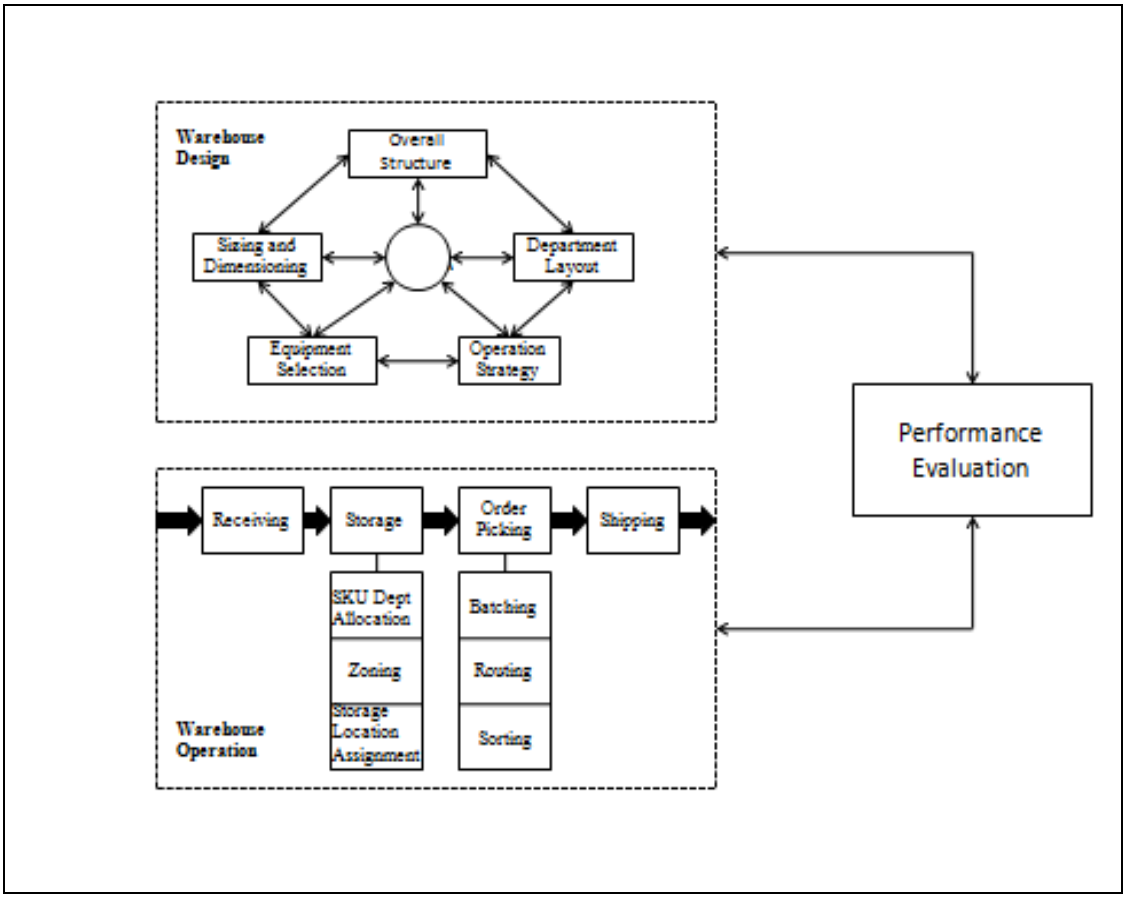

Figure 2.2. Framework for warehouse design and operation problem flow.
Source: Adapted from Gu *et al.* (2007)

Meanwhile, in warehousing operations, Figure 2.2 shows that it involves:

(a) receiving and shipping (truck-dock assignment, order-truck assignment, and truck despatch schedule);

(b) storage – SKU department assignment (assignment of items to different warehouse departments and space allocation);

(c) storage – zoning (assignment of SKUs to zones and assignment of pickers to zones);

(d) storage – storage location assignment (storage location assignment, specification of storage classes or for class-based storage);
(e) order picking – batching (batch size and order batch assignment, routing and sequencing of order picking tours, dwell point selection for Automated System (AS)/Retrieval System (RS));
(f) and sorting (order lane assignment).

Gunasekaran *et al.* (1999) described that the general warehousing concept includes storage and retrieval operations, organisational aspects, mechanisation equipment for materials handling, media for material storage, and the building itself, which is necessary to protect the goods' environment. Therefore, the task of distribution consists of moving goods from the production line to the customer in an acceptable time and doing it economically. In addition, the research findings on the reduction of throughput time in warehousing operations concluded that the processing of information effectiveness plays a vital role in warehouse activities that can finally generate benefits to the stakeholders involved. However, this is provided that it is running competently, such as the operation inventory level of an item (particularly low value and low volume items). It would be pegged at a point between JIT delivery and the holding stock, and solving productivity problems. This is done by improving the manufacturing productivity through the application of principal concept of JIT philosophies in reducing lead time and throughput time in the warehouse operations (Gunasekaran *et al.*, 1999).

Govindaraj, Blanco, Bodner, Goetschalckx, McGinnis, and Sharp (2000) regarded that warehousing operations are concerned with the physical storage and retrieval of

materials as well as the processing of information needed about the goods stored. Lot (or the parcel) has an origin, its supplier, identification, its designation, a dimension (usually the quantity), a destination, and a customer. Additionally, warehouse and distribution systems constitute a significant part of many so-called supply chains. These systems are global and must be adaptive, due to the ever changing customer preferences and evolving alliances among the entities responsible for production, storage, and distributions (Govindaraj *et al.*, 2000; Bardi *et al*., 2006).

Gunasekaran *et al.* (1999) explained that the warehousing methodology is information oriented and requires the use of efficient media to store and handle data about the movement of goods. It is important to have good control over the inventory. Timely and accurate information about products, resources, and processes is essential to operate a planning and control structure in achieving high performance of warehousing operations as required in today's marketplace (Faber *et al.*, 2002).

Baker and Canessa (2006) clarified that in addition to traditional inventory holding roles, warehousing operations have been evolving to act as:

(a) cross-docking points (where goods are moved directly from inward to outward vehicles without being put away into inventory),
(b) value added service centres (e.g. pricing and labelling goods for customers), and
(c) production postponement points (configuring or assembling goods specifically to customer demand so that a smaller range of generic products could be held in inventory).

Conversely, it could be used as a returned goods centre (for reverse logistics of packaging, faulty goods, or end-of-life goods), and many other miscellaneous activities, such as service and repair centres.

Rouwenhorst, Reuter, Stockrahm, Van Houtum, Mantel, and Zijm (2000) in analysing the problems encountered during the research (re)design and subsystem of the warehouse at the operational level, pointed out that the main decisions are assignments and control problems of people and equipment. The analysis showed that during the storage process, the assignments of replenishment tasks to personnel and the allocation of incoming products to free storage locations are determined at the tactical level. In addition, they suggested that at order picking processes, the decisions are related to batch formation or order sequencing in line with the batch sizes. These assignments included picking task to order pickers, the sequencing of picks per order (routing), the selection of a dwell point for idle order pick equipment and products to sorter chutes (or lanes). This also includes the control decision assignment of arriving and departing trucks to docks (Rouwenhorst *et al.,* 2000).

Frazelle (2002) detailed that the concept of warehousing operations plays a pertinent role in supply chain management as a raw material and component warehouse, work-in-process warehouse, finished goods warehouse, distribution warehouse and distribution centres, fulfilment warehouse and fulfilment centres, local warehouse, and value added warehouse. All these functions come with the most basic fundamentals of their actual operations that are receiving, pre-packaging (optional), put away, storage, order picking, packaging and/or pricing (optional), sortation and/or accumulation and unitising, and shipping (Frazelle, 2002).

2.3.1 Warehousing Operations Relationships with Efficiency

According to Frazelle (2002) companies that need to implement lean operations begin with a time study and analysis of the order fulfilment process to improve efficiency in warehousing. They need to manage the average cycle time to process orders from beginning to end, identify value-added and non-value-added work elements, and determine the time consumed by each. This is to calculate the value-added ratio as an overall indicator of the potential improvement and then assess workflow for delays, inefficient picking paths, wasted motion, congestion, and equipment availability (Frazelle, 2002).

Cagliano, DeMarco, and Rafele (2011) mentioned that warehouse operations and efficiency are essential. It was described that receiving, transferring, handling, storage, packing, and expediting operations at the warehouse directly affect the effectiveness of a company as a whole as well as its quality and logistics service levels. Furthermore, the increasing need to improve supply chain performance has been forcing warehouses to focus on integrating the production effort with the market (Cagliano *et al.*, 2011).

Meanwhile, Rouwenhorst *et al.* (2000) established that efficiency and effectiveness in any distribution network in turn is largely determined by the operation of the nodes in such a network, for example the warehouses. However, warehousing operations and distribution are relatively simple from an operational perspective, which might be why they are so often overlooked when it comes to lean applications (Petersen, 1999; Petersen, Siu, & Heiser, 2005).

In supporting this issue, Faber *et al.* (2002) elaborated that warehouse complexity affects the planning and control structure through the comprehensiveness of the work to be done. In highly complex warehouses, feeding organisational actors with the right type of information and knowledge at the right time is difficult. Nonetheless, a complex warehousing operation requires a control structure that has a great deal of information, data and knowledge about products, processes, customers, and resources readily available so as to make it efficiently accessible (Petersen, 1999; Petersen *et al*., 2005).

Research by Gu *et al.* (2006) analysed that warehouses are an essential component of any supply chain and play major roles, including:

(a) buffering the material flow along the supply chain to accommodate variability caused by factors such as product seasonality and/or batching in production and transportation,
(b) consolidation of products from various suppliers for combined delivery to customers, and
(c) value-added processing such as kitting, pricing, labelling, and product customisation.

Such important activities require an efficient warehouse management to ensure excellent services to be rendered are maintained all the time.

Additionally, Koster and Warffemius (2005) mentioned that complexity of warehousing operation has large impact on the performance of the warehouse, and in

this case the efficiency of the warehouse. Koster *et al.* (2007) elaborated that warehousing operations apparently form an important part of a firm's logistics system. This is commonly used for storing or buffering products (raw materials, goods-in-process, and finished products) at and between points of origin and points of consumption. The term "warehouse" is used if the main function is buffering and storage as it reflects the efficiency of the warehouse process activities (Koster *et al*., 2007).

Gunasekaran *et al.* (1999) concluded that greater emphasis should also be placed on the information flow and the level of technology which have an effect on the intrinsic efficiency in the operating warehouse system. Thus, software packages are needed to cover their application across the manufacturing or distribution companies, which is currently lacking.

In this study of warehousing operations, the questionnaire items developed by Koster (2008) are appropriately adapted and implemented.

2.3.2 Theories Supporting Warehousing Operation

Theoretically, Stock (1997) mentioned that Dunn, Seaker, and Waller (1994) utilised an operations management model as proposed by Meredith, Raturi, Amoaka-Gyampah, and Kaplan (1989), and examined contemporary research in logistics (including warehouse as one of its major service providers). This is to determine the type of research that has been published in the major logistics journals. They identified a number of theories, many of which were first developed in other

disciplines than logistics, such as management. Among the theories were Hermeneutics (Gademar, 1976), Logical Empiricism (Suppe, 1977), and Logical Positivism (Ayer, 1959). This included Critical Theory (Miller, Coleman, Connolly, & Ryan, 1987) which was developed from the origins of political science (Stock, 1997).

Other theories identified and practised in logistics (and its major services providers, including warehousing) are in the areas of customer service and satisfaction, transportation mode choice, and partnerships/alliances, which relied on the use of an attitude measurement scale developed initially in psychology; namely the Likert Theory of 5-point Scale – strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree (Likert, 1932). With this scale, it allows the collection of metric data and researchers could utilise a variety of multivariate techniques to analyse the data, develop results, and conclusions. Likert type data has been widely used in logistics operations (including warehousing operations) studies using factor analysis, regression, and causal modelling.

Relationship Marketing Theory is another significant aspect of research implications between the marketing scholars and logistics studies (including warehousing) in its operations. Morgan and Hunt (1994) defined the concept of Relationship Marketing Theory as marketing activities directed toward establishing, developing, and maintaining successful rational exchanges. It has identified four general categories of costs and benefits of supply chain integration, which are:

(a) *supplier partnership*: exchange between manufacturers; and their goods suppliers and exchanges between companies and service providers (e.g., advertising agencies and market research firms);

(b) *lateral partnerships*: strategic alliances between competitors, such as technology alliances; alliances between firms and non-profit organisations (e.g., public purpose partnerships), and joint research and development relationships (e.g., firms and universities or government agencies);

(c) *buyer partnerships*: long term relationships between firms and ultimate customers; and partnerships between intermediaries in the channel of distribution; and

(d) *internal partnership*: (i) relational exchanges between departments or groups in a company; (ii) relationships between a firm and its employer; and (iii) in firm relationships between major business units, subsidiaries, or divisions.

Stock (1997) examined that the potentialities of Relationship Marketing Theory in logistics (and its major services providers including warehousing) are:

(a) *application of Just-in-Time (JIT) and Total Quality Management (TQM)*: relationships between companies and suppliers, vendors, and customers;

(b) *identification and classification*: types and nature of various logistics relationships that exist; and

(c) *application of constructs(e.g., commitment, communication, cooperation, shared values, and trust)*: used in relationship marketing research to better understand logistics relationships (and its major services providers, including warehousing).

Some other theories like Artificial Intelligence Theory and Costing have also been applied prominently in the major logistics services activities (including warehousing) in decision making and inventory management (Allen, 1986). In addition, Asset Valuation Theory in transportation and inventory management (Ernest & Whinney, 1983; Ernest & Whinney, 1985; Peschke, 1986; Schiff, 1972) and Conflict Theory have been used in discussing about the channels of distribution (Brown, Lusch, & Koenig, 1984; Brown, Lusch & Smith, 1991; Gaski, 1984; Larson, 1994; Wilkinson, 1981).

Meanwhile, Industrial Buyer Behaviour Models Theory is widely used by Stock (1997), and Wilson and Woodside (1994) in their research which focused on transportation mode selection in the logistics activities. Other studies are logistics decision making and planning (Tuninga, 1988) in Input and Output Analysis Theory; logistics decision making (Peschke, 1986) in Logical Flow Models Theory, and inventory management and logistics decision making (Bender, 1981) in Pareto Efficiency Theory. In addition, logistics decision making and strategy formulation (Kaminsky & Rink, 1984) in Product Life Cycle Theory, and inventory management and warehousing (Smith & Nixon, 1994) in Queuing Theory (Stock, 1997) have also been explored by previous research efforts.

2.4 WAREHOUSING HUMAN CAPITAL MANAGEMENT (HCM)

Human Capital Management or HCM refers to an organisation's employees, described in terms of training, experience, judgment, intelligence, relationships, and insight of company's employees (Noe, Hollenbeck, Gerhart, & Wright, 2008).

According to Offstein, Gnyawali, and Cobb (2005), HCM is the full range of knowledge, skills, and abilities an individual could use to produce a given set of outcomes. Components of general human capital are knowledge of one's competitors, suppliers, customers, and other significant external stakeholders. Offstein *et al*. (2005) refer to these combinations of firm-specific and general forms of human capital as to provide unique advantages to the firm as it relates to the launching of specific and observable competitive moves within the marketplace. Bartlett and Ghoshal (1995), and Hout and Carter (1995) commented that firms related to manufacturing industries (with warehousing as a major operational function) are the most affected in engaging warehousing HCM to be developed significantly.

Abeysekera and Guthrie (2004) mentioned human capital as a combination of factors possessed by individuals and the collective workforce of a firm. They described that it could (a) encompass knowledge, skills, and technical ability; (b) personal traits such as intelligence, energy, attitude, reliability, and commitment; (c) ability to learn including aptitude, imagination, and creativity; and (d) desire to share information, participate in a team, and focus on the goals of the organisation. Such factors are important functions for warehousing HCM in producing the competent manpower in warehouse management and operations.

Ellinger, Ellinger, and Keller (2005) believed that firms wishing to remain competitive effectively in the logistics industry could increasingly evaluate the feasibility of adopting more people-oriented supervisory approaches in warehousing HCM. For example, coaching that focuses on the company's growth and

development by producing more groups or teams of front-line logistics and warehouse employees is implemented continuously in producing quality operation workers.

Baron and Armstrong (2007) described that human capital represents the human factor in the organisation or a firm. These include the combined intelligence, skills, and expertise that give the organisation its distinctive character. It is the people that bring human capital to the organisation although it is then developed by experience and training. In addition, Becker (1993) mentioned that the most precious capital is investment in human capital by providing education and appropriate training that is useful in their daily operations or work. Therefore, warehouse management must always be sensitive and aware of the current requirements of their staff and worker working competency (Min, 2007b).

Meanwhile, Davenport (1999) stated that people possess innate abilities, behaviours, and personal energy. These elements make up the human capital at the workplace. They are (not the employers) who own this capital and decide when, how, where to contribute, and make choices. Practically, work is a two way exchange of value and not a one-way exploitation of an asset by its organisation. Base on this analysis, Ehrenberg and Smith (1997) regarded that human capital theory conceptualises workers as embodying a set of skills which could be “rented out” to the employer. In addition, Baron and Armstrong (2007) described human capital as an accord in economic theory where workers and employers invest in HCM. In warehousing HCM, such applications are widely applied especially in the multinational firms

through profit sharing and other employee benefits (Bartlett & Ghoshal, 1995; Bowersox, 1998; Drucker, 1999; Min, 2007b).

2.4.1 Warehousing HCM Relationships with Efficiency

Bartlett and Ghoshal (1995), and Hout and Carter (1995) suggested that the success of many firms are now becoming increasingly linked to the growth, development, and retention of human capital. This phenomenon includes the growth of the manufacturing industries where warehousing operations play important roles in the firms' performance efficiency. Managers and leaders are being urged to promote a more people-oriented approach to management (where communication is paramount and every employee's contribution is viewed as a significant factor) in the firm's on-going efforts to satisfy customer price, quality, and service demands.

Gowen and Tallon (2003), McAfee, Glassman, and Honeycutt (2002), and Rinehart and Ragatz (1996) mentioned that a firm's human resources management policy have an important impact on the success of its supply chain management strategy. However, logistics organisations (as warehouse is part of its major service providers) have been particularly guilty of not placing sufficient emphasis on the growth and development of personnel in terms of warehousing HCM efficiency (Bowersox, 1998; LeMay, Carr, Periatt, & McMahon, 1999).

Minter and Thomas (2000) described that firms often fail to establish a good communication process between employees and their managers. Such important activities related to the warehousing HCM and communication process is the key to

the success of logistics warehousing management. This could always be observed to happen in the logistics management (or warehousing HCM) failures in meeting the expectation of their employees' performances (LeMay *et al*., 1999). As pointed out by Pfeffer (1998) and Pfeffer (2000), managing people effectively is the key process in enhancing the company's economic performance success. In addition, it is a priority related to maintaining the efficiency of the logistics warehousing management.

Related to these issues, economic theory of business practice stated that firms tend to categorise the manual worker as a cost rather than as an asset to be developed (Drucker, 1999). This is proven over the research findings about the difficulties that firms face in retaining experienced warehouse workers, as revealed by the Warehousing Education and Research Council (WERC, 1999), where they are often modestly compensated and must perform relatively mundane and repetitive tasks.

Accordingly, the current research that examines ways to upgrade hourly logistics and warehousing workers' job experiences is urgently needed (LeMay *et al*., 1999; WERC, 1999). In this case, training in the warehousing HCM perspective is paramount, as mentioned earlier, in order to maintain a good logistics and warehouse management. O'Donnell and Garavan (1997) suggested that with a better training policy for warehousing HCM, an organisation could easily be able to achieve their organisational goals. Training is needed in order for the employees to keep up-to-date with their jobs description or specification, especially with the one that requires full knowledge (Noe *et al*., 2008), as in the warehousing functions and activities.

In other areas, Min (2007a) elaborated in his research that a gradual increase in industrial warehouse space might be due in part to the growth of third party logistics (3PL) markets and the increased establishment of mega-warehouses in the USA. Ruriani (1999) described that the average annual growth rate of the warehousing industry is approximately 15 to 20 percent and some 3PL companies grow at rates of up to 50 percent. This has resulted in the number of wage and salary jobs in the warehousing industry projected to grow 11 percent from 1998 to 2008 (US Department of Labour, 2000). This trend would ultimately increase the difficulty of finding and retaining qualified labour as evidenced by the relatively high employee turnover in some of the warehouses that have experienced this trend. This disturbing trend has impacted the warehousing HCM in firms due to poor control over continuous employee turnover.

Therefore, Kirkpatrick (1977) suggested that firms implementing or organising training programmes that are very much closer to warehousing HCM would be able to sustain their employees due to factors such as (a) increased pay; (b) better selection method; (c) fewer jobs available in the community; (d) seasonal situation; (e) improved working conditions; (f) change in management by improved security in the company; (g) and better working conditions as well as improved benefits. Noe *et al.* (2008) added that employees are able to learn job-related knowledge, skills, and behaviour from the firms' planned effort. Through sufficient training programmes, warehousing HCM is positively related with the logistics and warehousing activities elsewhere. As concluded by Marimuthu, Arokiasamy, and Ismail (2009), human capital is getting wider attention with increasing globalisation and also the situation of the job market due to the recent downturn in the various economies of the world.

In this study of warehousing HCM, the questionnaire items were developed by Murphy and Poist (1992), and Murphy and Poist (1993), and are appropriately adapted and implemented for this research.

2.4.2 Theories Supporting Warehousing HCM

Several theories have been previously applied in warehousing HCM. Among others is the Attribution Theory which has been mainly applied, as it is related to employee relations and performance appraisal (Taylor, 1991). This theory is widely employed to the organisation at all levels of activities including the logistics functions (including warehousing). In addition, this theory studies the attitudes and performances of the human capital behaviour within the organisation and reflects the action required by the employee to perform better at the work place. Thus, this theory is applied prominently in warehousing HCM aspects.

The other theories that could be applied are Congruity and Control Theories that are related to customer service (Pisharodi & Langley, 1990) and Bureaucracy Theory that is related to organisations (Bowersox & Daugherty, 1987; Bowersox, Closs, & Stank, 1989; Clark & Gourdin, 1991; McGinnis & Kohn, 1993).

2.5 WAREHOUSING LAYOUT

Hassan (2002) described that a general framework for the design of warehousing layout is to organise the design process, to facilitate the task of designers and to highlight the important design issues to warehouse managers. This is to assist them

in making the right decision with well-informed information. He added that most of the suitable warehousing layout depends on its particular operational conditions and characteristics. Thus, this would determine the type of warehouse whether it is a distribution centre, a manufacturing warehouse, or a public warehouse. Therefore, the information provided should be specified to the designers with an initial concept and expected levels of operations as required in the warehousing layout design (Hassan, 2002).

In this regard, these steps (Figure 2.3) are required in setting the capacity of warehouse and preparing the information which would be used in subsequent steps, as in Figure 2.4. These steps are important to determine the adequacy of warehousing layout capacity setting and information process flow before proceeding further with the warehouse layout design process (Hassan, 2002).

In addition, Hassan (2002) determined a framework of 14 steps for major warehousing layout design in order to support the operations. This would meet the objectives and their priorities, whether the warehouse would serve in global markets or perform value added services. The 14 steps flow process is shown in Figure 2.4.

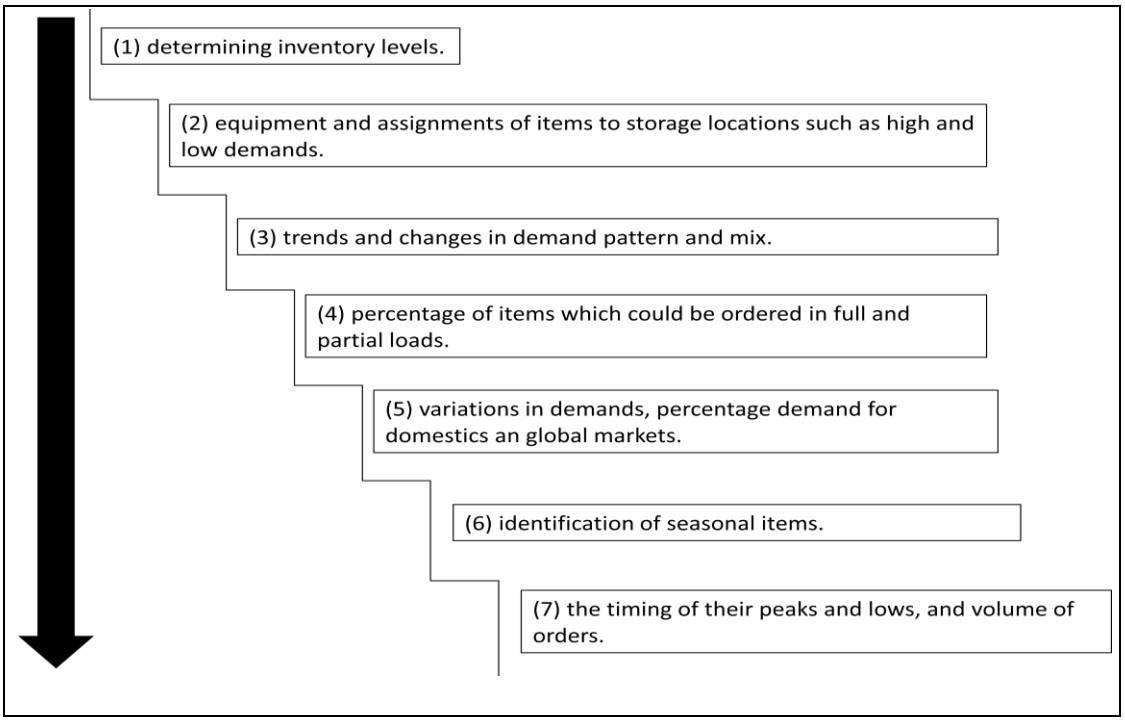

Figure 2.3. Warehousing layout capacity setting and information process flow.
Source: Adapted from Hassan (2002)

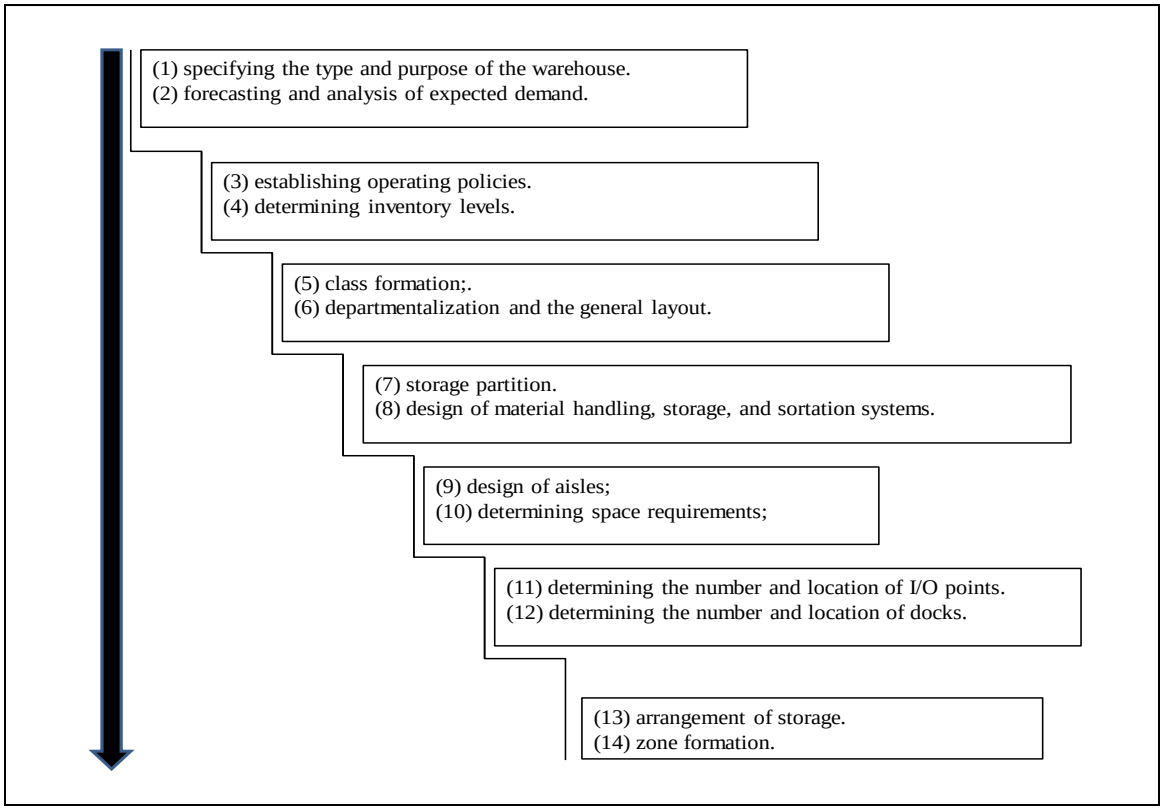

Figure 2.4. Framework of warehousing layout design 14 steps process flow.
Source: Adapted from Hassan (2002)

In conclusion, in order to have an effective warehousing layout, one needs to have the setting formation beforehand. This is important before one could consider the next step to help the warehouse operators to be more efficient.

2.5.1 Warehousing Layout Relationships with Efficiency

Frazelle (2002) mentioned that the process of laying out a warehouse is like putting a puzzle together and the puzzle-building process is defined by profiling, benchmarking, simplifying, computerisation, and mechanisation warehouse operations. Johnston (1995), Tompkins, White, Bozer, and Tanchoco (2002), and Bartholdi and Hackman (2005) described that an efficient warehouse layout contributes to the reduction in production cycles, work-in-progress, idle times, number of bottlenecks, and/or material handling times. This would ultimately increase the production output with obvious implications on productivity. The location of the manufacturing equipment, warehouse, and parking areas for work processes are some of the major factors to be considered in the definition of the material handling system. The design of the facility of warehousing layout is bound to affect the efficiency of the manufacturing system, as the facility of warehousing layout plays an important role in the business success of the organisation (Johnston, 1995; Gray, Karmarkar, & Seidmann, 1992; Tompkins *et al*., 2002; Bartholdi & Hackman, 2005).

Tompkins *et al*. (2002), Bartholdi and Hackman (2005), and Bartholdi and Hackman (2008) described that selecting the best warehousing layout efficiently is not a trivial matter because of the diversity of factors influencing warehousing operation success,

such as dock location, aisle access, rack types, rack access, and others. However, Faber *et al.* (2002) questioned whether the warehousing layout should be standard or customised to overcome the management constraint on cost expenditures. Other related issues such as security, manpower, facilities, system, communication, inventory control, and space optimisation and utilisation should be either flexible to cater for any demands or requests by customers or suppliers for their inventories (Tompkins *et al*., 2002).

Furthermore, Hassan (2002) mentioned that designing the layouts of a warehousing system is a complex task due to several reasons. Among them include: some design decisions are large and many of them are combinatorial problems that are difficult to solve optimally. Many operations (picking, dual command, cross docking, and value added services) and factors (demand, physical characteristics of items and unit loads, serving global markets, material handling, and JIT impact travel time, material handling cost, and throughput in a warehouse) are involved. Such operations and factors should be accounted for in a comprehensive design of warehousing layout so that they could support all operational changes without resorting to frequent modifications which would complicate the design. These operations and factors interact closely, and such interaction should be considered and accounted for in the layout design efficiently (Hassan, 2002).

Additionally, Gopalakrishnan, Turuvekere, and Gupta (2004) pointed out that the type of layout utilised would largely depend on the nature of the manufacturing activities, including the volume and variety of the products being produced. However, Canen and Williamson (1996) described that an effective layout design

depending on the manufacturing system is significant. The process of designing a warehouse determines the arrangement of items in storage or devising picking activities (Van den Berg, 1999). Thus, the efficient facility of warehousing layout plays an important role in the business success of the company (Johnston, 1995).

Hassan (2002) concluded that the operations in the warehouse have to be investigated carefully because it impacts the efficiency of the layout design. Thus, it has to be addressed early in the design to determine whether to operate the warehouse as several independent warehouses to serve global and local markets independently. The warehousing layout should efficiently sustain the demand and requirements of both markets (domestics and global) in necessitating and storing items for those markets separately (Hassan, 2002).

In this study of warehousing layout, the questionnaire items were developed by Koster (2008) and were appropriately adapted and implemented for this research.

2.5.2 Theories Supporting Warehousing Layout

Least Cost Location Theory and Waber's Theory of the Location of the Firm are applied mainly in most firms to determine the warehouse location and its warehousing layout design theories (Lambert & Stock, 1993). Both theories applied the combination of basic physical building foundation set-up of the organisation or factory where it should be situated, and how it should be built at minimum cost.

As the layout of the physical building of the firm is important to be decided, the warehousing layout structures play an important role for the firm to avoid any difficulties and problems, and in assuring the efficiency of the operational activities to be executed (Hassan, 2002). These theories directly explore the decision making of actual locations and cost reduction of the firm and in this case the warehousing layout structures. Another theory that may be suitable to be applied is Theory of the Firm for Logistics Strategy that focuses on its applicability of the firm set-up and the layout foundation (Stock, 1997).

2.6 WAREHOUSING MANAGEMENT INFORMATION SYSTEM (MIS)

Lucey (1997) defined Management Information System (MIS) as the combination of human and computer base resources. It is the collection of storage, retrieval, communication, and use of data for the purpose of efficient management of operations and business planning. Haag, Cummings, and Philips (2007) described MIS as dealing with the planning for development, management, and use of information technology tools to help people perform all tasks related to information processing and management. According to Comptroller's Handbook (1995), in practice MIS should be able to simplify prompt decision making in institutions. Thus, MIS should also be capable of providing and distributing current information to appropriate users. The information system should be designed to expedite reporting of information. This would enable the system to quickly collect and edit data, summarise results, and be able to adjust and correct errors promptly (Comptroller's Handbook, 1995).

On one hand, McLeod and Schell (2001) regarded MIS as a computer-based system that makes information available to users with similar needs that happened in the past and future. The information is made available in the form of periodic reports, and outputs of mathematical simulation. On the other hand, Oz (2009) viewed elements of MIS in such processes include hardware, software, training of personnel, and proper procedure guidelines in computer operations involving the latest data storage and latest telecommunications network, such as email and the Internet.

Furthermore, Autry, Griffis, Goldsby, and Bobbitt (2005) specified that the needs for data management to support logistics (and warehousing) processes has created demand for specialised information systems and custom-designed systems for fulfilling logistics management needs. As a result, many firms have begun to invest in technologies that enhance decision-making capabilities for transport management, warehouse management, and demand forecasting and planning among others (Bowersox, Closs, & Stank, 1999).

The widespread implementation of new information technologies (IT), such as bar-cording, radio frequency communication (RF), and the warehouse management system (WMS), provides new opportunities to improve warehouse operations (Autry *et al*., 2005; Richey & Autry, 2009). These opportunities include, but are not limited to, real-time control of warehouse operations, easy communication with other parts of the supply chain, and high levels of automation.

Murphy and Wood (2004) defined logistics information system (part of it is warehousing MIS) as “people, equipment, and procedures need to gather, sort,

analyse, evaluate, and distribute needed, timely, and accurate information to decision makers". It has been designed and implemented for different logistics activities and commonly implemented systems used to support transportation management, warehouse management, yard management, and operational planning and scheduling.

2.6.1 Warehousing MIS Relationships with Warehousing Operations

Chiu (1995) presented an integrated framework to improve the performance of distribution systems and warehousing operations. He further highlighted the role of warehousing MIS in improving the efficiency of the logistics value chain. Therefore, in warehousing operations, information on inbound and outbound flows, weight and volume of stored products by type, and cost of inventory are necessary (Pokharel, 2005). In addition, information on product design, assembly, packaging, and electronic tagging would also be needed if warehouse functions include receiving, storing, packing, kitting, and consolidation. Most of the warehouse related activities could be facilitated through the warehouse management system (WMS).

Pokharel (2005) regarded that in warehousing MIS, it is described that if WMS is wireless capable, then it can further enhance inventory utilisation, customer support, and value addition. Additionally, availability of automated guided vehicles, sorting devices, and automated storage and retrieval systems would be of greater advantage for easy loading and unloading activities in the warehouse.

Cowan and Mathieu (1994) summed up that the MIS manager charged with integrating the "isolated islands" of computing resources throughout the

manufacturing firm typically faces significant obstacles. These obstacles are both technical and organisational in nature. However, typically it is the organisational issues that present the greatest challenges to management. This condition also occurs for the warehousing MIS and warehousing operations functions.

2.6.2 Warehousing MIS Relationships with Warehousing HCM

Senge (1999) mentioned that in today's business organisations that wish to meet the external challenges of globalisation, changing workforces, evolving competition, and new technologies (particularly those related to logistics and warehousing functions) could not change just strategies, structures, and systems. Organisations after all are products of the ways that people think and interact. As pointed out by Tracey and Smith-Doerflein (2001), effective logistics (and warehousing) management is dependent on the people that execute these operational service initiatives. Therefore, warehousing MIS and warehousing HCM could be the main inter-related functions within the success of the organisation.

Hammer and Champy (1993) described that reengineering could be a great help to change business process focus, to make it bigger in their mind-set. Indeed this could be a challenged as identifying the company's major processes is a crucial step in reengineering. However, this needs further exploration of understanding if the organisations strongly desire to promote the warehousing HCM values, such as trust, initiative, collaboration, creativity, quality, humane treatment, and other related objectives.

There is not much research-based knowledge to show how these objectives could be achieved (Hassan, 2002), particularly in logistics (warehousing MIS) and warehousing HCM function relationships. It is important that warehousing HCM and warehousing MIS should be interrelated in their functions and roles to impact the warehouse efficiency for achieving better performance.

2.6.3 Warehousing MIS Relationships with Warehousing Layout

Chung, Bae, and Lee (1997) revealed that the new concept of warehousing MIS focuses on how information technology is used. This is closely related to firm strategy or the warehousing layout foundation. The top management is more concerned about strategic use of warehousing MIS and information technology so as to improve the efficiency in the warehousing layout to supplement the firm and warehouse efficiency. It is important to assess the degree of integration between firm and MIS strategies in the warehousing MIS planning and implementation processes to the warehousing layout.

Sherman, Rowley, and Armandi (2007) described that the management's ability is to gather and process information about the firm and its competitive environment. Therefore, providing logistics and warehouse managers to have far more accurate and reliable data for their strategic decision-making process is equally important. It is to make the firm effective and efficient in their management process. This is particularly important in designing the warehousing layout to run in parallel with the business demand of the firm, supported by the warehousing MIS.

Hassan (2002) pointed out that to develop warehousing layouts with the support of warehousing MIS, the warehouse requires several characteristics, including modularity, adaptability, compactness, accessibility, flexibility, and distribution of movement. This is to enable it to respond to changing conditions, improve space utilisation, and reduce congestion and movement. It determines efficiently the number of aisles, location, orientation, length, and width as an important step in designing warehousing layout due to its impact on space needs, operations, material handling, and storage.

Pokharel (2005) concluded that the level of warehousing MIS or those relate to Information, Communication, and Technology (ICT) application within the organisation (warehousing layout) could differ significantly. This refers to either small or large firms, but the level of risks, constraints, and expertise faced by these firms could be quite different. Closs, Goldsby, and Clinton (1997) described that this condition could create disillusions on its benefits of facilitating business processes. Thus it affects the functions and activities of the logistics (including warehousing MIS and warehousing layout).

In this study of warehousing MIS, the questionnaire items were developed by Cowan and Mathieu (1994), and Autry *et al.* (2005), and were appropriately adapted and implemented.

2.6.4 Warehousing MIS Relationships with Efficiency

Base on the roles of MIS, they could establish the importance of its role in warehousing MIS perspective. Simchi-Levi, Kaminsky, and Simchi-Levi (2003) mentioned that the objectives of MIS in Supply Chain Management (SCM), which logistics warehousing is an integral part of the supply chain, can be achieved by providing:

(a) information availability and visibility,
(b) enabling a single point of contact for data,
(c) allowing decisions based on total supply chain information, and
(d) enabling collaboration with supply chain partners.

The most important typical role of IT in SCM is reducing the friction in transformation between the supply chain partners through cost-effective information flow (Cross, 2000). This requires serious consideration in logistics and warehousing MIS functionalities.

Feraud (1998) pointed out that it is important for the firm to approach the latest development in MIS with an open and receptive mind, keen to learn both about their own business and the environment in which it operates. This could be helpful to install a faster, practical, and cohesive method in handling information relating to the running of the business efficiently. Laudon and Laudon (2003) mentioned that it is widely recognised that the information system knowledge is essential for managers because most organisations need an information system to survive. Thus the MIS

process is very much related to the importance of warehousing MIS functions in order for the firm to make the correct decisive and strategic decision.

Alshawi (2001) stated that information systems are increasingly being regarded as resources that support various business processes. In fact there are some similarities between strategic management of information technology and logistics (and warehousing) information management (Feraud, 1998). Some researchers (Baglin, Bruel, Garreau, Greif, & Van Delft, 1996; Christopher, 1997; Cooper, 1994) explained the close links between information systems and the efficient management of logistics (including warehousing MIS as part of its major service provider).

2.6.5 Theories Supporting Warehousing MIS

Neural Networks Theory Model (NNTM) is widely referred and applied to the firm or factory (including warehousing MIS) in the management decision-making process and information flows within the channels of distribution. The NNTM is a computer-based system with an internal structure that imitates the working of the human brain and the nervous system. It is practically capable of handling and transmitting enormous amounts of information quickly and efficiently. It is also capable of learning from mistakes so that repetitive tasks could be accomplished accurately when the task is carried out (Stock, 1997). Borowsky (1993) suggested that computers that are able to search through very large databases and identify patterns which can be performed by neural networks. NNRM offers promises in efficient and effective handling of large databases and other forms of information (Stock, 1997), and in the case of this research, warehousing MIS.

Besides the NNTM that is applied widely in the firm and warehouses, Expert System Theory (EST) is also widely employed in providing product information for customers, assisting with marketing of packaging materials, helping with manufacturing support decisions, assisting in retail product allocations, and developing railroad car schedules (Allen & Helferich, 1990).

In addition, there are other potential applications of EST, such as:

(a) development of control programmes for robotics used in various logistics (including warehouse) activities;
(b) generation of customer databases to be used in segmentation studies, profitability analysis, etc.; and
(c) use in machine translation systems.

This is necessary in international logistics with specific application in image, speech, and written recognition of foreign languages or other patterns of communication.

Both theories (NNTM and EST) are closely supported by Graph Theory to pursue into the communication networks and logistics engineering (Brierly, 1987). The other theories that might be suitable to be applied in logistics systems (in this case warehousing MIS) are:

(a) Information Processing (MIS, logistics decision making, and teams),
(b) Nash Equilibrium (logistics decision making, supplier relations, and system view of logistics teams),

(c) Network Model (channel flows and system view of logistics), and

(d) Statistical Learning (decision support systems and learning) (Stock, 1997).

2.7 WAREHOUSE EFFICIENCY

Generally efficiency is defined as quality of doing something well with no waste of time or money (Hornby, 2005). Kinicki and Williams (2006) pointed out that efficiency means to make use of resources, such as people, money, raw materials, and cost, effectively. Therefore, Jenkins (1990) described that the modern warehouses are more concerned with the speed and efficiency in terms of automation, computerisation, and exotic new means of communication. Warehouse efficiency and effectiveness could be measured by safety, shipping errors, on-time shipments, customer problems, cost-per-line shipped, and total warehouse expenses (Lambert *et al.*, 1998).

Frazelle (2002) mentioned that the manager usually should have vast experiences and knowledge to improve the warehouse performance by creating warehouse efficiency. He described that warehouse quality performance could determine warehouse efficiency activities by put-away, inventory, picking, and shipping accuracy. Jenkins (1990), Tompkins and Smith (1998), Frazelle (2002), and Emmett (2005) added that other factors are inventory control and accuracy, layout space saving, utilisation and optimisation, housekeeping (or 5S) practices using the latest software in MIS, computerised documentation process, trained employees (and HCM), top management support, and budget allocations.

Research findings by Krauth, Moonen, Popova, and Schut (2005a; 2005b; 2005c) supported the notion that high efficiency of the warehouse would positively influence the performance of the warehouse. The efficiency of the warehouse is involved in how the manpower is able to understand the functional activities of the warehouse. Bennet, Hewitt, and Robinson (1996) suggested that the process of efficiency, effectiveness, and reliability are the keys to competitiveness. Therefore the supply-line-process performance should be the comparator in benchmarking exercises. In an attempt to achieve world-class levels of supply-line management, the most advanced companies now see process improvement as the key, as reflected in the efficiency of the warehousing.

2.7.1 Warehouse Efficiency with Performance

Bennett *et al.* (1996) described that warehouse efficiency is very much related to the performance in the areas of distribution. Warehousing is focused on discrete, easily measured task components, such as cubic capacity utilisation of warehouses, and the cost of the movement of goods per tonne/kilometre of cargo. They mentioned that discrete departmental activities are replaced by integrated logistics practices (which warehousing is part of the major service providers). It is also known as supply chain management (SCM). The established cost comparison approach to benchmarking is supplemented or replaced by a focus on service level comparisons. The focus could have changed from lowest cost to best value for money as a benchmark (Bennett *et al.*, 1996).

Tompkins and Smith (1998) argued that these issues actually require measurements related to internal, external, and performance issues of the warehouse (Table 2.3). The efficiencies of the warehouses that resulted in the performance (goals, standards, feedback, opportunity, means, competence, and motive) success or failure are due to the internal issues such as space utilisation, equipment utilisation, labour productivity, inventory accuracy, safety and housekeeping (5S), theft and pilferage, and contamination and damage. These issues are later interrelated with the external issues such as stocks-out, fill-rate, backorder rate, complaints, order accuracy, and promises kept.

Table 2.3.
Warehouse Issues and Performance Measurement

Internal Issues	**External Issues**	**Performance**
Space utilisation	Stock-outs	Goals
Equipment utilisation	Fill rate	Standards
Labour productivity	Back order rate	Feedback
Inventory accuracy	Complaints	Opportunity
Safety and housekeeping	Order accuracy	Means
Theft and pilferage	Promises kept	Competence
Contamination and damage		Motive

Source: Tompkins and Smith (1998)

The Framework of Warehouse Excellence in Figure 2.5 presents several of the warehouse and performance measurement issues in Table 2.3. It starts from input to output results in the organisation, based on its planning, implementation, and measurement. Tompkins and Smith (1998) explained that in most conditions, many organisations are trying to measure their progress against traditional financial measures. These include return on investment, return on equity, cash flow, net income, and sales growth, instead of focusing on issues like those presented in Table 2.3. These measures are irrelevant and do not truly reflect the issues of quality,

service, learning, and continuous improvement of the warehouse. In the case of this research, the efficiencies of the warehouse may cause good or bad performance of the warehouse (Tompkins & Smith, 1998).

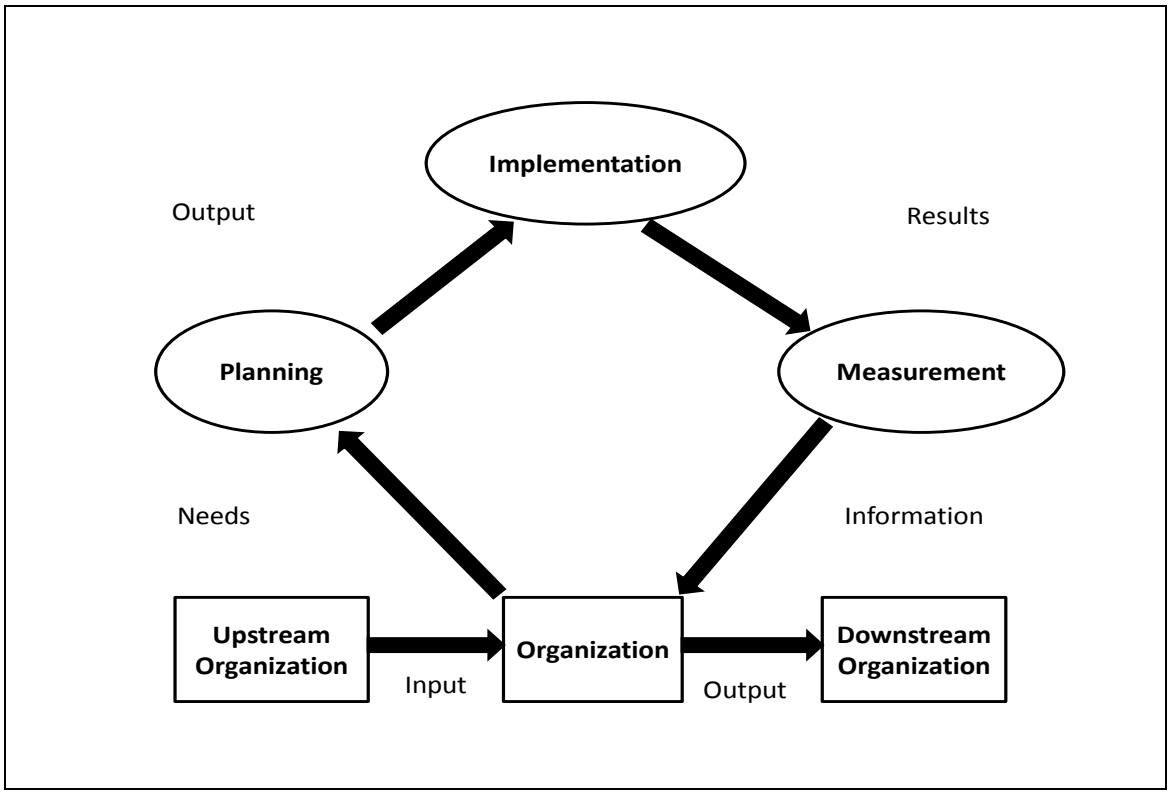

Figure 2.5. The framework for warehouse excellence.
Source: Tompkins and Smith (1998)

Also based on the framework, generally it can be concluded that the warehouse efficiencies are very much related to the performance measurements. Rizzi and Zamboni (1999) described that companies (or organisations) have allowed the creation of foundations to implement suitable optimisation techniques. This is in order to improve warehouse efficiency parameters, such as mean order shipping time, inventory accuracy, space utilisation rates, and shelf life issues. The significant measurement of warehouse efficiency is actually reflected in its performance in total, and more basic considerations are required to fulfil the actual efficiency.

In this study of warehouse efficiency, the questionnaire items developed by Jenkins (1990), and Tompkins and Smith (1998) are appropriately adapted and implemented.

2.7.2 Theories Supporting Warehouse Efficiency

Zero-Based Budgeting Theory (ZBT) in the accounting discipline is widely used in explaining firm and warehouse efficiency. This is because the firm needs to have a budget for expenditure to support the goals and objectives of the latest annual business plan (Pyhrr, 1973; Sarant, 1978). For warehousing, such control over the budget is necessary because warehousing is more service oriented. It is also not a profit making function in the firm. Cost and budgetary control is a must for all levels of its staff and activities. This is to ensure that the efficiency and effectiveness of the warehousing management is maintained at all times.

Stock (1997) examined that in ZBT, the budget could vary each year, up or down, depending on the particular decisions that have to be made. The approach attempts to reduce unnecessary spending by requiring organisations to justify their entire budget each accounting period. Pyhrr (1973) and Sarant (1978) stressed that each manager must prepare a "decision package" for each activity or operation and this package includes an analysis of cost, purpose, alternative courses of action, measures of performance, consequences of not performing the activity, and benefits. This approach is applicable in rapidly changing industries, where conditions from one budgetary period to the next vary significantly. An additional benefit of this theory is the involvement of the senior management in the budgeting process that would ultimately approve or disapprove such budgets.

Stock (1997) specified that ZBT is potentially related to three main areas: firstly, the development of logistics mission statements. Secondly is the development of logistics budgets in international markets where changes can often be rapid and unpredictable. While thirdly, it is related to the development of specific logistics related goals and objectives each year that directly tie to budgetary expenditures for personnel, equipment, etc., which are all related directly or indirectly to the warehousing functions and activities.

Activity Based Costing (ABC) Theory is also widely employed in organisations, especially the manufacturing firms and warehousing activities, so as to control its costing and performance measurement (Pohlen & La Londe, 1994). This theory is widely used during the physical inventory audit during the firm's annual fiscal audit. The efficiency of the warehouse is tested after the inventory audit is done by producing the accuracy report of the audit results. Usually the results of the inventory audit reflect the practice and performance of the management efficiency in managing the firm (especially the warehouses).

Other theories that have been popularly applied are Critical, Hermeneutics, Logical Empiricism, and Logical Positivism Theories in the logistics research, all by Dunn *et al.* (1994); Learning Curve Theory in warehouse strategy (Pooley, 1991); Likert Scale Theory in attitude measurement and data collection (Dunn *et al.*, 1994); and Management Accounting Technique in productivity measures and standards (Armitage, 1984). In addition, Equity Theory has been applied to demonstrate performance, strategic alliances and partnerships, supply chain management, and teams, while Expectancy Theory was used for customer behaviour, logistics decision

making, strategic alliances, partnerships, as well as teams also. In some cases, some firms used Signal Detection Theory for benchmarking, channel communications, environmental scanning, JIT, and supplier relations. In addition, Social Comparison Theory is used for logistics decision making and performance evaluation (Stock, 1997).

2.8 UNDERPINNING THEORIES

Based on the literature and research, this researcher had found that some major theories like Organisational Learning (OL) Theory (Cyert & March, 1963; Senge, 1992); System Theory (Luhmann, 1995; Charlton & Andras, 2003a; Charlton & Andras, 2003b); and Resource Based View (RBV) Theory (Wernerfelt, 1984; Wernerfelt, 1995) were found to be appropriately applicable as the research underpinning theories of this study. However, this researcher prefers Lewin's Force Field Theory (Lewin, 1946; Lewin, 1948; Elsey & Tse, 2007; Ronnenburg, Graham, & Mahmoodi, 2009) supplemented by Lewin's conceptual theory, the Three Steps Model, as more adequate, appropriate, and applicable. Therefore, this researcher now focuses to explain the underpinning theories by using and applying the Force Field Theory (FF) and the Three Steps Model in this study.

2.8.1 Force Field Theory and 3-Steps Change Model

Lewin's (1946) famous motto of "no action without research", which was ultimately called the Force Field Analysis Model (Lewin, 1947; Lewin, 1948), became the centre of the study on "perceived change to be the result of an imbalance of opposing

forces acting on a situation" (Elsey & Tse, 2007). Ronnenburg *et al.* (2009) described the ideas of this theory match with more current interpretations. Those studies explained the imperative for transformation in production process, product design and quality, service delivery, and other aspects of business enterprise (including logistics and warehousing). It impacts the structures of strategies, policies, budgets, reward systems, learning and competence, attitudes, and behaviour of the work force (Elsey & Tse, 2007; Ronnenburg *et al*., 2009).

People working in any organisation (including warehouses) would be the focus of planned change in preparing them to be efficient in ensuring that the organisation is efficiently and pragmatically managed. This could contribute toward a new transformation of the management, people, and organisation in total. The approach of such changes could imperatively survive an increasing competitive business environment, in particularly under the current business globalisation (Harmon, 1993; Hamel & Pralahad, 1994; Gonzalez, 2000; Senge, 1992). In addition, this theory impacts the cause of the efficiency planning toward the overall implementation of its variables (operations, HCM, layout, and MIS), especially when dealing with changes, upgrading, reduction, consolidation, or downsizing of the organisation.

Elsey and Tse (2007) analysed that the contributions of Lewin's Force Field Theory (Figure 2.6) lay on its emphasis on the dynamics of organisational change which suits the overall thinking as it deals with two forces impacting each other. The model is built on ideas representing forces, such as persons, habits, customs, attitudes, drive, and restrained change that could be used at any level (personal, project,

organisational, and network). This is to visualise the forces that might work in favour or against change initiatives.

Figure 2.6 also illustrates the relationship of the dynamic balance of forces or factors that Lewin (1946) and Lewin (1948) called "quasi stationary equilibrium", where the horizontal line represents the current circumstance. When the forces which operate on one side of the line exert pressure, it consequently forces the driving forces to apply the opposing pressure on the other side of the line. This creates tension between the two forces in trying to balance each other on opposite sides (Lewin, 1946; Lewin, 1948).

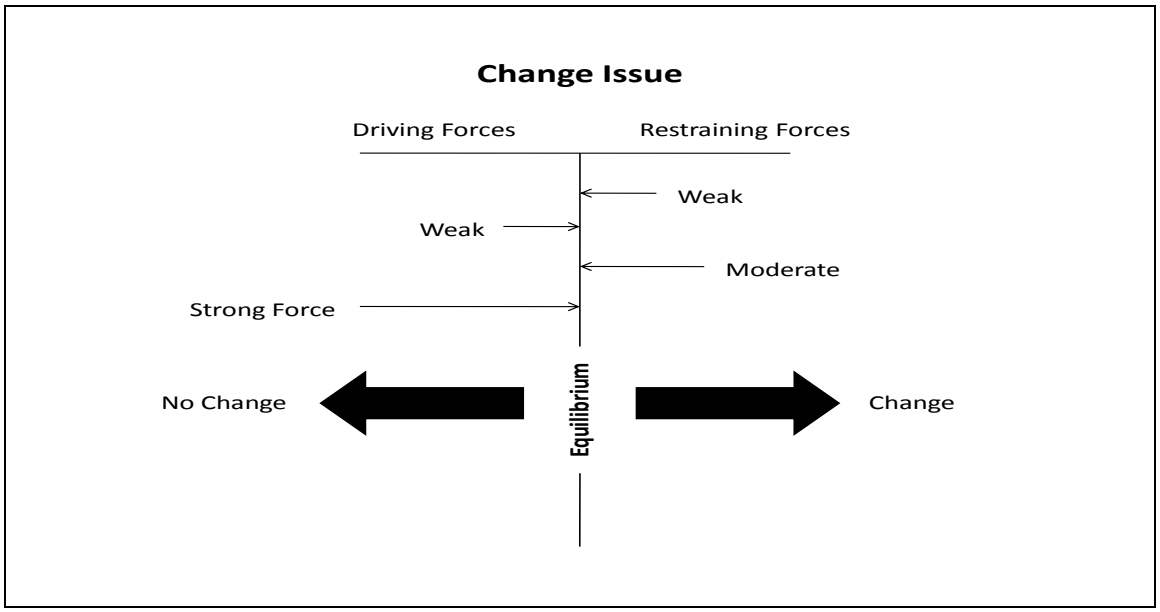

Figure 2.6. Force Field Theory Model.
Source: Adapted from Value Based Management.net (2012)

Lewin (1946) and Lewin (1948) further explained that when the group or organisational behaviour is stabilised, the theory suggested that the driving forces (pushing for change) are equal to the restraining forces (acting against change). The "tug-of-war" between the forces around the issues would drive the forces into left

column, while restraining the right column. This could be described from the arrows toward the middle with the longer ones indicating the stronger forces, thus making the idea to be widely understood and explicit that all the forces are based on given issues. Furthermore Lewin's Theory suggested that for change to happen, the balance of forces must be changed by strengthening or adding the driving forces in removing or reducing the restraining forces, and changing some of the forces' direction.

However, Stacey (1996) concluded that Lewin Force Field Theory emphasised on people and their perceptions, the consistency of change, and the importance of the change. Thus this highlights that these reasons would stress those characteristics of participation and collaboration to be vital for achieving change. Therefore, a change that succeeds in a higher level of group performance often erodes to a point where performance returns to the previous level, and that happens when the goal of change could not be the attainment of a desired level of performance. Instead, it is permanency at the new level or permanency for a desired period that should be the objective (Stacey, 1996).

This theory has led to the development of Lewin's 3-Steps Change Model: Unfreeze, Freeze, and Refreeze (Figure 2.7). In this case, Lewin believed that a successful change needs to be characterised by three steps:

Step 1: Unfreeze

Burnes (2004) analysed that Lewin believes the stability of human behaviour is based on a quasi-stationary equilibrium supported by a complex field of driving and

restraining forces. He argued that equilibrium needs to be disrupted (unfrozen) before old behaviour could be discarded (unlearnt) and finally new behaviour successfully adopted. Therefore, this first step of the change process is unfreezing the present level of behaviour, making the individual or organisation uncomfortable enough with the old way (or causing pain and make the present situation less comfortable), thus wanting to try something new (as perceived to be more comfortable).

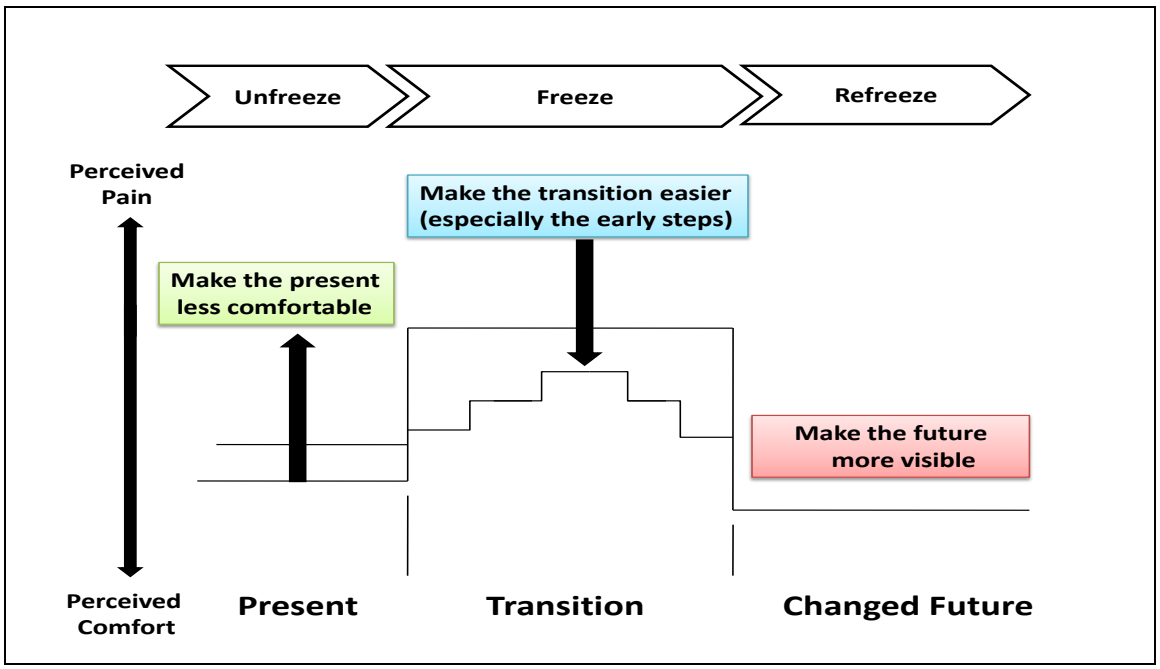

Figure 2.7. The 3-Steps Change Model.
Source: Adapted from Value Based Management.net (2012)

For warehouse activities which before this have been storing many materials, it is time that the management plan and give way to implement Just-In-Time (JIT) to reduce the inventory quantities in their warehouse. Such practice could reduce the manpower and warehouse space utilisations (Tompkins & Smith, 1998). In practice, it reduces other redundancy of the works such as reporting and documentations, less people to work with, but having full control of the situation. This makes the decision-

making process easier but there are more responsibilities and control over the operations (Jenkins, 1990; Frazelle, 2002; Emmett, 2005). The person responsible for JIT operations also need to be well trained in planning and timely delivery of materials to the warehouse or directly to the production floor. This is to avoid any problems occurring that would affect the whole supply of the delivery to the production (Coyle, 1996).

Step 2: Freeze

Unfreeze is not the end of itself but according to Schein (1988), though it might create motivation to learn it does not necessarily control or predict the direction. In this case, it is necessary to take into account all the forces or factors at work by identifying and evaluating all the available options. Burnes (2004) viewed that it is not possible to change the group behaviour with success unless there is an understanding of the interactions (dynamics) between its members. Therefore this second step is moving toward action being taken to implement the change to a new level, but it would not change the social system from its original level of behaviour and operation. On the other hand, it is to assist in seeing, feeling, judging, and reacting clearly and differently based on the new point of view. This is obtained through the new roles played by the management and new relevant information provided for the employees' attention. It is a transition period but an effective mechanism for causing changes to the situation in order to make the flow easy to achieve and in accordance with the plan by the management (Burnes, 2004).

For warehousing, efficiency does not mean a total change of management and structures to implement the new policy of the firm, but it is to instil the right work attitudes toward achieving excellent work disciplines, and also provide training programmes and good communication by giving feedbacks. This is to further improve the workplace and instilling good rapport between the management and subordinates. With such commitment, the top management would appreciate the contributions done by the warehouse employees (Gunasekaran *et al.*, 1999; Govindaraj *et al.*, 2000). Related to this, any directives that require total commitment from the warehouse employees could be easily followed. This is because of the mutual respect borne from the positive relationship between the management and subordinates that have already been developed.

Such situations also become easy to resolve when the firm is exercising the down-sizing policy of cost reduction and manpower. This could directly affect the warehouse operations activities, especially in reducing the manpower. Before such activities are carried out in full scale, the management would transparently communicate with the employees and inform them of the situation. In addition, those who might be involved with this exercise can be given more opportunities to be trained and compensated, and only those who apply for the exercise might even be given the approval. With this early information, the employees may not feel pressured, stressed, and lose focus in their daily work.

Step 3: Refreeze

Schein (1988) analysed that in organisational terms, refreezing often requires changes to organisational culture, norms, policies, and practices. In this case, this final step stresses on stabilising the group at a new quasi-stationary equilibrium to ensure that the new behaviours is set and will not return to the previous state. This is viewed as a successful change of group activity due to group norms and routines which are transformed, and changes to individual behaviour will not be sustained. Referring to the new behaviour or attitude, this final step involves the establishment of a process that will make the new level of behaviour "relatively secure against change". This is to make the future look more visible with confidence as there is a change for the future (Schein, 1988).

The organisation is going for better transformation and no longer being dubbed as "too conservative, selfish, and scared of changes". This gives an opening and many opportunities for the employees to be exposed to new and current style of business operations, enhancing them to be well trained. This could occur when a manager provides adequate rewards, compliments, or encouragement for the person who are adapting to or adopting the new response. In warehouse activities, the importance of maintaining the quality work activities is paramount and stern actions are usually taken for those who are undisciplined and perform at an unsatisfactory level. However, the consequences of such actions also cause the worker turnover to be quite high. This is due to the high expectations of their work performance which might not be achievable within the short amount of time. Most of them who resign are actually being well trained. On the other hand, a company that has to recruit a

new employee would incur extra cost to train the new employee and take time to make them an expert of their respective areas. Therefore, rewarding the workers with good salary and bonus, besides other perks, is very important so as to make them feel at ease and comfortable with their jobs. This would provide and make them more positive with their work, aside from achieving an excellent relationship with the management. The employees are regarded as firm assets and not liabilities.

As Lewin pointed out, life within any group of people is "never without change"; all that differs is the amount and type of change (The Antidote, 1998). Managers have to manage groups of people who need to understand group dynamics, insights, resistance, and specific change. Lewin's Force Field Theory is all about effectiveness of change with the additional conceptual theory model of 3-Steps Change. These theories could determine that such support to improve the changes of activities in the organisations have encouraged everyone to focus on the intended situation, which is to enhance the plan to be achieved. For warehouse management to achieve the efficiency of its activities through the operations, human capital management, layout, and management information system, it could easily develop this theory into practice and determine the implementation effectively.

In conclusion, modern organisations are faced with the reality that survival is contingent on the ability to transform rapidly and successfully (Kanter, 1989). The theoretical framework model provided has a simplistic foundation to understand the interaction of forces influencing the success of change among its attributes. The model is easily understood with regard to organisational change that involves the context of complexity theory. Related to that, vision has consistently been identified

as a key responsibility of managers. They need to make important decisions and planning in ensuring the warehouse is managed efficiently. The company's vision and goal must be tangible, measurable, and realistic to the business that directs it toward the end state (Atkinson & Millar, 1999).

However, this is not an easy passage to practice without years of work experience supported by proper education and training background. Leading academicians and practitioners need to search out for new models that could accurately explain any forces that are being associated with management of the firms (generally) and warehousing (specifically). This could determine the success or failure in the future for any potential change.

2.9 THEORETICAL FRAMEWORK AND HYPOTHESES

This process takes place after the researcher has established the definition of the problem, reviewing relevant literature and proceeds in planning a sample, collecting data, analysing data and formulating the conclusions, and preparing a report (Zikmund, 2003). The framework has five major variables which establish a set of formal hypotheses to the proposed decision process. It focuses on the warehouse efficiency and its mediating process of warehousing MIS. The study explains the relationship between warehouse efficiency (dependent variable or DV); warehousing attributes of independent variables (IV) that are operations, HCM, and layout, and the mediating variable (MV), MIS.

2.9.1 Theoretical Framework

Different approaches have been made by different researchers in attending various issues with different scenarios. They might have different factors needed and considered in making certain particular decisions. Based on the literature review, most of the studies were conducted with various objectives and perspectives. Particularly, not many attempts were made to investigate and explore these relationships of warehouse efficiency in one research framework, as in this study (Figure 2.8).

This study focuses on the SME manufacturing warehouses toward its efficiency relating to its warehousing attributes, which are operations, HCM, and layout with MIS as the mediator. Based on the problem statement and literature review, the research has now developed the theoretical research framework model. The model is used to consider its relationships consisting of three warehousing independent variables, which are operations, HCM, and layout, and warehousing mediating variable, MIS, toward the dependent variable, warehouse efficiency.

In this study, the dependent variable is the primary interest to the researcher (Sekaran & Bougie, 2010). This is to measure whether the treatment or manipulation of the independent variables have an effect or to examine its impact on the dependent variable (Salkind, 2009). Independent variables are the ones that influence the dependent variable in either positive, negative, or no change way (Sekaran & Bougie, 2010).

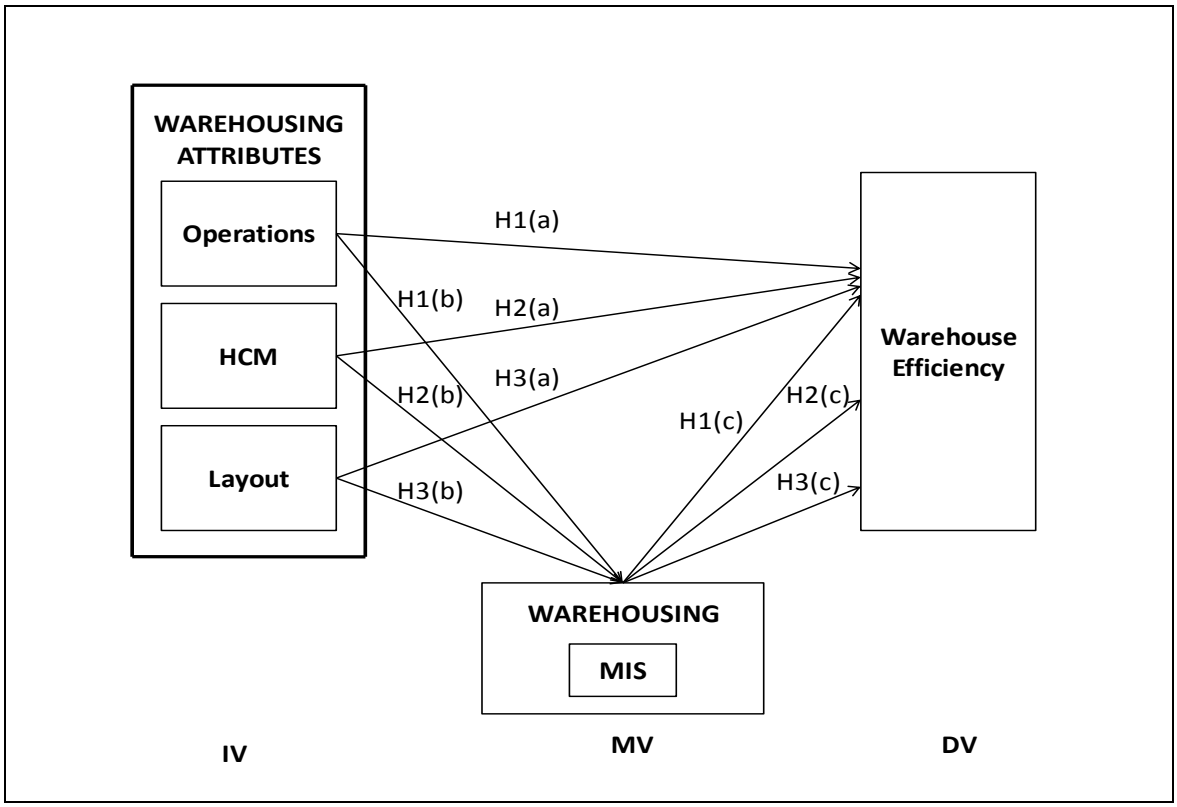

Figure 2.8. Theoretical Framework for the research.

Meanwhile, the mediating factor represents the generative mechanism through which the local independent variables are able to influence the dependent variable of interest (Baron & Kenny, 1986). Therefore, the warehousing independent variables (operation, HCM, and layout) and warehousing mediating variable (MIS) are believed to be influential factors in dependent variable (warehouse efficiency).

2.9.2 Relationships among Warehousing Attributes

A firm that knows its warehousing attributes and capability to fully utilise them would have better potential to confront the efficiency of its process, functions, activities, and management. For example, a firm that exercises best practices in inventory control and accuracy in operation, space saving in the layout, well trained

personnel and HCM, latest MIS updating on its software and hardware, and 5S working spirit within the organisation (refer to Section 1.1.1 in Chapter One and the whole of Chapter Two). These could improve its quality, innovativeness, and productivities tremendously, thus enhancing its efficiency.

Due to the existing gap in the literature in studying the role of warehousing MIS as a mediating variable in the relationship between the warehousing attributes, this study uses similar attributes in other related literature as reference. For example, the literature indicated that there have been similar characteristics which are narrowed into organising efficiency, or in this case warehouse efficiency (Jenkins, 1990; Tompkins & Smith, 1998; Frazelle, 2002; Emmett, 2005). Furthermore, these attributes are embedded in the same Force Field Theory and 3-Steps Change Model Theory (Lewin, 1946; Lewin, 1948; Elsey & Tse, 2007; Ronnenburg *et al*., 2009).

The study also analysed the problems related to the warehouse efficiency relationship and the warehousing attributes. This study investigated the characteristics of the warehouse efficiency as a basis of its investigation. The literature indicated that the dimensions have similar characteristics, such as inventory control and accuracy operations (Gunasekaran *et al*., 2000; Gu *et al*., 2007; Koster *et al*., 2007), space saving layout (Hassan, 2002; Faber *et al*., 2002; Gopalakrishnan *et al*., 2004), and trained personnel (Murphy & Wood, 2004; Pokharel, 2005; Ellinger *et al*., 2005; Min, 2007b). Other characteristics are the latest software and hardware updating in MIS (Bowersox *et al*., 1999; Autry *et al*., 2005; Haag *et al*., 2007) and 5S practices (Bayo-Moriones *et al*., 2010) to ensure the warehousing efficiency (Bennet *et al*., 1996; Ling *et al*., 2008; Connolly, 2008)

Similar scenarios and approaches are used in studying the relationship between warehousing attributes and warehouse efficiency attributes. The variables of warehouses possess almost similar attributes such as operational process in order picking, retrieving, and storing materials, as well as issuing materials in operations (Gunasekaran *et al.*, 1999; Faber *et al.*, 2002; Frazelle, 2002; Koster *et al.*, 2007); and planning and design in the layout (Tompkins, White, Bozer, Frazelle, Tanchoco, & Trevino, 1996; Rouwenhorst *et al*., 2000). Other attributes are training to upgrade skills and knowledge related to HCM (Murphy & Poist, 1992; Murphy & Poist, 1993; Bowersox & Daugherty, 1995; Pfeffer, 1998; Pfeffer, 2000); latest MIS technologies (Cowan & Mathieu, 1994; Pokharel, 2005; Autry *et al.*, 2005); and warehouse performance and efficiency (Lambert *et al.*, 1998; Tompkins, 1996; Ruriani, 1999).

This study encounters the same problem with limited information available in the literature in studying the relationship between unrelated warehouse efficiency and its practices. However, the literature indicated that the dimensions have several similarities such as effective operations performance (Jenkins, 1990; Tompkins & Smith, 1998; Lambert *et al*., 1998); and HCM practices based on its HRM policies (Murphy & Poist, 1992; Murphy & Poist, 1993; Bowersox *et al.*, 1999; Ellinger *et al.*, 2005; Min, 2007b). Other similarities are layout foundation for warehousing in the manufacturing firm (Hassan, 2002; Rouwenhorst *et al.*, 2000; Roodbergen & Vis, 2006; Huertas, Ramirez, & Salazar, 2007), and the importance of MIS within the organisation (Cowan & Mathieu, 1994; Pokharel, 2005).

However, significant numbers of empirical studies have been conducted in investigating the effect of warehousing operations (Rouwenhorst *et al*., 2000; Petersen, 1999; Petersen *et al*., 2005); warehousing HCM (Murphy & Poist, 1993; WERC, 1999; WERC, 2001; Min, 2007b); warehousing layout (Gray *et al.*, 1992; Huertas *et al.*, 2007; Ling *et al.*, 2008); and warehousing MIS (Cowan & Mathieu, 1994; Pokharel, 2005; Min, 2007b). This investigation is on organisational performance and most of them confirmed that these attributes contributed significantly to the firms' efficiency.

The proposed hypotheses are productive and relevant to the global business and it requires a firm to take various organisational and environmental factors into consideration. Using the warehouse efficiency as its dependent variable in relation to other independent variables (operations, HCM and layout) and mediating variable (MIS), one may form a conjecture that firms might end up with different organisational efficiency.

Based on the problem statement made in Chapter One (Section 1.2), a hyper, volatile, and global competitive business environment would affect so much on the efficiency and performance of warehousing operations and management process. This had forced the firms to be strategically competitive, flexible, and sourcing that befits the organisational practices and market requirements. This is thus so in order to secure a better organisational performance. It is known that these issues are influential factors in determining organisational performance and competitiveness (Combe & Greenly, 2004; Chan, 2005; Kim, 2006), especially the efficiency of the firms from the

process and management perspectives. However, there is a gap in the literature in studying the relationship of these issues simultaneously as proposed in this study.

Even though integrating issues from other perspectives is not new, the trend to study the combination effect of warehousing issues in a one-research framework is relatively recent (Yang & Huang, 2000).

2.9.3 Development of Hypotheses

This study focused on warehousing attributes that are in the operation, HCM, and layout as independent variables with MIS as the mediating variable, and their effect on warehouse efficiency (as dependent variable) of manufacturing SMEs based in Malaysia. Since the business globalisation took place in the development of logistics, including warehousing, it has rapidly evolved and underwent great challenges. Thus this made warehouse excellence become harder to achieve. If warehousing before this has been viewed as a supportive industry to other functional areas, it is now being regarded as a strategic industry on its own (Tompkins & Smith, 1998; Gundlach *et al.*, 2006; Sum *et al.*, 2001). It is important for the firm in today's warehouse operation, while facing such enormous challenges, to equip themselves professionally more than just adopting their daily planning, managing, and improving operations (Tompkins & Smith, 1998). This is especially so for those who are facing significant competitive forces and aiming to improve the firm's efficiency.

In relation to that, the objectives of this study are to investigate the relationships between these attributes and their effects on firms' efficiency either as independent,

dependent, or mediating variable(s). As mentioned earlier, the warehousing attributes used in this study are: (1) warehousing operations, (2) warehousing HCM, and (3) warehousing layout as independent variables; warehousing MIS (4) as the mediator; and warehouse efficiency as the dependent variable. Nine hypotheses have been developed based on the theoretical research framework for the research measurements.

(a) Hypothesis 1(a): There is a relationship between warehousing operation and warehouse efficiency.

(b) Hypothesis 1(b): There is a relationship between warehousing operations and warehousing MIS.

(c) Hypothesis 1(c): There is a mediating effect of warehousing MIS in the relationship between warehousing operations and warehouse efficiency.

(d) Hypothesis 2(a): There is a relationship between warehousing HCM and warehouse efficiency.

(e) Hypothesis 2(b): There is a relationship between warehousing HCM and warehousing MIS.

(f) Hypothesis 2(c): There is a mediating effect of warehousing MIS in the relationship between warehousing HCM and warehouse efficiency.

(g) Hypothesis 3(a): There is a relationship between warehousing layout and warehouse efficiency.

(h) Hypothesis 3(b): There is a relationship between the warehousing layout and warehousing MIS.

(i) Hypothesis 3(c): There is a mediating effect of warehousing MIS in the relationship between warehousing layout and warehouse efficiency.

The numbers of question items in the questionnaires can be referred to in Appendix 2, with the related hypotheses and linkages with the research questions and objectives in Appendix 1.

Theoretically in the theoretical framework model, the warehousing attributes (operation, HCM, and layout) are described to have direct relationship factors toward warehouse efficiency. Thus this creates a form of efficiency measurements in assessing each independent variable whether there is any form of change toward the dependent variable. Hypotheses H1(a), H2(a), and H3(a) are related to these factors of relationship as whether there are forms of less or more effect. The same goes for H1(b), H2(b), and H3(b) between the independent variables and the mediating variable, as whether there is any form of relationships that could give a less or more effect. The MIS, which is the mediating variable, has a direct relationship factor toward warehouse efficiency and hence could mediate the dependent variable. This could be a mediating test as whether there is more or less form of relationship toward the warehouse efficiency as compared to the independent variables. Hypotheses H1(c), H2(c), and H3(c) describe the intention and requirements of such relationship as whether there is any less or more effect for such mediation.

2.10 CHAPTER SUMMARY

The literature review explained the development of SMEs, its manufacturing performance, expansion, and challenges in Malaysia. It reflects the actual performance of the warehouse efficiency to support the success of SME manufacturing, especially in the wake of business globalisation. The literature review

further explained the variables of the framework theory on warehousing operations, HCM, layout, and MIS. This includes the relationships of warehouse efficiency and warehousing theories applied to each of the variables.

Theoretically, the review concluded with the applications of Lewin's Force Field Theory as the major underpinning theory. It is supplemented by Lewin's 3-Steps Model Theory. The theories have been chosen due to its suitability and adaptation to the research framework of this study relating to its function and process of its variables; the warehousing operations, HCM, layout, and MIS. Conclusively, the theories provided have a strong but simplistic foundation in upholding the theoretical framework, understanding its interrelated variables to its major process flow, and influencing the success of change to the organisation.

Finally, based on the literature review and the supporting rationales, this researcher has proposed the theoretical framework for the research and the derived hypotheses. The model of the theoretical research framework is used to consider the relationships consisting of three warehousing independent variables, namely operations, HCM, and layout; warehousing mediating variable, MIS; and the important dependent variable, warehouse efficiency. It also explained the relationships among the warehousing factors, revealing the gaps existing in the literature of this study. These gaps led to the exploration and analysis of the warehouse efficiency characteristics as basis of the investigations, including warehouse attributes, problems, and limitations of the information available in the literature studying the relationship between unrelated warehouse efficiency and its practices. Furthermore, the lack of significant empirical studies in the effect of warehousing operations, HCM, layout, and MIS on

organisational performance was also uncovered. Therefore, nine hypotheses have been proposed for this study for the questionnaires to be developed.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 INTRODUCTION

This chapter describes the research methodology employed in this study. It is organised into six sections: (a) design of study; (b) population and sampling; (c) instrumentation; (d) reliability and validity of survey instrument; (e) pre-testing survey instrument; and (f) data collection procedures. Specifically this study analysed the relationship between the warehouse attributes and the effect on warehouse efficiency among the SME manufacturing firms in Malaysia. Three independent variables (IV) and one mediating variable (MV) with a dependent variable (DV) were selected in this study based on the thorough review of the effect of the variables on organisational efficiency.

In this study, the proposed theoretical research framework (Figure 2.8) is considered as a new one. Previous studies strongly supported the relationship between each variable individually with the organisational efficiency. However, not many studies have been done to examine the relationships and effect of all the variables simultaneously within the same framework, especially those related to warehouse efficiency. However, the relationships between the individual variables with organisational efficiency have some origination from earlier researchers in their respective areas (Cowan & Mathieu, 1994; Gunasekaran *et al*., 1999; Hassan, 2002; Min, 2007b; Gu *et al*., 2007).

The literature review did explain the warehouse efficiency concept and the discussion of the mediating effect within the organisations could be deduced from the direct and positive relationships or logical linkages between these dimensional variables. It is apparent that the independent variables which comprised three dimensions (operation, HCM, and layout) and a mediating with one dimension (MIS) influence the dependent variable – warehouse efficiency.

3.1 RESEARCH DESIGN

The research design includes the approach employed in data collection; instruments used during the study, as well as the operational management definition (refer to Section 1.1.2) of the variables under study. Questionnaires are designed based on the research questions, objectives, and hypotheses of the study. Babbie (2004) mentioned that a research design is an action plan for getting from here to there, where here might be the initial set of questions to be answered, and there is the set of answers or conclusions about these questions. Leedy and Ormrod (2005) described that a research design is used to measure the relationships among variables in order to explain, predict, and manage the phenomenon.

A quantitative research approach was chosen for this study. Anderson, Sweeney, and Williams (2000) argued that a quantitative research approach could reliably determine if one idea or concept is better than the alternatives. It could to the extent that quantitative multivariate methods enable researchers to measure and control variables. Cresswell (2003) described quantitative methods being very useful for analysing or proving theories, discovering important variables for future research,

relating variables posed by questions or hypotheses, and using standards of validity and reliability as well as statistical procedures.

This study involved three independent variables (operation, HCM, and layout), one mediating variable (MIS), and one dependent variable (warehouse efficiency). As the variables are neither controlled nor manipulated as in the research framework, the main concern is on the relationships among these variables. It is also the ability of the independent variables and the mediating variable in explaining and predicting the value of the dependent variable, based on these relationships.

3.2 POPULATION

3.2.1 Population of Respondents

A population is defined as all members of any well-defined class of people, events, or objects (Ary, Jacobs, & Razavieh, 2002). The target population for this study is SME manufacturing firms in Malaysia, which is officially listed as being more than 7,000 SMEs registered under the SME Business Directory (2009). It can be obtained from http://secure.smeinfo.com.my. A total of 16,515 SMEs in Malaysia are listed according to the business sectors with manufacturing dominating the sector with 5,947 SMEs, including agro-based manufacturing (Table 2.1).

Specifically, this study uses all the SME manufacturing firms as the population listed in the SME Business Directory in various manufacturing sectors (Table 2.2). This study focuses on SME manufacturing companies because of its current importance

and significant contributions in the Malaysian manufacturing sector. Lee and Lee (2007) described that 90.00 percent of the total establishments in the manufacturing sector are SMEs. These include 29.00 percent of total output and 33.00 percent of employment in the manufacturing sector. Therefore, efforts have been made by the Malaysian government to promote the development of SMEs in this sector (Lee & Lee, 2007). Among the top distributions in SME manufacturing are textiles and apparels; food and beverages; metal and metal products; paper, printing and publication; furniture; and rubber and plastics products. Others include wood and wood products; non-metallic mineral products; machinery and equipment; electrical and electronics; chemical and chemical products; transport equipment; and general manufacturing (jewellery, leather products, tobacco products, medical precision and optical instruments, recycled, and petroleum products).

Owners of SMEs are given the questionnaire surveys for them to respond by using a self-stamped envelope via the postal service, because it seems they are the most knowledgeable about the company's warehouse management and activities. It has been shown in many studies that business owners or high-level managers are primarily the decision makers setting the strategic orientation of the organisation (Covin & Slevin, 1991; Cunningham & Lischeron, 1991). A survey of an industry's leader could provide important information of the industry's basic philosophy, as they typically guide the organisation's overall business philosophy (Chaganti & Sanbharya, 1987; Miles & Arnold, 1991; Zelditch, 1962).

3.2.2 Sample Size

A sample size should be chosen to achieve the most desirable balance between the chances of making errors, the costs of these errors, and the costs of sampling. The idea is to find an optimal sample size, which minimises the total costs of sampling error. A large sample is much more likely to be representative of the population (Ary *et al.*, 2002).

In a random sample, each person in the population has an equal probability of being chosen or selected (Creswell, 2003). Leedy and Ormrod (2005) also highlighted that when a random sample is selected, the researcher could assume that the characteristics of the sample approximate the characteristics of the total population. McMillan and Schumacher (2001) stated that the sample size should be sufficiently broad to estimate the characteristics of the population satisfactorily to provide credible results.

Sekaran and Bougie (2010) regarded that in research, the theoretical framework has several variables of interest, and the question arises as to how many one should come up with a sample size when all the factors are taken into account.

In this research, the total number of population of SMEs manufacturing sectors is 5,947 (Table 2.1). A total of 1,000 questionnaires or 16.8 percent of the total random questionnaires (as specified by Krejcie & Morgan, 1970) of the chosen SME manufacturing companies were sent with a pre-paid postage self-addressed envelope for return. According to Jobber and Saunders (1989), and Jobber (1990), this total

sampling of the questionnaires is justifiable since it is above 14 percent of the total population. The questionnaires were sent to SME manufacturing owners in the West Coast of Peninsular Malaysia. The reason this study was performed in that geographical location is because it is more industrialised with ports facilities and more than 50 percent of the SMEs are located in that area. Johor has the largest concentration of manufacturing firms with 17.50 percent, followed by Selangor (16.70 percent), Perak (9.40 percent), and Penang (8.7 percent) (Saleh & Ndubisi, 2006a).

However, out of 1,000 questionnaires posted to the population, 220 responded and only 182 were useful for further analysis, thus the overall response rate is 18.9 percent. This was deemed an acceptable response rate for top management or their representatives, which represent above 14 percent of total number of questionnaires in mail survey for Asian countries (Jobber & Saunders, 1989; Jobber, 1990).

Table 3.1.
The Percentage of Usable Respondents

No.	Items	Response
1	Total number of distributed questionnaires (A)	1000
2	Total number of returned questionnaire (B)	220
3	Number of non-usable responses (C)	38
4	Number of usable responses (D)	(B – C) = 182
5	Adjusted number of distributed questionnaires, (E)	(A – C) = 962
6	Percentage of overall responses (including A)	(B / A) x 100 = 22%
7	Percentage of usable responses	[(B – C) / (A – C)] x 100 = 18.9 % or 19%.

Furthermore, Lu and Beamish (2001), and Bartholomeow and Smith (2006) stated that in mail surveys of SME businesses, the response rate is normally lower than expected due to the lack of time and availability of resources to respond. The

response rate is usually less than 10 percent. Table 3.1 depicts the calculation of the percentage of usable responses.

3.3 RESEARCH INSTRUMENT AND CONSTRUCTION

The primary data for the study were collected through a survey method by using standardised structured self-administered questionnaires. Questionnaires are essential to and most directly associated with survey research (Babbie, 2004). For the purpose of this study, the questionnaires used were adapted and amended from previously used instruments of studies which had already been validated and found to be reliable and valid, and subsequently used in many studies. The researcher took almost six months to adapt and amend the questionnaires before proceeding for pre-testing in mid-May 2010 (further explanation is in Section 3.5.2). After the pre-testing was done by mid-June 2010 and the researcher was satisfied with the results outcome, the full data collection process was conducted beginning August 2010 until December 2010. The analysis of the data took place in March 2011 and by June 2011 the full thesis write-up started.

The questionnaires were reviewed by warehouse professionals and experts, and faculty members of Universiti Utara Malaysia (UUM) to ensure the format and wordings are easily understood, competent, and relevant. This was done before the questionnaires were validated and pre-tested for further improvements. Further reviews were conducted by the researcher and his supervisors to detect any anomalies that might be found due to limited exposure with respect to the standard use of business and management terms. Initially they were 48 questions but after the

reliability, validation, and pre-testing phases, the questions were reduced to 42. The questionnaire sections which have the questions reduced and deleted were Warehouse Efficiencies (3), Warehousing Operation (1), and Warehousing MIS (2). There were some changes over the sections of the questionnaires that involved the General Warehouse Activities Section which was initially separated from Warehouse Efficiency Section but after the reliability, validation, and pre-testing phases, these sections were combined under the Warehouse Efficiency Section to avoid any redundancies of questions. The same changes occurred with Warehousing MIS (A) and Warehousing MIS (B), which were initially separated but combined after the validation and pre-testing phases for the same reason. Details are explained in the reliability and validity sections in Section 3.5.2 and Section 3.5.3, respectively.

The research questionnaire (refer to Appendix 2) is designed based on the framework variables which are the warehouse efficiency, operation, HCM, layout, and MIS, with a final total of 42 questions. The first part of the research instrument measures the Warehouse Efficiency with 18 questions. The researcher adapted this questionnaire from Jenkins (1990), and Tompkins and Smith (1998). Others are the operations (four questions) and layout (five questions) variables which the researcher adapted from Koster (2008); HCM (five questions) variable was adapted from Murphy and Poist (1992; 1993); and the MIS (10 questions) variable was adapted from Cowan and Mathieu (1994), and Autry *et al.* (2005). The last part of the research instrument sought information about the company profile (three questions) and respondent demographics (eight questions).

Respondents were required to determine the degree to which they agree with the items on a Likert Scale (Likert, 1932) of 1 = “strongly disagree” and 5 = “strongly agree” for the extent of their usage in the warehouse management and organisational performance. The same scale measurements were used for the other dimensions. The statistical test used in measuring the relationship with other variables is a simple linear regression, similarly to the relationship between the independent variables (operation, HCM, and layout), mediating variable (MIS), and dependent variable (warehouse efficiency). However, multiple linear regression (MLR) was used to see the relationship of these variables simultaneously and their effect on organisational performance.

3.4 DATA GATHERING AND ANALYSIS

This section discusses about how the data collection and analysis procedures were implemented. These were done by using descriptive analysis, non-response bias examination, and preliminary examination of the data. Assessments of raw data, normality, and multicollinearity were also performed later.

3.4.1 Data Collection Procedure

The quantitative survey type research design was particularly chosen for this study because it allows for a wide scope of information to be gathered at one time. A postal mail survey for data collection was used in this study, as explained in Section 3.5.2. Each questionnaire is accompanied by a cover letter with an introduction and explanation of the purpose of the survey with an enclosed pre-paid postage self-

addressed envelope for return. To limit response errors arising from the respondents, partly due to their reluctance to answer the questions or other sensitivity issues related to the company policies, certain extra precautions were taken. This is in the form of an assurance of confidentiality and anonymity written in the cover letter enclosed with the questionnaire.

Questionnaires were sent by postal mail to 1000 SME manufacturing firms listed under the 14 types of distribution of SMEs in the Manufacturing Sector, as in Table 2.2, in 2 stages between months of August to December 2010. During the first stage, 500 questionnaires were sent in the month of August with 80 responded, but only 73 were useful. In the second stage, another 500 questionnaires were sent in the month of September 2010, with 140 responded, but only 109 were useful. By months of November and December 2010, the researcher performed follow-up procedures to most of the companies and requested them to reply to the questionnaire by making a personal call or visit to their offices. This was because the response from them was very slow and most of them were unresponsive.

3.4.2 Data Analysis Procedure

After the mail questionnaires were received, codes are assigned by indexing the questionnaires received before the data were entered into the computer. The data are analysed using the SPSS Version 19 computer software. Non-respondent characteristics were studied in order to check if the lack of response is significant. The collected data were summarised, analysed, interpreted, and presented to address the research objectives that prompted the entire research process.

Specifically, Multiple Linear Regressions Test (Section 3.7), and Sobel Test (Section 3.8) were performed. The statistics employed were determined to an extent by the design of the study and also by the types of measurement scale characterising the dependent variables.

The non-response bias, which includes the Levene's Test and ANOVA (Section 4.2) and Correlation Test (Section 3.6), were also investigated. Test on the mediating role of warehouse efficiency was based on a multiple linear regressions, as suggested by Baron and Kenny (1986) and Sobel Test was conducted accordingly in Chapter Four.

3.4.3 Descriptive Analysis

This study used descriptive analysis in order (1) to determine the basic characteristics of respondents and firm respondents, and (2) to check any violation of the assumptions of tested variables. The descriptive analyses of profile corresponding to the responding firms comprised respondents' response, type of industry, firm size (according to the number of employees and sales turnover), and number of years the firm has competed in the industry. Also included was the profile of the individual respondent, in this case the owner of the SME, which consisted of their educational background, age, gender, work experience, and position within their respective firms.

This analysis was used in detecting any violation of the assumptions made by the individual test (Pallant, 2001; Pallant, 2007), such as the detection of outliers, normality and singularity of the data, and missing data. The descriptive analyses often involve statistical tests for mean, standard deviation, range of scores, and

skewness and kurtosis (Pallant, 2007). Frequency, description, and exploration are among the statistical techniques used for the descriptive analysis of this study. All investigations on the descriptive analyses can be found later in this chapter.

3.4.4 Non-Response Bias

Issues on non-response bias and key informant bias are addressed since it can influence the effect of the ability to generalise the findings of the study in order to define the population (Bryman, 2001). It would also indicate problems with the sampling procedure and the reliability of the dataset. For example, this study comprised the compilation of all manufacturing SMEs (based on the SME Business Directory, 2009), with totalled 1000 sample of respondents. Different sectors with different sizes of companies might affect the reliability and generality of the study. Armstrong and Overton (1977) analysed that the sample size should never be generalised without estimating the potential for bias. A test of non-response bias was necessary in order to ensure that these responses could be generalised and are representative for the population of the study (Armstrong & Overton, 1977). The test of non-response bias also enables the researcher to purify and analyse the data for the later stages of empirical analysis.

Non-response bias is determined by examining whether there are significant statistical differences among the sectors (Gilley & Walters, 2002; Gilley, Greer, & Rasheed, 2002), company size (Kalafsky, 2004), and respondents (Armstrong & Overton, 1977). Company size is checked according to (a) when the company is founded; (b) number of employees; (c) total annual sales turnover; and (d) operating

industries; whereas respondents' bias is checked through (a) gender; (b) ethnicity; (c) marital status; (d) age (years); (e) highest education level; (f) years of employment in the company; and (g) years of previous working experience.

To identify potential non-responses bias among respondents, a Levene's test analysis was conducted to check whether there is a significant difference between means for the two sets of scores (gender). Meanwhile, a one-way analysis of variance (ANOVA) would be an appropriate test to be used in comparing the means of more than two groups. ANOVA was also used in identifying significant bias among the sectors and company sizes. Details of the test for non-response bias are explained further in Section 4.2.

3.4.5 Preliminary Examination of Data

The computing of the statistical analysis was done after the empirical data were screened. Examining the raw data revealed critical characteristics of the data. Hair, Black, Babin, Anderson, and Tatham (2006) described the examination of data would enable researchers to attain a basic understanding of the data and relationship between variables. Matters such as coding errors could be appropriately corrected at this stage.

3.4.6 Assessment of Raw Data

Neuman (2003) suggested that several matters should be done to the raw data in order to see what could be said about the hypotheses by using the descriptive

statistics to find obvious coding errors. The minimum and maximum values for each variable must fall within admissible range. Pairwise correlations depict that all relationships must be in the expected directions. Likewise deletion of missing values indicates that the data can be used for analysis.

Keller and Warrack (1997) mentioned that an outlier is an observation that is unusually small or large. Outliers assist researchers in detecting coding errors. Meanwhile, Bagozzi and Baumgartner (1994) said that outliers are not recommended, to be routinely excluded from further analysis. Data collected are analysed by using three approaches as suggested by Abdullah (2010):

(a) Cronbach's alpha (α) is used to test the reliability. Cronbach's alpha indicates how well the items in a set are positively correlated to one another. This is to make sure that the scales are free of random or unstable errors and produce consistent results over time (Cooper & Schindler, 2006).

(b) Descriptive statistics where the researcher used mean, standard deviation, and variance to get an idea on how the respondents reacted to the items in the questionnaire. The major concern of descriptive statistics is to present information in a convenient, usable, and understandable form (Runyon & Audrey, 1980). Descriptive summary, including frequency and descriptive results, was used to screen the data set. Among basic statistics used were mean, median, mode, sum, variance, range, minimum, maximum, skewness, and kurtosis.

(c) Inferential statistics concerns the generalisation of a sample to make estimates and inferences about a wider population (Neuman, 2003). Inferential statistics use probability theory to test hypotheses formally, thus permitting inferences from a sample to a population. This is to test whether the descriptive results are likely to be due to random factors or to real relationships. Linear regression and multiple linear regressions were used to test the predictiveness of factors on the likelihood of the dependent variable (Neuman, 2003).

An inspection of the raw data, with the use of instruments suggested above, showed no obvious coding errors. This was indicated by the minimum and maximum values for each variable which fell within an admissible range for independent variables: **Operation, HCM** and **Layout**; mediating variable: **MIS**; and dependent variable: **Warehouse Efficiency**. Pair-wise correlations showed that all relationships were in the expected direction and list-wise of missing values indicated that the 182 observations were available for further analysis.

3.4.7 Assessment of Normality

Normality refers to the shape of the data distribution for individual metric variables and its correspondence to the normal distribution (Hair *et al.,* 2006). Normality consists of univariate normality and multivariate normality. Univariate normality can be tested by examining the skewness and kurtosis. The skewness and kurtosis should be within the +2 and -2 range when the data are normally distributed (Chou & Bentler, 1995; Pallant, 2001).

According to the central limit theorem, regardless of the shape of a population, the distribution of samples and proportions are normal if sample sizes are large, i.e. more than 30 (Hair *et al.*, 2006). Sekaran and Bougie (2010) suggested the approximation to normality of the observe variables could be investigated by inspecting the data through histograms, stem-an-leaf displays, probit plots, and by computing univariate and multivariate measures of skewness and kurtosis. Histogram, stem-and-leaf and probit plots would indicate the symmetric distribution of variables or sets of variables. In this study, it was found that the distribution of variables or sets of variables were normally distribute, based on the Histogram Graph and P-P Plots (Figure 3.1). The distribution sets of variables were between the dependent variable (Warehouse Efficiency or AWE) and warehousing attribute variables (Operations, HCM, Layout, and MIS).

Tabachnick and Fidell (1996) suggested the value of skewness and kurtosis is equal to zero if the distribution of variable is normal. Chou and Bentler (1995) stressed the absolute values of univariate skewness indices of greater than 3 could be described as extremely skewed. Meanwhile, a threshold value of kurtosis greater than 10 could be considered problematic, while a value greater than 20 could be considered as having serious problems (Hoyle, 1995; Kline, 1998).

Base on the result which used the test of Kolmogorov-Smirnov statistic for normality, the distribution of variables of this study falls within the normal range +2 to -2, and the significant value is 0.000 for each group.

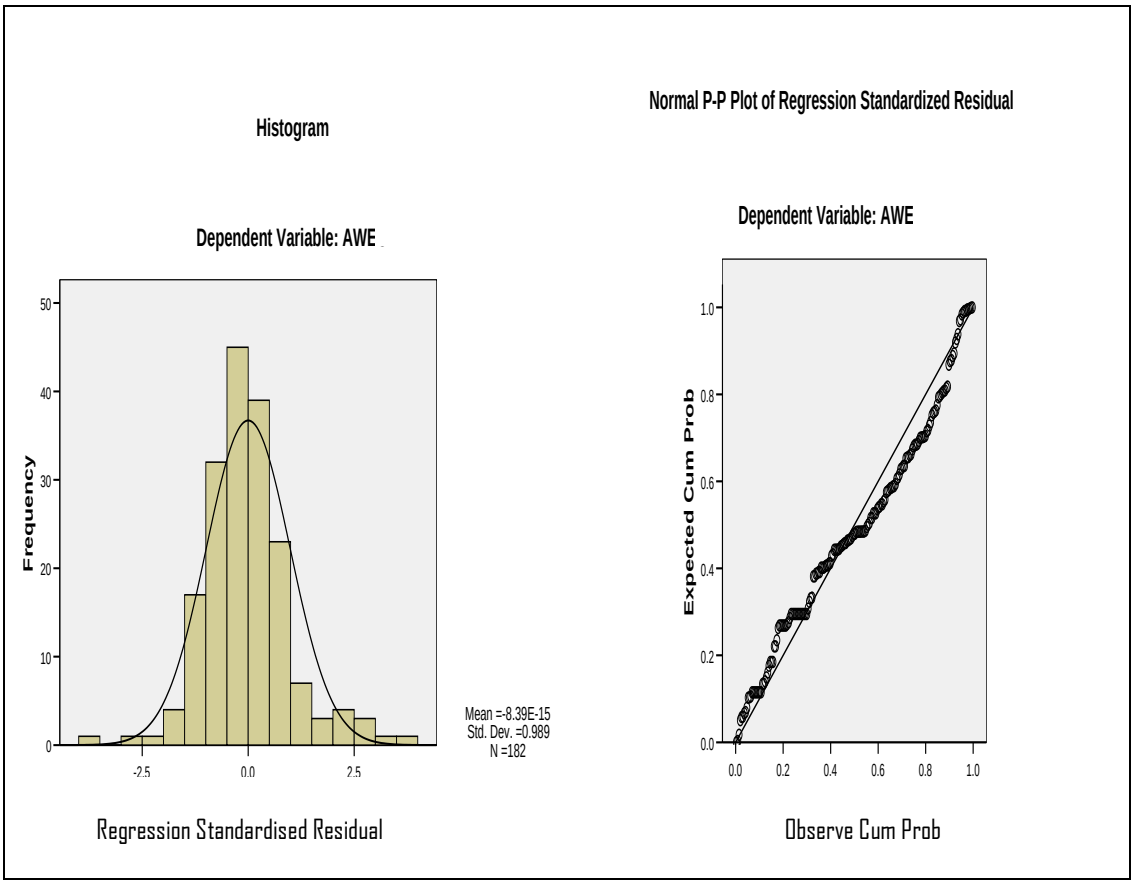

Figure 3.1. Histogram graph and normal P-P Plot between dependent variable warehouse efficiency (AWE) and warehousing variables.

3.4.8 Multicollinearity

Multicollinearity refers to the situation in which two or more independent variables in a multiple regression model are highly correlated (Gujarati, 1995). It would be a perfect multicollinearity if the correlation between two independent variables is equal to 1 or -1. There are several signals or indicators which indicate that there is multicollinearity problem: (a) large changes in the estimated regression coefficient when a predictor variable is added or deleted; and (b) insignificant regression coefficients for affected variables in the model. In addition, the consequences of the multicollinearity problem could be in form of less precise estimation. In this study,

the Pearson correlation matrix was used to detect it and the results are as in Appendix 5. All the results are between or equal to 1 or -1.

3.5 RELIABILITY AND VALIDITY

In exploring and describing the relationship between the warehousing, operations, HCM, layout, MIS, and warehousing efficiency, it was deemed necessary to gauge the extent of reliability and validity for each of the instruments used in the study. Thus all the necessary tests were carried out.

3.5.1 Reliability

Reliability which is occasionally referred to as internal consistency also refers to the extent to which the measurement instrument precisely and repeatedly measures the intended construct (Churchill, 1979; Peter, 1979). In this study, certain tests were carried out in line with the appropriate statistical analysis. The measure is considered reliable if the results of a measure could be repeated. According to Cronbach (1951), α coefficient is one of the test reliability as that measures the proportion of the scale's total variance that is attributable to a common source, presumably the true score of the latent variable underlying the item. Peter (1979) mentioned that the reliability is also the extent that a measure is free from error. Reliability measures are used for all scales employ and are used widely in the literature to evaluate the reliability of strategy measures (Ventakaraman & Grant, 1986; Ventakaraman, 1989).

Ideally the Cronbach α coefficient of a scale should be a least 0.7 (Hair, Anderson, & Tatham, 1995). However, it has been noted that Cronbach α values are quite sensitive and it is quite normal to find quite low Cronbach α values for short scales. Nunnally's (1978) range for Cronbach α is 0.70, while Briggs and Cheek (1986) recommended an optimal range for inter-item correlation of 0.20 to 0.40. Cortina (1993) held that the measure is item specific variance when the score is greater than 0.70. However, Sekaran and Bougie (2010) maintain that α coefficient of more than 0.60 is still acceptable. Reliability of the scales of the instruments used to operationalise the variables was tested by using the SPSS Version 19 software. However, in this study the researcher maintains the scale of at least 0.7 as suggested by Hair *et al.* (1995).

3.5.2 Pre-Test and Post Reliability of Instruments

Babbie (2004), and Sekaran and Bougie (2010) viewed a pre-test questionnaire as useful because it could ensure that there are no problems with wording or the measurements, rectify any inadequacies in time, and ultimately reduce biases. It also ensures that reliability and validity of the scales used are acceptable before data collection is carried out. Cooper and Schindler (2006) also supported this idea and pointed out that pre-testing is conducted to detect weakness in design and instrumentation, as well as provide proxy data for selection of a probability sample.

The pre-testing exercise took place after discussing the instrument with the supervisory committee and experts in the area of research methodology. Based on their evaluations and suggestions, the pre-testing was conducted. So as to ensure that

the correct number of respondents was selected for the pre-testing, it was based on the suggestion by Narrins (1999) and Roscoe (1975).

According to Narrins (1999), the respondents participating in the pre-testing should be a minimum of 30 respondents and should be excluded from the final sample. Roscoe's (1975) rule of thumb determined that the sample size for the research project should more than 30 but less than 500, only then it is considered appropriate for most research. Therefore in this research, the selection of pre-test respondents is excluded from the final sample.

The pre-testing exercise was conducted in mid-May 2010 with 50 SME manufacturing firms listed in the SMI Business Directory (2009), but only 36 of the pre-tested sampling were returned, with only 30 questionnaires were found useful. Generally, the users recommended that the questionnaire was precise and easy to understand. It takes approximately 10 to 15 minutes for each respondent (owner of the SME manufacturing firms) to complete the questionnaire. Based on the feedback received from the respondents, the items on layout of the questionnaires were revised accordingly before the final distribution.

Results of the final pre-testing of all the variables are above 0.70 to 0.90, as shown in Table 3.2, thus proving acceptance of the reliability coefficient test. Based on Nunnally (1978), and Hair *et al.* (1995), the items of each construct in the questionnaire were considered reliable or have an internal consistency and the research could proceed to the post-test analyses.

Based on the final results of post-testing exercises in Table 3.2 and Appendix 3, all the items for each construct posted a Cronbach α value of above 0.794 to 0.945.This means that the rules tests in post-test modes indicated that the instruments are highly reliable and the research could proceed to the next stage, which is the validity test.

Table 3.2.
Cronbach α Coefficient of Reliability (Pre- and Post-Test Analysis)

Constructs	No. of Items Pre-test	No. of Items Post-test	Reliability Index Pre-test (n: 30)	Reliability Index Post-test (n: 182)
Warehouse Efficiency	21	18	0.814	0.945
Warehouse Operations	5	4	0.757	0.921
Warehouse HCM	5	5	0.713	0.794
Warehouse Layout	5	5	0.900	0.926
Warehouse MIS	12	10	0.835	0.859

3.5.3 Validity

Nunnally (1978) defined validity as the degree to which the measurement scale measures what it is intended to measure. Peter (1981) mentioned that validity refers to the extent to which a measurement tool actually measures the construct that is used to measure. Validity suggests truthfulness and refers to the match between a construct on the way a researcher conceptualises the definition and a measure. It is defined as the extent to which any measuring instrument measures what it is intended to measure (Salkind, 2009; Pallant, 2001; Hair *et al.*, 2006; Sekaran & Bougie, 2010). The instrument would include a point attitude scale measuring awareness, attitude, and opinion of the sampling unit. It refers to how well an ideal reality fits with actual reality (Neuman, 2003). Strong validity scores would ensure that the items used in the questionnaire correctly measures what they are intended to measure (Hair *et al.*, 2006). Therefore, internal consistency in terms of reliability, convergent

validity, discriminant validity, and nomological validity are the minimal properties required for reviewing measurement tools (Bagozzi & Philips, 1982; Ventakaraman & Grant, 1986). There are three aspects of validity which are suitable and applicable in this study, which are face validity, content validity, and construct validity.

Face validity refers to the judgment by the scientific community that the indicator really measures the construct (Neuman, 2003) or the measure apparently reflects the content of the concept in question (Bryman & Bell, 2003). In this study, face validity was established by asking those with experience or expertise in a field whether the measure seems to be getting at the concept that is the focus of attention. Therefore the measures were amended based on the comments and suggestions from several academics and practitioners after pre-testing was performed.

Content validity is a special type of face validity (Neuman, 2003). This validity type has to do with the degree to which the scale items represent the domain of the concept under study (Neuman, 2003). Furthermore content validity is a function of how well the dimension and elements of a concept have been delineated (Sekaran & Bougie, 2010). Measures should represent all ideas or are in the conceptual space (Neuman, 2003). Content validity is the only type of validity that the evidence is subjective and logical rather than statistical (Bryman, 1988).

Furthermore, content validity is established through literature review and pre-testing of the questionnaire. The items and questions were selected based on substantive theory and pre-testing results showed that the measurement scale demonstrated reasonable content validity. Abdullah (2010) cited Malhotra (2002) in suggesting a

few methods to provide evidence of validity for a multi-item scale: (a) agreement among three experts regarding all items in the scale; (b) high correlations between the scales; (c) using theory to explain; and (d) high level of reliability.

In this study, the Bartlett test of sphericity and the Kaiser Meyer Olin (KMO) measure of sampling adequacy (SMA) were used to investigate the validity of the constructs. Moreover, they were used to quantify the degree of inter-correlations among variables and the appropriateness of factor analysis, which illustrates the index ranges from 0 to 1 (Hair, Anderson, Tatham, & Black, 1998). The KMO measurement could be interpreted according to five conditions, which was suggested that at 0.80 or greater, it is to be considered as "meritorious"; 0.70 or above is "middling"; 0.60 and above is "mediocre"; and 0.50 and below is "unacceptable" and thus it should be excluded from the analysis (Hair *et al.*, 1998).

The statistical scores of this test for all constructs are shown in Table 3.3 and Appendix 4. Therefore, it was concluded that all the questions used in the questionnaire (Warehouse Efficiency, Warehousing Operation, Warehousing HCM, Warehousing Layout, and Warehousing MIS) were mostly valid as the results were more than 0.70, which falls into the "middling" and "meritorious" category scales. Therefore, they are deemed appropriate and valid for further analysis.

In order to prove further the existence of validity, the Bartlett's test of Sphericity was used to examine the overall significance of all correlations among variables within the correlation matrix (refer to Table 3.3).

Table 3.3.
Investigating Validity: Results of KMO Measure of Sampling Adequacy and Bartlett's Test of Sphericity

Constructs	Kaiser Meyer-Olin Measure (KMO) of Sampling Adequacy	Bartlett's Test of Sphericity
Warehouse Efficiency	0.887	3950.906
Warehousing Operation	0.756	609.759
Warehousing HCM	0.793	652.894
Warehousing Layout	0.845	1196.652
Warehousing MIS	0.790	1223.955

The scores are in the range of above 100 to more than 1000 with all the measurements showing high significant relationships ($p \leq 0.01$) among the variables of each construct (Pallant, 2007). Therefore it was concluded that the correlation is sufficiently large to permit factor analysis and represent the validity of constructs.

3.6 CORRELATION ANALYSIS

Correlation analysis serves as an early stage of investigation of the accuracy of the hypotheses model. A correlation analysis is used to evaluate the strength and direction of the linear relationships between two variables (Pallant, 2007). The strength of the relationship could be checked through Pearson's correlation coefficients on a range of -1 to +1. Meanwhile, the direction of a relationship can be identified based on (1) a correlation of zero, which indicates no relationship between two variables; (2) a positive value, which indicates a positive relationship; and (3) a negative value, which represents a negative relationship. Once the direction of the relationship is established it is necessary to determine the significance of that relationship. This is indicated by the level of confidence that the researcher should

have in obtaining the results, which should not be greater than a 10 percent level of significance (Pallant, 2007).

3.7 MULTIPLE REGRESSION ANALYSIS

This study adopted standard linear and multiple regression analysis to test hypotheses 1(a), 1(b), 2(a), 2(b), 3(a), and 3(b), as shown in Appendix 5, while the Sobel test analysis was employed to test hypotheses 1(c), 2(c), and 3(c), as shown in Appendix 6. This different approach was used due to the different way of linking between the variables. In standard multiple regression analysis, all independent (or predictor) variables are entered into the equation at once in order to examine the relationship between the whole set of independent variables and the dependent variables (Coakes & Steed, 2007; Pallant, 2007). However, hypotheses 1(a), 1(b), 2(a), 2(b), 3(a), and 3(b) examine the direct association between the independent and dependent variables.

Multiple linear regression analysis is a common method used in business and management research in order to analyse the relationship between a single dependent (criterion) variable and several independent (predictor) variables (Hair *et al*., 1998; Meyers, Garnst, & Guarino, 2006). It is a dependence technique which requires the decisions of which variables should be selected to be independent variables (predictor variables) and the dependent variables (variable being predicted). This regression analysis is based on correlation analysis but it permits an examination of a more complicated interrelationship among a set of variables in a more complex real-life research context. Due to this, the multiple regression analysis could serve for

greater explanation on how much of the variance in the dependent variable could be explained by the independent variables. Meanwhile at the same time, the test could serve as an indication of the relative contribution of each independent as suggested by Pallant (2007).

Furthermore, Pallant (2007) recommended that this analysis allows the researcher to determine the statistical significance of the results regarding the model itself as well as the individual independent variables. To summarise, this analysis has several significant uses, such as (1) to determine how well a set of variables is able to predict the particular outcome selected by the researcher; (2) to address which variable in a set of variables is the best predictor of an outcome, and; (3) to resolve whether a particular predictor variable is still able to predict an outcome when the effects of another variable are controllable or act as a mediator (Hair *et al.,* 1998; Hair *et al.,* 2006; Meyers *et al.,* 2006; Brace, Kemp, & Snelgar, 2006; Pallant, 2007).

3.8 SOBEL TEST

The researcher could determine the testing of mediation by using Sobel Test, as proposed by Baron and Kenny (1986), in order to understand the mechanism through the initial variable which affects the outcome. Mediation analysis is a key part of what has been called process analysis (Judd & Kenny, 1981; Baron & Kenny, 1986). Therefore in this study, hypotheses 1(c), 2(c), and 3(c) were attempts to identify the variables that are not directly measured by including the mediating factor that might impact on the link with the dependent variable. Judd and Kenny (1981), and Baron

and Kenny (1986) discussed four steps in establishing the mediation (Figure 3.2and Figure 3.3). The steps are:

Step 1 (Figures 3.2 and 3.3): Show the initial variable being correlated with the outcome. Use Y as the criterion variable in a regression equation and X as a predictor (estimate and test path c). This step establishes that there is an effect that may be mediated.

Step 2 (Figures 3.2 and 3.3): Show that the initial variable is correlated with the mediator. Use M as the criterion variable in the regression equation and X as a predictor (estimate and test path a). This step essentially involves treating the mediator as if it were an outcome variable.

Step 3 (Figures 3.2 and 3.3): Show that the mediator affects the outcome variable. Use Y as the criterion variable in a regression equation and X and M as predictors (estimate and test b). It is not sufficient just to correlate the mediator with the outcome; the mediator and the outcome may be correlated because they are both caused by the initial variable X. Thus, the initial variable must be controlled in establishing the effect of the mediator on the outcome.

Step 4 (Figures 3.2 and 3.3): To establish that M completely mediates the X-Y relationship, the effect of X on Y controlling for M (path c') should be zero. The effects in both Steps 3 and Steps 4 are estimated in the same equation.

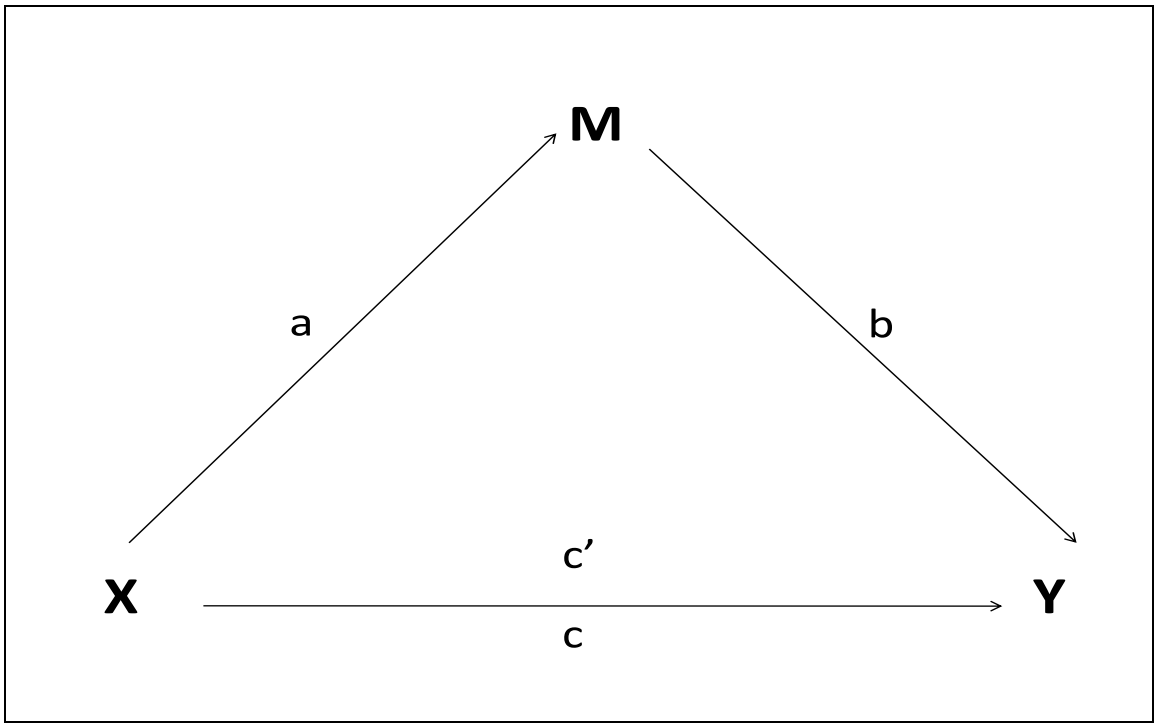

Figure 3.2. The process of mediation.
Source: Adapted from Kenny (2012)

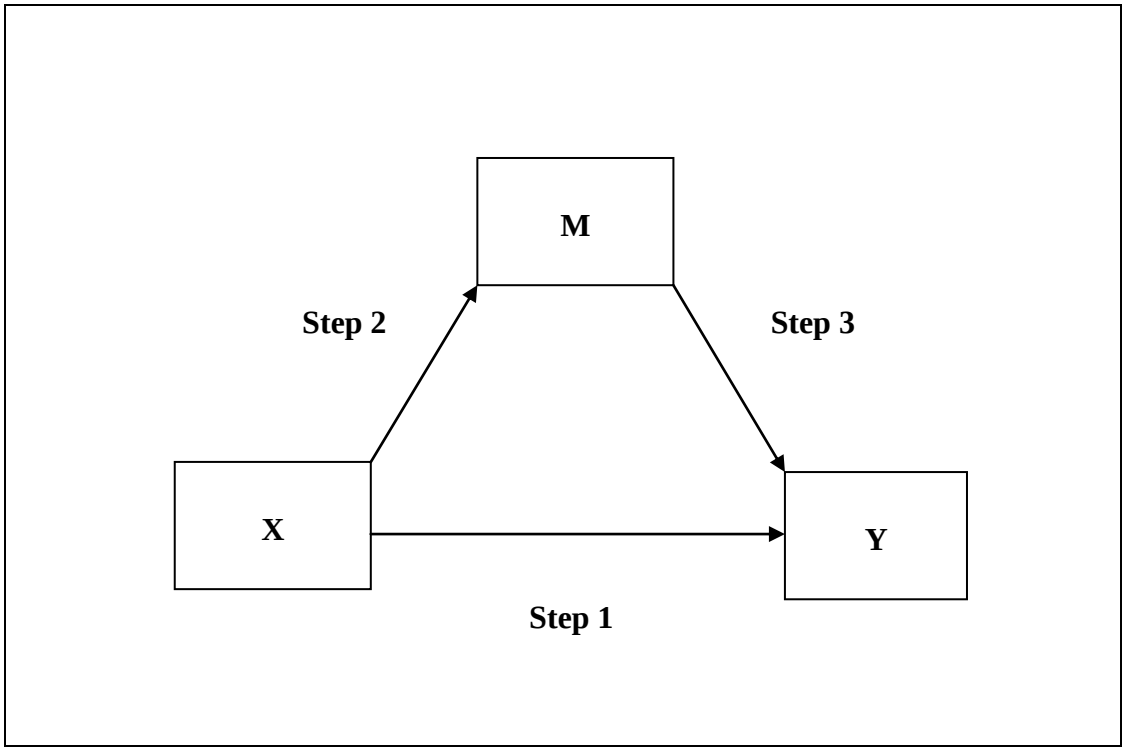

Figure 3.3. The steps involved in the mediation process.
Source: Adapted from Kenny (2012)

Kenny (2012) concluded that if all four of these steps are met, then the data are consistent with the hypothesis that variable M *completely* mediates the X-Y relationship. However, if the first three steps are met but Step 4 is not, then *partial* mediation is indicated. Meeting these steps does not, however, conclusively establish that mediation has occurred because there are other (perhaps less plausible) models that are consistent with the data (Kenny, 2012).

In Sobel Test, Kenny (2012) explained that it is common and highly recommended (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002) to perform a single test of *ab*. The test was first proposed by Sobel (1982). It requires the standard error of *a* or s_a (which equals a/t_a where t_a is the *t* test of coefficient a) and the standard error of *b* or s_b. The Sobel test provides that the standard error of *ab* could be shown to equal approximately the square root of $b^2s_a^2 + a^2s_b^2$. However, the derivation of the Sobel standard error presumes that the estimates of paths *a* and *b* are independent, something that is true when the tests are from multiple regression but not true when other tests are used (e.g., logistic regression, structural equation modelling, and multilevel modelling). In such cases, the researcher ideally provides evidence for approximate independence. Additionally, the Sobel test could not be conducted using the standardised or unstandardised coefficients (Kenny, 2012). In this research, the researcher used Preacher and Leonardelli (2012) webpage to calculate these tests.

3.9 CHAPTER SUMMARY

In this chapter, several aspects of research methodologies were covered, such as research design, population and sampling, instrumentation, reliability and validity of

survey instrument, pre-testing survey instrument, and data collection procedures and analysis. It was also noted that the proposed framework is a new one, where not many studies have been done to examine the relationships and effect of all variables simultaneously in the same framework that are related to warehouse efficiency.

The study involved three independent variables (operation, HCM, and layout), one mediating variable (MIS), and one dependent variable (warehouse efficiency). A total of 1,000 questionnaires were sent through postal mail to SME manufacturing owners throughout Malaysia (as specified by Krejcie & Morgan, 1970) but only 220 responded with 182 found to be useful, equalling a response rate of approximately 19 percent. The rate is deemed to be acceptable for top management or their representative, since it is more than 14 percent that responded (Jobber & Saunders, 1989; Jobber, 1990).

The data were analysed by using the SPSS Version 19 and the non-response bias (which include the Levene's test and ANOVA), Pearson Correlation, and multiple regressions were used for the testing of the data. Test on mediating role of warehouse efficiency was based on a multiple regression and Sobel Test, as suggested by Baron and Kenny (1986).

CHAPTER FOUR

FINDINGS AND DISCUSSIONS

4.0 OVERVIEW

This chapter presents and describes the findings, analysis, and discussion of the results. It covers the issues related to the descriptive analysis and non-response bias. In addition to that, this chapter also covers pre- and post-testing of the survey through the analysis of the validity and reliability of scales, correlations, regressions, and Sobel test analysis. Finally, this chapter discusses the findings of the hypotheses and data analysis support.

4.1 PROFILE OF RESPONDING FIRMS IN DESCRIPTIVE ANALYSIS

The early part of the survey questionnaire covered the demographic background of the respondents. It consisted of respondents' characteristics, type of industry, firm size (according to number of full time employees and sales turnover), and number of years the company has competed in the industry, and the results of which are tabulated in Table 4.1. Meanwhile, Table 4.2 refers to the demographic profiles of the owners of the SMEs.

4.1.1 Respondents' Characteristics

Table 4.1 shows that majority of the respondents (75.80 percent or 138 respondents) have established their business since year 2001, as compared to 24.20 percent (44

respondents) having established prior to 2000. This phenomenon is coincidental with the promotion and incentives given by the Malaysian government especially to SMEs which manufacture raw materials and produce products locally (MITI, 2006). Aligned with the nature of SME policy, most of them were initially set up to support local suppliers to supply materials to the large, established, or multi-national companies that manufacture products locally for export purposes.

Respondents involved in the survey can be classified into three major categories, which are Textiles and Apparel (23.10 percent), followed by Food and Beverages (20.30 percent), and Metal and Metal Products (9.90 percent). These are followed by Paper, Printing, and Publication (7.10 percent), Furniture (7.10 percent), Rubber and Plastic Products (6.60 percent), Wood and Wood Products (6.00 percent), Non-Metallic Mineral Products (5.50 percent), Machinery and Equipment (5.50 percent), Electrical and Electronics (3.30 percent), Chemical and Chemical Products (3.30 percent), Transport Equipment (1.60 percent), and General manufacturing (0.50 percent).

From the survey of the SMEs involved, it was identified that there were 97.30 percent (177 respondents) with less than 50 employees in their company as compared to only 2.70 percent (5 respondents) accommodating between 51 to 150 employees in the company. The survey also revealed that 97.30 percent (177 respondents) have between RM250,000 and RM10 million annual sales turnover, while 2.70 percent (5 respondents) have between RM10 million and RM25 million.

Table 4.1.
Summary of Respondent Characteristics

Items		**Frequency**	**Percentage (%)**
Length of company establishment	Year 2001 and onwards	138	75.80
	Year 2000 and before	44	24.20
Number of employees	≤ 50	177	97.30
	51 – 150	5	2.70
Annual sales turnover (RM million)	0.25 ≤ 10	177	97.30
	10– 25	5	2.70
Type of industry	Textile & Apparel	42	23.10
	Food & Beverages	37	20.30
	Metal & Metal Products	18	9.90
	Paper, Printing, & Publication	13	7.10
	Furniture	13	7.10
	Rubber & Plastics Products	12	6.60
	Wood & Wood Products	11	6.00
	Non-Metallic Mineral Products	10	5.50
	Machinery & Equipment	10	5.50
	Electrical & Electronics	6	3.30
	Chemical and Chemical Products	6	3.30
	Transport Equipment	3	1.60
	*General Manufacturing	1	0.50
	Others	0	0.00

*Include jewellery; leather products; tobacco; medical precision and optical instruments; and recycled and petroleum products.

4.1.2 Profile of SME Owners

Table 4.2 shows the results of the demographic profiles of the respondents. It shows that out of 182 owners, 83 percent (151 owners) were male while 17 percent (31 owners) were female. It could be said that the males are still dominating the SME manufacturing firm management as well as the warehouse management operations. It also shows that the majority of owners are Chinese with 77.50 percent (141 owners); Malays with 21.40 percent (39 owners); Indian and Others with 0.50 percent (1 owner). A total of 76.40 percent (139 owners) of respondents are married; 23.10

percent (42 owners) are single; and 0.50 percent or 1 owner is a widow. The large percentage of married owners reflects the owner's personal maturity level.

The table further revealed that the highest owners in terms of age are those between 34 to 41 years old, which constitute 72.00 percent (131 owners); between 26 to 33 years old with 19.80 percent (36 owners); between 42 to 49 years with 8.20 percent (15 owners); and no respondents are available for those less than 25 years as well as above 50 years old. This reflects that the establishment of the SME manufacturing companies are being spearheaded by mainly those aged between 34 to 41 years. The years of working experience before embarking into their own business or performing better in management level especially in SME manufacturing and warehousing management was one of the factors that contribute to this phenomenon. This also coincides with their maturity level. In relation to their education background, the highest education level of the owners are Bachelor Degree or equivalent with 47.80 percent (87 owners); Diploma or equivalent with 39 percent (71 owners); SRP/SPM/STPM with 11.50 percent (21 owners); and Master Degree or higher with 1.60 percent (3 owners).

Also based on Table 4.2, there are 71.40 percent (130 owners) of respondents that have 6 to 10 years work experience in the respective firms; 19.20 percent (35 owners) have 1 to 5 years; 8.20 percent (15 owners) for 11 to 15 years; and 0.50 percent each (1 owner each) for the categories of less than a year and 16 to 20 years. From this observation, it could be said that the SME manufacturing firms and warehousing are controlled and managed by the majority of owners who have more than six years but less than 10 years of work experiences in their firms only.

Table 4.2.
Summary of Profile of SME Owners

Items		**Frequency**	**Percentage (%)**
Genders	Male	151	83.00
	Female	31	17.00
Ethnicities	Chinese	141	77.50
	Malay	39	21.40
	Indians	1	0.50
	Others	1	0.50
Marital status	Married	139	76.40
	Single	42	23.10
	Widow	1	0.50
	Widower	0	0.00
Ages (Years)	18 – 25	0	0.00
	26 – 33	36	19.80
	34 – 41	131	72.00
	42 – 49	15	8.20
	50 and above	0	0.00
Educational levels	Primary school certificate	0	0.00
	SRP/SPM/STPM	21	11.60
	Diploma or equivalent	71	39.00
	Bachelor Degree or equivalent	87	47.80
	Master Degree or higher	3	1.60
Number of years working in this company	≤ 1	1	0.50
	1 – 5	35	19.20
	6 – 10	130	71.40
	11 – 15	15	8.20
	16 – 20	1	0.50
Number of years of previous working experiences	≤ 1	0	0.00
	1 – 5	3	1.60
	6 – 10	24	13.20
	11 – 15	101	55.50
	16 – 20	50	27.50
	≥ 20	4	2.20

Regarding previous work experience, 55.50 percent (101 owners) have previous work experiences elsewhere of between 11 to 15 years; 16 to 20 years is made up of 27.50 percent (50 owners) of respondents; 6 to 10 years is represented by 13.2 percent (24 owners); above 20 years is 2.20 percent (4 owners); and 1 to 5 years is 1.60 percent (3 owners). This would mean that the firms have very experienced owners who have more than 11 years of work experiences in previous firms beside

their current firms. It can be surmised that a long history of work experience may potentially contribute highly to the decision of establishing the current firm.

4.2 NON-RESPONSE BIAS

It was found that the distribution scores for company size in the distribution of total sales turnover and number of employees in the company did not violate the assumption of normality. Levene's test and ANOVA were performed to check whether there is a significant demographic difference of the data of the respondents. This was to ensure that there is reasonable consistency of response pattern.

Levene's test is used to test homogeneity of variance. In this case, the first 73 responses received from the first stage group of respondents were classified as the "early group". The second stage of 109 respondents was classified as the "late group". Thus, this makes a 40-60 percent of the grouping respectively as being mentioned in Section 3.5.2. If the significance level is greater than 0.05 ($p > 0.05$), then it could be assumed that the population variances for each group are approximately equal, as shown in Table 4.3.

The results showed that there is not enough evidence to prove there is significant difference between early and late respondents. This is related to the company size that comprises how long the company is established, total number of full time employees, and annual sales turnover, and respondent bias based on gender in the company (which reflect no significance in the demographic differences).

Table 4.3.
Levene's Test on Company Size and Gender for Non-Response Bias

Items (Questionnaire Constructs)	Early Group (40%) (n=73)	Late Group (60%) (n=109)	Levene's Test for Equality of Variances	
	Mean	Mean	F Statistics	Significance Level
B1. When the company was founded (Year)?	1.78	1.74	1.386	0.241
B2. How many employees for the company as a whole?	1.07	0.10	1.939	0.078
B3. What is the annual sales turnover?	0.274	0.310	1.950	0.081
C1. Gender (Male or Female)?	1.21	1.21	1.155	0.073

In ANOVA, a test of homogeneity of variances with significance level of $p < 0.05$ is performed. The results showed that the company size and the respondent characteristics are not significant ($p > 0.05$), except for C4 which is significant (Table 4.4). This shows that there is not enough evidence to prove that there are significant differences in the company size. There is also no significant respondent bias over the marital status, ethnicity, education levels, total number of years work experience in the company, and total number of years work experience in previous companies. The study found that only the age factor of C4 showed the response bias.

Table 4.4.
ANOVA Homogeneity of Variances Test in Non-Response Bias

Items	*p-value*
B4. In which industrial do you operate?	0.988
C3. Marital Status	0.510
C5. Highest Education Level	0.510
C6. How many years have you been in this company?	0.469
C7. How many years of previous working experience?	0.145
C2. Ethnicity	0.052
C4. Age (Years)	0.006

4.3 PEARSON CORRELATION

The overall summary analyses of the Pearson correlations (Table 4.5) were conducted to evaluate and determine the strength and direction of the linear relationships between two variables (Pallant, 2007). Normally, two variables show strong relationships when the correlation value is more than 0.7 or less than -0.7. For this research regarding the correlation coefficient, anything that is below 0.05 or equal to 0.05 is considered significant or positive. Anything that is above that is considered not significant or having no relationship.

Table 4.5.
Summary of Pearson Correlation Results

	ITEMS	AWE	AWO	AHCM	AL	AMIS
AWE	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	182				
AWO	Pearson Correlation	.772(**)	1			
	Sig. (2-tailed)	.000				
	N	182	182			
AHCM	Pearson Correlation	.744(**)	.570(**)	1		
	Sig. (2-tailed)	.000	.000			
	N	182	182	182		
AL	Pearson Correlation	.240(**)	.071	.199(**)	1	
	Sig. (2-tailed)	.001	.339	.007		
	N	182	182	182	182	
AMIS	Pearson Correlation	.518(**)	.375(**)	.405(**)	.633(**)	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	182	182	182	182	182

** Correlation is significant at the 0.01 level (2-tailed)

It was revealed that Warehouse Efficiency (AWE) was considered highly significant with all the constructs in Warehousing Operations (AWO) and Warehousing Human Capital Management (AHCM), where the Pearson coefficient values were above 0.7. Meanwhile AWE in relation to Warehousing MIS (AMIS) was considered normal at

approximately 0.5, while Warehousing Layout (AL) was considered having a low relation with only 0.24. In the correlation significance test based on *p-value* or significance, the study found that AWE has positive linear relationships with AWO (0.00), AHCM (0.00), AL (0.001), and AMIS (0.00).

The study also found that in the AWO relationships with other variables (except for AL), all the coefficient values were greater than 0.3 thus reflecting the importance of activities being carried out in increasing warehouse efficiency. Coefficient value of AWO with AL (0.071) reflects the minimum role in maintaining warehouse efficiency. In the correlation significance test based on *p-value*, the study found AWO with other variables (except AL) were significant, thus reflecting all the AWO have positive linear relationships with AWE (0.00), AHCM (0.00), and AMIS (0.00). However, the relationship between AWO and AL (0.339) was not significant, thus reflecting that AWO has very low effect on a linear relationship with AL.

Meanwhile for AHCM relationships with other variables, the study found variables AWE and AWO are above 0.5 of its correlation reflecting that there are major elements being implemented to maintain the warehouse efficiency. However, the correlation coefficient values for variables AL (0.199) and AMIS (0.405) were less than 0.5, which reflects the fewer roles of elements in maintaining warehouse efficiency. In the correlation significance test based on *p-value*, the study found all the variables to be significant, thus revealing that AHCM has positive linear relationships with AWE (0.00), AWO (0.00), AL (0.00), and AMIS (0.00).

With regard the AL relationship with other variables, the study found that the coefficient values for all variables (except AMIS) were below 0.5, thus showing that the layout roles are not actively prominent in maintaining warehousing efficiency. In the correlation significance based on *p-value* test or 2-tailed significance test, it was observed that AL with AWE, AHCM, and AMIS were significant. This reflects that AL has positive linear relationships with AWE (0.00), AHCM (0.00), and AMIS (0.00), but has no significant relationship with AWO.

The study found that in AMIS relationships with other variables (AWE, AWO, AHCM, and AL) have correlation coefficient values of above 0.3, meaning that AMIS activities are important in maintaining warehouse efficiency. In the correlation significance test based on the *p-value*, it was revealed that the relationships between AMIS and the other variables are significant. This reflects AMIS having positive linear relationships with AWE (0.00), AWO (0.00), AHCM (0.00), and AL (0.00).

Drawing on a conclusion based on Table 4.5 in terms of multicollinearity, the relationship between AWO and AHCM is average (0.570). This may suggest that AHCM does not really affect the warehouse operations management. On the relationship between AWO and AL, again it is an average relationship (0.375), which suggests the possibility of a mild relationship.

Regarding the AMIS and AHCM relationship, it is still considered as a mild relationship (0.405) and this suggests that there is a mild affect among these two variables. Meanwhile, AMIS and AL (0.633) show a better relationship which reflects that if MIS is being fully optimised and utilised with regard to the computer

hardware and software, it may help the arrangement and movement of materials within the specific warehouse. Thus, this might increase the overall warehouse efficiency.

However, the relationships between AHCM and AL are very weak (0.199). This shows that HCM perhaps does not play an important role in determining the warehouse layout. This may suggest that HCM should inculcate themselves with advanced MIS in their daily warehouse operations.

4.4 MULTIPLE LINEAR REGRESSIONS

Upon the completion of correlation analysis, the multiple regressions analysis using the SPSS Version 19 were performed to find any influence between the independent variables (Warehousing Operations, Warehousing HMC, and Warehousing Layout), mediating variable (Warehousing MIS), and the dependent variable (Warehouse Efficiency). The steps taken in analysing the relationships of the variables were based on Multiple Regression Analysis (Section 3.7), and the recommendations of Baron and Kenny (1986), as described in the Sobel Test (Section 3.8). The results of the analysis are explained as in the following paragraphs.

The study referred to the applications of multiple linear regressions formula by Bowerman, O'Connell, and Koehler (2005) as:

$$y = \mu_{y/x1,x2,\ldots,xk} + \varepsilon = \beta_0 + \beta_1 x_1 + \ldots + \beta_2 x_2 + \ldots + B_k x_k + \varepsilon \quad (1)$$

where:

1. $y = \mu_{y/x1,x2,\ldots,xk} + \varepsilon = \beta_0 + \beta_1 x_1 + \ldots + \beta_2 x_2$ is the mean value of the dependent variable *y* when the values of the independent variables are $x_1, x_{2,\ldots,} x_k$,
2. $\beta_0 + \beta_1 x_1 + \ldots + \beta_2 x_2 + \ldots$ B_k are (unknown) regression parameters relating the mean value of y to $x_1, x_{2,\ldots,} x_k$, and
3. ε is an error term that describes the effects on *y* of all factors other than the values of the independent variables $x_1, x_{2,\ldots,} x_k$.

Based on Equation 1, the model used in this study is as follows:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \boldsymbol{\varepsilon} \quad (2)$$

where:

Y = Warehouse Efficiency or AWE

x_1 = Warehousing Operation or AWO

x_2 = Warehousing HCM or AHCM

x_3 = Warehousing Layout or AL

x_4 = Warehousing MIS or AMIS

β_0 = Constant

$\beta_{1,\ldots,}\beta_4$ = Coefficient for each $x_{1,\ldots,} x_4 = 1,\ldots,4$

$\boldsymbol{\varepsilon}$ = Error

Calculations were made based on the data tested by using the SPSS version 19 on the summary of the variables (Appendix 5) and Sobel Test (Appendix 6).

4.4.1 Results and Analysis of the Variables

Based from the regression analysis, the results of the study are as follows:

$$Y = \underset{(2.677)^*}{0.420\beta_0} + \underset{(10.286)^*}{0.402x_1} + \underset{(8.569)^*}{0.387x_2} + \underset{(0.492)^*}{0.010x_3} + \underset{(2.999)^*}{0.122x_4} \quad (3)$$

where:

$R^2 = 0.758$

$F = 138.847$

( ) = *t* value

* = significant at 0.05 level ($\alpha = 0.05$)

Based on the results of the regression analysis, the *F* value showed that the model is significant at 0.001, with the R^2 indicating that more than 75% of the variances in AWE can be explained by other variables (AWO, AHCM, AL, and AMIS) in maintaining warehouse efficiency.

Based on this model, for every level increase in this set-up *of* $x_0 + x_1 + x_2 + x_3 + x_4$, it will increase the *Y* by the value of the coefficient respectively.

Based on the *t* value, the study found that only one variable is non-significant (that is AL), where the significance level is $\alpha = 0.05$.

4.5 TESTING OF HYPOTHESES

The research questions as describe in Section 1.5 of Chapter One, and hypotheses H1(a), H1(b), H1(c), H2(a), H2(b), H2(c), H3(a), H3(a), H3(b), and H3(c) in Section 3.4 of Chapter Three, were tested using the multiple linear regressions and Sobel tests. The 0.05 level of significance was used to test whether the stated hypotheses were significant or not for the given hypotheses.

4.5.1 Relationship between Warehousing Operations (AWO) and Warehouse Efficiency (AWE)

Figure 4.1, Appendix 5, and Appendix 6 indicate that there is a strong relationship between AWO and AWE with its correlation coefficient of 0.772. Based on the *p*-value 0.00, the study also found that it is very significant with the *p*-value of 0.00 (refer to Appendix 5). These reflect very significant relationships between these two variables in enhancing warehouse efficiency activities with the implementation of warehousing operations activities.

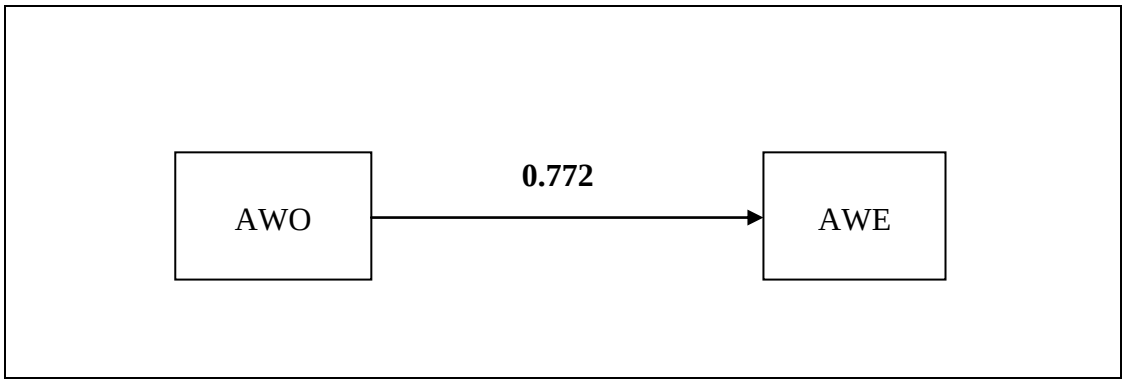

Figure 4.1. Relationship of tested variables (AWO and AWE) after mediation.

Hypothesis 1(a): There is a relationship between warehousing operations and warehouse efficiency.

Therefore, based on the findings and explanation above, the study found that there is a relationship between warehousing operation and warehouse efficiency, which is a positive relationship in enhancing the warehouse efficiency. This means that, as the AWO activities increase in effectiveness, it would increase AWE significantly and similarly when there is a decrease.

4.5.2 Relationship between Warehousing Operations (AWO) and Warehousing MIS (AMIS)

As shown in Figure 4.2 and supported by the statistical output in Appendix 5 and Appendix 6, there is a strong relationship between AWO and AMIS with the significant correlation of 0.375 and correlation coefficient based on *p-value* = 0.00. This reflects very significant relationships between these two variables in enhancing warehousing MIS activities with the implementation of warehousing operations activities.

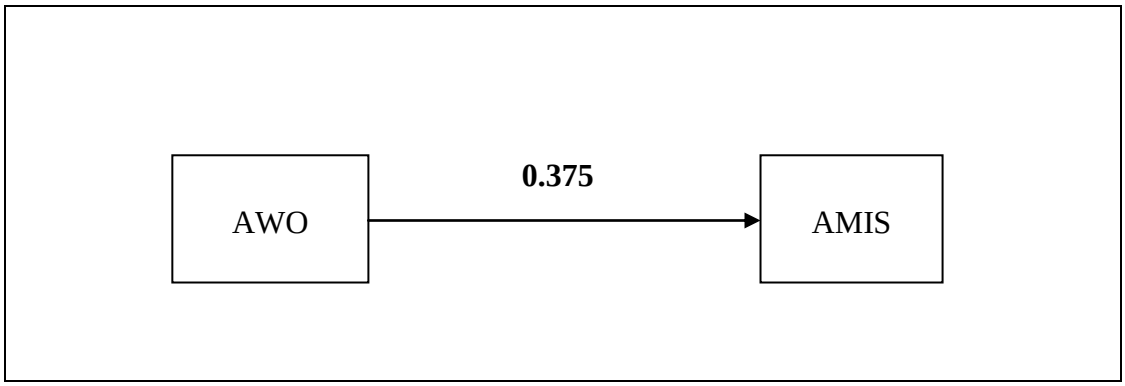

Figure 4.2. Relationship of tested variables (AWO and AMIS) after mediation.

Hypothesis 1(b): There is a relationship between warehousing operations and warehousing MIS.

Therefore, based on the findings and explanation above, the study found that there is a relationship between warehousing operation and warehousing MIS, which is a positive relationship in enhancing warehouse efficiency. This means that as the AWO activities increase in effectiveness, it would also increase AMIS significantly or similarly if there is a decrease.

4.5.3 Relationship between Warehousing Operations (AWO), Warehousing MIS (AMIS), and Warehouse Efficiency (AWE)

The mediating role of warehouse efficiency in particular was tested by a multiple linear regression in a four-step approach as suggested by Baron and Kenny (1986), which was explained in Section 3.6. Appendix 5, Appendix 6, and Figure 4.3contain the analyses necessary to test the mediation hypotheses. Table 4.6 shows Steps 1, 2, and 3 while Table 4.7 shows Step 4.

Step 1 is to test whether the AWO (predictor) is related to the AWE (outcome). The results for the significant unstandardised regression coefficient (B = 0.436) indicated that the AWO affects the AWE significantly ($p < 0.01$). Therefore, this step established an effect to be mediated as suggested in Step 1 by Baron and Kenny (1986).

Step 2 is to test whether the AWO (predictor) is related to the AMIS (outcome). The results of the unstandardised regression coefficient (B = 0.141) indicated that the AWO affects the AMIS significantly ($p < 0.01$). Therefore, this step essentially involved treating the mediator, since it is an outcome variable as suggested in Step 2 by Baron and Kenny (1986).

Table 4.6.
Measurement of the Degree of AMIS Influence in the Relationship between AWO and AWE

	F	R^2	B	SE B	Beta	T	Sig
Step 1							
Outcome: Warehouse Efficiency	**265.77**						
Predictor: Warehousing Operations		**0.596**	**0.436**	**0.039**	**0.772**	**16.302**	**0.00**
Step 2							
Outcome: Warehousing MIS	**29.451**						
Predictor: Warehousing Operations		**0.141**	**0.410**	**0.076**	**0.375**	**5.427**	**0.00**
Step 3							
Outcome: Warehouse Efficiency	**117.525**						
Predictor: Warehousing Operations		**0.596**	**0.560**	**0.039**	**0.672**	**14.240**	**0.00**
Mediator: Warehousing MIS		**0.657**	**0.230**	**0.036**	**0.266**	**5.64**	**0.00**

Step 3 is to test whether the AWO (predictor) is related to the AMIS (mediator) and AWE (outcome). The results of the unstandardised regression coefficient associated with the relation between the AMIS and AWE were significant (0.203). This regression equation also provides an estimate of the relation between the AWO and

AWE, while controlling for the AMIS (B = 0.560). Therefore, the initial variables are controlled in establishing the effect of the mediator on the outcome as suggested in Step 3 by Baron and Kenny (1986).

Table 4.7.
Sobel Test Output Measuring the Mediating Effect of AMIS in the Relationship between AWO and AWE

	Input		**Test Statistics**	***p*-value Significance**
A: Warehousing Operation	0.410	Sobel test:	4.51	0.00
B: Warehousing MIS	0.394	Aroian test:	4.48	0.00
Sa: Warehousing Operation	0.076	Goodman test:	4.53	0.00
Sb: Warehousing MIS	0.048			

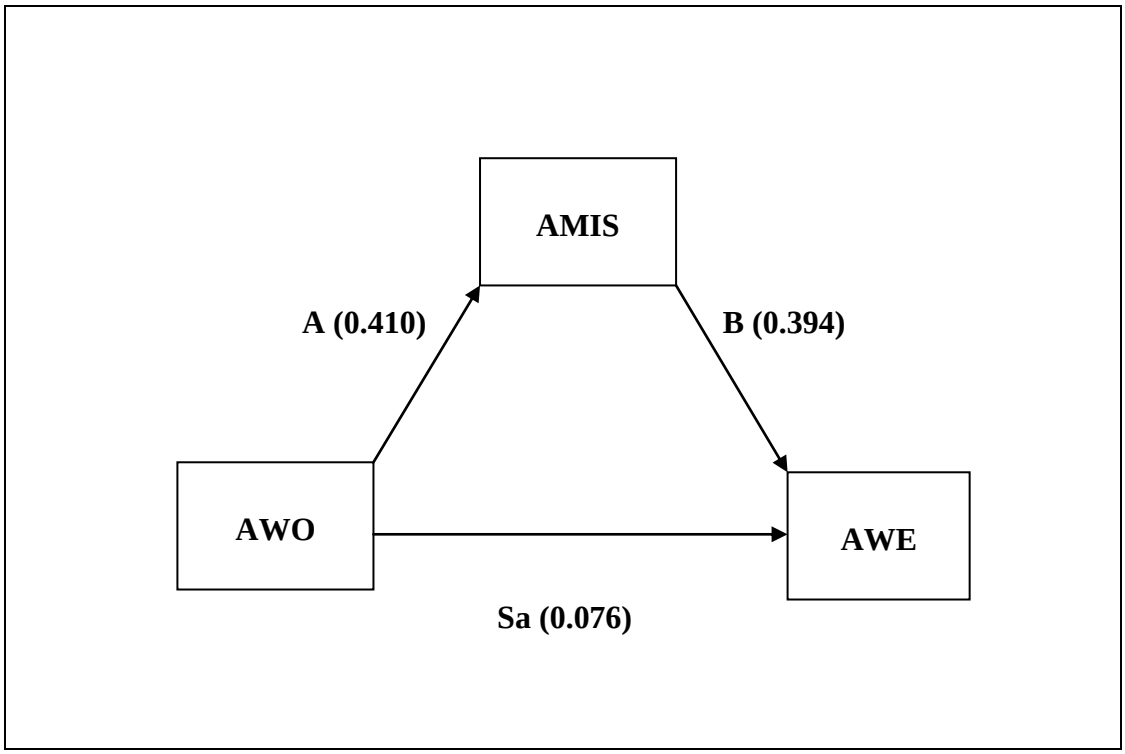

Figure 4.3. Relationship of tested variables (AWO, AMIS, and AWE) after mediation.

In Step 4, the Sobel, Aroian, and Goodman Tests (Preacher & Leonardelli, 2012) were used to test whether the mediator carries the influence (Baron & Kenny, 1986) of the AWO to the AWE, as shown in Table 4.7. Meanwhile, Table 4.6, Figure 4.3,

and Appendices 5 and 6 also show the results being significant at $p < 0.05$. This confirms that the AMIS variable mediates the relationship between AWO and AWE.

Hypothesis 1(c): There is a mediating effect of Warehousing MIS in the relationship between Warehousing Operations and Warehouse Efficiency.

Base on the findings and explanation above, the study found that there is a mediating effect by Warehousing MIS in the relationship between Warehousing Operations and Warehousing Efficiency.

4.5.4 Relationship between Warehousing HCM (AHCM) and Warehouse Efficiency (AWE)

Figure 4.4, Appendix 5, and Appendix 6 all indicate that there is a strong relationship between WHCM and AWE with the correlation coefficient of 0.744 and a significant correlation based on *p-value* = 0.00. This outcome reflects strong significant relationships between these two variables in enhancing the warehouse efficiency activities by practising and implementing appropriate AHCM activities.

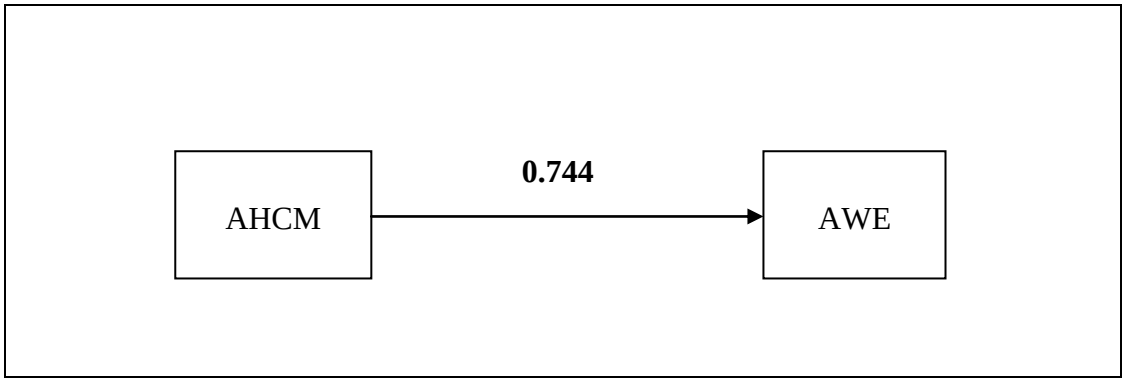

Figure 4.4. Relationship of tested variables (AHCM and AWE) after mediation.

Hypothesis 2(a): There is a relationship between Warehousing HCM and Warehouse Efficiency.

Base on the findings and explanation above, the study found that there is a relationship between Warehousing HCM and Warehouse Efficiency, which is a positive relationship in enhancing Warehouse Efficiency. This means that as AHCM activities increase in effectiveness, it would also increase AWE significantly, and similarly there is a decrease.

4.5.5 Relationship between Warehousing HCM (AHCM) and Warehousing MIS (AMIS)

Figure 4.5, Appendix 5, and Appendix 6 all indicate that there is a strong relationship between AHCM and AMIS with a correlation coefficient value of 0.405 and a significant correlation, based on *p-value* = 0.00. This outcome reflects significant relationships between these two variables in enhancing the AMIS activities with the implementation of AHCM activities.

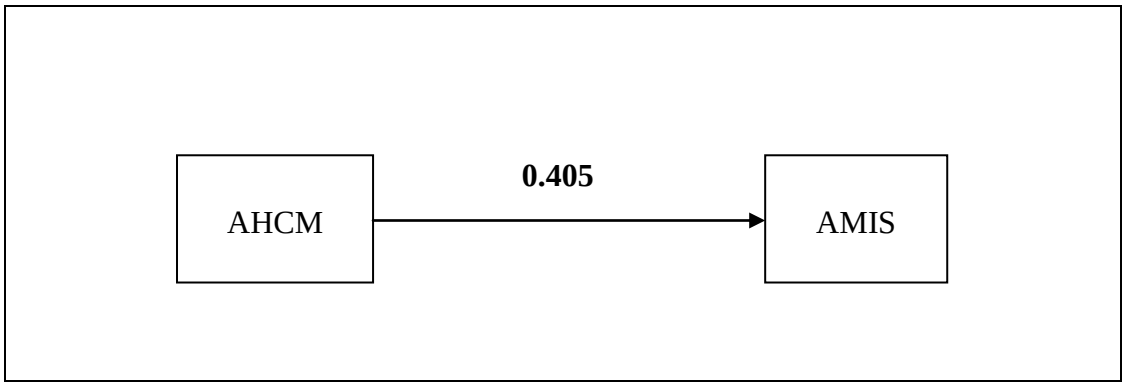

Figure 4.5. Relationship of tested variables (AHCM and AMIS) after mediation.

Hypothesis 2(b): There is a relationship between warehousing HCM and warehousing MIS.

Base on the findings and explanation above, the study revealed that there is a relationship between Warehousing HCM and Warehousing MIS, which is a positive relationship in enhancing Warehouse Efficiency. This means that as AHCM activities increase in their effectiveness, it would also increase AMIS significantly, and a similar trend can be seen if there is a decrease.

4.5.6 Relationship between Warehousing HCM (AHCM), Warehousing MIS (AMIS), and Warehouse Efficiency (AWE)

The mediating role of warehouse efficiency in particular is tested by a multiple linear regression in a four-step approach, as suggested by Baron and Kenny (1986) and explained in Section 3.6. Appendix 5, Figure 4.6, and Appendix 6 contain the output of the analyses necessary to examine the mediation hypotheses. Table 4.8 shows Steps 1, 2, and 3, while Table 4.9 shows the output for Step 4.

Step 1 is to test whether the AWE (predictor) is related to the AHCM (outcome). The results for the unstandardised regression coefficient ($B = 0.723$) indicated that the AHCM affects AWE significantly ($p < 0.01$). Therefore, this step establishes an effect to be mediated as suggested in Step 1 by Baron and Kenny (1986).

Table 4.8.
Measurement of the Degree of AMIS Influence in the Relationship between AHCM and AWE

	F	R^2	B	SE B	Beta	T	Sig
Step 1							
Outcome: Warehouse Efficiency	**222.514**						
Predictor: Warehousing HCM		**0.553**	**0.723**	**0.048**	**0.744**	**14.917**	**0.00**
Step 2							
Outcome: Warehousing MIS	**35.284**						
Predictor: Warehousing HCM		**0.164**	**0.518**	**0.087**	**0.405**	**5.940**	**0.00**
Step 3							
Outcome: Warehouse Efficiency	**139.591**						
Predictor: Warehousing HCM		**0.553**	**0.621**	**0.050**	**0.638**	**12.492**	**0.00**
Mediator: Warehousing MIS		**0.609**	**0.198**	**0.039**	**0.260**	**5.088**	**0.00**

Step 2 is to test whether the AMIS (predictor) is related to the AHCM (outcome). The results of the unstandardised regression coefficient (B = 0.518) indicated that the AHCM affects the AMIS significantly ($p < 0.01$). Therefore, this step essentially involves treating the mediator, as it is an outcome variable as suggested in Step 2 by Baron and Kenny (1986).

Step 3 is to test whether the AWE (predictor) is related to the AHCM (outcome) and AMIS (mediator). The results of the unstandardised regression coefficient associated with the relation between the AMIS and AWE were significant (0.621, $p < 0.01$). This regression equation also provides an estimate of the relation between AHCM and AWE, while controlling for AMIS (B = 0.198). Therefore, the initial variables were controlled in establishing the effect of the mediator on the outcome as suggested in Step 3 by Baron and Kenny (1986).

Table 4.9.
Sobel Test Output Measuring the Mediating Effect of AMIS in the Relationship between AHCM and AWE

	Input		**Test Statistics**	***p*-value Significance**
A: Warehousing HCM	0.518	Sobel test:	4.819	0.00
B: Warehousing MIS	0.394	Aroian test:	4.79	0.00
Sa: Warehousing HCM	0.087	Goodman test:	4.843	0.00
Sb: Warehousing MIS	0.048			

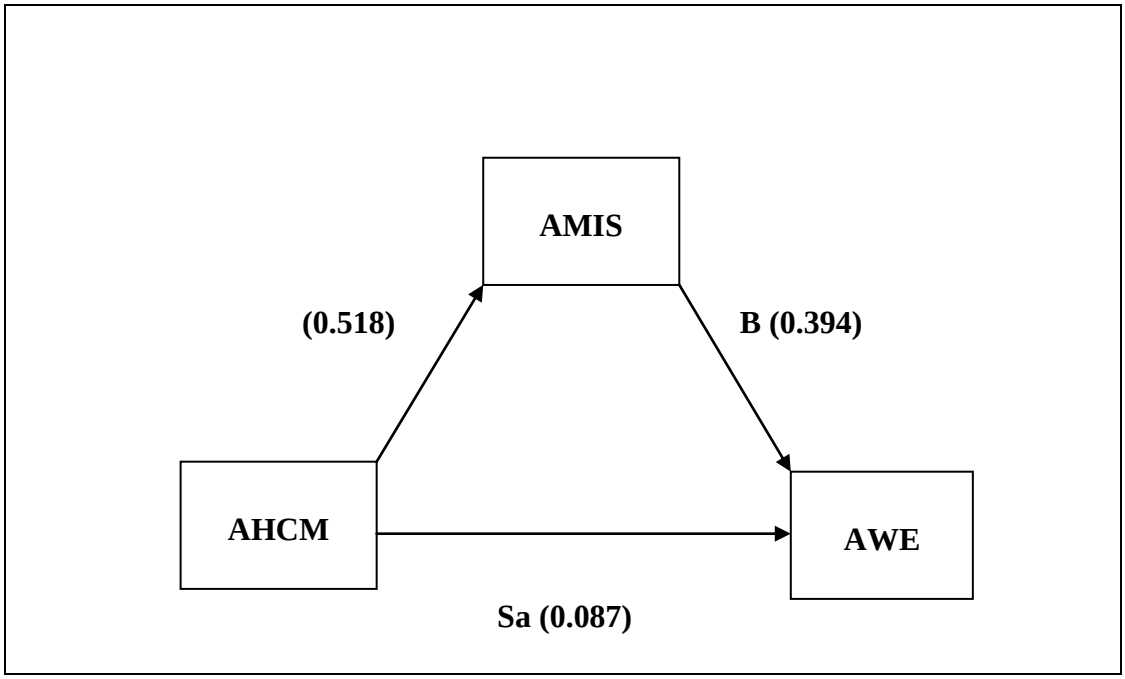

Figure 4.6. Relationship of tested variables (AHCM, AMIS and AWE) after mediation.

In Step 4, the Sobel, Aroian, and Goodman Tests (Preacher & Leonardelli, 2012) were used to test whether the mediator carries the influence (Baron & Kenny, 1986) of AHCM to AWE, as shown in Table 4.8. Meanwhile, Table 4.9, Figure 4.6, and Appendices 5 and 6 show that the results are significant at $p < 0.05$. This means that the AMIS variable mediates the relationship between AHCM and AWE.

Hypothesis 2(c): **There is a mediating effect of Warehousing MIS in the relationship between Warehousing HCM and Warehouse Efficiency.**

Base on the findings and explanation above, the study found that there is a mediating effect exhibited by Warehousing MIS in the relationship between Warehousing HCM and Warehousing Efficiency.

4.5.7 Relationship between Warehousing Layout (AL) and Warehouse Efficiency (AWE)

Figure 4.7, Appendix 5 and Appendix 6 indicate there is a strong relationship between AL and AWE with a correlation coefficient value of 0.240 and a significant correlation based on *p-value* = 0.01. This means that there are significant relationships between these two variables in enhancing the warehouse efficiency activities with the implementation of warehousing layout activities.

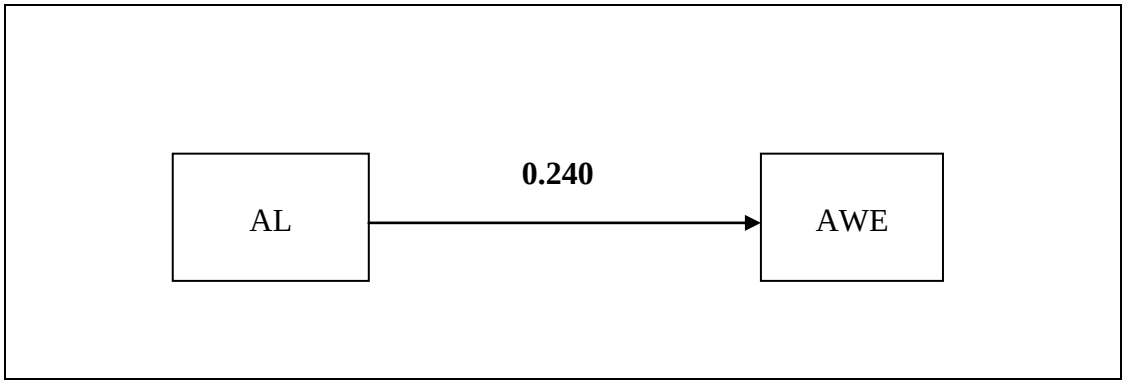

Figure 4.7. Relationship of tested variables (AL and AWE) after mediation.

Hypothesis 3(a): There is a relationship between Warehousing Layout and Warehouse Efficiency.

Based on the findings and explanation above, it can be confirmed that there is a relationship between warehousing layout and warehouse efficiency, which is a positive relationship in enhancing warehouse efficiency. This means that as AL activities increase in effectiveness, it would also increase AWE significantly, and a similar trend would occur if there was a decrease.

4.5.8 Relationship between Warehousing Layout (AL) and Warehousing MIS (AMIS)

Figure 4.8, Appendix 5, and Appendix 6 indicate that there is a strong relationship between AL and AMIS with a correlation coefficient of 0.633 and a significant correlation based on *p-value* = 0.00. This reflects very significant relationships between these two variables in enhancing AMIS activities with the implementation of AL activities.

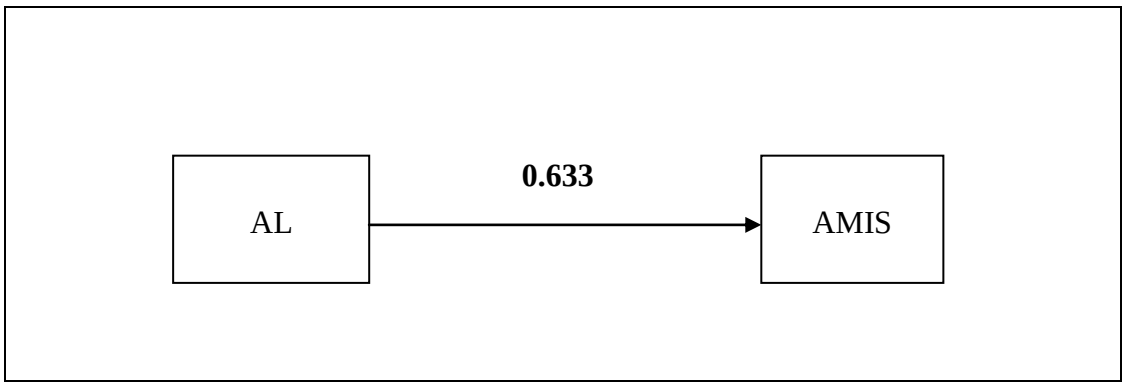

Figure 4.8. Relationship of tested variables (AL and AMIS) after mediation.

Hypothesis 3(b): There is a relationship between Warehousing Layout and Warehousing MIS.

Base on the findings above, the study found that there is a relationship between warehousing layout and warehousing MIS, which is a positive relationship in enhancing warehouse efficiency. This means that as AL activities increase in effectiveness, it would also increase AMIS significantly, and similarly in a decreasing trend.

4.5.9 Relationship between Warehousing Layout (AL), Warehousing MIS (AMIS), and Warehouse Efficiency (AWE)

The mediating role of warehouse efficiency in particular was tested by a multiple linear regression in a four-step approach as suggested by Baron and Kenny (1986) and explained in greater detail in Section 3.6. Meanwhile, Appendix 5, Figure 4.9, and Appendix 6contain the analyses necessary to examine the mediation hypotheses. Table 4.10 shows results for Steps 1, 2, and 3 while Table 4.11 shows the outcome of Step 4.

Step 1 is to test whether the AWE (predictor) is related to the AL (outcome). The results for the unstandardised regression coefficient ($B = 0.160$) indicated that AL affects the AWE significantly ($p < 0.01$). Therefore, this step establishes an effect to be mediated as suggested in Step 1 by Baron and Kenny (1986).

Step 2 is to test whether the AMIS (predictor) is related to the AL (outcome). The results of the unstandardised regression coefficient (B = 0.347) indicated AL affects AMIS significantly ($p < 0.01$). Therefore, this step essentially involves treating the mediator, as it is an outcome variable as suggested in Step 2 by Baron and Kenny (1986).

Table 4.10.
Measurement of the Degree of AMIS Influence in the Relationship between AL and AWE

	F	R^2	B	SE B	Beta	T	Sig
Step 1							
Outcome: Warehouse Efficiency	**10.977**						
Predictor: Warehousing Layout		**0.057**	**0.160**	**0.030**	**0.240**	**3.313**	**0.00**
Step 2							
Outcome: Warehousing MIS	**120.43**						
Predictor: Warehousing Layout		**0.401**	**0.347**	**0.032**	**0.633**	**10.974**	**0.00**
Step 3							
Outcome: Warehouse Efficiency	**35.106**						
Predictor: Warehousing Layout		**0.057**	**0.062**	**0.034**	**-0.148**	**- 0.804**	**0.02**
Mediator: Warehousing MIS		**0.282**	**0.465**	**0.062**	**0.612**	**7.476**	**0.00**

Step 3 is to test whether the AWE (predictor) is related to the AL (outcome) and AMIS (mediator). The results of the unstandardised regression coefficient associated with the relation between the AMIS and AWE were significant (0.062, $p < 0.01$). This regression equation also provides an estimate of the relation between AL and AWE, while controlling for AMIS (B = 0.465). Therefore, the initial variables were

controlled in establishing the effect of the mediator on the outcome as suggested in Step 3 by Baron and Kenny (1986).

In Step 4, the Sobel, Aroian, and Goodman Tests (Preacher & Leonardelli, 2012) were used to test whether the mediator carries the influence (Baron & Kenny, 1986) of the AL to the AWE, as can be observed in Table 4.11. Meanwhile, Table 4.10, Figure 4.9, and Appendices 5 and 6 show that the results are significant at $p < 0.05$. This means that the AMIS mediates the relationship between the AWO and AWE.

Table 4.11.
Sobel Test output Measuring the Mediating Effect of AMIS in the Relationship between AL and AWE

	Input		**Test Statistics**	***p*-value Significance**
A: Warehousing Layout	0.347	Sobel test:	6.544	0.00
B: Warehousing MIS	0.394	Aroian test:	6.527	0.00
Sa: Warehousing Layout	0.032	Goodman test:	6.562	0.00
Sb: Warehousing MIS	0.048			

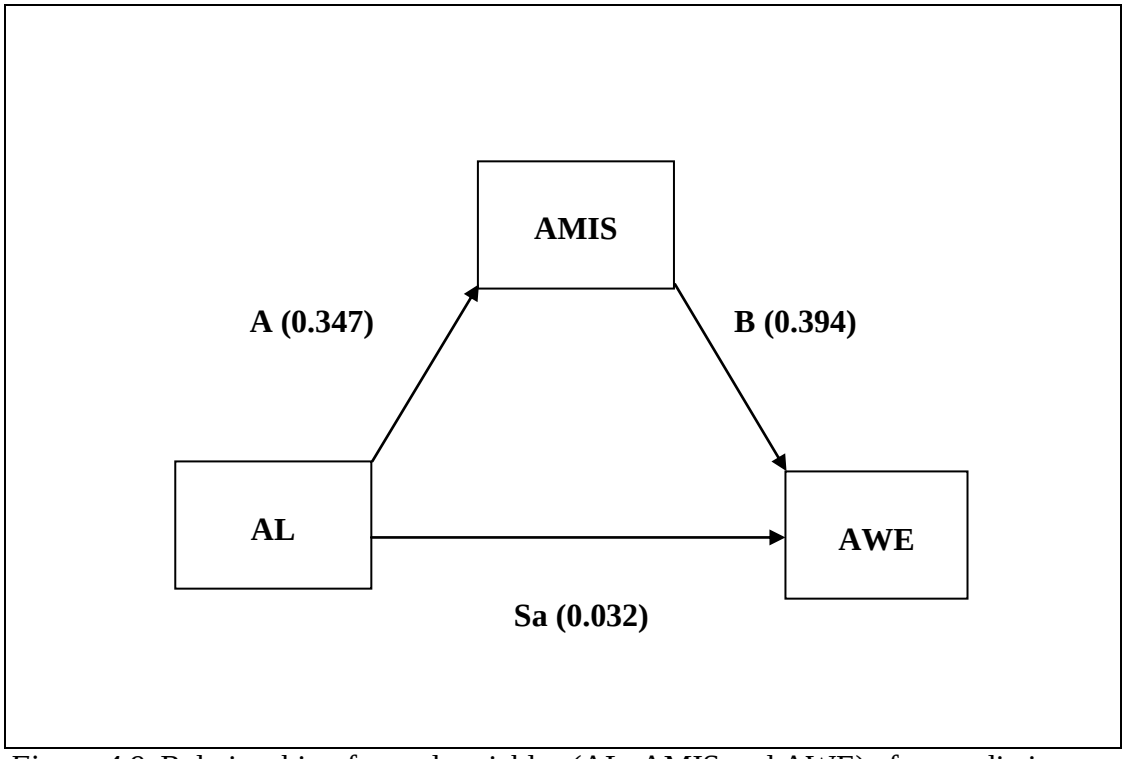

Figure 4.9. Relationship of tested variables (AL, AMIS and AWE) after mediation.

Hypothesis 3(c): **There is a mediating effect of Warehousing MIS in the relationship between Warehousing Layout and Warehouse Efficiency.**

Based on the findings and explanation above, the study found that there is a mediating effect by Warehousing MIS in the relationship between Warehousing Layout and Warehousing Efficiency.

4.5.10 Summary of the Hypotheses Results

Based on the overall results of the hypotheses testing phase, it was found that all of the hypotheses are accepted with a significant *p-value* at 0.00. This is summarised accordingly in Table 4.12. The implications of the accepted results show that there are relationships between the warehouse attributes and warehouse efficiency. In addition, the mediating effects signify the positive impact between the warehouse attributes and warehouse efficiency.

Table 4.12.
Summary of Hypotheses Results

Research Hypotheses	*p-value*	Sobel Test	Results
H1(a)	0.00	-	Accepted
H1(b)	0.00	-	Accepted
H1(c)	0.00	0.00	Accepted
H2(a)	0.00	-	Accepted
H2(b)	0.00	-	Accepted
H2(c)	0.00	0.00	Accepted
H3(a)	0.00	-	Accepted
H3(b)	0.00	-	Accepted
H3(c)	0.00	0.00	Accepted

4.6 CHAPTER SUMMARY

This chapter has presented the details of data analysis and its relevant findings. During the preliminary examination, the data are explained by the descriptions, outliers, and normality before the testing of hypotheses was conducted by using SPSS 19 and Sobel Test instruments.

The descriptive study analysis and findings refer to the respondents' response, type of industry, company size (according to number of full time employees and sales turnover) and, number of years the company has competed in the industry. The study found the distribution scores for company size in the distribution of total sales turnover and number of employees in the company did not violate the assumption of normality. Levene's test and ANOVA were performed to check whether there is a significant demographic difference in the data of the respondents. It was discovered that there is reasonable consistency of response pattern in the data of the "early group" and the "late group" constituted 40-60 percent of the grouping respectively. The results of the hypotheses showed that there are positive correlations and regressions conducted over the data collected. The tests were done base on the variables data tabulated by overall summary data.

Overall summary analyses of the Pearson correlations were conducted and the strength and direction of the linear relationships between all the variables under study were determined (Pallant, 2007).

It was found that Warehouse Efficiency (AWE) was considered highly significant with all the constructs in Warehousing Operations (AWO) and Warehousing Human Capital Management (AHCM). Meanwhile AWE in relation to Warehousing MIS (AMIS) was considered normal, while it was low with Warehousing Layout (AL). In the correlation significance test based on *p-value* or significance, the study found that AWE has positive linear relationship with AWO, AHCM, AL, and AMIS. Overall, the study found that in other variables of AWO, AHCM, AL, and AMIS, all the constructs were found to be significant and have positive linear relationships.

Based on the results of the regression analysis, it is found that the R^2 indicated that more than 75 percent of the variances in AWE could be explained by the other variables (AWO, AHCM, AL and AMIS) in maintaining the warehouse efficiency. Based on this model, for every level increase in this set-up *of* $x_0 + x_1 + x_2 + x_3 + x_4$, it would increase the *Y* by the value of the coefficient respectively. Based on the *t* value, the study found that only one variable was non-significant (AL).

In hypotheses testing, the tests showed positive results in the relationship effect between the independent variables (warehousing operations, warehousing HCM, and warehousing layout) and dependent variable (warehouse efficiency). Multiple linear regressions and Sobel Tests were later used to test the relationships effect between the mediating variable (warehousing MIS) and dependent variable (warehouse efficiency). All the results showed a significant *p-value* of 0.00 and all the hypotheses were not rejected, and thus accepted.

CHAPTER FIVE

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

5.0 INTRODUCTION

This chapter summarises the findings of the study based on the initial research questions. This includes the objectives and recommendations for the practice of warehouse efficiency. The chapter also identifies the relevancy of the literature in the discussions, as well as theoretical and knowledge contributions. As for future research endeavours that are recommended, studies of further exploration of the research model in other organisations, sectors, or industries has been revealed.

5.1 OVERVIEW OF THE STUDY

This study analysed the effect of warehousing attributes, which are operations, HCM, layout, and MIS on warehouse efficiency of manufacturing firms. The framework explored each of the dimensions and constructed the effect on warehouse efficiency. The proposed constructs are as follows:

(a) *Warehousing Operations* (allocations to operate, inventory audit, material handling, and space accessibility).

(b) *Warehousing HCM* (education qualifications, experiences and skills, training and planning, and manpower).

(c) *Warehousing Layout* (systematic layout plan, 5S, material handling and movement, space saving, and optimisation).

(d) *Warehousing MIS* (computer hardware, networks, staff training, standard operating procedures or SOP, data storage, latest version of computer, documents preparation and operation, usage of up-dated MIS, and productivity of using MIS).

(e) *Warehouse Efficiency* (budget, top management support, documentations with authorisation, inventory accuracy and its importance, computer assisting, material movement, space optimisation as priority, 5S practice, layout plan, material flow, manpower requirement, education background, use of minimum type of software, computer facilities, monitoring of material quantities, and descriptions for traceability and action for discrepancies).

This study was conducted with the cooperation of SME owners in the manufacturing sectors in Malaysia. The total number of the firms reported to operate as Malaysian SMEs by Business Sectors is 5,947, including agro-manufacturing sectors (UNDP 2007). A total of 1,000 questionnaires were posted to the listed respondents and 182 usable questionnaires were processed for further analysis. The research study chose the mail questionnaire as the survey and data collection instrument. A pre-tested phase for reliability testing of the 5-point Likert scale was used. SPSS Version 19 was used to analyse the collected data after the gathering of data samples. This chapter focuses on the results and implications to the warehouse efficiency besides the performance recommendations to the firm, contribution to the knowledge, and possible directions for future research.

5.2 CONCLUSION OVERVIEW

The competitive business trends of today could not be avoided ever since the globalised business concept emerged into the scene. It is important for the firm to understand the business scenario of today and to be aware of the continually changing needs of the business direction. This turbulent environment would very much affect the firm decision-making process and thus impact the performance of the firms trying to survive in this competitive market. Warehousing depends very much on the changes in the firm's business direction.

The following subsections conclude the study that was carried out with the results indicating that specific warehouse operations, HCM, layout and MIS are capable of improving warehouse efficiency. With the sample size of 182 to generate the results of the research, the following subsections discuss each hypothesis based on this sample size.

5.2.1 Distribution of Respondents

This research is limited to the firms listed in the SME Business Directory (2009) as an official reference of the owners of the SME firms. It is divided into a distribution of SMEs in the various manufacturing sectors (namely, Textile & Apparel; Food & Beverages; Metal & Metal Products; Paper, Printing, & Publication; Furniture; Rubber & Plastics Products; Wood & Wood Products; Non-metallic Mineral Products; Machinery & Equipment; Electrical & Electronics; Chemical & Chemical Products; Transport Equipment; and General Manufacturing, which includes

jewellery; leather products; tobacco products; medical, precision & optical; and recycled and petroleum products).

5.2.2 Distribution of Warehouse Efficiency (AWE)

The results of the research showed positive and significance of the variables and the constructs. It clearly indicated that the analysis of the study have expectedly explored all the relationships between the independent variables (warehousing operations, HCM, and layout), mediating variables (warehousing MIS), and dependent variables (warehouse efficiency).

This expectedly confirmed the initial analysis of this study in investigating the characteristics of warehouse efficiency. The basis of this investigation showed that theoretically, the explored dimensions have similar characteristics retrieved from the literature, such as financial allocation, inventory control and accuracy operations (Gunasekaran *et al*., 1999; Faber *et al.*, 2002; Gu *et al*., 2007), space saving layout (Hassan, 2002; Faber *et al*., 2002; Tompkins *et al*., 2002), trained personnel (Cowan & Mathieu, 1994; Murphy & Wood, 2004; Min, 2007b), latest software and hardware updating in MIS (Bowersox *et al*., 1999; Autry *et al.*, 2005; Haag *et al*., 2007), and 5S practices (Bayu-Moriones *et al.*, 2010) to ensure the warehousing efficiency (Bennet *et al.*, 1996; Gu *et al.*, 2007; Ling *et al.*, 2008).

5.2.3 Discussions of Hypothesis Findings

The findings of Hypothesis 1(a) (refer to Section 4.5.1) found that there is always a strong relationship between the AWO and AWE activities, such as order picking, retrieving and storing materials, and issuing materials operations (Gunasekaran *et al.*, 1999; Faber *et al.*, 2002; Frazelle, 2002; Koster *et al.*, 2007; Gu *et al.*, 2007).

This study suggested that there is strong influence of operational activities that affect the warehouse efficiency performance as in previous studies (Jenkins, 1990; Tompkins & Smith, 1998; Lambert *et al*., 1998). This indicated that warehousing operations play an important role to all sizes of warehouses in the firms.

The findings of Hypothesis 1(b) (refer to Section 4.5.2) found that there is always a strong positive relationship between the AWO and AMIS activities, such as using the latest MIS technologies (Cowan & Mathieu, 1994; Pokharel, 2005; Autry *et al.*, 2005) to upgrade and improve the performance and efficiency of the warehouse, as in the previous studies (Tompkins, 1996; Lambert *et al.*, 1998; Ruriani, 1999).

This study suggested that there is always a strong influence of MIS activities over the operations activities in the warehouse. This is clearly highlighted by the research where all warehouse documents that are prepared and processed by the computer would expedite the warehousing process. Thus, this emphasises that MIS activities are important in warehouse operations.

The findings of Hypothesis 1(c) (refer to Section 4.5.3) found that the AMIS is tested as a mediating variable between AWO and AWE due to its important influence over the operational activities on the warehouse efficiency. The findings also indicated that MIS is a good mediator in the relationship between the independent variables and dependent variable.

Specifically, the study suggested that AMIS is a good mediator of the relationship between AWO and AWE. The results had indicated that it has performed positively in its effect and should play an important role to all the warehouses regardless of their size.

The findings of Hypothesis 2(a) (refer to Section 4.5.4) found that there is a strong positive relationship between AHCM and AWE, especially in training to upgrade skills and knowledge (Murphy & Poist, 1992; Murphy & Poist, 1993; Bartlett & Ghoshal, 1995; Hout & Carter, 1995; Bowersox & Daugherty, 1995; Pfeffer, 1998; Pfeffer, 2000) that are related to warehouse performance efficiency.

This study suggested strong relationship influence over the warehouse efficiency performance that is related to employee education, skills, and experiences by enhancing it through training. Thus it could produce a competent and productive HCM in the warehouse operational roles. Management commitment in this case is very important as they need to make necessary replacements if any shortages of manpower occur in the warehouse. This highlighted such important functions are applicable to any of the warehouses in the firms, regardless of their size.

The findings of Hypothesis 2(b) (refer to Section 4.5.5) found that there is a strong positive relationship between AHCM and AMIS reflecting the importance of MIS in the organisation (Cowan & Mathieu, 1994; Pokharel, 2005) that influences the performance of the warehouse efficiency.

The study suggested that the staff and workers in the warehouse of the firm must always have the knowledge and capability of MIS, especially during the operations and activities involved in the warehouse process (Murphy & Poist, 1992; Murphy & Poist, 1993; Bowersox & Closs, 1996; Ellinger *et al.*, 2005; Min, 2007b). Thus HCM needs to be updated regularly through training with a proper planned schedule. This emphasises that this process of training and MIS capability is applicable to any of the warehouses in the firms, no matter what the size.

The findings of Hypothesis 2(c) (refer to Section 4.5.6) found that the AMIS is tested as a mediating variable between AHCM and AWE due to its important influence over the activities of the operations in the warehouse. The findings also indicated that MIS is a good mediator in the relationship between the independent variable and dependent variable.

The study showed that AMIS is a good mediator of the relationship between AHCM and AWE. It indicated that it has performed positively to its effect and should play an important role in all warehouses, regardless of their size.

The findings of Hypothesis H3(a) (refer to Section 4.5.7) found that there is a positive relationship between AL and AWE, such as planning and design the layout

(Tompkins *et al*., 1996; Rouwenhorst *et al*., 2000) and layout foundation for warehousing of the manufacturing firm (Gray *et al*., 1992; Hassan, 2002; Rouwenhorst *et al.*, 2000; Roodbergen & Vis, 2006; Huertas *et al.*, 2007). All these activities are performed in order to ensure that the efficiency of the warehouse performance is maintained and up-graded continually.

The study suggested that the layout should be systematically planned with serious 5S activities being put in to practice. This could be the main efficiency in handling the movement of the material flow to produce the optimum space utilisation and space saving in the warehouse. It highlighted the important roles and functions of the layout to be applicable to all the warehouses in the firms, no matter what their size.

The findings of Hypothesis H3(b) (refer to Section 4.5.8) found that there is a positive relationship between the warehousing layout and warehousing MIS, as indicated in the results findings of the overall variables. In the individual test related to inventory accuracy and space optimisation, these activities were found to be not significant.

The study suggested that proper training should be implemented related to the layout planning, 5S practice, handling the movement of materials, space saving, and optimisation. This emphasises the importance of these activities to be carried out at all times and they are applicable to any type of warehouse in the firms, regardless of their size.

The findings of Hypothesis 3(c) (refer to Section 4.5.9) found that **t**here is a positive relationship between AL and AMIS reflecting the importance of MIS in the organisation (Cowan & Mathieu, 1994; Pokharel, 2005) that influences the performance of the warehouse efficiency. The study suggested that the staff and workers in the warehouse of the firm must have the knowledge and capability of MIS, especially during the operations and activities involved in the warehousing process (Murphy & Poist, 1992; Murphy & Poist, 1993; Bowersox *et al.*, 1999; Ellinger *et al.*, 2005; Min, 2007a).

It was also found that good layout practice includes a systematic plan, excellent 5S practice, good material movement, practice of space optimisation, and space savings. This is compulsory in the warehouse management best practice. This indicated those activities are applicable to any of the warehouses in firms, no matter their size.

Thus to sum up, it can be concluded that in these hypotheses discussions, the researcher found that there are strong positive relationships between the warehouse attributes and warehouse efficiency. In fact, when the warehousing MIS mediates between warehouse attributes and warehouse efficiency, the researcher found that the warehouse activities are applicable to any warehouses in the firms, regardless of the size.

5.3 IMPLICATIONS OF STUDY

The research study has several implications toward the managers and firms in planning, implementing, achieving, and evaluating the efficiency of the warehouses.

This study has clearly indicated that the performance base of the warehouses is related very much to the firm competitive business globalisation and logistics evolution in creating the supply chain. The future success and failure of the firm depends very much on its competencies to overcome the market challenges. Therefore a good and balanced decision-making process is important in deciding the direction of the firm. This would positively affect the warehousing functions and roles to adapt into the firm business requirements.

As explained in Section 1.1 of Chapter One, warehousing before this was considered as a supportive industry, playing a minor role in the supply chain. However, it has now become a core competency and a strategic weapon that many firms are using to enhance their competency positions in the marketplace. To remain competitive in the global market, firms must work hard to maximise both their production and their product quality. Warehousing also plays a pivotal role to achieve those successes.

The managerial and firm performance in charting the success of the business indicated their acuteness in applying a good decision-making process to enhance the continuous achievements. Warehouse efficiency is one of the major competencies in order to achieve such performance. It depends how the warehouse operations, HCM, layout, and MIS could perform as being planned, including financial allocation, and be applied to any of the warehouses of the firms of all sizes.

5.3.1 Managerial and Firm Performance Implications

This study provided information and issues of the management decision process to enhance firm performance. The results and discussions could assist the management of the company in making the right decisions and to strategise their plans specifically in the context of warehousing operations, HCM, layout, and MIS. This could create an efficient warehouse to support the firm in the supply chain management with regard to any sizes of the warehouse.

5.3.1.1 Relationship between Warehousing Attributes and Warehouse Efficiency

The researcher now elaborate on the relationship between warehouse attributes (operations, HCM, and layout) and warehouse efficiency related to managerial and firm performance implications.

Based on the findings and analysis that supported Hypothesis 1(a), it would enable the owners in SME manufacturing sectors to plan better and ahead for the firm. The best practice of warehousing in striving for excellent results is inventory accuracy and space optimisation (thus creating the space saving). This could be given priority in creating the warehouse efficiency. SME owners or their managers should be able to focus and manage the warehouse by producing a good inventory accuracy and space saving. This is for realising firm benefits and better performance, including financial enhancement.

Based on the findings and analysis that supported Hypothesis 1(b), it would assist the SME owners in data analysis of all the materials stored in the warehouses. This would enable the firm to plan ahead of the delivery of the physical materials through its procurement division by comparing its inventory level in data system and physical quantity in the warehouse. The report of the inventory data generated by the computer is an important tool for SME owners or their managers in analysing the inventory levels in the warehouse.

Materials which are at lower level quantities could be identified and would be procured immediately as they are active materials in use. Some of the materials in the report could even be identified as slow moving items or non-moving items (which is known to be the end-of-life or EOL materials). Actions could be taken immediately and those materials which are at high level quantities could be controlled for its delivery until the inventory level is down to the bare minimum. Those materials which are in the slow moving stock category would be rectified for other usages in other models of production assembly. The non-moving or EOL materials would be planned to be sold or disposed as scrap. These activities would help the warehouse from being congested with non-active materials and focus to optimise its space utilisation or space saving planning. In fact by selling those scrap materials, the warehouse could directly generate some income for the company.

The control over the inventory would help the firm from buying any excess materials and the purchase of low stock material would enable the production assembly from having shortage of materials. This could happen in the case when materials are not delivered on time or if there is a case of shortages of materials in the warehouse due

to lost, mixed with other locations and materials, or theft. Operational-wise through the generated MIS report, it could assist the manager to overcome such problems and avoid the warehouse from messy material shortage problems.

Based on the findings that supported Hypothesis 2(a), there is strong positive management relationship between the Warehousing HCM and Warehouse Efficiency. The findings also found that there are 47.8 percent of the respondents (owners of the SMEs) that have a Bachelor Degree or equivalent, followed by those with Diploma or equivalent (39 percent). There are only 11.6 percent of the respondents who are below that category or those with SRP/SPM/STPM. In this case, SME owners' background with good education qualifications reflects the quality management they possess in managing the warehouse specifically, and the firm in general.

Based on this, warehouse management needs managers who are able to plan and perform the operations effectively. Warehousing is now considered to be managed by professional managers and no longer qualified for the non-professional personnel. This is due to the current intensity and competitiveness of the global business perspective. To manage the warehouse the managers should not only focus on the operations but also the quality of their manpower also. Therefore academic qualifications, skills, and experiences are compulsory besides the training that they have to undergo in managing the warehouse by creating the efficiency of the work stations. In other words, practically it is suggested that those who are appointed to the post as warehouse managers could now be considered as one of the senior positions in the operations management hierarchy within the firm.

Based on the findings and analysis of the results that supported Hypothesis 2(b), there is a strong relationship between the warehousing HCM and warehousing MIS. It involves the up-grading of knowledge and skills of the employees related to the data storage system and other supporting systems to make warehousing more compatible. Strong foundation is established with the usage of computer in the documentation process in the warehouse. This establishment should not be questioned about its competencies unless it is to be upgraded. Employee training related to MIS are prioritised as top priority. It requires a good academic background of qualification to go through with such training. They would later train the down level employees for simple data entry and other computer report generation.

As most of the warehouses in the firms are now gearing into globalised business, the importance of HCM related to MIS functions and roles are so significant in establishing warehouse efficiency with high performance achievements. It clearly indicated that such application is viable to any of the warehouses in the firms with regard to their sizes and type of manufacturing they are involved in.

Based on the findings that supported Hypothesis 3(a), there is a positive relationship between warehousing layout and warehouse efficiency. The managers are able to determine and focus on the type of layout required to establish the efficiency of the warehouse. In this case, the SME owners or managers could impose stringent procedures in accepting types of materials stored in the warehouse based from the layout design and planning. In case there is any infringement, materials would not be allowed to be stored in the warehouse. This indicates that the material handling and

movement for the material process flow in the warehouse is strictly managed by the managers concerned.

The imposition of 5S best practice needs to be exercised to all levels with high commitment from the managers and owners of the SMEs. This suggests that creating the layout is not only to systemise the material stored but also to discipline the people who are managing and working in the warehouse.

Based on the findings that supported Hypothesis 3(b), the managers should be informed of the basic requirements of documentation process through computer generated processes as a pre-requisite foundation. However for layout purposes, besides focusing on the layout activities such as material handling and movement, managers should also be creative and innovative in creating such movement through the computer data storage. MIS performance is highly anticipated in creating such systemised design layout in the computer. This is by establishing the actual locations or zones of the materials, rack numbers, rack levels, carton or box numbers, and descriptions of the materials with part numbers. Any such movements physically from the store should also be highlighted in the computer. It should be updated immediately once the movement of materials are done.

This provides the suggestion for managers to be more exploratory in determining the best practice of material movement through MIS innovation in the warehouse layout. The warehouse efficiency could be up-graded and improve the firm performance by having the best materials handling achievable according to any size of warehouse.

5.3.1.2 Mediating Effect of Warehousing MIS in the Relationship between Warehousing Attributes and Warehouse Efficiency

Based on the findings that supported Hypothesis 1(c), this should assist the managers to determine the best solution for the warehouse by planning ahead based on the firm business development plan. In manufacturing, such planning is very important as any change of plan or diversion from the original operational plan could affect the overall implementation of the warehouse operations and its financial allocation. This includes the receiving of materials, storage, issuing to the production floors, packaging, and delivery for shipping or export purposes. System support is required to ensure efficiency, especially during the documentation process which is critical since it could upset the accuracy of the inventory at all locations (receiving, storage, issuing, packaging, and shipping stations). The manager would be able to identify the expected amount of materials to come in and issued out during the operations based on the business planning down to production schedules.

Warehousing as the transition location would be able to monitor the flow process effectively based on the system support and generated report of the production schedules. Strategically, managers could plan ahead to ensure the output and shipment would not be disrupted with the emergence of any untoward problems. The firm therefore could meet the production output for export purposes without fail.

The findings and analysis that supported Hypothesis 2(c) could aid the SME owners or managers to plan and establish good manpower successions, for the current and future career workers. Most important of such establishment is the proper training

and career advancement of employees in the warehouse sections. It can be noted here that the high turnover of the operational work activities among employees are mostly in the manufacturing sectors. This is due to the high work pressure conditions (which is normal for manufacturing sectors). Other reasons include lack of skills and training (particularly the low ranked workers as most of them are employed urgently without going through the proper training process before being absorbed to work), and low basic salary (mainly the down line people working as material handler, material picker, and material clerical staff) which is also considered as one of the serious factors that causes high turnover in the firm.

With the introduction of MIS or computer driven operations, more unskilled workers could be reduced and the firm would only be left with some very competent workers (who are well trained) in the warehouse. The managers could review their salaries and other perks to ensure that these employees would stay with the firm for a long period of time. This would enable the warehouse to be maintained and managed efficiently most of the time. This would also reflect on the professionalism of the managers and firm in establishing the needs of HCM in the warehouse with the introduction and upgrading of MIS so as to achieve high performance of warehouse efficiency.

Based on the findings that supported Hypothesis 3(c), there are positive relationships provided by AMIS between AL and AWE. Managers should be able to focus on the efficiency of the layout by providing the system support innovation through the MIS.

It can be concluded that such relationship is positive and thus require the managers to be aware of good warehouse practice in maintaining its efficiency. Therefore, such determination of good decision making is applicable to all warehouses in firms according to their sizes.

5.3.1.3 Overall Implications on Managerial Implications and Firms Performance

All these findings suggest that the generation of efficiency in warehousing is related to its relationships with the operations, HCM, layout, and MIS. This can be gleaned from the literature on theories and practices, where it has brought significant changes in the warehousing and firm performances. These are due to the competitiveness of global business and commitment in the supply chain management that requires logistics management (which warehouse is part of its main service) to be more innovative in their operations. The analytical findings have provided direction for the warehousing management to make a decisive decision making in strategising the warehousing activities with the firm's business and financial planning. This study implicated the importance of managers in assisting the business in manufacturing firms. This could be done through the creation of warehouse efficiency in the firms or in the context of Malaysia SME manufacturing sectors.

Furthermore, based on the Organisational Learning (OL) Theory, most managers have increasingly adopted this theory as a powerful mechanism to improve the organisational performance (Senge, 1990; Senge, 1992). Most of the adaptive process is through the experiences of objectives, procedures, and searching rules

made within the organisation (Cyert & March, 1963). Therefore decision making needs to be done fast in case it requires immediate actions to be taken with fast positive results. Managers are trained as such so that they could resolve problems fast and make decisive decisions promptly as well. In warehouse management, this adaptation is an improvement suitable for the warehousing process activities in enhancing the efficiency of its management.

The Lewin's Force Field theory has also been acknowledged for the changes that occurred in the manufacturing firm cultures with strong practical words such as to become more supportive, proactive, and innovative (Lewin, 1946; Lewin, 1948). It is considered as the most important method in encouraging the employees at all levels of management to give their full commitment. It is also for supporting any changes or reform undertaken. It might become culture shock to those who are not used to such conditions, but such situations are normal and it benefits the warehouse management specifically and firm generally. It is not surprising for the firm to react, but instead of focusing on the efficiency of the overall productivity, the profit and loss (P & L) of the firm remains the actual main target priority to be looked after.

The results showed that MIS mediates the relationship of operation, HCM, and layout with warehouse efficiency. Related to that, warehouse efficiency is among the major contributors that determines the performance of the manufacturing firm. Therefore, it is significant that appropriate actions need to be taken and maintained under such relationships. Any decision making should be carefully taken into serious consideration because it could imbalance the roles that the MIS is playing. Managers

who are involved under such condition should know the best direction be taken in ensuring the stability and efficiency of the warehousing management.

5.3.2 Theoretical Implications

This research study proposed to strengthen the existing theory by providing a better insight of influence and relationship between the tested variables. The similarities and differences with previous research would also lend support to the main schools of thought in warehouse management.

Stock (1997) mentioned that in the logistics research and theory development, or in this case warehousing, is part and parcel of the major logistics service providers (Sink *et al.*, 1996), though initially it could benefit from borrowing and applying existing theories from other disciplines. This is because it does not have a rich heritage of theory development and empirical research. Therefore, all major logistics service providers have its root theories borrowed from the more established disciplines. It then expands from the business disciplines of marketing and management into some input from engineering (Stock, 1997). Since then, greater use of theory in logistics (especially warehousing) and supply chain management have been committed to. Mentzer and Kahn (1995) summed that logistics research (including warehousing as one of its major services providers) have been influenced by economic and behavioural approaches to scientific inquiry theories. These theories existed in all the current conditions of warehouse management or through the other related variables. This would benefit the manufacturing firm through its

efficiency applications, model development, theory construction, and new disciplines (Esper, Defee, & Mentzer, 2010; Garver & Williams, 2010).

The study also confirmed the MIS as a mediator in the context of relationships among the variables (operations, HCM, and layout) to maintain its warehouse efficiency. Theories such as a Likert 5-point scale (Warehousing Operations), Attribution theory (Warehousing HCM), Least Cost Location theory, and Waber's theory of the Location of the Firm (Warehousing Layout), Neural Networks (Warehousing MIS), and Activity Based Costing (Warehouse Efficiency) are popularly applied in the warehouse management (detailed explanation in Chapter Two). It can be confirmed here that such theories are effectively being used for the warehouse management and process benefits.

Based on these warehousing theories, it impacts the cause of the efficiency planning toward the overall implementation of the variables under study, namely operations, HCM, layout, and MIS. This would happen when dealing with changes, upgrading, reduction, and consolidation or downsizing of the organisation. People working in the warehouse under any organisation would be the focused on planned changed in preparing them to be efficient. This is to ensure that the warehouse is efficiently managed and pragmatic, thus contributing toward the new transformation of management, people, and organisation (Tokar, 2010). The approach of such changes could imperatively survive an increasing competitive business environment, in particular under the current business globalisation era (Daugherty, 2011).

5.4 LIMITATIONS OF THE STUDY

This study revealed its limitations theoretically and practically. Both have its implications with several methodological limitations.

A total of 1,000 questionnaires or 16.8 percent of the random questionnaires of the chosen SME manufacturing from the total population of 5,947 SMEs as listed in the SME Business Directory (2009) were sent with a pre-paid postage self-addressed envelope for easy return. The questionnaires were sent to SME manufacturing owners in West Coast of Peninsular Malaysia. This total sampling of the questionnaires is justifiable as it is above 14% of the total population (Jobber & Saunders, 1989; Jobber, 1990). The reason this study was done in that location geographically because it is more industrialised with ports facilities and more than 50% of the SMEs are located in that area. Johor has the largest concentration of manufacturing firms with 17.50 percent, followed by Selangor (16.70 percent), Perak (9.40 percent), and Penang (8.7 percent) (Saleh & Ndubisi, 2006a).

However, out of 1,000 questionnaires posted to the population, only 220 responded and only 182 were found to be useful for the study, which is equivalent to an overall response rate of 19 percent (rounded up). Based on the total number of respondents, only five were the medium-sized firms while the rest are categorised as small-sized firms. It would be preferable if the research could have a balanced number of medium-sized companies.

Furthermore, this research instrument used in the study gathered the perceptual measures by the owners themselves. Therefore, personal bias and misconceptions might have influenced those respondents. Therefore, given the scenario and the likely response bias, inferences made from such results should not be considered as definitive.

5.5 RECOMMENDATIONS FOR FUTURE RESEARCH

This study was done by using the mailed-questionnaire survey method and to cover its geographical coverage, other backgrounds of industries in manufacturing were conducted. Therefore the study suggested that a combination of quantitative and qualitative approaches should be conducted to get better and fair results. This is so as to understand the issues comprehensively and specifically about the warehousing management and its process.

Besides the constraints the research had gone through, it could be improved as an initiative for future research. Therefore, future research should focus on the other resources aside from capabilities and management processes. Both processes are considered as firm resources (Wernerfelt, 1984). Therefore, research may look into other resources or variables that are considered potential in influencing the warehousing management efficiency and performance. Potential ones to mention are security, environment, safety and health, waste management, integrated systems such as ISO 9000, ISO 14000, and ISO 18000. Others are related operational process such as supply chain management that could specifically be more value added to the warehouse and generally to the firm.

Warehousing management is very much related to the Third Party Logistics (3PL) because most of the firms are competitively involved with global business (Tompkins & Smith, 1998). Therefore, it is important that a study looks into the variations and requirements between these two areas. Questions on why 3PL is given priority during the process of supply chain management rather than the firm's own warehouse should be further explored and studied.

5.6 CONTRIBUTIONS TO KNOWLEDGE

The theoretical research framework is considered as the main contribution of this thesis as it is "a one research framework". So far not many attempts have been made to investigate and explore these relationships between variables of warehouse efficiency. The contributions of this theoretical framework would enhance a better understanding of warehousing management activities in the SME manufacturing firms.

Theoretically, this research would contribute to the growth development of the warehouse efficiency theory. This is especially so in developing and bringing better inputs for the decision-making process in warehousing management, particularly in SME manufacturing firms. The outcome of this research, such as framework, model, matrix, or guidelines proposed, would be able to assist warehouses or SME manufacturing owners and managers in establishing an effective and efficient warehouse environment.

Practically, the research contribution would also positively facilitate the warehousing managers and owners in the manufacturing firms to enable them to make the right decisions in their operational activities and to establish a better workplace environment. It could be done by laying out the guidelines in managing the complicated issues of the warehousing in relation to its attributes and efficiency. This is especially focused on the business planning of the firms, operational activities, and training for the workers.

5.7 CONCLUSION

The results indicated the importance of warehouse efficiency in the SME manufacturing firms. The warehousing operations, HCM, layout, and MIS are the main basic variables for process management improvement in making the warehouses to be efficient and high firm performance would be achievable.

There are not many researchers conducting studies on warehouse efficiency and performance improvement in Malaysia, particularly related to Small and Medium Enterprises (SMEs). It has become a major issue in the study and also exposed the research gap with the difficulties in getting warehouse data. This happened even though warehousing is part of the major logistics activities of service providers. As described by Rosena *et al.* (2008), that despite a remarkable expansion of the industry in the country, there have been very little published research in the area of logistics (including warehousing) and supply chain. This causes very limited information for the purpose of coordination, learning, and advancement in the supply chain management.

From the literature review perspective, there are many areas that have not been explored in the modern organisations. Companies need to face the reality, and in order to survive, they need to incorporate the ability to transform rapidly and successfully to the changing global business related to warehousing efficiency. Thus the model of the study provides a simplistic foundation to understand the interaction of forces or attributes influencing the success of change. Related to that, vision has consistently been identified as a key responsibility of the owners of the firms. This included their competent managers to make important decision and planning in ensuring the warehouse is managed efficiently. Atkinson and Millar (1999) described that the vision or goal must be tangible, measurable, and realistic to the business and directed toward the end of state. However, it is concluded that this is not an easy passage to practise without years of work experience supported by proper education background. The academicians and practitioners are to search out for new models that could accurately explain any forces or attributes that are being associated with management. Leadership success and failure in the future for any potential changes, particularly in warehousing management and its best practices, is the main concern of the firm success.

Therefore, the objectives of this study were to determine and examine the relationships between these attributes and their effects on organisational efficiency either as independent variables or mediating variable. As mentioned earlier, the attributes used in this study were: (1) warehousing operations; (2) warehousing HCM; (3) warehousing layout; and warehousing MIS (4). Nine hypotheses have been developed based on the theoretical research framework. Several aspects of research methodologies were covered such as research design, population and

sampling, instrumentation, reliability and validity of survey instrument, pre-testing survey instrument, and data collection procedures and analysis. It was also noted that the proposed single research framework is a new one and not many studies have been done to examine the relationships and effect of all variables simultaneously. This happened in the same framework that is related with the warehouse efficiency. The results of the hypotheses showed that there are positive correlations, mediations, and regressions conducted over the data collected.

It is through the warehousing MIS mediation on the warehouse attributes (operations, HCM, and layout) that mediate positively to its relationship over the warehouse efficiency. Therefore this study significantly contributed to its theoretical and practical contribution of the study. This is very much related to warehouse efficiency in the SME manufacturing firms.

Hopefully the research would expose the horizon clearly to the top management of the manufacturing firm of the importance of warehousing management and its process operations. With the globalised business getting more competitive and volatile, the functions of warehousing realistically could not be denied of its crucial role. The remarks circulating in the industry among the practitioners that a warehouse is liked a “bank” and “heart of the factory” only speaks volumes of its contributions to the SME manufacturing firms or any organisations in the industry.

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APPENDIX 1

LINKAGES BETWEEN RESEARCH QUESTIONS, RESEARCH OBJECTIVES AND HYPOTHESES

No:	Research Questions	Research Objectives	Hypotheses
1.0	Is there any relationship between the warehousing operation and warehouse efficiency?	To determine whether there is any relationship between the warehousing operation and warehouse efficiency.	**H1(a): There is a relationship between the warehousing operation and warehouse efficiency.**
2.0	Is there any relationship between the warehousing operation and MIS?	To determine whether there is any relationship between the warehousing operations and MIS.	**H1(b): There is a relationship between the warehousing operations and MIS.**
3.0	Is there any mediating effect of MIS in the relationship between warehousing operation and warehouse efficiency?	To examine the mediating effect of MIS in the relationship between warehousing operations and warehouse efficiency.	**H1 (c): There is a mediating effect of MIS in the relationship between warehousing operations and warehouse efficiency.**
4.0	Is there any relationship between the warehousing HCM and warehouse efficiency?	To determine whether there is any relationship between the warehousing HCM and warehouse efficiency.	**H2(a): There is a relationship between the warehousing HCM and warehouse efficiency.**
5.0	Is there any relationship between the warehouse HCM and MIS?	To determine whether there is any relationship between the warehousing HCM and MIS.	**H2(b): There is a relationship between the warehousing HCM and MIS.**
6.0	Is there any mediating effect of MIS in the relationship between warehousing HCM and warehouse efficiency?	To examine the mediating effect of MIS in the relationship between warehousing HCM and warehouse efficiency.	**H2 (c): There is a mediating effect of MIS in the relationship between warehousing HCM and warehouse efficiency.**

7.0	Is there any relationship between the warehousing layout and warehouse efficiency?	To determine whether there is any relationship between the warehousing layout and warehouse efficiency.	**H3(a): There is a relationship between the warehousing layout and warehouse efficiency.**
8.0	Is there any relationship between the warehouse layout and MIS?	To determine whether there is any relationship between the warehousing layout and MIS.	**H3(b): There is a relationship between the warehousing layout and MIS.**
9.0	Is there any mediating effect of MIS in the relationship between warehousing layout and warehouse efficiency?	To examine the mediating effect of MIS in the relationship between warehousing layout and warehouse efficiency.	**H3(c): There is a mediating effect of MIS in the relationship between warehousing layout and warehouse efficiency.**

APPENDIX 2

QUESTIONNAIRE

Letter of Instructions to Owners

A SURVEY OF MEDIATING EFFECT OF MANAGEMENT INFORMATION SYSTEM ON THE RELATIONSHIP OF WAREHOUSE ATTRIBUTES AND ITS EFFICIENCY IN MALAYSIA'S SMALL AND MEDIUM ENTERPRISES

My name is Adam Mohd Saifudin and I am a Doctoral of Business Administration (DBA) candidate at the Universiti Utara Malaysia (UUM), Sintok, Kedah. I am actually conducting a research on the topic mentioned above. The objective of this research is to examine the mediating effect of MIS on the relationship between warehouse attributes and its efficiency in Small and Medium Enterprises (SMEs), Peninsular Malaysia.

I hope this questionnaire will not take long for you to complete (10-15 minutes). The information gathered will be treated strictly confidential. The result of this survey is for research purposes only and there is no connection between your name and the result that will be reported in this research. All data obtained during this survey will only be used for academic purpose once this research is completed.

Once you have answered the questionnaire, please insert into envelope provided (complete with my address and stamp) and return to me via Pos Malaysia. Your cooperation and participation in this research is highly appreciated. Thank you.
Regards,

Adam Mohd Saifudin
(HP No: 019-452-9828)

Section A: WAREHOUSE MANAGEMENT

(1) Warehouse Efficiency (AWE)

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.

1 – strongly disagree 2 – disagree 3 – neither agree 4 – agree 5 – strongly agree

Item	Statement	1	2	3	4	5
AWE3	Enough budgets are necessary to enhance the warehouse development.					
AWE4	Top management support must be supportive in warehouse activities.					
AWE5	Documentations with authorisation at each stage would expedite the warehousing process.					
AWE6	Warehouse inventory accuracy would enhance warehouse efficiency.					
AWE7	Organise layout assists warehouse to arrange and retrieve materials easily.					
AWE8	Computer assists warehouse efficiency.					
AWE9	Materials movement in the warehouse is well organised.					
AWE10	Inventory accuracy is the most important element for warehouse efficiency.					
AWE11	Space optimisation is always the priority activities in the warehouse.					
AWE12	In order to ensure the warehouse is efficient, 5S need to be practice regularly.					
AWE13	Layout is properly plan for every type of materials at respective locations.					
AWE14	Materials flow in the warehouse is moving smoothly due to efficiency of the layout.					
AWE15	Minimum manpower for a small-medium size warehouse is 6 to 10 people.					
AWE16	Warehouse workers qualifications do contribute to warehouse efficiency.					

AWE17	Warehouse workers who have no education background contribute significantly to warehouse efficiency.					
AWE18	Warehouse in regards to their size must use at least one type of software to upgrade and improve its operation efficiency.					
AWE19	Computer facilities at all locations are necessary.					
AWE21	Immediate action should be taken if any discrepancies found in the warehouse process.					

Section A: WAREHOUSE MANAGEMENT

(2) Warehouse Operations (AWO)

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.
1 – strongly disagree 2 – disagree 3 – neither agree 4 – agree 5 – strongly agree

Items	Statement	1	2	3	4	5
AWO1	It is necessary to have enough allocation to operate warehouse operation efficiency.					
AWO2	Warehouse inventory audit should be carried out at all time.					
AWO3	Appropriate warehouse materials handling equipment (e.g., Forklift, Hand Jack etc.) are necessary to operationalise warehouse operations.					
AWO4	Space accessibility is important for easy material movements within warehouse.					

Section A: WAREHOUSE MANAGEMENT

(3) Human Capital Management (AHCM)

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.

1 – strongly disagree 2 – disagree 3 – neither agree 4 – agree 5 – strongly agree

Items	Statement	1	2	3	4	5
AHCM1	Employees are employed based on their suitable education qualifications.					
AHCM2	Experiences, skills and know the job functions are necessary.					
AHCM3	Warehouse operations training are important and necessary.					
AHCM4	A training plan should be well prepared and supervised effectively during implementation.					
AHCM5	In case of manpower shortage, management would ensure there must have replacement.					

Section A: WAREHOUSE MANAGEMENT

(4) Layout (AL)

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.

1 – strongly disagree 2 – disagree 3 – neither agree 4 – agree 5 – strongly agree

Item	Statement	1	2	3	4	5
AL1	The warehouse layout is systematically plan.					
AL2	5S are seriously being practice.					
AL3	There is smooth material handling and movement in the warehouse.					
AL4	There is space saving in the warehouse even during the peak of production.					
AL5	Space optimisation is utilised at all time in the warehouse.					

Section A: WAREHOUSE MANAGEMENT

5: Management Information System (MIS)

Please tick (x) in the appropriate box to indicate your level of agreement for each statement below.
1 – strongly disagree 2 – disagree 3 – neither agree 4 – agree 5 – strongly agree

Item	Statement	1	2	3	4	5
AMIS1	Sufficient computer hardware has been used in the warehouse management and operations.					
AMIS2	Fully usage of telecommunication Network (e.g., Internet, Email) managing the warehouse.					
AMIS3	Our staffs have been given enough training computer operations.					
AMIS4	We developed our own Standard Operating Procedure (SOP) guidelines for each of computers operations.					
AMIS5	All data are stored in computers.					
AMIS6	We are using the latest version of computer software for the warehousing operations.					
AMIS7	All warehouse documents are prepared and operated by computer would expedite the warehousing process.					
AMIS8	The usage of up-date MIS would enhance the warehousing process.					
AMIS9	The networking of MIS within warehouse assists the warehousing process.					
AMIS10	The necessary use of appropriate and latest software available in the market would enhance MIS.					

Section B: COMPANY BACKGROUND INFORMATION
Please tick (x) in the space provided.

B1. When the company was founded (Year)?

No.	Items	
1.	Year 2000 and before	
2.	Year 2001 and onwards	

B2. How many employees for the company as whole?

No.	Items	
1.	Less than 50 people	
2.	51 to 150 people	

B3. What is the annual sales turnover?

No.	Items	
1.	Between RM250,00 and RM10 million	
2.	RM10 million to RM25 million	

B4. In which industry do you operate?

No.	Items	
1.	Textile & Apparel	
2.	Food & Beverages	
3.	Metal & Metal Products	
4.	Paper, Printing, & Publication	
5.	Furniture	
6.	Rubber & Plastics Products	
7.	Wood & Wood Products	
8.	Non Metallic Mineral Products	
9.	Machinery & Equipment	
10.	Electrical & Electronics	
11.	Chemical and Chemical Products	
12.	Transport Equipment	
13.	*General Manufacturing	
14.	Others	

*Include jewellery, leather products; tobacco products; medical, precision and optical instruments; and recycling and petroleum products.

Section C: Respondents Background Information

Please tick (x) in the appropriate box or fill in the space provided.

No.	Items	
C1.	Gender	☐ Male ☐ Female
C2.	Ethnicity	☐ Malay ☐ Chinese ☐ Indian ☐ Other (Please specify: ……..)
C3.	Marital Status	☐ Single ☐ Married ☐ Widow ☐ Widower

C4.	Age (Years)	☐ 18 - 25 ☐ 26 – 33 ☐ 34 - 41 ☐ 42 – 49 ☐ 50 and above
C5.	Highest education level	☐ Primary school certificate ☐ SRP / SPM / STPM ☐ Diploma or equivalent ☐ Bachelor's degree or equivalent ☐ Master's degree or higher
C6.	How many years have you been in this company?	☐ Less than a year ☐ 1 to 5 years ☐ 6 to 10 years ☐ 11 to 15 years ☐ 16 to 20 years ☐ above 20 years
C7.	How many years of previous working experience?	☐ Less than a year ☐ 1 to 5 years ☐ 6 to 10 years ☐ 11 to 15 years ☐ 16 to 20 years ☐ above 20 years

APPENDIX 3

RELIABILITY

Reliability Statistics

Scale Items	Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
Warehouse Efficiency (AWE)	.947	.954	18
Warehousing Operations (AWO)	.921	.923	4
Warehousing Human Capital Management (AHCM)	.794	.851	5
Warehousing Layout (AL)	.926	.913	5
Warehousing Management Information System (AMIS)	.859	.833	10
Total			42

APPENDIX 4

FACTOR ANALYSIS

Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

Scale Items	KMO Measure of Sampling	Bartlett's Test of Sphericity		
		Approximate Chi-Square	Df	Sig
Warehouse Efficiency (AWE)	.887	3950.906	153	.000
Warehousing Operations (AWO)	.756	609.759	6	.000
Warehousing Human Capital Management (AHCM)	.793	652.894	10	.000
Warehousing Layout (AL)	.845	1196.652	10	.000
Warehousing Management Information System (AMIS)	.790	1223.955	45	.000

APPENDIX 5

MULTIPLE REGRESSIONS AND CORRELATIONS (SUMMARY)

Descriptive Statistics

	Mean	Std. Deviation	N
AWE	4.0559	.31108	182
AWO	4.0755	.37368	182
AHCM	3.9945	.31983	182
AL	3.2945	.74617	182
AMIS	3.4022	.40887	182

Correlations

		AWE	AWO	AHCM	AL	AMIS
Pearson Correlation	AWE	1.000				
	AWO	.772	1.000			
	AHCM	.744	.570	1.000		
	AL	.240	.071	.199	1.000	
	AMIS	.518	.375	.405	.633	1.000
Sig. (1-tailed)	AWE	.	.000	.000	.001	.000
	AWO	.000	.	.000	.169	.000
	AHCM	.000	.000	.	.003	.000
	AL	.001	.169	.003	.	.000
	AMIS	.000	.000	.000	.000	

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.871(a)	.758	.753	.15465	.758	138.847	4	177	.000

a Predictors: (Constant), AMIS, AWO, AHCM, AL
b Dependent Variable: AWE

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.420	.157		2.677	.008
	AWO	.402	.039	.483	10.286	.000
	AHCM	.387	.045	.398	8.569	.000
	AL	.010	.020	.024	.492	.623
	AMIS	.122	.041	.161	2.999	.003

a Dependent Variable: AWE

Correlations (AL – AMIS)

		AL1	AL2	AL3	AL4	AL5	AMIS 1	AMIS 2	AMIS 3	AMIS 4	AMIS 5	AMIS 6	AMIS 7	AMIS 8	AMIS 9	AMIS 10
AL1	**Pearson Correlation**	1														
	Sig. (2-tailed)															
	N	182														
AL2	**Pearson Correlation**	.978**	1													
	Sig. (2-tailed)	.000														
	N	182	182													
AL3	**Pearson Correlation**	.926**	.924**	1												
	Sig. (2-tailed)	.000	.000													
	N	182	182	182												
AL4	**Pearson Correlation**	.841**	.851**	.860**	1											
	Sig. (2-tailed)	.000	.000	.000												
	N	182	182	182	182											
AL5	**Pearson Correlation**	.360**	.346**	.367**	.332**	1										
	Sig. (2-tailed)	.000	.000	.000	.000											
	N	182	182	182	182	182										
AMIS1	**Pearson Correlation**	.566**	.566**	.571**	.553**	.157*	1									
	Sig. (2-tailed)	.000	.000	.000	.000	.035										
	N	182	182	182	182	182	182									
AMIS2	**Pearson Correlation**	.497**	.491**	.510**	.381**	.263**	.690**	1								
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000									
	N	182	182	182	182	182	182	182								
AMIS3	**Pearson Correlation**	.573**	.570**	.552**	.697**	.109	.668**	.414**	1							
	Sig. (2-tailed)	.000	.000	.000	.000	.143	.000	.000								
	N	182	182	182	182	182	182	182	182							
AMIS4	**Pearson Correlation**	.491**	.475**	.485**	.419**	.282**	.748**	.789**	.498**	1						
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000							
	N	182	182	182	182	182	182	182	182	182						
AMIS5	**Pearson Correlation**	.561**	.568**	.564**	.576**	.181*	.674**	.535**	.778**	.608**	1					
	Sig. (2-tailed)	.000	.000	.000	.000	.015	.000	.000	.000	.000						
	N	182	182	182	182	182	182	182	182	182	182					

AMIS6	**Pearson Correlation**	.453**	.455**	.374**	.496**	.090	.418**	.263**	.673**	.287**	.571**	1				
	Sig. (2-tailed)	.000	.000	.000	.000	.226	.000	.000	.000	.000	.000					
	N	182	182	182	182	182	182	182	182	182	182	182				
AMIS7	**Pearson Correlation**	-.011	-.011	-.019	-.007	.017	-.029	-.055	.003	-.049	-.016	-.056	1			
	Sig. (2-tailed)	.882	.887	.803	.923	.823	.698	.462	.965	.511	.832	.453				
	N	182	182	182	182	182	182	182	182	182	182	182	182			
AMIS8	**Pearson Correlation**	.358**	.356**	.340**	.370**	.030	.451**	.340**	.385**	.353**	.384**	.273**	.007	1		
	Sig. (2-tailed)	.000	.000	.000	.000	.689	.000	.000	.000	.000	.000	.000	.929			
	N	182	182	182	182	182	182	182	182	182	182	182	182	182		
AMIS9	**Pearson Correlation**	.137	.164*	.128	.168*	.013	.184*	.211**	.182*	.121	.221**	.190*	-.020	.686**	1	
	Sig. (2-tailed)	.065	.027	.086	.023	.866	.013	.004	.014	.104	.003	.010	.789	.000		
	N	182	182	182	182	182	182	182	182	182	182	182	182	182	182	
AMIS10	**Pearson Correlation**	.118	.143	.112	.145	.049	.200**	.209**	.178*	.150*	.229**	.158*	-.016	.605**	.903**	1
	Sig. (2-tailed)	.114	.054	.132	.051	.509	.007	.005	.016	.043	.002	.033	.827	.000	.000	
	N	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations (AHCM – AMIS)

		AHCM1	AHCM2	AHCM3	AHCM4	AHCM5	AMIS 1	AMIS 2	AMIS 3	AMIS 4	AMIS 5	AMIS 6	AMIS 7	AMIS 8	AMIS 9	AMIS 10
AHCM1	**Pearson Correlation**	1														
	Sig. (2-tailed)															
	N	182														
AHCM2	**Pearson Correlation**	.485**	1													
	Sig. (2-tailed)	.000														
	N	182	182													
AHCM3	**Pearson Correlation**	.351**	.436**	1												
	Sig. (2-tailed)	.000	.000													
	N	182	182	182												
AHCM4	**Pearson Correlation**	.317**	.430**	.852**	1											
	Sig. (2-tailed)	.000	.000	.000												
	N	182	182	182	182											
AHCM5	**Pearson Correlation**	.283**	.429**	.897**	.858**	1										
	Sig. (2-tailed)	.000	.000	.000	.000											
	N	182	182	182	182	182										
AMIS1	**Pearson Correlation**	.160*	.156*	.191**	.222**	.154*	1									
	Sig. (2-tailed)	.031	.036	.010	.003	.038										
	N	182	182	182	182	182	182									
AMIS2	**Pearson Correlation**	.001	.133	.259**	.326**	.219**	.690**	1								
	Sig. (2-tailed)	.994	.074	.000	.000	.003	.000									
	N	182	182	182	182	182	182	182								
AMIS3	**Pearson Correlation**	.260**	.110	.134	.163*	.151*	.668**	.414**	1							
	Sig. (2-tailed)	.000	.138	.071	.028	.042	.000	.000								
	N	182	182	182	182	182	182	182	182							
AMIS4	**Pearson Correlation**	.071	.091	.225**	.323**	.268**	.748**	.789**	.498**	1						
	Sig. (2-tailed)	.338	.224	.002	.000	.000	.000	.000	.000							
	N	182	182	182	182	182	182	182	182	182						
AMIS5	**Pearson Correlation**	.169*	.160*	.161*	.288**	.212**	.674**	.535**	.778**	.608**	1					
	Sig. (2-tailed)	.023	.031	.030	.000	.004	.000	.000	.000	.000						
	N	182	182	182	182	182	182	182	182	182	182					
AMIS6	**Pearson Correlation**	.281**	.114	.057	.096	.096	.418**	.263**	.673**	.287**	.571**	1				
	Sig. (2-tailed)	.000	.125	.446	.198	.195	.000	.000	.000	.000	.000					
	N	182	182	182	182	182	182	182	182	182	182	182				
AMIS7	**Pearson Correlation**	.005	-.021	.010	.009	.005	-.029	-.055	.003	-.049	-.016	-.056	1			
	Sig. (2-tailed)	.945	.777	.888	.899	.947	.698	.462	.965	.511	.832	.453				
	N	182	182	182	182	182	182	182	182	182	182	182	182			

AMIS8	**Pearson Correlation**	.353**	.411**	.171*	.178*	.167*	.451**	.340**	.385**	.353**	.384**	.273**	.007	1		
	Sig. (2-tailed)	.000	.000	.021	.016	.024	.000	.000	.000	.000	.000	.000	.929			
	N	182	182	182	182	182	182	182	182	182	182	182	182	182		
AMIS9	**Pearson Correlation**	.387**	.633**	.301**	.306**	.301**	.184*	.211**	.182*	.121	.221**	.190*	-.020	.686**	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.013	.004	.014	.104	.003	.010	.789	.000		
	N	182	182	182	182	182	182	182	182	182	182	182	182	182	182	
AMIS10	**Pearson Correlation**	.343**	.587**	.366**	.364**	.365**	.200**	.209**	.178*	.150*	.229**	.158*	-.016	.605**	.903**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.007	.005	.016	.043	.002	.033	.827	.000	.000	
	N	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations (AWO – AMIS)

		AWO 1	AWO 2	AWO 3	AWO 4	AMIS 1	AMIS 2	AMIS 3	AMIS 4	AMIS 5	AMIS 6	AMIS 7	AMIS 8	AMIS 9	AMIS 10
AWO1	**Pearson Correlation**	1													
	Sig. (2-tailed)														
	N	182													
AWO2	**Pearson Correlation**	.776**	1												
	Sig. (2-tailed)	.000													
	N	182	182												
AWO3	**Pearson Correlation**	.770**	.576**	1											
	Sig. (2-tailed)	.000	.000												
	N	182	182	182											
AWO4	**Pearson Correlation**	.804**	.789**	.791**	1										
	Sig. (2-tailed)	.000	.000	.000											
	N	182	182	182	182										
AMIS1	**Pearson Correlation**	.129	.063	.183*	.116	1									
	Sig. (2-tailed)	.082	.395	.013	.119										
	N	182	182	182	182	182									
AMIS2	**Pearson Correlation**	.107	.102	.207**	.109	.690**	1								
	Sig. (2-tailed)	.151	.169	.005	.144	.000									
	N	182	182	182	182	182	182								
AMIS3	**Pearson Correlation**	.131	.109	.169*	.126	.668**	.414**	1							
	Sig. (2-tailed)	.077	.144	.023	.091	.000	.000								
	N	182	182	182	182	182	182	182							
AMIS4	**Pearson Correlation**	.084	.010	.169*	.037	.748**	.789**	.498**	1						
	Sig. (2-tailed)	.259	.891	.023	.618	.000	.000	.000							
	N	182	182	182	182	182	182	182	182						
AMIS5	**Pearson Correlation**	.189*	.130	.205**	.145	.674**	.535**	.778**	.608**	1					
	Sig. (2-tailed)	.011	.081	.006	.051	.000	.000	.000	.000						
	N	182	182	182	182	182	182	182	182	182					
AMIS6	**Pearson Correlation**	.058	.033	.087	.112	.418**	.263**	.673**	.287**	.571**	1				
	Sig. (2-tailed)	.438	.654	.245	.131	.000	.000	.000	.000	.000					
	N	182	182	182	182	182	182	182	182	182	182				
AMIS7	**Pearson Correlation**	-.011	-.023	-.002	-.015	-.029	-.055	.003	-.049	-.016	-.056	1			
	Sig. (2-tailed)	.883	.756	.975	.841	.698	.462	.965	.511	.832	.453				
	N	182	182	182	182	182	182	182	182	182	182	182			

AMIS8	**Pearson Correlation**	.413**	.420**	.426**	.524**	.451**	.340**	.385**	.353**	.384**	.273**	.007	1		
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.929			
	N	182	182	182	182	182	182	182	182	182	182	182	182		
AMIS9	**Pearson Correlation**	.591**	.682**	.564**	.724**	.184*	.211**	.182*	.121	.221**	.190*	-.020	.686**	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.013	.004	.014	.104	.003	.010	.789	.000		
	N	182	182	182	182	182	182	182	182	182	182	182	182	182	
AMIS10	**Pearson Correlation**	.591**	.689**	.559**	.726**	.200**	.209**	.178*	.150*	.229**	.158*	-.016	.605**	.903**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.007	.005	.016	.043	.002	.033	.827	.000	.000	
	N	182	182	182	182	182	182	182	182	182	182	182	182	182	182

**.

Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX 6

MULTIPLE REGRESSIONS ANALYSIS (SOBEL)

(1) Warehouse Operation (AWO) and Warehouse MIS (AMIS)

Descriptive Statistics

	Mean	Std. Deviation	N
AMIS	3.4022	.40887	182
AWO	4.0755	.37368	182

Correlations

		AMIS	AWO
Pearson Correlation	AMIS	1.000	.375
	AWO	.375	1.000
Sig. (1-tailed)	AMIS	.	.000
	AWO	.000	.
N	AMIS	182	182
	AWO	182	182

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.375[a]	.141	.136	.38009	.141	29.451	1	180	.000

a. Predictors: (Constant), AWO
b. Dependent Variable: AMIS

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.730	.309		5.591	.000		
	AWO	.410	.076	.375	5.427	.000	1.000	1.000

Dependent Variable: AMIS

(2) Warehouse MISC (AMIS) and Warehouse HCM (AHCM)

Descriptive Statistics

	Mean	Std. Deviation	N
AMIS	3.4022	.40887	182
AHCM	3.9945	.31983	182

Correlations

		AMISC	AHCMC
Pearson Correlation	AMIS	1.000	.405
	AHCM	.405	1.000
Sig. (1-tailed)	AMIS	.	.000
	AHCM	.000	.
N	AMIS	182	182
	AHCM	182	182

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.405[a]	.164	.159	.37491	.164	35.284	1	180	.000

a. Predictors: (Constant), AHCM
b. Dependent Variable: AMIS

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.335	.349		3.823	.000		
	AHCM	.518	.087	.405	5.940	.000	1.000	1.000

a. Dependent Variable: AMIS

Dependent Variable: AMIS

(3) Warehouse Layout (AL) and Warehouse MIS (AMIS)

Descriptive Statistics

	Mean	Std. Deviation	N
AMIS	3.4022	.40887	182
AL	3.2945	.74617	182

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.633[a]	.401	.398	.31736	.401	120.430	1	180	.000

a. Predictors: (Constant), AL
b. Dependent Variable: AMIS

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.259	.107		21.158	.000		
	AL	.347	.032	.633	10.974	.000	1.000	1.000

(4) Warehouse Efficiency (AWE) and Warehouse MIS (AMIS)

Descriptive Statistics

	Mean	Std. Deviation	N
AWE	4.0559	.31108	182
AMIS	3.4022	.40887	182

Correlations

		AWE	AMIS
Pearson Correlation	AWE	1.000	.518
	AMIS	.518	1.000
Sig. (1-tailed)	AWE	.	.000
	AMIS	.000	.
N	AWE	182	182
	AMIS	182	182

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.518[a]	.269	.265	.26676	.269	66.131	1	180	.000

a. Predictors: (Constant), AMIS
b. Dependent Variable: AWE

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.714	.166		16.333	.000		
	AMIS	.394	.048	.518	8.132	.000	1.000	1.000

a. Dependent Variable: AWE

(5) Warehouse Efficiency (AWE) and Warehouse Operations (AWO)

Descriptive Statistics

	Mean	Std. Deviation	N
AWE	4.0559	.31108	182
AWO	4.0755	.37368	182

Correlations

		AWE	AWO
Pearson Correlation	AWE	1.000	.772
	AWO	.772	1.000
Sig. (1-tailed)	AWE	.	.000
	AWO	.000	.
N	AWE	182	182
	AWO	182	182

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.772[a]	.596	.594	.19822	.596	265.767	1	180	.000

a. Predictors: (Constant), AWO
b. Dependent Variable: AWE

Coefficients[a]

		Unstandardised Coefficients		Standardised Coefficients			Correlations			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.436	.161		8.900	.000					
	AWO	.643	.039	.772	16.302	.000	.772	.772	.772	1.000	1.000

a. Dependent Variable: AWE

(6) Warehouse Efficiency (AWE) and Warehouse HCM (AHCM)

Descriptive Statistics

	Mean	Std. Deviation	N
AWE	4.0559	.31108	182
AHCM	3.9945	.31983	182

Correlations

		AWE	AHCM
Pearson Correlation	AWE	1.000	.744
	AHCM	.744	1.000
Sig. (1-tailed)	AWE	.	.000
	AHCM	.000	.
N	AWE	182	182
	AHCM	182	182

Model Summary[b]

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.744[a]	.553	.550	.20860	.553	222.514	1	180	.000

a. Predictors: (Constant), AHCM
b. Dependent Variable: AWE

Coefficients[a]

		Unstandardised Coefficients		Standardised Coefficients			Correlations			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.167	.194		6.008	.000					
	AHCM	.723	.048	.744	14.917	.000	.744	.744	.744	1.000	1.000

(7) Warehouse Efficiency (AWE) and Warehouse Layout (AL)

Descriptive Statistics

	Mean	Std. Deviation	N
AWE	4.0559	.31108	182
AL	3.2945	.74617	182

Correlations

		AWE	AL
Pearson Correlation	AWE	1.000	.240
	AL	.240	1.000
Sig. (1-tailed)	AWE	.	.001
	AL	.001	.
N	AWE	182	182
	AL	182	182

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.240[a]	.057	.052	.30284	.057	10.977	1	180	.001

a. Predictors: (Constant), AL
b. Dependent Variable: AWE

Coefficients

		Unstandardised Coefficients		Standardised Coefficients			Correlations			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.727	.102		36.574	.000					
	AL	.100	.030	.240	3.313	.001	.240	.240	.240	1.000	1.000

a. Dependent Variable: AWE

(8) Warehouse Efficiency (AWE), Warehouse MIS (AMIS), and Warehouse Operations (AWO)

Descriptive Statistics

	Mean	Std. Deviation	N
AWE	4.0559	.31108	182
AWO	4.0755	.37368	182
AMIS	3.4022	.40887	182

Correlations

		AWE	AWO	AMIS
Pearson Correlation	AWE	1.000	.772	.518
	AWO	.772	1.000	.375
	AMIS	.518	.375	1.000
Sig. (1-tailed)	AWE	.	.000	.000
	AWO	.000	.	.000
	AMIS	.000	.000	.
N	AWE	182	182	182
	AWO	182	182	182
	AMIS	182	182	182

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.811[a]	.657	.653	.18317	.657	171.525	2	179	.000

a. Predictors: (Constant), AMIS, AWO
b. Dependent Variable: AWE

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.086	.162		6.721	.000
	AWO	.560	.039	.672	14.240	.000
	AMIS	.203	.036	.266	5.639	.000

a. Dependent Variable: AWE

(9) Warehouse Efficiency (AWE), Warehouse MIS (AMIS), and Warehouse HCM (AHCM)

Descriptive Statistics

	Mean	Std. Deviation	N
AWE	4.0559	.31108	182
AHCM	3.9945	.31983	182
AMIS	3.4022	.40887	182

Correlations

		AWE	AHCM	AMIS
Pearson Correlation	AWE	1.000	.744	.518
	AHCM	.744	1.000	.405
	AMIS	.518	.405	1.000
Sig. (1-tailed)	AWE	.	.000	.000
	AHCM	.000	.	.000
	AMIS	.000	.000	.
N	AWE	182	182	182
	AHCM	182	182	182
	AMIS	182	182	182

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.781[a]	.609	.605	.19552	.609	139.581	2	179	.000

a. Predictors: (Constant), AMIS, AHCM
b. Dependent Variable: AWE

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.903	.189		4.770	.000
	AHCM	.621	.050	.638	12.492	.000
	AMIS	.198	.039	.260	5.088	.000

a. Dependent Variable: AWE

(10) Warehouse Efficiency (AWE), Warehouse MIS (AMIS), and Warehouse Layout (AL)

Descriptive Statistics

	Mean	Std. Deviation	N
AWE	4.0559	.31108	182
AL	3.2945	.74617	182
AMIS	3.4022	.40887	182

Correlations

		AWE	AL	AMIS
Pearson Correlation	AWE	1.000	.240	.518
	AL	.240	1.000	.633
	AMIS	.518	.633	1.000
Sig. (1-tailed)	AWE	.	.001	.000
	AL	.001	.	.000
	AMIS	.000	.000	.
N	AWE	182	182	182
	AL	182	182	182
	AMIS	182	182	182

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.531[a]	.282	.274	.26511	.282	35.106	2	179	.000

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.675	.167		16.060	.000
	AL	-.062	.034	-.148	-1.804	.073
	AMIS	.465	.062	.612	7.476	.000

a. Dependent Variable: AWE