# THE RELATIONSHIPS OF MANUFACTURING PRACTICES, KNOWLEDGE TRANSFER, ORGANIZATIONAL CAPABILITIES TOWARDS MANUFACTURING CAPABILITIES:MODERATING EFFECT OF TRAINING ACROSS INDUSTRIES IN NORTHERN REGION OF MALAYSIA

By

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## ABSTRACT

Malaysia is one of the countries which focus on the manufacturing sector to get income. That is why manufacturing capabilities are an important factor in running and developing a business. Therefore, this study aimed to identify the relationship between the factors that ensure that the manufacturing companies in Malaysia can survive among similar companies in the industry. The factors identified in this study are manufacturing practices, knowledge transfer, organization capability and manufacturing capabilities. Training is a moderating variable in this study. Through a mail survey, a total of 119 companies representing a variety of industries provided feedback. The hypothesis was tested using correlations and regression techniques. These findings support the hypothesis. The multiple regression analysis showed that there were significant correlations between the factors in each of the criteria for manufacturing capabilities. The hierarchical multiple regression analysis was conducted to test the role of the moderating variable in the relationship between the independent variables and the dependent variable. The hierarchical multiple regression results showed that training moderated and enhanced the companies to compete with others. To examine the relationship between manufacturing capabilities, manufacturing practices, knowledge transfer in manufacturing, organization capabilities and training, this research used a technology adoption theory - the Resource-based Theory. The research framework consisted of the following: four manufacturing practices, three knowledge transfer in manufacturing, two organization capabilities, three training as a moderating variables, and four manufacturing capabilities. This research used an adopted survey with a 5-

point- Likert-scale. To analyze data, SPSS version 19.0 was used to examine the path of relationships between the variables. This study will be beneficial to the shareholders and the directors of the companies to enhance their manufacturing capabilities to keep them relevant to the manufacturing industries

# ABSTRAK

Malaysia menjadi salah satu negara yang memfokuskan kepada bidang pembuatan sebagai salah satu sumber ekonomi negara. Oleh itu keupayaan pembuatan adalah salah satu faktor penting yang perlu diberi perhatian dalam menjalankan serta mengembangkan perniagaan. Justeru, kajian ini bertujuan untuk mengenal pasti hubungan antara faktor – faktor yang membolehkan syarikat-syarikat di Malaysia terus bersaing. Antara faktor yang dikenal pasti adalah amalan pembuatan, pemindahan pengetahuan, keupayaan organisasi dan keupayaan pengeluaran. Selain itu, faktor latihan menjadi faktor penaik dalam kajian ini. Tinjauan melalui pos telah dilakukan dan sejumlah 119 syarikat yang mewakili pelbagai industri memberi maklum balas. Hipotesis yang terlibat telah diuji menggunakan teknik korelasi dan regresi. Hasil kajian ini menyokong semua hipotesis. Analisis regresi berganda dijalankan bagi menguji hubungan pembolehubah bebas dengan pembolehubah bersandar. Keputusan regresi berganda hierarki menunjukkan bahawa latihan dapat meningkatkan hubungan untuk bersaing dengan pesaing lain. Kajian ini menggunakan teori penggunaan teknologi berasaskan sumber untuk melihat hubungan keupayaan pembuatan, amalan pembuatan, perkongsian pengetahuan dalam pembuatan, keupayaan organisasi dan latihan. Rangka kerja kajian ini termasuk empat amalan pembuatan, tiga perkongsian pengetahuan dalam pembuatan, dua keupayaan organisasi, tiga latihan sebagai pembolehubah sederhana dan empat keupayaan pembuatan. Kajian ini turut menggunakan kajian dengan berskala likert 5- mata. Bagi menganalisis data, kaedah SPSS versi 19.0 digunakan untuk memeriksa perhubungan di antara pembolehubah. Hasil kajian ini memberi manfaat

kepada pemegang saham dan pengarah syarikat-syarikat untuk meningkatkan keupayaan pembuatan bagi memastikan mereka sentiasa relevan dalam industri pembuatan.

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| | | |
|---|---|---|
| i. | MIDA | Malaysian Industrial Development Authority |
| ii. | SME | Small Medium Entrepreneur |
| iii. | RBV | Resource Based View |
| iv. | ICT | Information and Communication Technology |
| v. | GDP | Gross Domestic Products |
| vi. | NIE | Newly-Industrialized Economy |
| vii. | R&D | Research and Development |
| viii. | CAD | Computer Aided Design |
| ix. | ASRS | Automated Storage and Retrieval System |
| x. | OTD | On Time Delivery |
| xi. | OFLT | Order Fulfillment Lead Time |
| xii. | IPD | Integrated Product Development |
| xiii. | CD-I | Computer Designed Interactive |
| xiv. | FMM | Federation of Malaysian manufacturers |
| xv. | SPSS | Statistical Package for The Social Science |
| xvi. | KMO | Kaiser-Meyer-Olkin |
| xvii. | SMIDEC | Small and Medium Industries Development Corporation |

# CHAPTER 1

# INTRODUCTION

This chapter is consists of six major sections namely (i) background of study (ii) statement of research problem (iii) research objectives (iv) contribution of the study (v) scope of study and (vi) thesis structure. The purpose of this first chapter is to introduce the context of the research and the structure of the thesis, which explains briefly the contents of the subsequent chapters.

## 1.9 **Research Background**

Malaysia is an upper-middle income economy with a gross national income of USD 7,900 per capita. It is a highly open economy (exports comprise almost 100 percent of GDP) and a leading exporter of electrical appliances, electronic parts and components, palm oil, and natural gas. Malaysia is also externally competitive, ranking 18th (out of 135 economies) in the International Finance Corporation 2012 ranking of ease of doing business in the world.

Malaysia has progressed from being a producer of raw materials, such as tin and rubber, in the 1970s to being a multi-sector economy that grew on average 7.3 percent between 1985 and 1995. After the Asian financial crisis of 1997-1998 it has continued to post solid growth rates averaging 5.5 percent per year from 2000 – 2008. Growth was accompanied by a dramatic reduction in poverty, from 12.3 percent in 1984 to 2.3 percent in 2009. However, pockets of poverty exist and income inequality remains high relative to the developed countries Malaysia aspires to emulate.

The Malaysian economy continued to expand despite the more challenging external environment. The real Gross Domestic Product (GDP) recorded a growth of 5.1 per cent in 2011 (Department of Statistic,Malaysia) as shown in Table 1.1. Despite the challenging environment, the Malaysian economy registered a higher growth due to stronger domestic demand. The robust domestic demand was driven by an expansion in both household and business spending as well as higher public sector expenditure. Meanwhile, on the supply side, manufacturing sector recorded a significant ly better performance supported by strong output of construction-related materials and resource-based industries. In tandem with robust private consumption, the services sector is envisaged to grow strongly led by trade, transport and finance sub-sectors.

**Table 1.1**
**Malaysia – Key Economic Indicator**

| Malaysia – Key Economic Indicators | | | | |
|---|---|---|---|---|
| | 2009 | 2010 | 2011p | 2012f |
| Population (million persons) | 27.9 | 28.3 | 28.6 | 28.9 |
| Labour force (million persons) | 12.1 | 12.4 | 12.6 | 12.9 |
| Employment (million persons) | 11.6 | 12.0 | 12.2 | 12.5 |
| Unemployment(as % of labour force | 3.7 | 3.3 | 3.1 | 3.2 |
| Per Capita Income (RM) | 23,850 | 26,175 | 29,094 | 31,097 |
| (USD) | 6,767 | 8,126 | 9,508 | 10,134[6] |
| NATIONAL PRODUCT (%CHANGE) | | | | |
| Real GDP at 2000 prices[1] | -1.6 | 7.2 | 5.1 | 4.0-5.0 |
| (RM Billion) | 522.0 | 559.6 | 588.3 | 614.5 |
| Agriculture, forestry and fishery | 0.6 | 2.1 | 5.6 | 3.8 |
| Mining and quarrying | -6.3 | 0.2 | -5/7 | 0.6 |
| Manufacturing | -9.3 | 11.4 | 4.5 | 3.9 |
| Construction | 5.9 | 5.1 | 3.5 | 6.6 |
| Services | 3.1 | 6.8 | 6.8 | 5.1 |
| Nominal GNI | -7.5 | 11.1 | 12.3 | 8.0 |
| (RM Billion) | 665.3 | 739.5 | 830.7 | 897.4 |
| Real GNI | 0.6 | 3.9 | 4.7 | 5.7 |
| (RM Billion) | 497.4 | 516.8 | 540.9 | 571.5 |
| Real aggregate domestic demand[2] | -0.4 | 6.3 | 8.2 | 6.6 |
| Private expenditure[2] | -2.6 | 8.3 | 8.2 | 6.6 |
| Consumption | 0.7 | 6.5 | 6.9 | 6.2 |
| Investment | -17.0 | 17.7 | 14.4 | 8.3 |
| Public expenditure[2] | 5.4 | 1.5 | 8.2 | 6.7 |
| Consumption | 3.9 | 0.5 | 16.8 | 0.2 |
| Investment | 7.5 | 2.8 | -2.4 | 16.2 |
| Gross national savings (as % of GNI) | 31.6 | 34.1 | 34.6 | 34.4 |

***Source: adopted from Economic development in 2011.***

Manufacturing continued to be an important sector in the economy contributing 27.5 per cent of GDP in 2011.Total investment approved in the Malaysia Economy 2011 are 37.8% from total RM148.6 billion as shown in Figure 1.1. Value-added of the manufacturing sector expanded by 4.5 per cent Exports of manufactured products accounted for 67.7 per cent of Malaysia's total exports in 2011. It increased by 2 per cent to RM470.3 billion in 2011 from RM461 billion in 2010. Employment in the manufacturing sector was estimated at 3.5 million persons or 28.7 per cent of total employment in 2011( Economic Report 2011/2012, Ministry of Finance, Malaysia). The improved performance of the manufacturing sector was also reflected in the expansion of the sector's industrial output (as measured by the industrial production index), sales value and productivity. The production index and sales value of the sector expanded by 4.7 per cent and 10 per cent respectively in 2011 compared with 2010. Productivity in the sector, as measured by sales value per employee recorded a growth of 9.6 per cent in 2011.

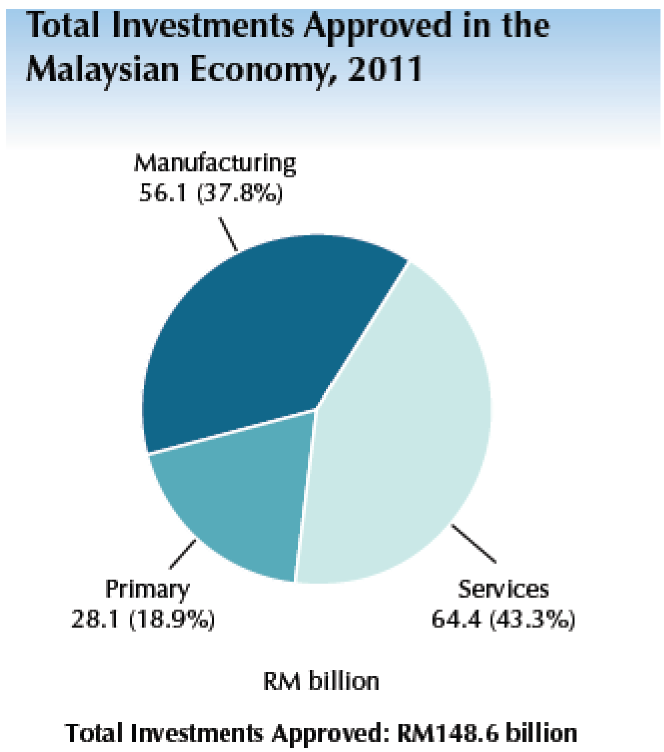



**Figure 1.1**
**Total Investment Approved in the Malaysian Economy 2011**
***Source: Malaysia Investment Performance 2011 MIDA (2011)***

In 2010, Malaysia launched the New Economic Model (NEM) which aims for the country to reach high income status by 2020 while ensuring that growth is also sustainable and inclusive. The NEM envisions economic growth that is primarily driven by the private sector and which moves the Malaysian economy into higher value-added activities in both industry and services. To achieve these goals, Malaysia will need better skills, more competition, a leaner public sector, a better knowledge base, smarter cities, and greater efforts to ensure environmental sustainability.

Manufacturing sector includes electric and electronics, food and beverage, automotive, just to name a few. Manufacturing sector develops the world's economy and provides job opportunities. Manufacturing capability in developing country and manufacturing in developed country are very different. They are different in terms of the time and management set up in the beginning (Grobler, 2007). The new manufacturing firm and the established manufacturing firm are different. For the firm that has established for a long period, the milestone to be achieved must be different from the firm that is new in this area. Manufacturing capabilities refer to the manufacturer's contribution to get success in their areas. Some past literature elaborated manufacturing capability as something that the manufacturers do to generate profit through their products and services.

The manufacturing industry in Malaysia became a significant contributor to the country's economy in the postindependence period beginning in the 1960s. During the colonial period, the country had been a major producer of raw materials, namely, tin and rubber. Secondary industries then were related to tin, rubber, timber, foodstuffs, and petroleum.

Tin smelting started in Kuala Lumpur in the early 1880s. In 1885, a reverbatory furnace was in operation in Telok Anson (now Telok Intan), Perak (now a state in Malaysia), for smelting low-grade ores. The Straits Trading Company erected smelting plants on Pulau Brani (c. 1887) and at Butterworth (1902) in Penang state. A Chinese-owned smelter at Datuk Keramat that started operation in 1897 was bought by the Eastern Smelting Company.

Oil was struck at Miri, Sarawak, in 1910. A Shell-owned distillation plant for crude oil at Lutong came into operation in mid-1919 to serve the needs of the oilfields of Miri and Seria, Brunei. The Borneo Company processed gold by utilizing the cyanidation process at its plants in Bau (1899) and Bidi (1900) in Sarawak.

Some light-engineering works involved motor repairs of machinery in tin mining, irrigation, and transportation (road and rail) equipment. Service maintenance of locomotives and coaches was an industry supporting the transportation sector. The manufacture of consumer goods (soap, matches, etc.) for domestic consumption was on a very small scale. There were also indigenous handicraft and cottage industries (textiles, foodstuffs, etc.). Beginning in the 1960s concerted efforts and programs were implemented to promote and develop the manufacturing industry in the country.

The electrical, electronics, and machinery-products industries experienced rapid growth and expansion during the 1970s. Malaysia progressed from assembling electrical goods and machinery to manufacturing a wide range of these products by the 1980s. The electronics industry is the largest in the region, and Malaysia is the leading exporter of semiconductor components to the United States. Multinationals like Intel, AMD, Sony, Sharp, Motorola, and others are well entrenched with huge amounts of capital investments.

Complementing its market position as the world's major producer and exporter of natural rubber, Malaysia also leads in the manufacture of latex goods. The manufacture of rubber-based products has attracted a constantly growing number of foreign manufacturers and investors, including Goodyear of the United States, Viking Askim of Norway, Ansell of Australia, BDF Beiersdorf AG of Germany, Pirelli of Italy, Sagami of Japan, Dongkuk Techco of South Korea, and others.

The food, beverages, and tobacco industries are the province of small- and medium-scale (SMIs) establishments. Food manufacturing continues to be heavily dependent on imported inputs. Efforts are being undertaken to encourage import substitution in this sector.

Optimism is high for the petroleum industry and the manufacture of related products. From its beginning in Lutong in 1919, Malaysia had five oil refineries by 1998: two are owned by PETRONAS (Petroliam Nasional Berhad), the national petroleum company, two by Shell, and one by Exxon Mobil. The PETRONAS-owned Liquefied Natural Gas (LNG) plant at Bintulu, Sarawak, which started operation in 1983, is the world's third-largest LNG exporter. The Association of Southeast Asian Nations (ASEAN) Bintulu Fertiliser plant, an ASEAN joint-venture project that commenced operation in 1985, is reputedly the world's largest in terms of production-train capacity. Another joint venture, the Middle Distillate Synthesis plant that converts natural gas into diesel, kerosene, solvent, and so on, is a project by PETRONAS, Shell Gas BV, Mitsubishi Corporation, and the Sarawak state government. It started production in 1993. There are also several petrochemical industries operating under PETRONAS.

The heavy-industry sector can trace its beginnings to the period of large-scale tin mining in peninsular Malaysia from the mid-nineteenth century. The manufacture of cast-iron parts for tin mines was important then. When railways were introduced, steel casting of replacement parts for locomotives and coaches was undertaken by this sector. In 1967, the country's first integrated commercial steel mill (Malayawata Steel Bhd) was established. Foreign vehicle giants like Toyota, Honda, and Volvo have had assembly plants in Malaysia since the 1960s. Two national car projects and one national motorcycle project boosted the heavy-industry sector. Malaysia has emerged as a producer and exporter of motor vehicles since the appearance of the Proton Saga (1985), Perodua Kancil (1992), and Modenas Kriss (1995). In Malaysia, Proton held more than 60 percent of the market share for automobiles throughout the 1990s.

The chemical industry in Malaysia continues to rely on imported intermediate chemical and petrochemical products in production ranging from household items to material inputs for the rubber, palm-oil, and timber industries. The chemical-industry sector has a conspicuous foreign participation, including ICI, Unilever, Colgate Palmolive, Borden, Exxon Mobil, Shell, and Mitsubishi Chemical Industries.

The timber-based industries manufacture a wide range of wood products including sawn timber, plywood, prefabricated houses, doors, window frames, wall panels, fiberboard, particleboard, wood briquette, wood wool, timber moldings, veneer, and block board. Furniture and wood fixtures are produced for the domestic and foreign markets.The textile industry focuses on textiles and yarn production and garments and knitwear that cater for local and international markets. The industry is dominated by local enterprise.The manufacturing sector also produces plastics (containers, pipes and hoses, electrical components), precision products (surgical, dental, photographic, optical), palm oil–based products (margarines, shortenings), clay-based products (bricks, ceramic articles), and leather goods.

The Federation of Malaysian Manufacturers (FMM, 1968) focuses on creating and sustaining a dynamic business environment. Its membership of more than two thousand is representative of the various subsectors of the Malaysian manufacturing industry. The FMM Institute of Manufacturing offers skills training. FMM operates and manages the Malaysian Product Numbering System as well as being the authorized body for issuing and endorsing certificates of origin.The manufacturing industry in Malaysia comes under the purview of the Ministry of International Trade and Industry (MITI). Specifically the Industrial Policy Division and the Industries Division in MITI oversee the promotion and development of the manufacturing sector. Other related government organizations and agencies include the Malaysian Industrial Development Authority (1965), Malaysian Industrial Development Finance Berhad (1960), and Malaysian Industrial Estates Sdn Bhd (1964).In concert with the National Development Policy, the Second Outline Perspective Plan (1991–2000) and the Seventh Malaysia Plan (1996–2000), the Second Industrial Master Plan (IMP2) targets the manufacturing sector as a major contributor to the national economy. The industrial sector is entrusted with the pivotal task of propelling the country toward industrialization and sustainable economic growth and development. IMP2 emphasized the strengthening of Malaysia's industrial base as well as diversifying the export of manufactured products. The promotion of foreign investment in the manufacturing sector will continue to be adopted as one of the pivotal strategies in developing and expanding the sector.

Whether in the stable economy or in the economy downturn, Malaysia is still one of the destinations that is capable of attracting multinational and foreign companies to invest in the country. The economic contribution is immense, through investment from multinational manufacturing and services sectors that creates significant linkages (PMD, 2005). Market demands have changed dramatically over the past decades and today’s competition is on variety and time to market, with price and quality continuing to play their ever important role (Banker & Khosla, 1995).

Competition from the manufacturers is showing a sharp decline. With more firms are unable to achieve their target and profit, many firms decided to close their operations in this economy environment. To regain competitiveness in this environment, Malaysian’s manufacturers must refocus and define new and innovative strategies to struggle.

Although, competition in Malaysian industries has been increased for recent years, according to the 2004 World Competitiveness Yearbook released by the Institute for Management Development (IMD) based in Lausanne, Switzerland, Malaysia is the fifth most competitive country in the world among countries with a population of greater than 20 million (MIDA, 2005). It has improved from the seventh position that Malaysia attained in 2003. One of the ways for local manufacturers to remain competitive is to be able to upgrade their manufacturing capabilities especially during economy downturn.

Consequently, to keep up with the current situation, local manufacturers need to keep their value-added chain and keep increasing the quality, flexibility, and innovativeness of their organization, process, technologies and product. To enable firm to keep up with value added activity, manufacturing capability is the main factor to be considered because if firm has strong capabilities, it achieves competitive advantage and capable of surviving in the current situation.

This is inline with the Tenth Malaysia Plan 2011- 2015, together with the Third Industrial Master Plan (IMP3) 2006 – 2020, that Focusing On Key Growth Engines that includes twelve National Key economic Areas which are takes a holistic approach in facilitating the transformation process by enhancing the electric and electronic sector's capability, to produce high value added products and services and also to develop new sources of growth to remain competitive. The drive to enhance the sector's innovative capacity will contribute to the sustainability of long-term growth of the sector and the economy.

Manufacturing capability is the concept of strategic capabilities that determine a manufacturing's contribution to the success of a firm is closely related to the notions of strategic resources, competences and priorities. In contrast to capabilities, resources are something a firm possesses or has access to, is very important to consider for competitive advantage. Manufacturing capability is developed to make sure the productivity is at higher level (Li, 2000). High productivity can be ensured by high quality product. Other than that, the company which develops high manufacturing capability can survive in the long term. Through manufacturing capability, the company can developed their competitiveness, use their resources at optimum level and keep on adding value not only in stable economic condition, but also during recession (Okejiri, 2000).

While the manufacturing sector has made significant inroads in transforming into high value added industries, there will be greater challenges ahead. Part of these challenges comes from the race among firms to achieve competitive advantage especially from new economy which will continue to exert competitive pressure on the world global economy (Woodcock, 1996). Manufacturing companies face an increasingly challenging and complex environment, driven by macroeconomic, consumer and competitive trends that influence both growth and profitability. Companies need to focus on strengthening core capabilities in terms of product development, marketing and channel management – while ensuring that non-core activities are performed in the most cost-effective and scalable manner ( Swink & Way, 1995).

In developed countries, where firms are already established in the manufacturing sectors, the manufacturing capabilities are more on upstream capabilities such as compare to the developing countries. In developing countries, manufacturing companies focus more on assembly and operations as compared to upstream manufacturing capabilities such as product development and design (Dankbaar, 1999). For examples, General Motors, a car manufacturer in United States, which is already established in the industry focuses on R&D to keep the company competitive and to make sure customers loyal to them.

In Malaysia, manufacturing capability issue specifically the upstream capabilities has gaining the manufacturers interest and not many companies focuses on this issues as a way to improve company's performance (Leung & Lee, 2004). Many companies in Malaysia focus on downstream manufacturing capabilities such as producing and assembling their products, such as quality management, time management, management practices, work teams, product/process development and manufacturing technologies. In this case their target is more on short term profit and sometimes they do not focus on the quality of the product and hardly focus on upstream manufacturing capability( Business Times, 2000).

Manufacturing capability is determined as a manufacturing's contribution to the success of a firm and is closely related to the notions of strategic resources, competences and priorities (Teece, Pisano & Shuen, 1997). In order to enhance and utilise these capabilities, manufacturing practices need to be developed. Knowledge includes know how and know what in terms of converting inputs to outputs and their combining process. Training has been considered as a part of the assistance" or "general support" provided by the manufacturer, but not as a factor in its own right. The combination of all these can help company to attain high performance manufacturing companies (Sohal, Gordon, Fuller & Simon, 1999 ).

Besides, in current economic situation where the condition is uncertain, a global economy does not support manufacturers, and due to the state of slow down in economy, the manufacturers must revise their ways to survive in their businesses. The manufacturers must know how they should compete in the industries (Skinner, 1985). In different economic atmosphere, manufacturing capability will not be similar as before, according to Leung and Lee (2004), manufacturing capabilities were developed through a reinforcement order in fulfill the needed or request from the customer. Due to changes in economic environment, manufacturers are compelled to upgrade their capabilities to meet the current economic condition.

## 1.10 **Problem Statement**

Based on these issues, there are seven problems are derived and identified. Uma kumar *et. al.* (2009) highlighted none of the existing studies examines the comprehensive set of variables that could influence the development of manufacturing strategy like the role of innovation orientation/type or manufacturing capability has not been studied in combination with resource and market orientation. The adoption of innovation as a manufacturing strategy has not been empirically tested despite recent literature highlighting its importance.

According to T Ramayah *et. al.* (2004), there has been no study conducted on how manufacturing firms in Malaysia, develop their capabilities and resources in pursuit of better performance and competitive advantage. Therefore this research will explore how manufacturing firms develop capabilities and resources in pursuit higher performance and competitive advantage. These resources and capabilities play an important role in the adoption of specific manufacturing practices as well as the formulation of the firm's manufacturing strategy. Manufacturing capabilities is a new concept in developing countries, because they not aware and they do not require manufacturing capability to successfully manufacture their product. In most developing countries, manufacturing companies focus more on assembling part compared to upstream manufacturing capabilities, such as product development and design (Business Times, 2000). From past studies, most of past researchers highlight the important of manufacturing practices in developing manufacturing capability (Haifeng, Yezhuang & Zhandong, 2006; Grobler, 2007: Leung & Lee, 2004; Grobler & Grobner; 2006; White, 1996; Swink & Hegarty, 1998; Gao, Zhang & Liu, 2007; Sohal, Gordon, Fuller & Simon, 1999, Lukas & Bell, 2000). Manufacturing practices are significantly related to manufacturing capability to improve company performance. Hayes and Wheelwright (1984) identified a set of manufacturing practices as being fundamental to achieving manufacturing excellence, leading to the inference that 'best practices' result in superior performance. Manufacturing practices is the keys and drivers of high performance, and more recently, sustainability of competitive performance (Ketokivi & Schroeder, 2004).

There are eighty nine's manufacturing practices were classified by past researchers (Bolden, Waterson, Warr, Clegg & Wall, 1997). In order to enhance and utilize manufacturing capability, manufacturing practices need to be developed. From eighty nine manufacturing practices, this study focused on identifying manufacturing practices that had a very significant influence on company success (Gordon & Wiseman, 1995). This study show that a three manufacturing practices contribute to the good performance in multiple dimensions. Based on the majority of past study, there were six manufacturing practices that have a significant influence on company success. There are Quality Management, Time Management, Workforce Empowerment, Work Teams, Product/Process Development, Manufacturing Technologies (Sohal, Gordon, Fuller & Simon, 1999; Bolden, Waterson, Warr, Clegg & Wall, 1997; Mullarkey, Jackson & Parker, 1995; Report of Survey Wainwright Industries, 1995). These six best practices are universally applicable in improving the performance of an industry. Since the context of these study are in developed country, these six practices will be tested in the context of firms in developing country to determine whether they are significantly related in developing firms manufacturing capability. Manufacturing capability building assumes that firms are more effective than their rivals at deploying resources (Teece, 1997). The ultimate goal is to develop a position (capability) on one or more of the market performance dimensions that is both highly valued by customers, and superior to that of competitors (Wheelwright & Bowen 1996; Pandza, 2003). But, others suggest that better performing firms are more likely to address multiple manufacturing capabilities simultaneously, which supports the rationale behind the cumulative model (Roth & Miller 1992, Noble 1997). Past studies reported that performance is related with manufacturing competitive items (Droge, 1994). The measures of performance include sales revenue, profit after tax, market share and return on investment. These measure have been used in the published literature (Clark,1982 ; Hill & Jones,1992; Nobel, 1995). Majority of past studies were conducted on manufacturing capability and the company performance. However, limited study investigating on develop of firm manufacturing capability especially during recession was hardly under taken. This study was under taken from year 2008, where set that time recession hits the manufacturing sector in Malaysia. These studies were undertaken during stable economic condition (Haifeng, Yezhuang & Zhandong, 2006 ; Grobler, 2007: Leung & Lee, 2004; Grobler & Grobner; 2006; White, 1996; Swink & Hegarty, 1998; Gao, Zhang & Liu, 2007; Sohal, Gordon, Fuller & Simon, 1999).

Haifeng, Yezhuang and Zhandong (2006) found that there is lacking on manufacturing capability, especially empirical studies, because of it big scope in definition and difficulty in investigating the factors. They found strong relationships between manufacturing practices and manufacturing capabilities. Grobler (2007) demonstrates the usefulness of a dynamic analysis of development and management of strategic capabilities and resources in manufacturing. Grobler (2007) suggested that the exact nature of strategic capabilities and their relationships needs to be further investigated. According to Leung and Lee (2004) found that the manufacturing firms did not have very clear visions on their current and future needs of capability improvement. Leung and Lee (2004) indicated it was hard to find the right strategic improvement targets-suitable area of capability improvement. Grobler and Grubner (2004) examine the relationship between strategic manufacturing capabilities whether they are cumulative or trade-off in nature. He found that most cumulative effects take place between strategic capabilities.

The development of manufacturing capability only looked into the manufacturing practices adopted by firms. However, good practices need to be accompanied by proper training in implementing the practices in the company. According to a study of 540 companies done in 1998 by ASTD, those that invested on training realized a 37% higher gross profit for employees, that show small number of cost used to developed this important things. From the study done by Training Magazine in 2001, companies that spent approximately $273 per employee per year on training averaged a 7% voluntary turnover rate while companies that spent about $218 per employee per year averaged a 16% voluntary turnover rate. Haslinda Abdullah (2009) examines that, training needs assessments in the manufacturing firms are found to be generally performed informally through observations. Size of firms had an effect on the way training needs is being assessed and analyzed. The absence of needs assessment and analysis is due to lack of expertise and it is irrespective of the size of firms. Elbadri (2001), highlight that they are not many study that focusing the important of training in improving improvement.

This study will develop the important core manufacturing capabilities theories that must be focusing in the normal economy and in the economy downturn. In this situation this study will provide complete information that important to make sure that the firm still in competitive.

This study stayed look to the relationships of i) manufacturing practices and manufacturing capabilities, ii) knowledge transfer in manufacturing and manufacturing capabilities, iii) organizational capabilities and manufacturing capabilities, iv) manufacturing practices, knowledge transfer in manufacturing and organizational capabilities on manufacturing capabilities, and v) the relationship between manufacturing practices, knowledge transfer,organizational capabilities, manufacturing capabilities on training.

### 1.3 Research Questions

This study was important for several reasons. From this study, it can produce a valuable guideline in term of developing a core manufacturing capabilities specifically in Malaysia situation. The research question that must be answer in this study were:-

1 What were the critical success factors that influence the manufacturing capabilities among local manufacturers in Northern Region Malaysia?

2 Why manufacturing practices, knowledge transfer in manufacturing, organizational capabilities and training had been a factor influence on manufacturing capabilities?

3 How manufacturing practices, knowledge transfer in manufacturing, organizational capabilities and training being a relationship to manufacturing capabilities?

### 1.4 **Research Objectives**

This study is intended to examine the relationship of manufacturing practices, knowledge transfer in manufacturing, organizational capabilities and training on manufacturing capabilities amongst manufacturing companies from a wide variety of industries in Northern Region of Malaysia. Specifically the objectives are as follows:

1. To determine the critical success factors that influences the manufacturing capabilities among manufacturers in Northern Region of Malaysia.
2. To analysis the relationship between manufacturing practices, knowledge transfer in manufacturing and organizational capabilities on manufacturing capabilities among local manufacturers in Northern Region of Malaysia.
3. To examine the relationship between training and manufacturing practices, knowledge transfer in manufacturing, organizational capabilities and manufacturing capabilities among local manufacturers in Northern Region of Malaysia.

## 1.5 **Scope of The Study**

The study focuses on investigating manufacturing practices, knowledge transfer, organizational capabilities, training and development of manufacturing capability among local manufacturers across industries in Northern region of Malaysia. Malaysia is one of the countries that received a good attention from investor. The Northern region of Malaysia includes Perlis, Kedah, Pulau Pinang, and northern Perak. The population of in this area are some 320 companies, has undergone an intensive and impressive process of industrial and technological transformation in the past 30 years. It has moved from being labour intensive with low technical processes into more technology-, skill- and capital-intensive production processes. Pulau Pinang and Kulim Kedah had been attracted by the international investor to invest in new technology like Intel. Malaysia target to get at least RM56 billion investment in manufacturing according to International Trade and Industry Minister Datuk Seri Mustapa Mohamed . Refer to ACCA Accountants for Business Forum Finance Transformation: Expert Insights on shared services and outsourcing on 22 March 2012 at G Hotel, Penang, As the Silicon Valley of the East, Penang Made The Largest Contribution To Malaysia's Foreign Direct Investments With RM17.7 billion Or 28% Of Malaysia's Total FDI Of 63.2 Billion Between 2010-2011. While in Kedah, Malaysia's Foreign Direct Investments With RM11.1 billion according to International Trade and Industry Deputy Minister Datuk Mukhriz Mahathir. With all the five top Foreign Direct Investments in Malaysia, The Northern Region being the focus on investigating manufacturing practices, knowledge transfer, organizational capabilities, training and development of manufacturing capability among local manufacturers.

This study is cross sectional study using survey method and individual company as unit analysis. The General Manager from production department in manufacturing companies are considered as the element of unit analysis.

Compared to previous study, this study will investigate these companies across industries categorized under the industry of textile, paper and allied products, chemical and allied products, rubber and plastic products, basic metals and fabricated metal products, industrial machinery, electronic, electrical equipment and components, instrumentation, and motor vehicle and accessories are selected as the subject of the study.

## 1.6 **Significant of The Study**

This study is important for several reasons. It can benefit to the shareholders of the manufacturing companies by identifying the critical success factors in manufacturing area, including in normal economic environment and operating in the recession economic atmosphere. This would also be valuable information and also serves as guide for future implement action of the important key elements of manufacturing capabilities. The findings and results of the research are important for the companies in order to guide them on focusing manufacturing practices, knowledge transfer in manufacturing, organizational capabilities which enable to develop their manufacturing capabilities in order to focus in normal and economy slowdown.

This research also has implications for manufacturing companies that have already been implementing manufacturing capabilities but failed to achieve the desired performance level. They may use the results or findings of this research to consider organizational capabilities and training to reinforce their manufacturing capabilities.

In addition, it also assists manufacturing firms to make decision in prioritizing types of manufacturing capabilities to be developed for their companies. The findings of this study are expected to provide important insight into the key factors such as manufacturing practices, knowledge transfer in manufacturing, organizational capabilities, training and manufacturing capability which are both very important to achieve the best performance production.

## 1.7 Operational Definition

Although most of the term in the study can be classified as common manufacturing term in the manufacturing capabilities' manufacturing firms, the following definitions are provided to avoid misinterpretation of their use within this study:-

1. Manufacturing Capability is the factor that company developed to win the competition and the market place (Swink & Hegarty,1998)
2. Manufacturing Practices defined as the basic preventive guidelines for plant and facility operations (Haifeng et. al, 2006).
3. Knowledge Transfer defined as spread of knowledge to another group: the communication of specialized knowledge developed in part of an organization to a wider group such as another part of the organization or business customers (Ismail & Sarif,2006).
4. Organizational capabilities include all tangible or in tangible firm-specific processes and assets representing the firms' ability of coordination and deployment of resources ( Bhatt & Grover, 2005).
5. Training is as assistances support or activity leading to skilled behavior to give a good result (Sohal *et. al.* 1999).

## 1.8 Organization of the Theses

This study is structured into three chapters. Chapter one presents the introduction, background of study, problem statement, research objectives, and scope of study, significance of study and operational definitions and thesis structure. The literature review in chapter two addresses the concepts of Manufacturing Capabilities, Factors of Manufacturing Practices, Knowledge Transfer in Manufacturing, Organizational Capabilities, Training, research framework and hypotheses. Chapter three explains the research methodology applied. It includes a description of the research design and methodology of study used to empirically test the framework.

# CHAPTER 2

# LITERATURE REVIEW

This chapter continues the discussion of the previous chapter which focuses on the background of the study. Further reviewing the literatures on an overview of the definition of manufacturing capability, overview on manufacturing practices, knowledge transfer and training are discussed in this chapter. This chapter also discussed the development of the theoretical framework and the hypotheses for this study.

## 2.1 Overview of Malaysia Manufacturing Industry.

Malaysia had becomes the transit and destination for foreign companies and multinational manufacturing companies to invest and develop their business. With this environment, Malaysia needs to be competitive in order to be a good player in manufacturing sector. The major step towards globalization was set by all our Prime Minister in the nation's vision 2020, the achievement of this vision is contingent upon how capable to use and manage our manufacturing practices, apply our knowledge and learning, manage our organization capabilities, and training to perform in our areas. As Zeleny (1986) explained, we must not lack the ideas, which will enable us to perform certain tasks effectively and efficiently.

Manufacturing continued to be an important sector in the economy contributing 27.5 per cent of GDP in 2011.Total investment approved in the Malaysia Economy 2011 are 37.8% from total RM148.6 billion. Value-added of the manufacturing sector expanded by 4.5 per cent Exports of manufactured products accounted for 67.7 per cent of Malaysia's total exports in 2011. It increased by 2 per cent to RM470.3 billion in 2011 from RM461 billion in 2010. Employment in the manufacturing sector was estimated at 3.5 million persons or 28.7 per cent of total employment in 2011 (Economic Report 2011/2012, Ministry of Finance, Malaysia).

From a largely agro-based economy, Malaysia has recently emerged as newly-industrialized economy (NIE). With its strong political stability and the farsightedness of the leader, the nation is set to achieve the full status of a developed country by year 2020. The significant achievements during the First Industrial Master Plan (1986-1995) in all manufacturing sub-sectors have further inspired the country to plan for greater heights of achievements through its Second Industrial Master Plan (1996-2005) and Third Industrial Master Plan (2006 -2015).

According to the Malaysian Industrial Development Authority (MIDA) list of industries, there are a number of manufacturing industries which are classified as manufacturing sectors. The major manufacturing industries are the electronic industry, the automobile industry, the textile industry, the wood based industry, the steel industry, and the petrochemical industry. Among these industries, the electronics industry is the major manufacturing sector (Malaysia Trade Union Congress, 2006). While manufacturing lines are also very capital intensive, requiring large monetary investments in equipment, long production runs are necessary to amortize the initial investments, and still produce the expensive products for which the lines are created (Katz, Rebentisch & Allen, 1996).

Manufacturing capabilities are grounded in the firm's people, skills, knowledge, processes, systems, and equipment. These capabilities can be assembled from different internal and external sources (Teece, Pisano and Shuen, 1997) and then deployed to create products and introduce them to the market in a timely manner (Zahra *et. al*). In this study, manufacturing capability involves four key elements that need to be addressed: the integration, acuity, control, and agility. Pursuing the idea that multiple capabilities are desirable, a few researchers have addressed the question of which capabilities a company should developed first (Grobler,2007). Recently, researchers have related that manufacturing capability can be performed with good manufacturing practices, knowledge transfer and training (Sohal, Gordon, Fuller & Simon,1999). With the combination of all this important factors, manufacturers would be able to develop their company capability to attain more profit and produce best product for customers.

## 2.2 Manufacturing Practices In Industry.

In order to enhance and utilize these capabilities, manufacturing strategies need to be developed. The nature, content and scope of these strategies and their link to agility and mass customisation are by no means clear (Papke Shields & Malhotra, 2001; Bozarth & McDermott, 1998). One consequence of the changing nature of manufacturing industry has been a difficulty for practitioners and academics to understand and evaluate findings relating to a particular practice before having to move on and examine new ones. Bolden, (1997), clustered the identify practices in terms of 'strategic emphasis' (i.e. why the practice is used) and the 'domain of application' (i.e. the part of the manufacturing process primarily involve). Within 'strategic emphasis', two types of primary emphases were identified: business focused and organization focused. While business focused strategic emphases draw primarily on operation management theory, organization-focused strategies represent the core subject areas of engineering and organizational psychology/ organizational behavior.

Business-focused strategic emphases represent the three competitive priorities for which manufacturing which have primary responsibility, namely cost, quality, and responsiveness (Swink & Way, 1995). Thus, all practices introduced with the specific aim of reducing costs, improving quality or increasing responsiveness to customers will fall into one of these categories. Organization-focused strategic emphases, on the other hand, include more generic practices which are aimed at developing the capabilities of the organization as whole, principally in relation to technology and employee development. These practices, by necessity, need to be capable of supporting all three business objectives.

In domain application, practices were placed within four categories, according to the part of the manufacturing operation in which they are primarily effective: design and production, inventory and stock, work organization, and the wider organization of manufacturing. “Design and production” refers to any practices which are specifically aimed at product design (e.g. CAD) or the manufacturing process itself (e.g automated storage and retrieval systems, ASRS). “Work organization” concerns the way in which the production area is organized and managed (e.g. cellular manufacturing). And the fourth dimension, “wider organization of manufacturing”, covers practices and philosophies which are organization-wide (e.g. lean production) (Sohal, Gordon, Fuller & Simon, 1998).

Sohal (1998), studied on manufacturing practices and competitive capability. They found that a very small number of significant differences among the practices employed by the more successful and those by the less successful manufacturing companies. The differences in competitive capability seem to be much greater than the differences in management strategies and practices used which indicate that competitiveness derive not only from the strategies and technology employed, but also from the way in which the strategies and technologies are implemented and managed. They suggest that a minor difference in management strategy or practice can result in a major difference in competitiveness. This study intent to determine the impact of manufacturing practices on manufacturing capabilities. Four major areas of manufacturing practices to be studied namely: Time Management, Management Practices, Work Teams, and Manufacturing Technology.

### 2.2.1 Time Management

The lead time is the time a customer must wait between order placements and receipt (New, 1992). Reliability or dependability (on-time delivery, OTD) reflects on the company's reliability in delivering a customer's order on or before the quoted delivery date (New, 1992). There is growing recognition of the importance of delivery reliability as a criterion in most markets. Its change toward being a qualifier is part of that competitive perspective (Hill, 1983; Roth and Miller, 1990; Meyer & Pycke 1996). Delivery lead time or speed (Order Fulfilment lead time, OFLT) is about short delivery lead times and involves decisions in production stability, investments in capacity and/or inventory and the control of workflow (Hill, 1983; Roth & Miller 1990; Neely et al. 1994; Laugen et al. 2005). Another measure could be Time-to-Market for new products which manufacturing effects.

### 2.2.2 Management Practices

Management practices are very important to make sure all of the practices are the best strategies that deliver superior manufacturing performance. Voss (1993) for example found that not many companies could be classified as world class and concluded that better practices lead better performance. Haifeng (2006) found that different practices affects particular manufacturing capability. The past researchers focus six fundamental areas which are workforce skills, management technical competence, competing through quality, workforce participation, rebuilding manufacturing engineering and incremental improvement approaches. But the most common management practices that had been highlight by past researchers are supplier delivery to shop floor, supplier certification, set-up time reduction, process changeover time reduction, manufacturing resources planning, just-in-time, electronics work order management, electronic data interchange, and distribution resources planning.

### 2.2.3 Work Teams

One aspect of manufacturing practices where companies have made considerable progress is in the use of work teams. Work Teams are a group of people who work together at a particular job. According to Bolden, Waterson, Warr, Clegg & Wall (1997), team works consider one of the aspects that focuses in manufacturing practices. They highlight in organization-focus in Employee development, team work is the second priority after harmonization in development an employee. Team mandates included quality, efficiency, cost control, safety, product improvement, customer service, hygiene, etc (Sohal, 1999).

### 2.2.4 Manufacturing Technology (AMT)

Successfully implemented Advanced Manufacturing Technologies (AMT) can provide manufacturers with many benefits. Improvements in flexibility, quality, costs, and lead- times are common benefit experienced by companies adopting Advance Manufacturing Technologies. However Advance Manufacturing Technologies also present a number of challenges during implementation. (Sohal, 1997). Manufacturing technologies includes computer-controlled machinery, programmable logic controllers, computer controlled processes, real time-process measurement, real-time production monitoring, bar coding, multi-task machinery, automated testing, robotics, automated warehousing technology.

## 2.3 Knowledge Transfer in Industry

Teece (1997), emphasize that capability is a mechanism from which enterprise learn and accumulate new skills and is devoted to use and allocate all kinds of resources. These resources can be transferred into exclusive capabilities after learning or knowledge input. Capability includes knowledge which enterprise accumulates from internal learning. Learning and knowledge are very important for development and usage of resources and capabilities.

Knowledge includes how and what in terms of inputs and outputs and their combining process (Haifeng et.al., 2006). Pillania (2008), define knowledge as a whole set of intuition, reasoning, insights, experiences related to technology, products, processes, customers, markets, competition and so on that enable effective action. And knowledge management as a systematic, organized, explicit and deliberate on going process of creating, disseminating, applying, renewing and updating the knowledge for achieving organizational objectives (Pillania, 2004).Table 2.1 highlighted The Aspects of the importance of knowledge (Johnson & Scholes 2002, The Aspects of the importance of knowledge (Johnson & Scholes, 2002).

**Table 2.1**

**Aspects of the importance of knowledge (Johnson & Scholes, 2002)**

| Knowledge… | The meaning |
|---|---|
| Of what customers value | Is important in determining the threshold requirements and critical success factors |
| As a threshold resource | For example, acquiring or developing an information systems infrastructure is a threshold requirement these days to help to meet customer requirements. |
| As a unique resource | Some knowledge, for example the knowledge of an outstanding research scientist or an intellectual property of a company, is considered to be a unique resource. |
| Providing a competence | Knowledge captured by a system or a business process can provide an important competence. The importance of processes that integrate knowledge between organizations is especially emphasized since the important knowledge resides often outside the organization. This level of competence is the threshold level needed to do business – the company must have knowledge of procuring, manufacturing and distributing to fulfill its duties in a supply chain. |
| As a core competence | When knowledge provides a company a competitive advantage it is considered to be an organizational core competence. The base of a core competence is then difficult to understand and imitate. When knowledge is embedded in the culture of an organization it is particularly difficult to imitate |

***Source: adopted from Laaksohlakti (2005).***

In the most general sense, manufacturing is central to the existence or survival of a business, and the manufacturing industry is a key industry. The activity of manufacturing is much more than machining metals or etching wafers: a manufacturing enterprise is an extended social enterprise (Rolstadas & Dolinsek, 2006). Within the manufacturing industry, challenging activities influencing competitiveness are therefore connected to radical new ways of operating (digital business) and to new products (extended products). Digital business involves an advanced use of the information and communication technology in every link of the supply chain to simultaneously reduce costs and lead times and to increase profit. Interesting problems are connected to e-commerce within the manufacturing systems design and production management, and e-commerce within the design and product development. In this context, manufacturing should not be understood in the traditional sense but as a new way of working as a digital business with extended products. Extended products mean taking a lifetime product support perspective and thus including all services to support the product in addition to the manufacturing of the product itself.

According to Sapsed and Salter (2005), the consideration of process knowledge arises with factors such as a lack of managerial know-how in the host, “commercial habits”, government requirements and poor Intellectual Property Protection. The sensitivity of a process to any of these factors indicates its “robustness”. Robustness here is used to mean a lack of specificity in application. “If a process was not, for example, climate specific, then it could be considered robust to climate.” In this logic then, implicitly the less specific the process knowledge, the more robust it is to process knowledge in the host. Here we encounter the familiar arguments about the tacitness of knowledge: Tacitness of experiential knowledge “is a function of its speed, contextuality, diffusion, and expressibility”. These are properties of the knowledge itself but they also mention resistance to codification from the “owners” of tacit knowledge as something to consider. This is not so much a cognitive variable but an attitudinal one.

The level of knowledge is also important, which “is related to the transferor’s experience of using the process and experimenting with it” (Grant & Gregory, 1997). Again this is discussed as a transferor-side variable. Knowledge-related or attitudinal factors on the transferee side are not extensively considered. So much of the discussion on the “fit and appropriate for transfer” issue is centred on the process knowledge itself, and the degree to which it is “host-independent”.i) A process that can be transferred unadapted to fit given host conditions can be said to be appropriate for that set of local conditions.ii) A process that can be transferred unadapted to fit any host conditions can be said to be robust. Iii)The transferability of a process in its innate, host-independent ability to be adapted (where necessary), transmitted and assimilated, within reasonable time and resource constraints.

Although the level of technical capability in the host is mentioned in the table of factors, the definitions for appropriateness, robustness show that it is the process’s properties that affect its transferability. Where the host is a factor it reduces the transferability of the process. Presumably on this logic where transferability is host dependence search continues until a host is found that is not a factor. These are demanding criteria, and moreover in spite of the extensive discussion of the transferor and the process itself it is ultimately the host which determines appropriateness and transferability and the extent to which the process needs adapting or not. The host is the silent partner in this search for host-independence.

### 2.3.1 The Process of Knowledge Transfer

In the language of Cook and Brown (1999) the typical operations management view of international manufacturing knowledge transfer would fit the epistemology of possession, where knowledge is a disembodied object that may or may not be owned by human beings. To quote Grant and Gregory (1997), "Transferors need to identify where in the process tacit knowledge resides and explore ways of managing its 'human containers". Elsewhere they refer it to "knowledge owners" (1997). Cook and Brown's alternative 'epistemology of practice' instead considers knowing, rather than knowledge, which emphasises more the use and application of accumulated skills and competences. This emphasis on 'knowledge as practiced' shifts the problem of knowledge transfer away slightly from the codification/tacitness debate. Where a high degree of practice knowledge –knowing- is shared between a transferor and a receiver this will obviate the need for much of the prompting, demonstration, explanation and codification that would be necessary if the receiver was not familiar with the transferor's domain of practice.

Practitioners with shared understanding typically form communities (Lave & Wenger, 1991; Brown & Duguid, 1991), which becomes a social process of inclusion, with all the associated political delicacies (Brown & Duguid, 2001). Viewing knowledge transfer in this way provides an alternative explanation of the differing success of knowledge transfer between distinct organisations. It raises the issues of differing interests and willingness to transfer. Studies on knowledge transfer have identified considerable difficulties. Dixon (2000) identifies five types of knowledge transfer: *serial* transfer within the same team; *near* transfer to a team in a different location; *far* transfer of non routine tasks; *strategic* transfer of complex knowledge and *expert* transfer. Yet for all these types of transfer, there are resisting forces. Szulanski (2003) describes five types of "stickiness" that may be encountered during the phases of transfer; initiation stickiness, the difficulty in recognizing opportunities to transfer and in acting upon them; implementation stickiness; ramp-up stickiness and integration stickiness where the knowledge becomes routinely used by a recipient. Szulanski's (1995, 1996; 2003) work on stickiness in the transfer of best practice within firms has shown the importance of preparedness and prior knowledge in the recipient of knowledge transfer, or 'absorptive capacity' (Cohen & Levinthal, 1990; Zahra & George, 2002) to successfully receive and process the knowledge. Szulanski (2003) argues that an intimate relationship between source and recipient reduces barriers to transfer, but that the capability to receive is crucial.

### 2.3.2 Knowledge Sharing

Knowledge sharing attracts much attention in recent years (Nam & Li, 2002). There is no doubt that knowledge sharing plays an important role for sustainable advantages.

Firms increasingly rely on building and creating a shared knowledge of individuals in order to solve problems and find innovative solutions (Davenport, Jarvenpaa & Beers, 1996). Shared knowledge is one of the unique, valuable and critical resources that is central to having a competitive advantage (Nonaka & Takeuchi, 1995; Prahalad & Hamel, 1990). Firms increasingly rely on building and creating a shared knowledge base as an important resource capability (Huber, 1991, 1996; Nonaka, 1994).

Knowledge sharing is at the heart of the concept of Knowledge management and it is all about sharing knowledge and not owning or hoarding it (Milner, 2001). Referring to the list presented by Baastrup (2003) on commonly used Knowledge management practices, sharing of knowledge basically done in most of the activities. Therefore it proves that sharing of practices is one of the main activities to be carried out in a knowledge management initiative (Specialist Library, 2005).

Theodore (2006) defines knowledge sharing as an activity about working together, helping each other, and collaboration. Grey (1996) explains that knowledge sharing is a commitment to inform, translate, and educate others especially the peers. It involves visions, aims, supports, feelings, opinion and questions besides the work aspects that will increase the job performance and increase the quality of work in the department. Knowledge sharing across the organization is increasingly used as a strategic tool, to boost customer service, decrease product development times, and to share best practice (Skyrme, 1997). It helps with wide range of decision making processes. (Battersby, 2003).

In addition, effective knowledge sharing practices enables reuse and regeneration of knowledge at individual and organizational level (Chaudry, 2005). Specialist Library (2005) stated that effective sharing of best practices can help organization to i) Identify and replace poor practices, ii) Raise the performers closer to that of best, iii) Avoid reinventing the wheel of process, iv) Minimise re- work by us by poor methods, v) Save cost through better productivity and efficiency and vi) Improve services to customers.

### 2.3.3 Shared Knowledge of Customer

Shared knowledge of customer refers to the extent of a shared understanding among product development members of current customers' needs and future value to customer creation opportunities (Narver & Slater, 1990; Calantone, 1996). The extent of this shared knowledge is an indication of a continuous intellectual work toward creating high customer values across the functions of an organization. It is regarded as an essential aspect of product development (Deshpande, 1993). Those who have a high level of contact with customers (e.g., a marketing manager or a chief engineer) may have high degrees of understanding the changing needs of customers, the value to customer attributes (Slater & Narver, 1994) and levels of customer satisfaction with the products.

### 2.3.4 Shared Knowledge of Suppliers

Shared knowledge of suppliers refers to the extent of the shared understanding (i.e., know-why) among product development team members of suppliers' design, process, and manufacturing capabilities (Hahn et al., 1990). Since suppliers are actively involved in key processes of integrated product development (IPD), the knowledge of suppliers' capabilities is critical for timely and cost effective decision making in IPD (Evans & Lindsay, 1996). Shared knowledge of suppliers allows product development members to improve their product processes (e.g., communication and collaboration among design and manufacturing engineers) and enhance customer values (e.g., fairly assessing costs of raw materials of the product supplied by the suppliers) because a substantial portion or part of their final product depends on suppliers' work.

### 2.3.5 Shared Knowledge of Internal Capabilities

At present, little is known about the impact of shared knowledge in IPD for manufacturing firms. Also, little is known about whether, or under what conditions, a particular aspect of shared knowledge enhances a firm's product development outcomes. This study will focus on what kinds of shared knowledge influence the process performance and ultimately improve the product performance.

Knowledge of internal capability refers to the extent of a shared understanding (i.e., know-why) among product development members of the firm's internal design, process and manufacturing capabilities (Clark & Wheelwright, 1993). Knowledge of internal capabilities resides usually among design and manufacturing team members. The key is how many different functional specialists (e.g., product design engineers, marketing managers) are aware of the strengths and weaknesses of various aspects of design capabilities, manufacturing processes, facilities and other manufacturing capabilities.

Standard work processes (e.g., standard forms and procedures that are simple, devised by the people who use them, and updated as needed) are an important element of process technologies (Sobek, 1998).

Nowadays, ICT are spreading, creating new needs while making some knowledge and technological watch, all of which requires increased codification and entails the set up of the appropriate organisational structures. The internet and ICT clear the way to accessing data mine. Data mining techniques have been gaining popularity as a tool to discover patterns and knowledge (Flach, 2001). It has been applied to the manufacturing domain, especially in the area of design, quality control, and customer service (Braha, 2001). It has proven to be useful in helping companies in the understanding of manufacturing process and equipments, as well as customer behaviour in the market.

New knowledge creation can occur as a result of insight or inspiration from within the organization; additionally it can also be provoked from external influences by expanding and/ or relaxing organizational boundaries. Whatever their source, such new ideas from the foundation for organizational improvement and learning, nevertheless they alone cannot create a learning organization unless there are accompanying changes to the manner in which the organization and its members behave (West & Burnes, 2000).

This study attempts to investigate the impact of the manufacturing knowledge and learning on manufacturing capabilities of the automotive assembler. The focus are on the level of education, knowledge transfer and knowledge management.

### 2.3.6 Learning Ability

The concepts of learning are highlight by Hayes, Wheelright and Clark who gave the subtitle, Creating the Learning to their influential book Dynamic Manufacturing (Hayes et al, 1988). Although on closer examination of this text they give only limited consideration to the nature of learning within manufacturing and the practical means whereby learning can be achieved. Learning ability included learning from the past experience, learning by the performance analysis, learning by training. And Penny West highlight that learning ability divided to three stage which are Foundation stage, Formation stage and Continuation stage. Foundation stage based on the individual is ready to learn, interest in acquiring the skills to learn, and involvement in learning activities. Formation stage based to self- development, independent learning, role interdependence, and interest in teamwork. Continuation stage based to the individual is self motivated, has achieved independence as a learner, has developed a questioning approach, demonstrates autonomy at a group and individual level.

## 2.4 Training in Industry

Training has become a key element in a far – reaching process of restructuring which is currently under way in the industry (Dankbaar, 1999). Attention is paid to the training issues, as it is a significant variable in the “franchise package” which is provided by the franchiser to the franchises, and through the literature proves to be a determining sources of power possessed and employed by the manufacturer/ franchiser over the dealer/ franchises.

Training has been researched as part of the assistance" or "general support" provided by the manufacturer, but not as a factor in its own right (Marie-Raphaele Davey-Rafer, 1998). A more general attribute of which training is a part is "assistances" (Etgar, 1976; Hunt and Nevin, 1974; Lusch, 1976, 1977) or "franchise support" (Anderson & Weitz, 1992; Stanworth, 1985) or "role performance" (Frazier & Summers, 1986 ; Gassenheimer, 1989) or "idiosyncratic investments" (Anderson and Weitz, 1992). Emperical evidence suggested the notion that training is perceived to be one of the main benefits of the franchise package (Izreali, 1972; Mendelsohn, 1985).

Studies of UK engineering employers (MacNeil, 2000; Mason 1999; Melia, 2001) have highlighted significant gaps between the current skills of the workforce and the skills required to meet business objectives. In addition, the attraction and retention of skilled staff has become more problematic, some employers reporting that their commercial prospects are being limited by this factor (Marsh, 1999). Many employers have realised that competing on cost alone is impossible, resulting in a drive for competitive advantage through quality, niche production, diversification and improved customer focus (MacNeil, 2000).

People are the most important asset. At few facilities has the commitment been based more solidly in the sincere trust and belief in its people. This commitment in turn provides the basis for the company's assertion that any product can be made "best in class" with the right "people" approach. Companies also committed to long-term improvements instead of looking for quick gains. Because training and support for the associates is a critical aspect of its business, some companies consistently invest up to seven percent of payroll toward training and education. The dedication of these assets helps ensure that the companies personnel are properly trained, work in a safe environment, and are dutifully rewarded for the significant number of implemented, employee-recommended process enhancement changes. The significant emphasis on employee value, involvement, and training produced significant returns and benefits for the company.

The process of change has placed increasing pressures on the skills base of the current workforce, already considered to be an obstacle to business development and sustained competitiveness in the sector (Mason, 1999). These skills shortages have been identified, principally by employers, as greatest in associated professional and technical occupations. They include key skills relating to the use of information and communications technology, problem solving, communication and general business, as well as more specialist programming and electronics, process manufacturing (Prime Research & Development, 1998). At the same time, national surveys of employees have revealed that in general they perceive they have necessary skills, suggesting a skills perception gap (Performance and Innovation Unit, 2001; *Road Haulage and Distribution Training Council Report*, 2001).

Yet, if training is perceived as critical, why is investment in training and development seen as a relatively unimportant factor in helping companies adapt to change? (Dufficy, 2001). Training is seen as the most important factor which clearly have competency (and thus training and development) implications. Companies see the need for leaders who can embrace and cope with changes and are comfortable with ambiguity, in situation where there are no right answers and so they must try things out and expect to make mistakes along the way, rather than simply copying established methods. Similarly, as hierarchies disappear, relationship-building and coaching skills take the place of the power of authority and, once again, training to develop these focuses on personal competencies rather than functional skills. (Dufficy, 2001).

This study attempts to investigate whether training moderates the relationship between manufacturing practices and knowledge and learning on manufacturing capabilities of the automotive assembler. The focus is on the training for new work structures in production, research, development and engineering, the global corporation ,training for co-makership and lastly new methods and approaches for learning-while-working. All this dimensions were the establish dimensions that had been used by practitioners.

### 2.4.1 Training for New Work Structure

Training for new work structures divided to three categories. First, training for work structures in production. The Second one, training for work structures in research, development and engineering. The third one is training for work structures in the global corporation. New work structures in production are characterized by introduction of various variants of teamwork, job rotation and multiskilling, the transfer of inspection, and maintenance task. Technological change is continuous, but the skills that had been applied as same as before. Training for new work structure focuses to the basic skills (reading, writing, etc., leader training, life skill problem solving, product knowledge, quality skills and technical skills (Saunders, 2000).

### 2.4.2 Training for Co-Makership

The tendency to increase outsourcing of parts and components involves more than a simple change in the balance of make-or-buy decisions. Responsibility for the development of a growing number of components is also shifting from the manufacturers to the suppliers. Close co- operation with, and indeed membership of, the product development teams of the manufacturers is necessary. Training for co-makership included whether the individual can master several skills, can cope new process and product technology, can function as team members, can contribute and adopt new form of leadership, effects and specialize in product development department, can improve communication between product development and product department, new attitudes, new methods of international communication and new capabilities (knowledge, cultures, and language), can put into practices the concepts of strategic sourcing and can develops a structural towards continuous improvement process which support strategic sourcing (Bolden, 1997).

### 2.4.3 New Methods and Approaches for Learning While Working

It is now widely agreed that people will have to continue learning during all of their working life. There is no reason to assume that this continuing learning will have to be off- the- job learning. On- the- job learning will become more important, not just in the old form of apprenticeship training, but as a regular feature of every job. Since new work structures involve training for the total workforce, there is a great interest in multiplier systems to cope with large-scale qualification needs. This may involve the introduction of new methods using new technologies, but also the definition and expansion for teaching tasks. New methods for learning while working included Introduce new methods using technologies, define and expense of teaching task, install open learning canters in manufacturing plants, and use interactive CD-I or other multimedia system (MacNeil, 2000).

### 2.5 Organizational Capabilities

According to Bhatt and Grover (2005), they state that Organizational Capabilities are all tangible or intangible firm specific processes and assets representing the firms' ability of coordination and deployment of resources. This includes functional skills and cultural perceptions impacting management of change and innovation (Molla, Deng, & Corbit, 2010). Literature discusses the pertaining of firm performance related to organizational capabilities corresponding to various tool (Caloghirou *et al*., 2004; Raman *et al*., 2006). Lin and Ho (2008) described that technological, organizational and environment factors have positive impacts while some studies found organizational learning capacity to be an important factor to be considered (Hult, 1998: Zahay & Handfield, 2004).

Due to their geographically and functionally, distributed structures, the management of the heterogeneous operational and organizational performance of global manufacturing companies becomes more complex. It is therefore necessary to guarantee that the different plants are functionally "capable", i.e. they reached to an accurate maturity level in business practices ( Raufet, Cunha & Bernard, 2011). Organizational capabilities have been identified as one major source for the generation and development of sustainable competitive advantages (Barney, 1991; Wernerfelt, 1984).

According to Laurent Renard and Gilles Saint-Amant (2003), organizational capability can be defined as a 'know how to act' a potential of action, resulting from the combination and the coordination of performance drivers of the organization.Capabilities are developed in the context of organizational resource allocation which is embedded in idiosyncratic social structures. On this basis capabilities are conceived as *distinct* behavioral patterns, which are complex in nature involving both formal and informal processes (Dosi, Nelson, and Winter, 2000; Hofer and Schendel, 1978; Sanchez and Mahoney, 1996). Capabilities represent a repository of historical experiences and organizational learning (Winter, 2000). In case of superior performance and a unique historical development, capabilities are assumed to build the foundation for sustainable competitive advantage.

In strategic management organizational capabilities are depicted as critical success factors and these days nearly every organization wants to be perceived as being capable of doing something in an outstanding manner. There seems to be a consensus that a capability does not represent a single resource in the concert of other resources such as financial assets, technology, or manpower, but rather a distinctive and superior way of allocating resources. It addresses complex processes across the organization such as product development, customer relationship, or supply chain management. In contrast to rational choice theory and its focus on single actor decisions, organizational capabilities are conceived as collective and socially embedded in nature. They are brought about by social interaction and represent a collectively shared 'way of problem-solving' (Cyert and March, 1963). Accordingly, organizational capabilities can be built in different fields and on different levels of organizational activity, for instance at departmental, divisional, or corporate level.

Additionally, it is evidenced that a firm's innovativeness can be characterized as a multidimensional construct that entails many aspects like product, process, market, and technological and strategic planning ( Hurkey & Hult, 1998; Wang & Ahmed, 2004). Moreover, information linkages, communication, quality of human resources, top management's leadership, and the amount of internal slack resources are also stated to significantly influence the adoption of technological innovation ( Tornatzky & Fleisher, 1990). Table 2.2 showed the  Twelve Organizational capabilities defined by Ulrich, Wilhelm and Solow (2003).

**Table 2.2**
**Twelve Organizational Capabilities**

| | Organizational Capabilities: Definitions | Organizational Indicators (how we know we're capable) | HR Strategic Enablers (what we have to do to increase capability) |
|---|---|---|---|
| TALENT | The ability of an organization to **ensure competent** (right people, right job, right time) and **committed** people throughout the organization. Talent ensures that organizations have the **know-how and willingness to** deliver on strategy. | • We have all the critical skills we need to achieve our strategy.<br>• We continuously grow/develop the talent we have.<br>• We attract the additional talent we need.<br>• We retain our best talent.<br>• Formal succession planning processes exist and are followed.<br>• Critical jobs can be filled from within the organization<br>• Our people do "whatever it takes" to get the job done | Define competencies for all critical jobs<br>Craft a succession planning process that gets used<br>Emphasize talent management<br>Craft a formal career development process<br>Recruit, select and hire the best talent available<br>Create policies and practices that encourage retention of key people<br>Sponsor and enable mobility across boundaries |
| SPEED | **Move quickly** into **new markets**, **introduce new products** or services **faster** than competitors, **reduce cycle time** on **administrative systems**, **process information quickly** | • Information moves quickly across internal and external boundaries<br>• A new product/market development process exists and is utilized.<br>• Our people act as soon as the minimum required information is available.<br>• Process improvement processes (Six Sigma, lean mfg. etc.) are utilized throughout the organization.<br>• Organization changes direction/focus quickly based on new information.<br>• Over time, our organization is perceived by our customers as moving faster than our competitors.<br>• Our Information Systems efficiently and effectively transfer information across the organization. | |

*Source: Organizational capabilities (Ulrich, Wilhelm and Solow 2003 )*

Amabile (1998) listed those management skills, organizational encouragement for innovation, and support of innovation resources assist in the organizational innovation improvement. Moreover, due to the climate change, there is an increasing requirement to inculate current and future workforce with the skills and knowledge and better manufacturing practices (Manufacturing Skills Australia( MSA, 2008).

### 2.5.1 Organizational Learning capabilities and Managerial Commitment

Although the category of organizational capabilities have been ‘hardly considered in literature’ (Hansen & Wernerfelt, 1989), some literature on this category did emerge, even though it has remained relatively scarce. This section reviews found descriptions of this category of company resources, it adopts a definition and describes the found common characteristics.

In general, ‘organizational relationships’ are deemed to have much to do with shaping organization members’ behavior (Argyris, 1960). These ’organizational relationships’ form the core of organizational capabilities as it has been the discerning element from *human capital* (Tomer, 1995). Tomer (1995) has described organizational capabilities as a form of human capital, only not vested in individuals, but in the intangible linkages *between* people. In the same way, Davenport (1999) looked upon organization capabilities as ‘the collective abilities of the organization, as distinct from the individual abilities that make up human capital’. In this sense, organizational capabilities are considered a form of human capital because its productive capacity is embodied in humans (Tomer, 2003).

However, investments in organizational capabilities should not be confused with human capital itself. Generally speaking, the productive capacity of humans is embodied in organizational capabilities, however, not in individuals *per se*, but in the *relationships* or *connections* between people (Tomer, 2003). This has been illustrated by the fact that the firm’s productivity would be unchanged, should one worker be replaced by another one with an equal human capital endowments. The firm’s organizational capabilities investment, which is embodied in the organization and not the workers, determines how productive workers and other inputs are (Tomer, 1987).

Tomer (1998) defined organizational capabilities (he used the notion of organizational *capital*) as: ‘the lasting productive capacity embodied in the relationships and patterns of activity among the firm’s participants’. Kaplan and Norton (2004) referred to organizational capabilities (they also used the phrase ‘capital’) as: ‘the ability of the organization to mobilize and sustain the process of change required to execute the strategy’.

Organizational Learning Capabilities refers to the capacity or processes in a firm that enable the acquisition of, access to and revision of organizational memory which will provide guidelines for organizational action ( Robey *et al.* 2002). Researchers (Helfat & Raubitschek, 2000;Llorens Montes, 2005; Montes, Moreno, & Morales, 2005; Weerawardena & O’ Cass, 2004) highlighted on the firm’s learning capability as a competency and its influence on the product innovativeness and enhanced performance. Organizational learning capacity also to be a crucial factor and firm could only innovate if they possess the requiredcompetencies and capabilities to make their learning worthwhile (Chipika & Wilson, 2006). A firm’s organizational learning capabilities has been identified as a necessary and essential component of its new technical innovation (Venkatesh & Speier,2000; Ke & Wei, 2006).

Wang, Lo and Yang (2004) defined a different kinds of competencies are emphasized in various ways. Among the competencies in the firm’s learning capability having an influence over product innovativeness and improved performance (Helfat & Raubitschek, 2000; Weerawardena & O'Cass,2004; Montes *et al*.2005). Firms are only capable of innovation if they have the competencies and capabilities to make their learning worthwhile (Chipika & Wilson, 2006). Certain competencies are developed through the learning process, and with this together with the results, a meta-learning system (i.e., learning to learn) is created which leads to the company's competitive advantage, innovation and success ( Real, Leal, & Roldan, 2006). Lee, Lee and Lin (2007) highlighted that the evidence point to the fact that failure to optimize organizational effectiveness is rampant owing to the inability of employees to accept new technologies.

Since the bottom line performance is what matters to (top) management and investors, relationships with performance may convincingly give a showcase for the 'power' of organizational capabilities (Eikelenboom, 2011). Organizational leraning capability enables the competence on: (1) information/knowledge gathering, disseminating, sharing and utilizing of activities; (2) managerial practices that encourage and enhance the learning processes; and (3) organizational structures making easy organizational learning process and generating new products and improved firm performance.

Jerez-Gomez, Cespedes-Lorente, and Valle-Cabrera (2005), have observed in the operational and emperical bases, organizational learning capability apperas as a complex and multidimensional concept comprising of (1) managerial commitment, (2) systems perspective, and (3) openness and experimentation.Based on the various literature concerning organizational capabilities (Hult & Ferrell, 1997; Jerez-Gomez *et al*., 2005; Lin & Lee, 2005; Gold et al., 2001; Teo *et al*., 2006; Lee & Kim (2007), the current research makes us of four aspects reflecting the construct of organizational capabilities. Managerial commitment, system orientation, knowledge acquisition, and knowledge dissemination are going to be used in the current study to measure the critical success factors on manufacturing capabilities.

Managerial Commitment refers to developing and facilitating managerial support and leadership commitment to upload the innovation process and employee motivation. It maintains personel efficiancy and learning as well as the organization' ability to modify itself according to manufacturing capabilities (Einkelenboom, 2011).

Top management support has been often linked with the success of the organizations (Eider & Igbaria, 2001; Kearns, 2006), business process reengineering ( Lai & Mahapatra, 2004), virtual enterprise formation (Meade & Liles, 1997). Top management's commitment must be considering to develop manufacturing capabilities (Einkelenboom, 2011).

**2.5.2 Systems perspective**

Systems perspective refers to encapsulating the organizational members into one common identity and shared vision, interrelating the employees activities together, promoting joint actions, and developing relationships according to exchange of information and shared mental models.

### 2.5.3 Openness and experimentation

Openness refers to be acceptance of a climate of new ideas and point of views, both internal and external, encouraging the constant renewal, widening and improvement of individual knowledge. It entails experimentation to assist in discovering innovative and flexible solutions to the present and future problems on the basis of the possible use of various methods and procedures.

### 2.5.4 Organization Innovation Capability

An innovation is defined as an idea, practice, object or a unit of adoption that is perceived as a novelty to an individual (Fruhling & Siau, 2007; Hsu, 2006) while innovation capability is the implementation or the creation of technology as used in systems, policies, programs, products, processes, devices that are all new to the organization

(Chang & Lee, 2008; Damanpour & Evan, 1984). In addition, innovation capability is the ability of the firms to assimilate and use external information for the transference into novel knowledge ( Cohen & Levinthal, 1990).

Lin, Chen and Chiu (2010) condected an examination of the aspects of innovation scope stressing on the five most frequently studied innovation capabilties namely, product innovastion, process innovation, process innovation, marketing innovation, service innovation, and administrative innovation. Existing literature has revealed that a complex innovation often needs effective resources and skills for its adoption, and it requires maximum cognitve effort on the side of the potential adopter which reduces the likelihood of adoption ( Sia, Teo, Tan, & Wei, 2004; Verhoef & Langerak, 2001). Complexity is generally believed to be a key barrier to adopt ( Thong, 1999).

In the absence of dedicated champions to the cause, organization innovations may get stuck in the initial idea stage ( Frost & Egri, 1991). Additionally, the increasing chances of using technologies in the achievement of strategic advantage need top management to be well-informed of their potential and to be proactively involved in their diffusion for effective adoption management ( Jackson *et al*., 1995).

Moreover, to this end, Rogers ( 2003) stated "innovations that are perceived by individuals as having greater relative advantage. Compatibility, trialability, observability and less complexity will be adopted more rapidly than other innovations". Various studies have indicated that the five mentioned qualities are the most important features of innovation ( attributes of innovations) which contributes in explaining the adoption rate (Wang *et al*., 2011).

**2.5.4.1 Relative Advantages**

Rogers (2003) explained Relative Advantages as "the degree to which an innovation is perceived as being better than the idea it supersedes". Rogers (2003) proceeded to explain that the level of relative advantage is often associated to; economic profitability, social prestige and other benefits. The more the perceived relative advantage of an innovation, the faster will be its rate of adoption (Rogers, 2003).

#### 2.5.4.2 Compatibility

Compatibility refers to the consistency of innovation with the current values and norms (social system), past experience, and the needs of potential adopters. According to Rogers (2003), "An idea that is more compatible is less uncertain to the potential adopter, and fits more closely with the individual's life situation.

A compatibility situation means that there is evidence of an overall and similar degree of performance achievement up to a determined level between two or more capabilities. This definition of "compatibility" covers the definition of "cumulative capabilities" that has been used by previous authors. Nonetheless, contrary to the definition of "cumulative capabilities", "compatibility" does not necessarily imply, for example, that just because two or more capabilities observe a generally compatible situation (e.g.; a positive and significant correlation/regression coefficient), such a scenario indicates the presence of at least one observation in which these capabilities all have achieved or will eventually achieve an "outstanding enough to create competitive advantage" level of performance.

We now present the three competing ideas and models.

## 2.6 Manufacturing Capabilities In Industry

The concept of strategic capabilities that determine a manufacturing's contribution to the success of a firm is closely related to the notions of strategic resources, competences and priorities. In contrast to capabilities, resources are something a firm possesses or has access to, not what a firm is able to do. Resources can be tangible, e.g. specialized production systems, and intangible, e.g. level of training of workers (Hall, 1992; Hall, 1991). Based on such resources, capabilities are developed. For instance, flexible production systems in combination with highly skilled workers or resources, allow to produce in a flexible way, capability. Capabilities allow an enterprise to develop and to exploit resources in order to generate profit through its products and services (Amit & Schoemaker, 1993). With the help of an organization's capabilities, resources are transformed (literally or metaphorically) into products and services (Warren, 2002).

In a manufacturing management view, strategic capabilities refer to plant's contribution to a company's success factors in competition, i.e. the strengths of a plant with which it wants to support corporate strategy and which helps to succeed in the market place (Grobler, 2006). Going back to one of the most prominent writers (Ward, 1998; Ward, 1996; Swink & Way, 1995) in the field, mostly four strategic capabilities are identified in operations and manufacturing: The ability to produce (1) with low cost, (2) in high quality, (3) with reliable delivery and (4) with flexibility concerning mix and volume of products (Wheelwright, 1984). Although the four capabilities *cost*, *quality*, *delivery* and *flexibility* are seen to be of general importance, other capabilities are discussed, e.g. innovativeness or environmental soundness, and are relevant in specific cases.

Vickery (1993) had compiled and developed a comprehensive list of 31 'components of production competence' based on an extensive review of literature. The manufacturing capability that Vickery developed are Product Flexibility, Volume Flexibility, Process Flexibility, Low Product Cost, Delivery Speed, Delivery dependability, Production lead time, Product reability, Product durability, Quality (comform to specs), Competitive pricing and Low price. All these items are the comprehensive manufacturing capabilities.

**Table 2.3**

**Components of Production Competence**

| Number | Item of Manufacturing capabilities |
|---|---|
| 1 | Product Flexibility |
| 2 | Volume Flexibility |

| | |
|---|---|
| 3 | Process Flexibility |
| 4 | Low Product Cost |
| 5 | Delivery Speed |
| 6 | Delivery dependability |
| 7 | Production lead time |
| 8 | Product reliability |
| 9 | Product durability |
| 10 | Quality(comform to specs) |
| 11 | Competitive pricing |
| 12 | Low price |

Source: White, 1996

However the classification of the manufacturing capability variables under the competitive priorities described what the manufacturing function should achieve with regard to cost, quality, flexibility, delivery and services in order to support the business strategy effectively (Hayes and Wheelwright 1984, Kim and Arnold 1992,1996) (see Table 2.3).

**Table 2.4.**

**Categorization of Manufacturing Capabilities Based On Competitive Priorities**

| **Prize** | Examples: |
|---|---|
| Price | Ability to profit in price competitive markets (Low price) |

| | |
|---|---|
| **Flexibility**<br>Design change<br>New products<br>Volume change<br>Mix change<br>Broad line | Examples:<br>Ability to make rapid changes in design (Design change)<br>Ability to introduce new products quickly (MPI)<br>Ability to make rapid volume changes (Volume change)<br>Ability to make rapid product mix changes (Mix change)<br>Ability to offer a broad product line (Broad line) |
| **Quality**<br>Conformance<br>Performance<br>Reliable products | Examples:<br>Ability to offer consistently low defect rates (Conformance quality)<br>Ability to provide high performance products or product amenities (Performance quality)<br>Ability to provide reliable/durable products (Reliable/durable) |
| **Delivery**<br>Fast delivery<br>On-time delivery | Examples:<br>Ability to provide fast deliveries (Fast delivery)<br>Ability to make dependable delivery promises (On-time delivery) |
| **Services**<br>After-sales services<br>Support<br>Distribute<br>Customize | Examples:<br>Ability to provide effective after-sales services<br>Ability to provide product support effectively<br>Ability to make product easily available<br>Ability to customize product and services to customer needs |

Source: (Modified from Kim and Arnold 1992).

For the purpose of this study, seven core capabilities which are commonly used by practitioners are focused in this research are integration, acuity, control, and agility. These capabilities address steady state and growth aspect of manufacturing performance. According to Swink and Hegarty (1998), steady state capabilities can be measured at any given point in time and are indicated by superior manufacturing outcomes. Growth capabilities are indicated by changes in manufacturing outcomes over time or by development of new steady state capabilities. The growth in manufacturing effectiveness stems from core capabilities for change: integration.

Integration is the ability to easily expand an operation to incorporate a wider range of products or process technologies. Company's proficiency at introducing custom mechanical seal designs into an existing mix of manufacture components greatly enhanced its ability to meet unique customer needs. Related abilities to quickly introduce and utilize new processes or equipment are also important, especially for firms that compete in dynamic environments involving rapidly changing process technologies (Haifeng, 2006).

Core steady state capabilities include acuity, control and agility.. Acuity refers to the insights of operations managers regarding process capabilities and performance. Control is the ability to direct and regulate operating processes. In a larger sense, control refers to management's ability to understand and reduce sources of unwanted variation in a process. Agility is the ability to move from one manufacturing state to another with very little cost or penalty. Agile manufacturing includes the ability to respond quickly and effectively to current market demands, as well as being proactive in developing future market opportunities (Swink & Hegarty, 1998). Teece and Pisano (1994) view such capabilities as vital in the modern era, which has been described as one of hyper-competition (D'Aveni, 1994).

**Table 2.5 Manufacturing Dimension-Literature Review.**
**Categorization of Manufacturing Dimension**

| Authors | Year | Cost/ Price | Quality | Reliability | Flexibility | Delivery | Innovation | Other-1 | Other-2 |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Kim & Arnold | 1996 | x | x | | x | x | | | |
| Krajewski & Ritzman | 1996 | x | x | | x | | | Time | |
| Avella *et al.* | 1998 | x | x | | x | x | | service | |
| Joseph | 1999 | x | x | | x | | | dependability | speed |
| Santos | 2000 | x | x | | | x | x | | |
| Boyer & Pagell | 2000 | x | x | | x | x | | | |
| Ward & Duray | 2000 | x | x | | x | x | | | |
| Dangayach & Deshmukh | 2001 | x | x | | x | x | x | | |
| Devaraj *et al.* | 2001 | x | x | x | | x | | product range | |
| Amoako-Gyampah | 2003 | x | x | | x | x | | | |
| Demeter | 2003 | x | x | | x | | | | |
| Brown & Bessant | 2003 | x | x | | x | | x | | |
| Dangayach & Deshmukh | 2003 | x | x | | x | x | x | | |
| Leung, Chan, & Lee | 2003 | x | x | | x | x | | product range | New-product |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pun | 2004 | x | x | | x | | x | dependability | |
| Devaraj *et al* | 2004 | x | x | | x | x | x | | |
| Chan | 2005 | x | x | | x | x | | | |
| Osmanagić, Prester, & Podrug | 2005 | x | x | | | x | x | service | |
| Takala *et al.* | 2006 | x | x | | | | | dependability | speed |
| Kazan, Özer, & Çetin | 2006 | x | x | | x | x | | | |
| Hallgren & Olhager | 2006 | x | x | | x | x | | | |
| Takala *et al* | 2007 | x | x | | x | | | customer | know-how |
| Taps & Steger-Jensen | 2007 | x | x | | x | x | | focus | |
| Theodorou & Florou | 2008 | x | x | | x | | | dependability | efficiency |
| Amoako-Gyampah & Acquaah | 2008 | x | x | | x | x | | | |

Table 2.4 higlighted that Manufacturing had a various dimension and from the previous study, many researchers focus on Cost/Price, Quality, Flexibility, Delivery. Some of the researcher highlighted some of the dimension that different from the previous researcher like Relibility, Time, Service, Dependability, Speed, Product Range, Focus, Efficiency

and Know – How. But in this study, the dimension are selected based on the a fixed set of resources. Agile processes are able to switch process set-ups quickly and efficiently, so that non-value-added time is minimized and so that smaller production runs are economical. Responsiveness refers to the ability to quickly adjust manufacturing processes to deal with changes in inputs, changes in resources, or changes in output requirements. For example, a responsive process can accommodate variations in the quality of raw materials or the uptime availability of equipment. In these ways, responsive processes are robust to input or demand variations (Li, 2000).

**2.6.1 Integration**

Integration is separated to four different items. Integration refer to the ability to incorporate new products or processes into the operation. Integration also involves formal or informal mechanisms that coordinate the use of internal and external manufacturing sources (Song *et al*., 1997). Integration can be the process by which the firm coordinates and deploys its different manufacturing sources in order to achieve (Grant,1991). These sources determine the type, quality, and deftness of manufacturing capabilities. These capabilities indicate the firm's capacity to perform productive activities (Grant,1998). The past researcher related Integration to product introduction flexibility, process ramp-up flexibility, modification flexibility and aggregate change flexibility. Product introduction flexibility is the ability to introduce and manufacture new product quickly. Process ramp-up flexibility refer to the ability to quickly learn new skills and adopt the new processes in manufacturing or mechanical processes. Modification flexibility is the ability to easily adjust processes to incorporate product design changes or special needs according to the customer's needs. Aggregate change flexibility refer to the ability to adjust smoothly to changes in product mix over the long term (Li, 2000).

### 2.6.2 Acuity

Acuity is one of the important manufacturing capabilities that must be focused. Acuity refers to the ability to understand the customer's needs and to acquire, develop and convey valuable information and insights regarding products or processes. Acuity divided to three focuses which are Consulting, Information Sharing and Showcasing. Consulting refer to the ability to assist both internal groups, and customers in problem solving (eg. in new product development, design for manufacturability, quality improvement, etc). Information sharing is the ability to furnish critical data on product performance, process parameters, and cost to internal groups and to external customers. Showcasing refer to ability to enhance sales and marketing by exhibiting technology, equipment, or production systems in a way that conveys the value or quality of manufacturing capabilities (Swink & Hegarty, 1998).

### 2.6.3 Control

Control is the ability to direct and regulate operating processes. In control processes, there are three criteria that will be focused. There are process understanding, feedback and adjustment. Process understanding is the ability to understand manufacturing process capability limits and sources of variation. Feedback refer to ability to monitor process outputs and to compare them with desired outputs. Adjustment is the ability to determine the causes of adverse effects and remedy undesired variations in manufacturing outcomes (Li,2000).

### 2.6.4 Agility

Agility is the ability to easily move from one manufacturing state to another. Agility divided to two criteria which are volume flexibility and mix flexibility. Volume flexibility refer to the ability of efficiently produce wide ranges in the demanded volumes of products. Mix flexibility is the ability to manufacture a variety of products, over a short time span, without modifying facilities (Swink & Hegarty, 1998). The new concept agility in manufacturing, these drivers are competition, fragmentation of mass market, cooperative production relationship, evolving customer expectations, and increasing social pressures.The main issue in this new area of manufacturing management is the ability to cope with unexpected changes, to survive unprecedented threats of business environment, and to take advantage of changes as opportunities. This ability is called agility or agile manufacturing (Sharifi & Zhang,1999).

Agile manufacturing that was sometimes mixed up and confused with previous thought schools of manufacturing management such as flexibility and lean manufacturing has been backed for having novel concepts beyond the former remedies. This has happened thanks to the wide concern it received during the past few years, though in place this has been a natural result of the increasing need to resolve problems with the so-called remedies and increasing pressures on manufacturing companies in competing for success. Agility in concept comprises two main factors. They are 1)Responding to change (anticipated or unexpected) in proper ways and due time. 2)Exploiting changes and taking advantage of them as opportunities. These, indeed necessitate a basic ability that is sensing, perceiving and anticipating changes in the business environment of the company. An agile manufacturer, in this way is an organisation with a broad vision on the new order of the business world, and with a handful of capabilities and abilities to deal with turbulence and capture the advantageous side of the business.

Agility is an ability and a character that every manufacturing company must have to be able to survive and prosper in the new order of the world business environment. Different organisations are di!erent in the way they should respond to changing business environment, so they need di!erent levels of agility.Agility is a response to the changes that a company faces, and shall become a characteristic of the company. Therefore, the way that the company should act in turbulent circumstances of the business environment, which is called agility, is a direct function of changes in the business environment, and also the business environment itself and the company's situation. Agility in concept is a strategic response to the new criteria of the business world, and in practice, is a strategic utilisation of business methods, manufacturing and management processes, practices and tools, most of which are already developed and used by industries for certain purposes, and some are under development to facilitate the capabilities that are required for being agile. Information system/technology in its utmost level of timeliness, coverage, communication ability, data banking and interchange, etc., is a major differentiator of an agile manufacturing company compared to traditional systems.

## 2.7 Theoretical Perspective

The theory that will be used in this study is a resource-based view (RBV) theory. This theory claims that firm's resources enable the firm to gain competitive advantage. This theory has been used in management literature over the past 20 years to understand the relationship between firm's resources and firm's performance ( Barney, 1986,1991).

The resource-based view (RBV) as a basis for a competitive advantage of a firm lies primarily in the application of the bundle of valuable interchangeable and intangible tangible resources at the firm's disposal (Mwailu & Mercer, 1983; Wernerfelt, 1984; Rumelt, 1984; Penrose, 1959). To transform a short-run competitive advantage into a sustained competitive advantage requires that these resources are heterogeneous in nature and not perfectly mobile (Peteraf, 1993). Effectively, this translates into valuable resources that are neither perfectly imitable nor substitutable without great effort (Barney, 1991). If these conditions hold, the bundle of resources can sustain the firm's above average returns. The VRIO and VRIN model also constitutes a part of RBV. There is strong evidence that supports the RBV (Crook et al., 2008).

The key points of the theory are 1) Identify the firm's potential key resources 2) Evaluate whether these resources fulfill the criteria. The first criteria is valuable which a resource must enable a firm to employ a value-creating strategy, by either outperforming its competitors or reduce its own weaknesses. Relevant in this perspective is that the transaction costs associated with the investment in the resource cannot be higher than the discounted future rents that flow out of the value-creating strategy (Mahoney & Prahalad, 1992; Conner, 1992). Then rare which is to be of value, a resource must be rare by definition. In a perfectly competitive strategic factor market for a resource, the price of the resource will be a reflection of the expected discounted future above-average returns (Barney, 1986; Dierickx & Cool, 1989). And then, In-imitable which a valuable resource is controlled by only one firm it could be a source of a competitive advantage. This advantage could be sustainable if competitors are not able to duplicate this strategic asset perfectly (Peteraf, 1993; Barney, 1986). The term isolating mechanism was introduced by Rumelt (1984) to explain why firms might not be able to imitate a resource to the degree that they are able to compete with the firm having the valuable resource (Peteraf, 1993; Mahoney & Pandian, 1992). An important underlying factor of inimitability is causal ambiguity, which occurs if the source from which a firm's competitive advantage stems is unknown (Peteraf, 1993; Lippman & Rumelt, 1982). If the resource in question is knowledge-based or socially complex, causal ambiguity is more likely to occur as these types of resources are more likely to be idiosyncratic to the firm in which it resides (Peteraf, 1993; Mahoney & Pandian, 1992). Conner and Prahalad go so far as to say knowledge-based resources are "*…the essence of the resource-based perspective*". Non-substitutable which even if a resource is rare, potentially value-creating and imperfectly imitable, an equally important aspect is lack of substitutability (Dierickx & Cool, 1989). If competitors are able to counter the firm's value-creating strategy with a substitute, prices are driven down to the point that the price equals the discounted future rents (Barney, 1986; Sheikh, 1991) resulting in zero economic profits. Care for and protect resources that possess these evaluations, because by highlighted this factors can improve organizational performance (Crook, Ketchen, Combs, & Todd, 2008).

A subsequent distinction, made by Amit & Schoemaker (1993), is that the encompassing construct previously called "resources" can be divided into resources and capabilities. In this respect, resources are tradable and non-specific to the firm, while capabilities are firm-specific and are used to engage the resources within the firm, such as implicit processes to transfer knowledge within the firm (Makadok, 2001, Hoopes, Madsen & Walker, 2003). This distinction has been widely adopted throughout the resource-based view literature (Conner & Prahalad, 1996, Makadok, 2001; Barney, Wright & Ketchen, 2001).

Makadok (2001) emphasizes the distinction between capabilities and resources by defining capabilities as “a special type of resource, specifically an organizationally embedded non-transferable firm-specific resource whose purpose is to improve the productivity of the other resources possessed by the firm” . “Resources are stocks of available factors that are owned or controlled by the organization, and capabilities are an organization’s capacity to deploy resources”. Essentially, it is the bundling of the resources that builds capabilities.

A competitive advantage can be attained if the current strategy is value-creating, and not currently being implemented by present or possible future competitors. Although a competitive advantage has the ability to become sustained, this is not necessarily the case. A competing firm can enter the market with a resource that has the ability to invalidate the prior firm's competitive advantage, which results in reduced or normal rents (Barney, 1986). Sustainability in the context of a sustainable competitive advantage is independent with regard to the time frame. Rather, a competitive advantage is sustainable when the efforts by competitors to render the competitive advantage redundant have ceased (Rumelt, 1984). When the imitative actions have come to an end without disrupting the firm's competitive advantage, the firm's strategy can be called sustainable. This is in contrast to views of others (e.g., Porter) that a competitive advantage is sustained when it provides above-average returns in the long run.

The resource based view has been a common interest for management researchers and numerous writings could be found for same. A resource-based view of a firm explains its ability to deliver sustainable competitive advantage when resources are managed such that their outcomes can not be imitated by competitors, which ultimately creates a competitive barrier (Mahoney & Pandian 1992; Hooley and Greenley 2005; Smith & Rupp 2002). RBV explains that a firm's sustainable competitive advantage is reached by virtue of unique resources being rare, valuable, inimitable, non-tradable, and non-substitutable, as well as firm-specific (Barney 1999; Finney et al.2004; Makadok 2001). These authors write about the fact that a firm may reach a sustainable competitive advantage through unique resources which it holds, and these resources cannot be easily bought, transferred, or copied, and simultaneously, they add value to a firm while being rare. It also highlights the fact that not all resources of a firm may contribute to a firm's sustainable competitive advantage. Varying performance between firms is a result of heterogeneity of assets (Lopez 2005, Helfat & Peteraf 2003 ) and RBV is focused on the factors that cause these differences to prevail (Grant 1991; Mahoney and Pandian 1992; Lopez 2005).

Fundamental similarity that unique value-creating resources will generate a sustainable competitive advantage to the extent that no competitor has the ability to use the same type of resources, either through acquisition or imitation. Major concern in RBV is focused on the ability of the firm to maintain a combination of resources that cannot be possessed or built up in a similar manner by competitors. Further such writings provide us with the base to understand that the sustainability strength of competitive advantage depends on the ability of competitors to use identical or similar resources that make the same implications on a firm's performance. This ability of a firm to avoid imitation of their resources should be analyzed in depth to understand the sustainability strength of a competitive advantage.

Resources are the inputs or the factors available to a company which helps to perform its operations or carry out its activities (Black & Boal 1994; Grant 1995; Ordaz et al.2003). Resources, if considered as isolated factors, do not result in productivity; hence, coordination of resources is important. The ways a firm can create a barrier to imitation are known as "isolating mechanisms", and are reflected in the aspects of corporate culture, managerial capabilities,information asymmetries and property rights (Hooley & Greenlay 2005;Winter 2003). Other than legislative restrictions created through property rights, the other three aspects are direct or indirect results of managerial practices.

King (2007) mentions inter-firm causal ambiguity may results in sustainable competitive advantage for some firms. Causal ambiguity is the continuum that describes the degree to which decision makers understand the relationship between organizational inputs and outputs (Ghinggold & Johnson, 1998, Lippman & Rumelt, 1982; King (2007), Matthyssens & Vandenbempt, 1998). Their argument is that inability of competitors to understand what causes the superior performance of another (inter-firm causal ambiguity), helps to reach a sustainable competitive advantage for the one who is presently performing at a superior level. Holley & Greenley (2005) state that social context of certain resource conditions act as an element to create isolating mechanisms and quote Wernerfelt (1986) that tacitness (accumulated skill-based resources acquired through learning by doing) complexity (large number of inter-related resources being used) and specificity (dedication of certain resources to specific activities) and ultimately, these three characteristics will result in a competitive barrier.

Referring back to the definitions stated previously regarding the competitive advantage that mentions superior performance is correlated to resources of the firm (Christensen & Fahey, 1984, Kay, 1994, Porter, 1980, Chacarbaghi; Lynch, 1999) and consolidating writings of King (2007) stated above, we may derive the fact that inter-firm causal ambiguity regarding resources will generate a competitive advantage at a sustainable level. Further, it explains that the depth of understanding of competitors—regarding which resources underlie the superior performance—will determine the sustainability strength of a competitive advantage. Should a firm be unable to overcome the inter-firm causal ambiguity, this does not necessarily result in imitating resources. As to Johnson (2006) and Mahoney (2001), even after recognizing competitors' valuable resources, a firm may not imitate due to the social context of these resources or availability of more pursuing alternatives. Certain resources, like company reputation, are path-dependent and are accumulated over time, and a competitor may not be able to perfectly imitate such resources (Zander & Zander, 2005, Santala & Parvinen, 2007).

The argue were on the basis that certain resources, even if imitated, may not bring the same impact, since the maximum impact of the same is achieved over longer periods of time. Hence, such imitation will not be successful. In consideration of the reputation of fact as a resource and whether a late entrant may exploit any opportunity for a competitive advantage, Kim & Park (2006) mention three reasons why new entrants may be outperformed by earlier entrants. First, early entrants have a technological know-how which helps them to perform at a superior level. Secondly, early entrants have developed capabilities with time that enhance their strength to out-perform late entrants. Thirdly, switching costs incurred to customers, if they decide to migrate, will help early entrants to dominate the market, evading the late entrants' opportunity to capture market share. Customer awareness and loyalty is another rational benefit early entrants enjoy (Lieberman & Montgomery, 1988; Porter, 1985; Hill 1997; Yoffie, 1990; Ma 2004; Agarwal et al. 2003 ).

However, first mover advantage is active in evolutionary technological transitions, which are technological innovations based on previous developments (Kim & Park, 2006; Cottam et al. 2001). The same authors further argue that revolutionary technological changes (changes that significantly disturb the existing technology) will eliminate the advantage of early entrants. Such writings elaborate that though early entrants enjoy certain resources by virtue of the forgone time periods in the markets, rapidly changing technological environments may make those resources obsolete and curtail the firm's dominance. Late entrants may comply with the technological innovativeness and increased pressure of competition, seeking a competitive advantage by making the existing competencies and resources of early entrants invalid or outdated. In other words, innovative technological implications will significantly change the landscape of the industry and the market, making early movers' advantage minimal. However, in a market where technology does not play a dynamic role, early mover advantage may prevail.

Analyzing the above-developed framework for the Resource-Based View, it reflects a unique feature, namely, that sustainable competitive advantage is achieved in an environment where competition does not exist. According to the characteristics of the Resource-based view, rival firms may not perform at a level that could be identified as considerable competition for the incumbents of the market, since they do not possess the required resources to perform at a level that creates a threat and competition. Through barriers to imitation, incumbents ensure that rival firms do not reach a level at which they may perform in a similar manner to the former. In other words, the sustainability of the winning edge is determined by the strength of not letting other firms compete at the same level. The moment competition becomes active, competitive advantage becomes ineffective, since two or more firms begin to perform at a superior level, evading the possibility of single-firm dominance; hence, no firm will enjoy a competitive advantage. Ma (2003) agrees stating that, by definition, the sustainable competitive advantage discussed in the Resource based view is anti-competitive. Further such sustainable competitive advantage could exist in the world of no competitive imitation (Peteraf, 1993;Ma 2003; Ethiraj et al., 2005,).

Based on the empirical study, RBV provides the understanding that certain unique existing resources will result in superior performance and ultimately build a competitive advantage. Sustainability of such an advantage will be determined by the ability of competitors to imitate such resources. However, the existing resources of a firm may not be adequate to facilitate the future market requirement, due to volatility of the contemporary markets. There is a vital need to modify and develop resources in order to encounter the future market competition. An organization should exploit existing business opportunities using the present resources while generating and developing a new set of resources to sustain its competitiveness in the future market environments; hence, an organization should be engaged in resource management and resource development (Chaharbaghi & Lynch 1999; Song et al., 2002). Their writings explain that in order to sustain the competitive advantage, it is crucial to develop resources that will strengthen the firm's ability to continue the superior performance. Any industry or market reflects high uncertainty and, in order to survive and stay ahead of competition, new resources become highly necessary. Morgan (2000) and

Finney et al.2004) agrees, stating that the need to update resources is a major management task since all business environments reflect highly unpredictable market and environmental conditions. The existing winning edge needed to be developed since various market dynamics may make existing value-creating resources obsolete.

RBV theory explains a firm ability to achieve sustainable competitive advantage when heterogeneous resources are employed and these resources cannot be imitated by competitors, then creates the competitive barrier ( Desarbo, Benedetto, & Song, 2007). Firm resources are defined by Daft (1983) as "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. Controlled by a firm that enables the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991).

Resources have been divided into two categories, which embracing tangible and intangible assets, such as human capital assets, organizational assets, technological assets, physical assets, financial assets (Zubac, Hubbard, & Johnson, 2010), and reputational assets (Lily Julienti & Hartini, 2010). Characteristics of firm resources that enable firms to achieve and to sustain competitive advantage consists of four criteria, which are valuable, rare, in-imitable, and non-substitutable (Barney, 1991). In manufacturing area, firms' resources are vital to ensure firms able to sustain in competitive industry.

People who are compose variety skills and functional background, experience, expertise, and knowledge to create profitable products very known as vital internal firm resources (Barney, 1991). The resource-based theory also argued the combinations of firm resources and capabilities, especially those that are valuable, rare, inimitable and hard to substitute, are seen as key contributors to distinctive competencies and sustainable competitive advantage against the firm's competition (Barney, 2001). Successful competitive strategies and outcomes depend on the development, effective deployment and maintenance of these resources and capabilities over time. Resource-based Theory dictates that company's internal resources can be source of competitive advantage (Khanna, & Dammon, 1999).

The traditional focus of manufacturing strategy, i.e. competing through manufacturing by aligning manufacturing capabilities with market requirements, is considerably impacted by theoretical lenses, resource-based view (RBV). On one hand, the development of RBV brings a major influence on the way in which we have viewed manufacturing strategy. On the other hand, along with the servitisation of manufacturing companies, competing through manufacturing capabilities is rapidly evolving into competing through the manufacturing and service capabilities (Cheng & Johansen, 2010).

Thus, manufacturing practices are the main reason to related to manufacturing capabilities to improve performance (Flynn *et al*. 1999). Hayes and Wheelwright described world class manufacturing as a set of practices, implying that the use of best practices would lead to superior performance. This practice-based approach to world class manufacturing has been echoed by numerous authors since then. For example, Voss (1995) describes world class manufacturing as a subset of the 'best practices' paradigm of operations strategy. Much of the study of Japanese manufacturing in recent years has also focused on the discernment and use of best practices.

> Knowledge transfer in manufacturing defined as the consideration of process knowledge arises with factors such as a lack of managerial know-how in the host, "commercial habits", government requirements and poor Intellectual Property Protection. The sensitivity of a process to any of these factors indicates its "robustness". Robustness here is used to mean a lack of specificity in application. "If a process was not, for example, climate specific, then it could be considered robust to climate." In this logic then, implicitly the less specific the process knowledge, the more robust it is to process knowledge in the host. Here we encounter the familiar arguments about the tacitness of knowledge: Tacitness of experiential knowledge "is a function of its speed, contextuality, diffusion, and expressibility". These are properties of the knowledge itself but they also mention resistance to codification from the "owners" of tacit knowledge as something to consider. This is not so much a cognitive variable but an attitudinal one (Calantone 1996).

The influence of the industrial and organisational context in the transfer of capabilities with respect to the rate of innovation has been extensively investigated by many authors (Teece, 2000; Grant, 2001). However, studies specific to knowledge management issues in manufacturing settings and to the transfer of manufacturingrelated capabilities are scarce and mainly conducted at the industry or industrial district levels (Scarso, 1999).

In their search for competitive advantage, multinational firms need not only coordinate crossboarder activities but must also integrate and coordinate access to global resource advantages and exploit their globally dispersed internal capabilities (Adameides & Manolias, 2010). In addition, only few researchers have paid attention to and started to redefine manufacturing as a globally distributed and coordinated network, distinct from the traditional plant model (Ferdows 1997; Shi and Gregory, 1998). In the view of manufacturing operations as an extension of the firm's brain, rather than its muscles, knowledge management and capability development at the shop-floor and across facilities can significantly contribute to the achievement of competitive advantage.

To achieve this through transnational manufacturing, firms are seeking efficient production ramp-up and controlled operations by transferring manufacturingrelated capabilities from the corporate (manufacturing) centre. In some cases, e.g. when the development of international operations is through an acquisition of a foreign factory, this transfer may be bi-directional. In both cases, what is sought for is efficient transfer of a diverse set of manufacturing-related technical and organizational capabilities in two phases: during the establishment or (re)organisation of the manufacturing facilities or processes and during their operation (Adameides & Manolias, 2010).

Organizational capabilities are a source for competitive advantage (Voola, Carlson & West, 2004). According to Bhatt and Grover (2005), they state that Organizational Capabilities are all tangible or intangible firm specific processes and assets representing the firms' ability of coordination and deployment of resources. This includes functional skills and cultural perceptions impacting management of change and innovation (Molla, Deng, & Corbit, 2010). Literature discuss the pertaining of firm performance related to organizational capabilities corresponding to various tool (Caloghirou *et al*., 2004;

Raman *et al*., 2006). Lin and Ho (2008) described that technological, organizational and environment factors have positive impacts while some studies found organizational learning capacity to be an important factor to be considered (Hult, 1998: Zahay & Handfield, 2004).

Organizational capabilities are internal to a firm are the main reason for the differences in its profitability (Barney, 1991; Wernerfeh, 1984). Organizational learning systems can be viewed as an especially important capability within this resource-based framework since, especially when coupled with an organizational emphasis on continuous improvement (Zhu & Sarkis, 2004). Organizational learning culture and absorptive capacity of firms can contribute in organizational capabilities (Cohen & Levinthal, 1990). Developing organizational learning has been considered an effective and efficient means of successful technological innovation (Martin & Matlay, 2003). Sustainable differences in firm profitability can be explained by the resource based view (Peteraf, 1993). Organizational learning processes can be approached from various different perspectives, such as the resource based view as well (Barney, 1991). The resource-based theory has applied in studying technology adoption for operations, supply chain management, use of information systems and technology in manufacturing (Caldeira & Ward, 2003).

### 2.7.1 Proposed Theoretical Framework

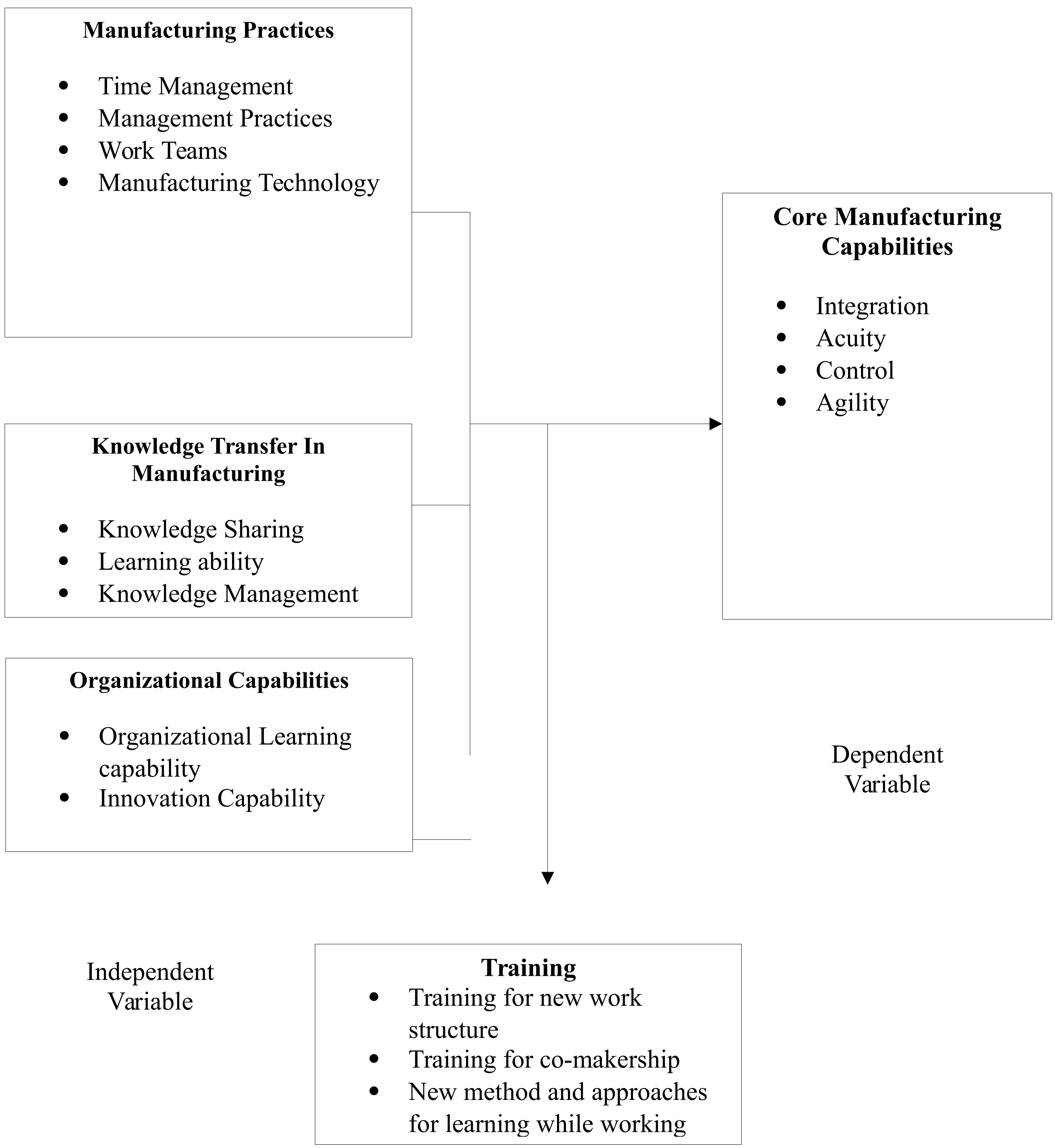
The theoretical framework of this study was developed based on the above discussion of the resource-based theory. This study was designed in order to investigate the critical success factor of Manufacturing Capabilities (Integration, Acuity, Control, and Agility) which had a relationship with manufacturing practices (Time Management, Management Practices, Work Teams, and manufacturing Technology), Knowledge Transfer In Manufacturing (Knowledge Sharing and Learning Ability), Organizational Capabilities (Learning Capability and Organizational Learning capability) and Training

(Training for new work structure, Training for co-makership and New Method and Approaches for learning while working).

Based on the extensive literature on Manufacturing Capabilities, Manufacturing Practices, Knowledge Transfer in Manufacturing, Organizational Capabilities and Training with the problem statement that presented in chapter one, as well as the Resource-based View Theory, an integrated theoretical framework will develope in order to investigate the critical success factor between Manufacturing Capabilities (Integration, Acuity, Control, and Agility) which had a relationship with manufacturing practices (Time management, Management Practices, Work Teams, and manufacturing Technology ), Knowledge Transfer In Manufacturing (Knowledge Sharing and Learning Ability), Organizational Capabilities (Learning Capability and Organizational Learning capability) and Training (Training for new work structure, Training for co-makership and New Method and Approaches for learning while working). Other than that, to investigate the relationship between manufacturing practices, knowledge transfer, organizational capabilities and manufacturing capabilities on training.

Theoretical framework is a conceptual model of how one theorized or makes logical sense of the relationship among the several variables that have been identified as important to the problem. From the theoretical framework, testable hypotheses can be developed to examine whether the theory formulated is valid or not. The hypothesized relationship can thereafter be tested through appropriate statistical analysis, so to be sure of the firmness of this research. Since the theoretical framework offers identify the network of relationships among the variables considered important to the study, it is essential to understand what variables are involved in the study of conceptual model (Sekaran, 2005).

Based on the Sekaran (2005), this research develops the following proposed framework to test the relationship between Manufacturing Capabilities (Integration, Acuity, Control, and Agility) , manufacturing practices (Time management, Management Practices, Work Teams, and manufacturing Technology), Knowledge Transfer In Manufacturing (Knowledge Sharing and Learning Ability), Organizational Capabilities
(Learning Capability and Organizational Learning capability) and Training (Training for new work structure, Training for co-makership and New Method and Approaches for learning while working). The following Figure 2.9 shows the relationships between all proposed variables.


Manufacturing Practices
Time Management
Management Practices
Work Teams
Manufacturing Technology
Knowledge Transfer In Manufacturing
Knowledge Sharing
Learning ability
Knowledge Management
Organizational Capabilities
Organizational Learning capability
Innovation Capability
Core Manufacturing Capabilities
Integration
Acuity
Control
Agility
Dependent Variable
Independent Variable
Training
Training for new work structure
Training for co-makership
New method and approaches for learning while working

Moderator

**Figure 2.9**

***Theoretical Framework of the Study***

### 2.7.2 Hypothesis Development

Based on the theoretical framework, the hypotheses for this research dimensions were formulated and developed in order to test the relationships among manufacturing practices (Time based management, Management Practices, Work Teams, and manufacturing Technology), Knowledge Transfer In Manufacturing (Knowledge Sharing, Learning Ability and Knowledge Management), Organizational Capabilities (Organizational Learning capability and Innovation Capabilities) and Training (Training for new work structure, Training for co-makership and New Method and Approaches for learning while working) with Manufacturing Capabilities (Integration, Acuity, Control and Agility) and finally to achieve the research objectives.

#### 2.7.2.1 Relationship between Manufacturing Practices and Manufacturing Capabilities.

Manufacturing practices (Time based management, Management Practices, Work Teams, and manufacturing Technology)

This lead the following hypothesis:

**H 1:** There is a positive relationship between manufacturing practices and manufacturing capabilities.

**H 2 :** There is a positive relationship between knowledge transfer in manufacturing and manufacturing capabilities.

**H 3:** There is a positive relationship between organizational capabilities and knowledge transfer in manufacturing on manufacturing capabilities.

**2.7.2.4 Relationship between Manufacturing Practices, Knowledge Transfer in Manufacturing and Organizational Capabilities and Manufacturing Capabilities.**

This lead the following hypothesis:

**H 4 :** There is positive relationship between training and manufacturing practices.

**2.7.2.5 Relationship between training and manufacturing practices.**

Training has become a key element in a far – reaching process of restructuring which is currently under way in the industry (Dankbaar, 1999).

This lead the following hypothesis:

**H 5 (H5):** There is positive relationship between training and knowledge transfer.

**H 6 (H6):** There is a positive relationship between training and organizational capabilities.

**H 7 (H8):** There is a positive relationship between training and manufacturing capabilities.

**H 8 (H8):** There is positive relationship between manufacturing practices, knowledge transfer, organizational capabilities on Integration

**H 9 (H9):** There is a positive relationship between manufacturing practices, knowledge transfer, organizational capabilities and manufacturing capabilities on acuity.

**H 10 (H10)** : The three independent variables will significantly explain the variance of Control.

**H11 (H11)** : The three independent variables will significantly explain the variance of Agility.

**2.7.2.9 Relationship between manufacturing practices, knowledge transfer, organizational capabilities and manufacturing capabilities on training.**

This lead the following hypothesis:

**H12 (H12)** : Training moderates the relationship between the three independent variables and core manufacturing capabilities.

**2.8 Summary of Chapter**

This chapter starts with introduction section, followed by core manufacturing capabilities, training as moderating variables, knowledge sharing, organizational capabilities and manufacturing practices. Based on the result of literature review, several conclusions seem reasonable. There is evidence showing that those factors are vitally important to show the relationships between manufacturing capabilities, knowledge sharing, organizational capabilities and manufacturing practices. The next chapter is devoted to discussing the methodology of the study.

# CHAPTER 3

# RESEARCH METHODOLOGY

## 3.1 Introduction

The purpose of this chapter is to present the methodology used to test the hypotheses in this research. An explanation of the process from the identification of item measures to the assessment of survey results has been included. The chapter consists of a methodological overview and discussion of item measure development, questionnaires development, and survey administration.

### 3.2 Research Approach

The main aim of this study is to investigate the relationship between manufacturing practices, knowledge transfer, organizational capabilities, training and development of manufacturing capability. This study is therefore a correlational study.

As the data for this study was collected at a single point in time (Zikmund, 1997); Sekaran, 1999), the study is a cross-sectional study in that time horizon. This is an appropriate strategy because the main focus of the study is to explain the factors which contribute to manufacturing capability in the manufacturing sector.

The study was conducted in a two phases, phase 1 is a pilot study to examine the reability of the instrument and phase 2 is main study using the revised instrument to examine the relationship among the variables. A survey method using questionnaires was chosen for data collection. Based on Zikmund, (2000), the selection of the survey approach design was done according to the following reasons, i) The individuals will be the unit of analysis, ii) Interest in collecting original data from a population which is too large to observe or interview, iii) Measuring the perception of the individuals, iv) Lower cost of time and money, v) Minimize the personal bias in providing a greater degree of objectivity, and vi) Usefulness of testing the hypotheses.

The use of survey method precludes the ability to establish the causal priorities of the independent and dependent variables (Nichoff, 1990).Figure 3.1 demonstrates an outline of the methodology that has been applied for this research. The discussion of methodology addresses four sections including item measure development, questionnaire development, survey management and data analysis. Data analysis is discussed in chapter 4.

Item measures that were identified and variously developed are included in the study. Most item measures were based on previous research instruments whether following the prior design or with several adjustments. Some measures were specifically developed for this research.

| **ITEM MEASURE DEVELOPMENT** |
| --- |
| Manufacturing Capability Measures<br>Manufacturing Practices measures<br>Knowledge Transfer measures<br>Training measures |

↓

| **QUESTIONNAIRE DEVELOPMENT** |
| --- |
| Construction of Initial Questionnaire<br>Pilot Test |

↓

| **SURVEY ADMINISTRATION** |
| --- |
| Survey Plan<br>Survey Implementation<br>Response Analysis |

↓

| **DATA ANALYSIS** |
| --- |
| (Chapter 4 FINDINGS) |

**Figure 3.1 : An overview of Research Process**

The development process of questionnaire will be described later. In this research, each aspect of the survey process, from developing the questionnaire to survey administration, was assured to lead the possible responses to the questionnaire. Furthermore, a pilot test included to obtain the best possible questionnaire.

Survey administration was done by several sub steps including survey planning, implementation, and post-survey analysis. The research design, sampling frame and sampling size were chosen and determined. A multiple ways were applied in conducting the mail survey. Analyses of the post-survey results include aggregate respondents' profile and responds rate analysis.

The final step of the methodology is data analysis. Data obtained from the survey was analyzed by using appropriate statistical methods in order to test all research hypotheses. Validity and reliability assessments were generated as well. The results of data analysis were summarized separately in Chapter 4.

### 3.3 Item Measurement Development

Measures for four manufacturing capability, four manufacturing practices, three knowledge transfer and training were largely identified. These items were formed based on the literature. The process resulted in multiple-item measures for each construct.

### 3.3.1 Manufacturing Capability Measurement

Through a focused literature search, four factors are deemed vital across these studies which were identified as manufacturing capability in manufacturing sectors. They include integration, acuity, control, and agility. In developing survey items for the factors, a multi sources has been used as indicated in Appendix A. The new items were also developed in order to operational several factors.

### 3.3.2 Manufacturing Practices Measurement

This study measures four criteria of manufacturing practices including time management, workforce empowerment, work teams, and manufacturing technology. For each criterion, measurement items were identified and developed using four elements to ensure an adequate coverage of the criteria. All items for each criterion were developed following Small (1999). A multi sources has been used as indicated in Appendix B.

### 3.3.3 Knowledge Transfer Measurement

In this study, it measures three criteria of knowledge transfer including knowledge sharing, learning ability and knowledge management. All the items were identified and developed to make sure they will cover all the criteria. All items for each criterion were developed following Narver & Slater (1990), Calantone (1996), Hahn (1990), Deshpande (1993), and Grey (1996). A multi sources has been used as indicated in Appendix C.

### 3.3.4 Training Measurement

They are three criteria of training which include training for new work structure, training for co-makership and new method and approaches for learning while working. They will cover all the criteria in training and each of the items was identified and they will cover all the topics in this scope. All items for each criterion were developed following Sohal (1999), Bolden (1997), Saunders (2000), Marsh (1999) and MacNeil (2000). A multi sources has been used as indicated in Appendix D.

### 3.3.5 Organizational Capabilities Measurement

In literature, researchers study Organizational Capabilities (Organizational Learning and Innovation capabilities) as enable for organization to adapt new innovation and in improving performance. Organizational capabilities enable organizations to be competitive, and success in the manufacturing sector.

Learning capability enable organizations in educating their workforce with the skills and knowledge required for cleaner production and better manufacturing practices due to increase of climate change (Manufacturing Skill Australia,2008). Learning capacity play the key factor in improving business performance (Helfat & Raubitschek, 2003; Montes *et al*., 2005; Weerawardena & O'Cass, 2004).

They are three criteria of Organizational capabilities which include Managerial Commitment, Systems Perspectives and Openness and Experimentation. They will cover all the criteria in Organizational Capabilities and each of the items was identified and they will cover all the topics in this scope. All items for each criterion were developed following Helfat & Raubitschek (2003), Montes *et al*. (2005), Weerawardena & O'Cass (2004), Manufacturing Skill Australia (2008), Hansen & Wernerfelt (1999), Robey *et al.* ( 2002), Venkatesh & Speier (2000), Ke & Wei (2006), and Wang, Lo and Yang (2004 ). A multi sources has been used as indicated in Appendix E.

### 3.4 Questionnaire Development

A mail questionnaire was used to obtain information from designated respondents. This means of gathering information is commonly used in organizational research because it offers many advantages. It allows researcher to obtain a substantial amount of information from a sample that is widely dispersed geographically at minimal costs (Gilbert, 2001; Sekaran, 2003). Besides promise confidentiality (Miller & Salkind, 2002), it also allows respondents to complete the questionnaires at their own convenience with ample time (Gilbert, 2001).

In spite of its advantages, there are some potential risks when researchers choose to use mail survey. Mail surveys usually have a low response rate (Gilbert, 2001) and one cannot be sure if the data obtained are biased because the non-respondents may be different from those who did respond (Miller & Salkind, 2002; Sekaran 2003). However, this research used some effective techniques to mitigate this risk as reported by Sekaran

(2003) and Miller and Salkind (2002) such as providing the respondent with introductory letter, self-addressed, stamp return envelopes, keeping the questionnaires as short as possible and make telephone follow-up.

### 3.4.1 Construction of Initial Questionnaire

Writing good questions is an important step for the success of a mail survey. In this study, the questions are short and straight to the point by using simple and specific words. Almost all the questions were closed-ended with ordered response choices. Each question provides a range of response choices representing a continuum from the lowest level to the highest level of single concept. Respondents answered the question by finding the most appropriate level on the continuum. Compared to open-ended questions, this kind of question is less demanding and easier for respondent to answer, and they also facilitate coding and analysis of responses by the researcher.

The questionnaire developed in this study consisted of three main sections; the background of the company; manufacturing capability of the company; manufacturing practices of the company; application of the knowledge in the company and finally training that had been conducted in the company. The first section was intended to determine fundamental issues, including the size of the company, type of industry, and also the position of the respondents in their company.

The major part of the questionnaires comprised the manufacturing capability section derived from a focused literature search. Seven major factors believed to be crucial for manufacturing capability were proposed (Haifeng, 2006; Swink & Hegarty, 1998; Li 2000).

For each of the factor, a number of items or statements were carefully formulated using Likert scale. Likert scale is used to measure a wide variety of latent constructs, particularly in social science research. The majority of the manufacturing capability research studies discussed in chapter two utilize. Likert scales to measure various factors. In this section, the scales ranged from '1' which means 'none' to '6' means "high" which show the degree of capability. '2' refers to "not applicable". '3' refers to "low", '4' for "medium" and '5' refers to "above average". Respondent were asked to indicate their agreement or disagreement with the statements as they though it was currently practices.

The second, third and fourth chapter of the questionnaire, also comprised the manufacturing practices section, knowledge transfer section and training section that also derived from a focused literature research. All the major factors believed to be crucial for all this section was also proposed (Sohal, 1999; Bolden, 1997; Li, 2000).The items also used Likert scale. Likert scale which was given as '1' refer to "not applied" to '4'means "fully applied". "2" refers to less applied, and "3" refers to "partially applied". All the items show the degree of application for manufacturing practices, knowledge and training. Respondent were asked to indicate their agreement or disagreement with the statements as they thought it was currently practices.

The intended respondent for the questionnaire was an individual at the selected company who was a General Manager or Manager in Engineering or Production Department. It was crucial that the data and information comes from those who have good understanding in production of the company.

To make sure the questionnaire was in a good condition and easy for respondent to understand all the single items of the questionnaire, the questionnaire were presented in two languages, first in English and second in Bahasa Melayu. The questionnaire were prepared in two language to make sure if the respondent not sure about some sentences or words, they can refer to the other language. So that, respondents can understand the question properly.

### 3.4.2 Pilot Test

Following the responsible survey research practice (Jackson, 1995; Miller & Salkind, 2002), the instrument was tested, through the administration of a pilot study, to assess the wording and preliminary information on the validity and reliability of measured items for each research variables. A total of 30 initial questionnaires were distributed to a range of industries in manufacturing companies in the Northern Region of Malaysia.

#### 3.4.2.1 Validity

In an attempt to ensure that the measures developed are reasonably good, it must meet two main criteria; validity and realibility. Validity refers to the extent to which the instrument measures what it supposed to measures while realibility refers to the consistency of this measurement instrument (Sekaran, 2003). Following the pilot test, the analysis was focused on the content validity and reability assessment. Content validity was the first criteria established. Content validity is always subjectively evaluated by the researcher (Sekaran, 2003). The survey was piloted to academicians and practitioners who verified its content. The instrument can be considered as having validity if it is indeed evaluated by a group of expert judges (Kidder & Judd, 1986).

In this research, opinion from managers that have experiences about manufacturing capability in manufacturing company were collected and analyzed. Some concern was expressed on wordings of the questions either need change or add several words to provide more understanding. For examples, they commented about the fonts which they advised to make it bigger, and they suggested to prepared the questionnaires in two language, so that respondents can understanding the question properly.

### 3.4.2.2 Reliability

Another test that has been done in pilot survey was Cronbach's Alpha. A classical measure of reliability, Cronbach's Alpha was used to examine the internal consistency and reliability of the items within each scale. Cronbach's Alpha is a reliability coefficient that reflects how well items are correlated to one another. Cronbach's Alpha is computed in terms of the average intercorrelation among the items measuring the concept. The closer the Cronbach's Alpha is to 1, the higher the internal consistency reliability (Sekaran, 2000).

### 3.5 Survey Administration

The success of a survey is not merely depended on the quality of the questionnaires but also considered on how the survey activities are administrated. Thus, this section will discuss the survey plan and its implementation that was done for this research.

#### 3.5.1 Survey Plan

The survey plan will describe the determination of the targeted populations and respondents, and the design of survey sampling.

##### 3.5.1.1 Targeted Population

The purpose of this research is to determine the status of manufacturers' manufacturing capabilities. The research was focused to three states in northern region of Malaysia including Kedah, Perlis, Northern Perak and Penang. In an attempt to complete the research, manufacturing companies across a large range of industries such as electrical and electronic, engineering supporting, machinery and equipment, life science, petrochemical and polymer, rubber-based, food product, transport equipment, wood-based, food and baverage, automotive and others were studied. The classification of this industry was followed by Federation of Malaysian Manufacturers (FMM) according to FMM Directory 2011, Malaysian Industries.

#### 3.5.1.2 Unit of Analysis and Targeted Respondent

In this research, the unit of analysis is the individual company. Each respondent was chosen to represent a company. Considering this matter, the targeted respondent should be someone who is familiar with the operations of the company and someone that manage the operation in the company. As mention earlier, the person should include the Manager or someone similar.

#### 3.5.1.3 Sampling Frame and Sample Size

The sampling frame is a list of targeted population members from which a survey sample will eventually be drawn. The list used in this study contained 320 manufacturing companies in Kedah, Perlis, Northern Perak and Penang, which are registered in Federation of Malaysian Manufacturer (FMM). As this research pertains to populations within identifiable geographical areas i.e state, an area sampling procedure will be done. The population has been clustered into four states namely Kedah, Perlis, Northern Perak and Penang.

The sample size in this research was determined by using the table provided by Krejcie and Morgan (1970). Based on this table, a number of 175 companies need to be selected as a sample in order to represent the overall population which is 320 companies. Then, a sample of members from each state was drawn using a proportionate random sampling procedure. The members drawn from each state were proportionate to the total number of companies in the state. This sampling procedure assures that each company has equal chance of being chosen as the sample within the state. Moreover, according to Lau and Idris (2001), generalization can only be drawn when random samples are used. Then, the samples are drawn by using a simple random sampling procedure which assures each company has equal chance of being chosen as the sample. As a result, approximately 60% of members from each state have been selected as shown in Table 3.1.

**Table 3.1 : Sample Size for the Research Population**

| State | Population size | Sample Size |
|---|---|---|
| Kedah | 68 | 40 |
| Perlis | 9 | 5 |
| Penang | 233 | 139 |
| Northern Perak | 10 | 6 |
| Total | 320 | 190 |

**3.6 Survey Implementation**

A number of techniques involved in implementing the survey. Firstly, a cover letter is attached together with the survey to describe the objectives of the study and to assure informants that their answers are private and confidential. Galbreath (2004) informed that personalization of cover letters and assurance of confidentiality are positively associated with response rates. Futhermore, the cover letter is using the letter head of Faculty of technology Management, Universiti Utara Malaysia. Lastly, Galbreath (2004) showed that subjects are more likely to give unbiased responses when their anonymity is assured. Thus, all informants were assured anonymity. Table 3.2 shows the items found in the questionnaire.

**Table 3.2 : Item Descriptions of Questionnaire Section**

| Part | Measures | Number of Items |
|---|---|---|
| Part I | Company Profile | 8 |
| Part II | Manufacturing Practices | 57 |
| Part III | Knowledge Transfer | 22 |
| Part IV | Training | 23 |
| Part V | Organizational Capabilities | 12 |
| Part VI | Manufacturing Capability | 34 |
| Part VII | Comments and Suggestion | |

### 3.6.9 Pilot Study

A pilot study was conducted to pre-test the validity and reliability of the questionnaire's instruments. A total of 40 firms were chosen but only 30 of them were committed and completed the questionnaire. Participants of the pilot test were a 10 managing director and 20 managers from production and engineering divisions of the companies in the Northern Region of Malaysia.

The sample size is quite small, so that the content validity was used to ensure that the measures had taped the concept. A group of panel judges can attest to the content validity of the instrument. Each part of the questionnaire design was involved substantial rewriting in order to get the questionnaire right. In designing ad administering the questionnaire for this study, the various information, suggestions and comments for improving response rate were included to meet the objectives of this research.

Cronbach's Alpha was used to examine internal consistency and reliability of the items within each scale. Cronbach's alpha is a reliability coefficient that reflects how well the items as a set are correlated to one another. Cronbach's alpha is computed in terms of the average inter- correlated among the items measuring the concepts. The closer Cronbach's Alpha is to 1, the higher the internal consistency reliability. Alpha values greater than 0.60 are suggested as being adequate for testing the reliability of factors (Sekaran, 2003). The statistical summaries for each scale of the pilot test analysis are shown in Table 3.3. From the table, Cronbach's Alpha value ranged from 0.638 to 0.966, which showed high internal consistency. All Cronbach's Alpha value are above acceptable value of 0.50 (Heir, 1998). Therefore, no items were deleted.

**Table 3.3 Statistic summary for each scale on pilot analysis**

| Variable | No. of items | Items deleted | Cronbach 's alpha value |
|---|---|---|---|
| **Manufacturing Practices** | | | |
| Time-Based Management | 7 | none | 0.732 |
| Management Practices | 9 | none | 0.842 |
| Team Work | 7 | none | 0.830 |
| Manufacturing Technology | 10 | none | 0.866 |
| **Knowledge Transfer** | | | |
| Knowledge Sharing | 4 | none | 0.927 |
| Learning Ability | 11 | none | 0.922 |
| Knowledge Management | 7 | none | 0.695 |
| **Training** | | | |
| Training for New Work Structure | 7 | none | 0.818 |
| Training for Co – Makership | 12 | none | 0.710 |
| New Method and approaches for Learning while working | 4 | none | 0.638 |
| **Manufacturing Capabilities** | | | |
| Integration | 4 | none | 0.874 |
| Acuity | 9 | none | 0.847 |
| Control | 5 | none | 0.946 |
| Agility | 3 | none | 0.864 |
| **Organization Capability** | | | |
| **Organization Learning capability** | | | |
| Managerial Commitment | 4 | none | 0.861 |
| Systems Perspectives | 4 | none | 0.713 |
| Openness and Experimentation | 4 | none | 0.511 |
| **Innovation Capability** | | | |
| Perceived relative advantage | 5 | none | 0.845 |
| Perceived compatibility | 4 | none | 0.902 |

### 3.7 Data Collection

In this study, questionnaire were printed and sent by mail. The finalized questionnaire is presented in Appendix F . The respondents were asked to complete the questionnaire on their own and to send it back. According to Forza (2002), mail questionnaires have the following advantages, cost savings; they can be completed at the respondent's convenience; there are no time constraints; the respondents too can give authoritative impressions; anonymity is assured; and this can reduce interviewer bias. In addition, Sekaran (2003) sees the main advantage of mail questionnaires in that a wider geographical area can be covered in the survey and the data collected in the actual work environment.

A set of questionnaire was formulated and designed into a booklet format to collect data from randomly selected samples. This booklet containing five sections (section 1, 2, 3, 4 and 5) was distributed to all 190 respondents through mail. A provision was made for code identification purpose that was placed in the upper left corner of the questionnaire. The code number allowed the researcher to keep track of which questionnaires have been returned and to identify incomplete questionnaire for subsequent follow-up (Erdogan & Tagg, 2003).

To maximize the respondent rate, every care was taken in preparing survey related materials. Each envelope contained a booklet and a cover letter from the researcher. The cover letters explained the purpose of the study, promise of confidentiality, and seeking the person to cooperate in responding to the questionnaire. No deadlines were stated in the cover letter. Importantly, the cover letter clearly requested the respondents to determine that whether they were the appropriate person to answer the questionnaire. If not, then they should direct the survey to someone who was more knowledgeable about the manufacturing capabilities or someone who has an experience in manufacturing practices. By stating this, the most appropriate person eventually becomes the respondents. The researcher also reiterated to the respondents that the survey was confidential and it was for academic purposes only. Lastly the self-addressed envelopes accompanied each questionnaire.

### 3.8 Method of Data Analysis

The data collected through questionnaire was coded and analyzed using Statistical Package for the Social Science (SPSS) version 19.0. An overview of the analysis was described before the actual finding was discussed.

Preliminary test were undertaken to determine the response rate, descriptive statistics, validity and reliability of the study constructs. Response rate was determined by computing frequency and percentage of response based on feedback received. Descriptive statistical analysis included frequencies and percentage were used to present the main characteristics of sample. Factor analysis and reliability analysis were used to assess the construct validity and reliability of the independent variable of manufacturing practices and knowledge sharing and dependent variables of manufacturing capabilities. The result of response rate, descriptive statistics, factor analysis and reliability analysis are reported to the following chapter.

### 3.8.1 Bivariate Correlation

Bivariate correlation was used to test the relationship between manufacturing capabilities and manufacturing practices and knowledge sharing. Correlation coefficient revealed the magnitude and direction of relationships. The magnitude is the degree to which variables moved in unison or in opposition (Sekaran, 2003).

### 3.8.2 Multiple Regression Analysis

Multiple Regression analysis is a form of general linear modeling. A multivariate statistical technique was used to examine the relationship between a single dependent variable and a set of independent variables. This application is useful for hypothesis H53 to explain the variance of the two independent variables on a single dependent variable.

There are four important statistical assumptions for multivariate technique to representing the requirements of the underlying statistical theory. They are normality, linearity, homoscedasticity and multicollinearity (Hair, 2006). The series of graphical and statistical tests directed towards assessing the assumptions underlying the multivariate techniques revealed relatively little in terms of violations of the assumptions. Where violations were indicated, they were relatively minor and did not present any serious problems in the course of data analysis.

### 3.8.3 Hierarchical Multiple Regression Analysis

Hierarchical multiple regression analysis is a statistical technique that can be used to analyze the relationship between a single dependent variable, moderator variables and several independent variables. Hierarchical multiple regressions were utilized to test research hypothesis H9 relating to the main effect of relationship manufacturing practices and knowledge sharing on manufacturing capabilities. Separate hierarchical multiple regressions were run for each manufacturing practices and knowledge sharing and dependent variables. This analysis was used in research to detect the moderating effects.

A form of hierarchical entry designed to determine if the relation between two variables was influenced by a third of moderating variable (Nunally & Bernstein, 1994). Russell and Bobko (1992) suggests that hierarchical multiple regression analysis is preferred statistical procedure for detecting interaction effects. The interaction effect involves using the main predictor and the moderators.

The general procedure for testing moderating effects was to enter the sets of predictors onto the regression equation in the following order. Step 1, the main effects of success factors dimension was entered. Step 2, the moderator variable was entered into the equation. The two- way interaction terms obtained by multiplying the moderator variable and independent variables were entered at step 3. A significant term was taken as an indication of moderating effect (Zhang & Leung, 2002). For the dependent variable, hierarchical multiple regression analysis will run separately for the criteria of core manufacturing capabilities.

### 3.8 Summary of the Chapter

In this chapter, the focus of the discussion has been on the research methodology used in this study. It encompasses six main topics namely the research design, measurement of instruments, questionnaire design, pilot study, data collection and data analysis. It also describes the process of checking the content validity and reliability of the construct instruments based on pilot study. The next chapter will present the results of main study followed by some discussions on how these outcomes compared to those of prior studies.

# CHAPTER 4

# ANALYSIS AND FINDINGS

The objective of this chapter is to present, interpret and discuss the result based on the data analysis and testing of hypotheses formulated in this study. This included the descriptive summary of respondents in respect to general information captured by survey instrument. Sample frequency and percentage are used to show the general distribution of the respondent's profile. Before proceeding in the main analysis, factor analysis and reliability analysis are used to assess the goodness of measures. Several assumptions were needed to fulfill this study such as normality, linearity, homoscedasticity etc. The chapter comprises the main results of hypotheses tested and the discussion with respect to the degree to which the data do or do not support the hypotheses.

## 4.1 Rate of Return

Questionnaires were posted at the end of July 2012 to 175 manufacturing companies representing 54.7 % of the total population of 320 manufacturing companies located in northern region of Malaysia. After five months, a total of 119 completed questionnaires were returned. Attempts through phone call reminders and follow up letters resulted in the response rate of 68%. A total 56 manufacturing companies are not responded which represent 32%. The response rates obtained is considered good return as previous studies in the same field give the low rate of response associated with mail surveys (e.g. Adams & Spann, 1995; Athaide 1996; Franke, 2006; Hise, 1989; Kassicieh, 2002; Mishra, 2004). According to Malhotra and Grover (1998), it is important to reach a response rate that is greater than 20 percent. Postal questionnaires are “received cold by the respondent” (Denscombe 1998); this means that there is no contact between the researcher and the respondent. The number of people who respond to such postal questionnaires is quite low. As a guide, researchers will be lucky to achieve a response rate of 20 per cent (Denscombe 1998) and even 10 per cent is not uncommon for some surveys (Buckingham and Saunders 2004). A response rate this low could result in the findings not being taken seriously because it is unlikely the sample represents a true crosssection of the population. As a consequence, this method should only be considered when using large samples that will still produce enough data for analysis with a low response rate (Denscombe 1998).

**Table 4.1 : Total Number of Questionnaire Distributed and Collected for Northern Region of Malaysia**

| State | Population Size | Number of Questionnaire Sent | Completed Reponses | Undeliverable Respondent | Non Responses | Percentage |
|---|---|---|---|---|---|---|
| Kedah | 61 | 30 | 20 | - | 10 | 66.6 |
| Perlis | 11 | 5 | 2 | - | 3 | 40.0 |
| Penang | 248 | 140 | 97 | - | 43 | 69.2 |
| Total | 320 | 175 | 119 | - | 56 | 80.0 |

## 4.2 Respondent Profile

This section provides background information of the respondents who participated in the survey. The section consists of information about type of industry, type of companies, size of company, designation position, year of designation, respondent positions, year of designation, age of company, company size, manufacturing practices, knowledge transfer, training and manufacturing capability. A total of one hundred and nineteen respondents participate in this study. The general information of the sample is explained in the following subsection.

### 4.2.1 Type of Industries

Table 4.2 shows the six types of industries representing one hundred and nineteen respondents. This includes agriculture, forestry and fishing, manufacturing, mining and quarrying, construction, and other types of industries. Manufacturing are in included electronic and electric industry and manufacturing industry. From the descriptive statistical analysis in Table 4.2, it showed that manufacturing were the dominant industry representing 92.4%. The next largest industry is other types of industries which is (2.5%). The minor industries in this study are agriculture, forestry and fishing, mining and quarrying and construction (1.7%).

**Table 4.2: Respondents' Characteristics based on The Type of Industry**

| Industry Type | Frequency | Percentage |
|---|---|---|
| Agriculture, Forestry & Fishing | 2 | 1.7 |
| Manufacturing | 110 | 92.4 |
| Mining & Quarrying | 2 | 1.7 |
| Construction | 2 | 1.7 |
| Others | 3 | 2.5 |
| Total | 119 | 100.0 |

### 4.2.2 Type of Companies

Table 4.3 shows the five types of industries representing eighty-nine respondents. This includes Malaysian owned, Foreign owned, Multi-National company, Joint Venture, and others. From the descriptive statistical analysis in Table 4.3, it showed that the Malaysian owned companies were the dominant industry representing 63%. The next larger company is foreign owned representing 23.5%. The minor company is joint venture representing 13.5%.

**Table 4.3: Respondents' Characteristics based on The Type of Company**

| Companies's Type | Frequency | Percentage |
|---|---|---|
| Malaysian owned | 75 | 63.0 |
| Foreign owned | 28 | 23.5 |
| Multi- National company | - | - |
| Joint Venture | 16 | 13.5 |
| Others | - | - |
| Total | 119 | 100.0 |

### 4.2.3 Size of Company

Table 4.4 summarizes the companies' sizes. They have been categorized into groups as employed by SMIDEC (2003). Respondents were asked to indicate the number of people employed in their companies. Their responses, classified into four groups, are shown in Table 4.4. As can be seen, no companies had employed 5 to 50, 36 companies (30.3%) had employed from 51 to 150 and the remaining companies surveyed had employed more than 150. No case is missing in number of employees data.

**Table 4.4: Respondents' Characteristics based on The Size of Company**

| Size of Company( In term of Full Time Employees) | Frequency | Percentage |
|---|---|---|
| Less than 5 | - | - |
| 5 to 50 | - | - |
| 51 to 150 | 36 | 30.3 |
| More than 150 | 83 | 69.7 |

| | | |
|---|---|---|
| Total | 119 | 100.0 |

#### 4.2.4 Designation of Respondents's Position

The survey questionnaire were addressed to General Manager, Manager or equivalent. Thus, the respondents hold variety of positions such as Manager, or General Manager. All the respondents were knowledgeable in manufacturing and operations or they have a common understanding with the concept of manufacturing capability. Each group represents personnel, who understand about manufacturing capabilities of their respective facilities. Table 4.5 shows the respondent positions. The result indicates that out of 119 respondents, 49 or 55.1% respondents are managers, 27 or 30.3% are executives and 10 or 11.2% are engineers. The rest of the respondents are from various positions such as General Manager and Director. It shows that majorities of respondent's are managers. There is no significant discrepancy among the percentage or number of respondents in each the five groups. This result indicates that the questionnaires were completed by the proper individuals.

**Table 4.5: Respondents' Job Designation**

| Designation | Frequency | Percentage |
|---|---|---|
| Director | - | - |
| General Manager | 3 | 2.5 |
| Manager | 89 | 74.8 |
| Executive | 27 | 22.7 |
| Engineer | - | - |
| Total | 119 | 100.0 |

### 4.2.5 Year of Designation

Respondents were grouped into four categories for years of designation; less than one years, between one and five years, between six and ten years and more than ten years. The majority of the respondent who are made up 52.9% (63) have working experience more than ten years in the current position. Table 4.6 also shows 8 respondents equal to 6.7% employed for less than one years. About 26.1% have worked between one and five years. While 17 respondents equal to 14.3% have worked between six and ten years. Figure 4.5 reports length of year employment of the respondent.

**Table 4.6: Respondents' Characteristics based on Length of Employment**

| Year of Designation | Frequency | Percentage |
|---|---|---|
| Less than 1 year | 8 | 6.7 |
| 1 – 5 years | 31 | 26.1 |
| 6 – 10 years | 17 | 14.3 |
| More than 10 years | 63 | 52.9 |
| Total | 119 | 100.0 |

## 4.3 Data Analysis

The research data was analyzed using SPSS (version 19) statistical software. The data was examined to see whether it fulfilled the main assumptions before the hypothesis testing was carried out. The data was examined to test the validity and reliability of the measurement instrument. An adequate examination was conducted to ascertain normality, linearity and homoscedasticity and collinearity assumptions were met in order to use correlation and regression techniques. The assumptions were examined using methods suggested by Coakes (2005) and Hair, Anderson, Tatham and Black (2006) as mentioned in Chapter 3.

### 4.3.1 Test for Validity

Before conducting the main analysis, a validity test was performed with all the items tapping in the independent variables, moderator variables and dependent variables that are included in the study. The validity test was conducted based on the data collected from 119 cases which are no respondents are outliers among the respondents. Therefore, established statistical tools such as factor analysis helped determine the construct adequacy of measuring device (Cooper & Schindler, 1998). The principal component analysis method with varimax rotation was used to identify underlying dimensions for each construct (Hair, 2006). A separate factor analysis was performed for all measures consisting two or more items.

Hypothetically, 131 items were to measure the dimensions of the nineteen models; manufacturing practices, knowledge transfer, training, organizational capabilities and manufacturing capability. The dimensionality of the model item was tested to ensure that they are important and fit in the model. Factor analysis addressed the problem analyzing the structure of the interrelationship (correlation) among a large number of variables by designing a set of common underlying dimensions (Hair, 2006). The factor analysis result indicated that multicollinearity between the produced factors was checked and the value of Kaiser-Meyer-Olkin (KMO) was found to be acceptable. Founded that this value is more than 0.5, it can be suggested that the factor analysis test had proceeded correctly, and the sample used was adequate (Hair, 2006). The result are outlined in Table 4.7.

The analysis resulted in a four-factors solution with three to twelve items loading in each constructs. The first run of the nineteen constructs proved to be unsatisfactory since ten of the constructs were unifactorial, and the rest were bifactorial. The results were checked for items that had low correlation with others, and a low factor loading that provided candidates removal for secondary analysis. A secondary factor analysis was performed for ten variables that are Timed Based Management, Management Practices, Team Work, Manufacturing Technology, Learning Ability, Knowledge Transfer, Training for new work structure, Training for co-makership, Perceived Relative advantage and Acuity. All these items which did not have strong correlations with the component, as well as having low community, were eliminated. This resulted in all variables being unifactorial. As indicated in Table 4.7, each variable account for over 47 percent of variance as explained by the respective item sets. The KMO values are in the range of 0.559 to 0.855. The KMO value for managerial commitment is 0.559, systems perspectives is 0.579 and openness and experimentation is 0.586. All the KMO values are acceptable which high values (between 0.5 and 1.0) indicate factor analysis is appropriate (Hair, 2006). Thus, the results of the scales used in the study measure the proposed construct appropriately.

## Table 4.7 : Results of Factor Analysis

| Variable | KMO | Factor loading | Initial Eigenvalues | %Variance Expalined by component 1 | Item for Deletion |
|---|---|---|---|---|---|
| Time-Based Management | 0.796 | 0.944, 0.845, 0.884 0.716, 0.659, 0.619 | 3.716 | 62 | A10 |
| Management Practices | 0.793 | 0.878, 0.840, 0.345 0.724, 0.896 | 2.923 | 58 | A18, A 21, A 22, A 23 |
| Team Work | 0.745 | 0.810, 0.258, 0.867, 0.876, 0.714, 0.865 | 3.497 | 58 | A 28 |
| Manufacturing Technology | 0.841 | 0.818, 0.878, 0.758 0.819, 0.899, 0.912, 0.893, 0.750 | 5.684 | 71 | A 54 |
| Knowledge Sharing | 0.806 | 0.871, 0.929, 0.953 0.790 | 3.152 | 79 | None |
| Learning Ability | 0.855 | 0.777, 0.793, 0.746 0.790, 0.452, 0.818 0.837, 0.755 | 4.558 | 57 | B19, B 14 |
| Knowledge Transfer | 0.638 | 0.843, 0.640, 0.801 0.345, 0.929 | 2.744 | 55 | B 17, B 18 |
| Training for New Work Structure | 0.607 | 0.840, 0.699, 0.807 0.812, 0.475, 0.797 | 3.365 | 56 | Q6 |
| Training for Co – Makership | 0.827 | 0.753, 0.671, 0.818 0.766, 0.868, 0.834 0.893, 0.783 | 5.132 | 64 | C8, C 10, C 14 C 16 |
| New Method and approaches for Learning while working | 0.711 | 0.722, 0.811, 0.906 0.731 | 2.534 | 63 | None |
| Managerial commitment | 0.559 | 0.564, 0.367, 0.947 0.924 | 2.202 | 55 | None |
| Systems Perspectives | 0.579 | 0.911, 0.489, 0.529 0.894 | 2.150 | 54 | None |
| Openness and Experimentation | 0.586 | 0.842, 0.799, 0.544, 0.484 | 1.877 | 47 | None |
| Perceived relative advantage | 0.612 | 0.962, 0.748, 0.953 0.266 | 2.465 | 62 | D5 |
| Perceived compatibility | 0.876 | 0.783, 0.887, 0.879 | 2.915 | 73 | None |
| Integration | 0.751 | 0.764, 0.895, 0.918 0.880 | 3.000 | 75 | None |
| Acuity | 0.808 | 0.547, 0.823, 0.765 0.805, 0.874, 0.823 | 3.453 | 58 | E14, E16, E20 E21 |
| Control | 0.808 | 0.804, 0.768, 0.804 0.855, 0.909, 0.880 | 3.567 | 71 | None |
| Agility | 0.702 | 0.877, 0.951, 0.919 | 2.519 | 84 | None |

### 4.3.2 Test for Reliability

Reliability is an assessment of the degree of consistency between multiple measurements of variables (Hair, 2006). The most common reliability measure is Cronbach's Alpha (α). The reliability test was performed with all the items tapping in the independent variables, moderator variable and dependent variables included in the study. Thus, the reliability test were conducted based on the data collected from 119 cases.

Cronbach's Alpha for the entire variable were re-examined based on the responses of the data main study. The Cronbach Alpha coefficient for each variable after the elimination of twenty one items (A10,A18, A 21, A 22, A 23,A 28,A 54, B19, B 14,B 17, B 18, C6, C8, C 10, C14, C 16, D5, E21, E14, E16, E20, and E21) is presented in Table 4.7. The Cronbach Alpha from 0.614 to 0.932, indicates that all scales are acceptable. Alpha values greater than 0.60 are suggested as being adequate for testing the reliability of factors (Sekaran, 2003). From the results obtained, it can be concluded that this instrument has high internal consistency and is therefore reliable. Table 4.8 below presents the summary of reliability analysis of variables in this study.

**Table 4.8 Cronbach's Alpha for the Study Variables**

| Variable | No. of items | Items deleted | Cronbach's Alpha if item deleted |
|---|---|---|---|
| Time-Based Management | 7 | 10 | 0.874 |
| Management Practices | 9 | 18,21,22,23 | 0.804 |
| Team Work | 7 | 28 | 0.836 |
| Manufacturing Technology | 10 | 54 | 0.932 |
| Knowledge Sharing | 4 | - | 0.903 |
| Learning Ability | 11 | 9,14 | 0.895 |
| Knowledge Transfer | 7 | 17,18 | 0.749 |
| Training for New Work Structure | 7 | 6 | 0.830 |
| Training for Co – Makership | 12 | 8,10,14,16 | 0.915 |
| New Method and approaches for Learning while working | 4 | - | 0.801 |
| Managerial commitment | 4 | - | 0.657 |
| Systems Perspectives | 4 | - | 0.699 |
| Openness and Experimentation | 4 | - | 0.614 |
| Perceived relative advantage | 5 | 5 | 0.767 |
| Perceived compatibility | 4 | - | 0.876 |
| Improvement | 3 | - | 0.793 |
| Innovation | 6 | 9 | 0.752 |
| Integration | 4 | - | 0.886 |
| Acuity | 9 | 14,16,21 | 0.848 |
| Control | 5 | - | 0.895 |
| Agility | 3 | - | 0.896 |
| Responsive | 4 | - | 0.881 |

### 4.3.3 Test for Normality

The first important assumption to be met is normality. The assumption of normality is a prerequisite for many inferential statistique techniques such as skewness and kurtosis. Normality test refers to the shape of data distribution for each variable and its correspondence to normal distribution. As mentioned before, normality test can be tested using statistical techniques. If the calculated z value exceeds a crtitical value, then the distribution is not normal in terms of those characteristics. The critical value is from a z distribution, based on the desired significance level. The first normality test are skewness and kurtosis. The statistical value (z) for the skewness and kurtosis value is calculated in

Table 4.9.

**Table 4.9 Z Value (Skewness and Kurtosis)**

| Skewness | Kurtosis |
| --- | --- |
| $Z_{skewness} = \frac{skewness}{\sqrt{6/N}}$ | $Z_{kurtosis} = \frac{kurtosis}{\sqrt{24/N}}$ |

- N is sample size

Skewness and kurtosis refer to the shape of the distribution. Thus, the skewness and kurtosis tests being objective methods of testing the normality were carried out (Coakes, 2005). The result for skewness values obtained ranged from -2.493 to 2.577, while the result for kurtosis gave the value ranged from -2.525 to 1.164. All the skewness and kurtosis value are significantly around ±2.58. Thus all variables exhibit a statistically significant departure from normality at the 0.01 probability level (Hair, 1998). Table 4.10 shows the results obtained for skewness and kurtosis value.

## Table 4.10 : Shape of distribution

| Variable | Statistic | | | |
|---|---|---|---|---|
| | | Shape of Distribution[2] | | |
| | | Skewness | | Kurtosis |
| | Statistic | | Statistic | |
| Time-Based Management | - 0.322 | - 1.428 | - 1.052 | - 2.342 |
| Management Practices | - 0.562 | - 2.493 | - 0.849 | - 1.890 |
| Team Work | - 0.286 | -1.268 | - 0.898 | -2.000 |
| Manufacturing Technology | - 0.391 | - 1.734 | - 0.552 | -1.229 |
| Knowledge Sharing | - 0.557 | -2.471 | 0.523 | 1.164 |
| Learning Ability | 0.232 | 1.029 | -1.156 | -2.574 |
| Knowledge Transfer | -0.114 | -0.505 | - 1.073 | - 2.389 |
| Training for New Work Structure | 0.095 | 0.421 | 0.032 | 0.071 |
| Training for Co – Makership | -0.167 | -0.740 | -1.124 | -2.503 |
| New Method and approaches for Learning while working | 0.427 | 1.894 | - 0.709 | - 1.579 |
| Managerial commitment | 0.420 | 1.871 | -0.583 | -1.298 |
| Systems Perspectives | -0.049 | -0.218 | -0.901 | -2.006 |
| Openness and Experimentation | 0.305 | 1.359 | -0.911 | -2.028 |
| Perceived relative advantage | 0.086 | 0.383 | -1.134 | -2.525 |
| Perceived compatibility | 0.581 | 2.577 | -0.718 | -1.599 |
| Integration | 0.135 | 0.598 | - 0.664 | - 1.478 |
| Acuity | - 0.016 | - 0.070 | - 0.430 | - 0.957 |
| Control | - 0.064 | - 0.283 | - 0.422 | - 0.939 |
| Agility | 0.145 | 0.643 | - 0.740 | - 1.648 |

[a] The z value are derived by deviding the statistics by the appropriate standard errors of 0.225 (skewness) and 0.449 (kurtosis)

In addition, this study also uses graphical methods for normality test. There are several ways to show graphically such as normal probability plot (p-p plot). Figure 4.11 shows an example of normal probability plot of core manufacturing capabilities. The normal plot of regression standardized residuals for the dependent variables also indicate a relatively normal distribution. The dotted and straight line is the normal line while the other is standardized residual. It is seen that the observed residual is not far above of far below the normal line. It is found to indicate support for the normality assumption for all the variables. Therefore, normal probability plots; skewness and kurtosis value provide sufficient evidence that the data of the present study are approximately normally distributed.

**Figure 4.11: Normal P-P Plot of Regression Standardized Residual**

### 4.3.4 Tests for Linearity and Homoscedasticity

The second assumption is linearity and homoscedasticity. The linearity of the relationship between dependent and independent variables represent the degree to which the change in the dependent variables is associated with the independent variable. A scatterplot is a good means for judging how well a straight line fits the data, while homoscedasticity refers to the assumption that the dependent variable being explained in the dependence relationship should not be concentrated in only a limited range of the independent values. Homoscedasticity is verified through the scatter plots of the regression standardized residual versus regression standardized predicted values.

The scatterplot given in the figure 4.12 displays visible relationships between manufacturing practices and the seventh core manufacturing capabilities namely responsive. It is seen that the points are randomly scattered. A pattern seems to be in graph. The points are concentrated in a band from the bottom left of the plot to the top right of the plot displaying a relationship between manufacturing practices and the seventh core manufacturing capabilities. An examination of scatterplot relating to all other variables have a pattern similar to the one observed in the scatterplot for manufacturing practices and responsive . There are no any cases, which are really very far removed from the overall pattern in this plot.

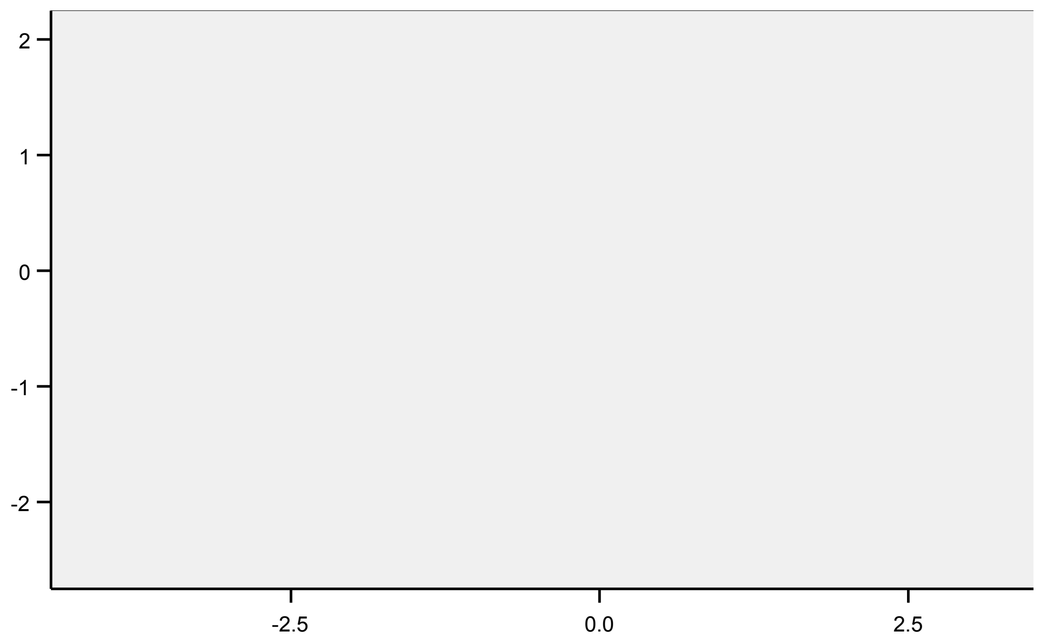



**Figure 4.12 : Scatterplot between Organizational Capabilities (Managerial Commitment) and Manufacturing Capabilities (Acuity)**

Another method is an examination of residuals scatterplots that allows researcher to test the assumption of linearity and homoscedasticity. Figure 4.13 shows the plotting of the residuals against the predicted values for variables and core manufacturing capabilities. The figure shows that the residuals are randomly distributed in a band clustered around the horizontal line through zero (0). This suggests that the linearity assumption between variables is satisfied. Examination of the residual scatterplots relating to other variable show that the relevant residuals are randomly distributed in a band clustered around the horizontal line through zero (0). In addition, the analysis of the residuals in the figure below show no pattern of increasing or decreasing residuals, meeting the assumption of homoscedasticity test. The randomized patterns of the scatter plot indicate that this assumption is fulfilled. Therefore, the assumption of linearity and homoscedasticity relating to the data of all variables and manufacturing capabilities are supported.

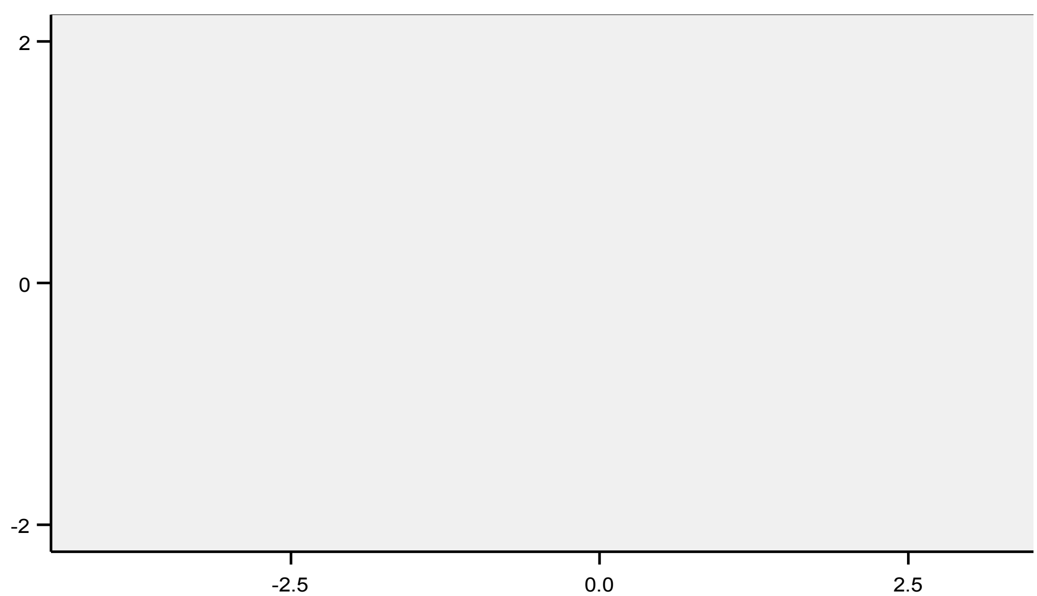



Figure 4.13: Scatterplot between Standardized Residual of Responsive and Standardized Predicted Values of Manufacturing Capabilities(Integration)]\\"

### 4.3.5 Tests for Collinearity

The next assumption is the non-existence of multicollineairty problem. According to Coakes (2005), multicollineairty refers to high correlation among independent variables, whereas singularity occurs when perfect correlation among independent variables exist. The simplest technique of identifying collinearity is an examination of the correlation matrix for the independent variables. As can be seen, the correlation coefficient for Time-Based Management, Management Practices, Team Work, and Manufacturing Technology are not greater than 0.860. The high correlation generally of 0.90 and above is the first indication of substantial collinerity (Hair, 2006). Table 4.11 reveals that the four variables are correlated with each other showing that no collinearity problem seen to exist.

**Table 4.11 : Intercorrelation Matrix for Success Factor Variables**

| | | | Correlations | |
|---|---|---|---|---|
| Variable | A1 | A2 | A3 | A4 |
| A1 Time-Based Management | 1.00 | | | |
| A2 Management Practices | 0.860** | 1.00 | | |
| A3 Team Work | 0.762 ** | 0.831** | 1.00 | |
| A4 Manufacturing Technology | 0.691 ** | 0.720** | 0.706** | 1.00 |

** Correlation is significant at the 0.01 level (1-Tailed)
* Correlation is significant at the 0.05 level (1-Tailed)

In addition, this study also calculates the tolerance and variance inflation factor (VIF) values for each independent variables by selecting collinearity diagnostics. Tolerance test was carried out for each independent variable by selecting collinearity diagnostics in SPSS as recommended by Coakes (2005). According to Hair (2006), a common cutoff threshold is a tolerance value of .10, which corresponds to a VIF value above 10. None of the tolerance for each independent variable is less than 0.10. While no VIF value exceeds 10 and the tolerance values show that collinearity does not explain more than 10% of any independent variable's variance. The result of collinearity test in Table 4.12 shows that data for success variables are not existence of multicollinearity in this study.

**Table 4.12 Testing Multicollinearity ( Tolerance and VIF Values)**

| Independent variables | Tolerance | Variance Inflation Factor(VIF) |
|---|---|---|
| Manufacturing Practices | 0.702 | 1.425 |
| Knowledge Transfer | 0.702 | 1.425 |
| Organizational Capabilities | 1.000 | 1.000 |

### 4.4 Descriptive Analysis

Descriptive analysis examines statistical description of variables in the study. Statistics such as mean and standard deviations are used as descriptive statistics in this study by calculating for independent variables, moderating variable and dependent variables. These scores highlight the respondents' feedback obtained from the data collected through the questionnaires. These scores are presented in Table 4.13. All variables have been tapped on a five point scale. As can be seen, the value of Manufacturing Practices mean score ranges from 4.0087 to 4.1498. The standard deviation for Manufacturing Practices ranges are from 0.5091 to 0.6849. Knowledge Transfer mean score ranges from 3.8739 to 4.3011. The standard deviation for Knowledge Transfer are from 0.2810 to 0.4158. In addition, the mean for moderating variable is from 4.1669 to 4.3352 with standard deviation from 0.3412 to 0.4007. Organizational Capabilities consists of Perceived compatibility, Systems Perspectives, Openness and Experimentation, Perceived relative advantage and Managerial commitment. The mean values for Organizational Capabilities range from 3.6000 to 3.7227 and the standard deviation ranging from 0.5347 to 0.9162. The core manufacturing capabilities consist of Integration, Acuity, Control, and Agility. The mean values for Manufacturing Capabilities range from 3.6667 to 3.7506 with standard deviation ranging from 0.4869 to 0.6494. The result obtained show that some effort need to be focused on developing the companies' ability to incorporate the important factors in their practice to ensure the success of practicing the core manufacturing capabilities. Therefore, correlation analysis and regression analysis were carried out to emphasize this success factors.

**Table 4.13 : Descriptive Statistics of Variables**

| Variables | Mean | Standard Deviation |
|---|---|---|
| Time Based Management | 4.1498 | 0.5499 |
| Management Practices | 4.1303 | 0.5091 |
| Team Work | 4.0899 | 0.5539 |
| Manufacturing Technology | 4.0087 | 0.6849 |
| Knowledge Sharing | 3.8739 | 0.4158 |
| Learning ability | 4.3011 | 0.3491 |
| Knowledge Transfer | 4.0434 | 0.2810 |
| Training for New Work Structure | 4.3352 | 0.3412 |
| Training for Co-Makership | 4.3050 | 0.4007 |
| New Method and Approaches for Learning while Working | 4.1669 | 0.3494 |
| Managerial commitment | 3.6000 | 0.6288 |
| Systems Perspectives | 3.7227 | 0.6199 |
| Openness and Experimentation | 3.7164 | 0.5347 |
| Perceived relative advantage | 3.6324 | 0.8044 |
| Perceived compatibility | 3.6639 | 0.9162 |
| Integration | 3.7051 | 0.5990 |
| Acuity | 3.6902 | 0.4869 |
| Control | 3.7506 | 0.6055 |
| Agility | 3.6667 | 0.6494 |

### 4.5 Hypothesis Testing

Fourty eight hypotheses were formulated and tested in this study. There are three variables considered for these study, hypotheses ( H1 to H48) were formulated to test the relationship between each of the variables and manufacturing capabilities. Hypotheses H49 to H52 was tested using multiple regression analysis. Hierarchical multiple regression analysis were used to test hypotheses H53 .

#### 4.5.1 Correlation Analysis

As the levels of measurement of the variables concerned are interval and the normality assumption has been met reasonably, the parametric correlation technique was used to test the alternative hypotheses for the first of fourteenth hypotheses. Therefore, to answer the first research objective, the Pearson product-moment correlation method must be used to measure the relationship of a set of independent variable that is success factor variables and the dependent variables. The significant level is 0.01, as a 99 percent confidence level is desired. The hypotheses are concerned with directional relationship that is positive, one tailed test was used.

A Pearson correlation analysis was performed between the core manufacturing capabilities and the other two independent variables, namely manufacturing practices and knowledge transfer.

#### 4.5.1.1 Testing of Hypotheses

#### 4.5.1.2 Testing of Hypotheses 1.

The following hypotheses was concerned with the relationship between manufacturing practices and core manufacturing capabilities.

Hypothesis 1 (H1) tested extend to which manufacturing practices was positively related to the core manufacturing capabilities. The manufacturing practices combined four items which were integration, acuity, control and agility. As can be seen from Table 4.14, manufacturing capabilities are significantly related with manufacturing practices.

Table 4.14 shows there is significant correlation between manufacturing practices and core manufacturing capabilities. It shows that manufacturing practices had a positive correlation on core manufacturing capabilities items. The pattern of correlation is as expected as stated in literature. The strength of the relationship between manufacturing practices and core manufacturing capabilities was 0.874. The correlation coefficient are significant at the 0.01 levels and 0.05 levels with all success criteria. Therefore, the alternative hypotheses proposed for the variables are supported. The full result is given in the following table.

**Table 4.14 : Correlation Coefficients between Manufacturing Practices and Manufacturing Capabilities**

| | | Correlations |
|---|---|---|
| Variable | F1 | Manufacturing Capabilities |
| F1 | 1.00 | |
| Manufacturing Capabilities | 0.874** | 1.00 |

** Correlation is significant at the 0.01 level (1-Tailed)
* Correlation is significant at the 0.05 level (1-Tailed)

### 4.5.1.3 Testing of Hypotheses 2.

This group of hypotheses seeks to explore the relationships between knowledge transfer dimension and manufacturing capabilities.

Hypothesis 2 (H 2) was tested to examine whether knowledge transfer was positively related to the core manufacturing capabilities. The four items of core manufacturing capabilities were integration, acuity, control and agility. As can be seen from Table 4.15, knowledge transfer was significantly related to the core manufacturing capabilities.

**Table 4.15 : Correlation Coefficients between Knowledge Transfer and Manufacturing Capabilities**

| | | Correlations |
|---|---|---|
| Variable | F1 | Manufacturing Capabilities |
| F1 | 1.00 | |
| Manufacturing Capabilities | 0.837** | 1.00 |

** Correlation is significant at the 0.01 level (1-Tailed)
* Correlation is significant at the 0.05 level (1-Tailed)

Table 4.15 shows there is significant correlation between knowledge transfer and core manufacturing capabilities. It shows that knowledge transfer had a positive correlation on core manufacturing capabilities items. The pattern of correlation is as expected as stated in literature. The strength of the relationship between knowledge transfer and core manufacturing capabilities was 0.837. The correlation coefficient are significant at the 0.01 levels and 0.05 levels with all success criteria. Therefore, the alternative hypotheses proposed for the variables are supported.

#### 4.5.1.4 Testing of Hypotheses 3.

This group of hypotheses seeks to explore the relationships between Organizational Capabilities dimension and Manufacturing Capabilities.

Hypothesis 3 (H 3) was tested to examine whether Organizational Capabilities was positively related to the core manufacturing capabilities. The four items of core manufacturing capabilities were integration, acuity, control and agility. As can be seen from Table 4.16, Organizational Capabilities was significantly related to the core manufacturing capabilities.

**Table 4.16 : Correlation Coefficients between Organizational Capabilities and Manufacturing Capabilities**

| | | | Correlations |
|---|---|---|---|
| Variable | F1 | Manufacturing Capabilities | |
| F1 | 1.00 | | |
| Manufacturing Capabilities | 0.767** | 1.00 | |

** Correlation is significant at the 0.01 level (1-Tailed)
* Correlation is significant at the 0.05 level (1-Tailed)

Table 4.16 shows there is significant correlation between Organizational Capabilities and core manufacturing capabilities. It shows that Organizational Capabilities had a positive correlation on core manufacturing capabilities items. The pattern of correlation is as expected as stated in literature. The strength of the relationship between Organizational Capabilities and core manufacturing capabilities was 0.767. The correlation coefficient are significant at the 0.01 levels and 0.05 levels with all success criteria. Therefore, the alternative hypotheses proposed for the variables are supported.

**4.5.1.5 Testing of Hypotheses 4.**

The following hypotheses was concerned with the relationship between training and manufacturing practices.

Hypothesis 4 (H4) tested extend to which training was positively related to manufacturing practices. Training combined four items which were training for new work structure, training for co-makership, and new method and approaches for learning while working. As can be seen from Table 4.17, training were significantly related with manufacturing practices.

Table 4.17 shows there is significant correlation between training and manufacturing practices. It shows that training had a positive correlation on manufacturing practices items. The pattern of correlation is as expected as stated in literature. The strength of the relationship between training and manufacturing practices was 0.242. The correlation coefficient are significant at the 0.01 levels with all success criteria. Therefore, the alternative hypotheses proposed for the variables are supported. The full result is given in the following table.

**Table 4.17 : Correlation Coefficients between Training and Manufacturing Practices**

| | | Correlations |
|---|---|---|
| Variable | F1 | Manufacturing Capabilities |
| F1 | 1.00 | |
| Manufacturing Capabilities | 0.242* | 1.00 |

** Correlation is significant at the 0.01 level (1-Tailed)
* Correlation is significant at the 0.05 level (1-Tailed)

#### 4.5.1.6 Testing of Hypotheses 5.

The following hypotheses was concerned with the relationship between training and knowledge transfer.

Hypothesis 5 (H5) tested extend to which training was positively related to the knowledge transfer. As can be seen from Table 4.17, training was significantly related with knowledge transfer.

Table 4.18 shows there is significant correlation between training and knowledge transfer. It shows that training had a positive correlation on knowledge transfer items. The pattern of correlation is as expected as stated in literature. The strength of the relationship between training and knowledge transfer was 0.313. The correlation coefficient are significant at the 0.05 levels with all success criteria. Therefore, the alternative hypotheses proposed for the variables are supported. The full result is given in the following table.

**Table 4.18 : Correlation Coefficients between Training and knowledge transfer**

| | | Correlations |
|---|---|---|
| Variable | F1 | Manufacturing Capabilities |
| F1 | 1.00 | |
| Manufacturing Capabilities | 0.313** | 1.00 |

** Correlation is significant at the 0.01 level (1-Tailed)
* Correlation is significant at the 0.05 level (1-Tailed)

#### 4.5.1.7 Testing of Hypotheses 6.

The following hypotheses was concerned with the relationship between training and Organizational Capabilities.

Hypothesis 6 (H6) tested extend to which training was positively related to the Organizational Capabilities. As can be seen from Table 4.19, training was significantly related with Organizational Capabilities.

Table 4.19 shows there is significant correlation between training and knowledge transfer. It shows that training had a positive correlation on knowledge transfer items. The pattern of correlation is as expected as stated in literature. The strength of the relationship between training and Organizational Capabilities was 0.538. The correlation coefficient are significant at the 0.05 levels with all success criteria. Therefore, the alternative hypotheses proposed for the variables are supported. The full result is given in the following table.

**Table 4.19 : Correlation Coefficients between Training and Organizational Capabilities**

| | | Correlations |
|---|---|---|
| Variable | F1 | Manufacturing Capabilities |
| F1 | 1.00 | |
| Manufacturing Capabilities | 0.538** | 1.00 |

** Correlation is significant at the 0.01 level (1-Tailed)
* Correlation is significant at the 0.05 level (1-Tailed)

**4.5.1.8 Testing of Hypotheses 7.**

The following hypotheses was concerned with the relationship between training and core manufacturing capabilities.

Hypothesis 7 (H7) tested extend to which training was positively related to the core manufacturing capabilities. Training combined three items which were training for new work structure, training for co-makership, and new method and approaches for learning while working. As can be seen from Table 4.20, training was significantly related with manufacturing capabilities.

Table 4.20 shows there is significant correlation between training and core manufacturing capabilities. It shows that training had a positive correlation on core manufacturing capabilities items. The pattern of correlation is as expected as stated in literature. The strength of the relationship between training and core manufacturing capabilities was 0.447. The correlation coefficient are significant at the 0.05 levels with all success criteria. Therefore, the alternative hypotheses proposed for the variables are supported. The full result is given in the following table.

**Table 4.20 : Correlation Coefficients between Training and Manufacturing Capabilities**

| | Correlations | |
|---|---|---|
| Variable | F1 | Manufacturing Capabilities |
| F1 | 1.00 | |
| Manufacturing Capabilities | 0.447** | 1.00 |

** Correlation is significant at the 0.01 level (1-Tailed)
* Correlation is significant at the 0.05 level (1-Tailed)

### 4.5.2 Multiple Regression Analysis

Multiple regression are used to evaluate the effects of all variables for core manufacturing capabilities. The test of these hypotheses leads to accomplish the second objective in this study; that is to determine the effects of core manufacturing capabilities as perceived by respondents. Before proceeding to multiple regression analysis, it is necessary to fulfill the seventh assumptions that are normality, linearity, homoscedasticity and multicollinearity (Hair, 2006). All the assumptions have been fulfilled in the previous section. No assumption have been violated. Therefore, the regression analysis can be carried out.

Multiple regression analysis evaluates the simultaneous effect of all the variables for the core manufacturing capabilities. Hypothesis 8 (H8) of this study significantly explain the variances in the core manufacturing capabilities. Table 4.21 shows the model of regression equation.

**Table 4.21 : Multiple Regression Equation**

$$Y_{INTEGRATION} = b_0+b_1V_1+ b_2V_2+ b_3V_3+ b_4V_4+ e$$

$$Y_{ACUITY} = b_0+b_1V_1+ b_2V_2+ b_3V_3+ b_4V_4+ e$$

$$Y_{CONTROL} = b_0+b_1V_1+ b_2V_2+ b_3V_3+ b_4V_4+ e$$

$$Y_{AGILITY} = b_0+b_1V_1+ b_2V_2+ b_3V_3+ b_4V_4+ e$$

Where,

$b_0$ Constant level of Core manufacturing Capabilities independent of Integration, Acuity, Control, and Agility

$b_1$ Change in core manufacturing capabilities achieved associated with unit change in Integration

$b_2$ Change in core manufacturing capabilities achieved associated with unit change in Acuity

$b_3$ Change in core manufacturing capabilities achieved associated with unit change in Control

$b_4$ Change in core manufacturing capabilities achieved associated with unit change in Agility

$V_1$ Integration

$V_2$ Acuity

$V_3$ Control

$V_4$ Agility

#### 4.5.2.1 Testing of Hypothesis 8.

Hypothesis 8 (H8) seeks to determine whether the three independent variables will significantly explain the variance of core manufacturing capabilities.

Hypothesis 8 (H8) : The three independent variables will significantly explain the
Variance of Integration

The testing procedure utilized is the multiple regression analysis and the results are shown in Table 4.22. The result shows that the multiple regression analysis coefficients (R) of the three independent variables in core manufacturing capabilities were 0.915 and the R Square ($R^2$) 0.838. The result suggest that 83.8% of the variance ($R^2$) has been significantly explained by the group of three independent variables, as shown by the F value of 197.697 $p<0.01$ and its sustaining alternative hypotheses 8 (H8). This result means the three independent variables contribute 83.8% to the core manufacturing capabilities. However, the rest percentage is cover by another independent variables which have not been discussed in this study.

**Table 4.22 : Aggregate Effect of the Independent Variables on Integration**

| R | R Square | Adjusted R Square | Std. Error of The Estimate | F Value | Sig. F |
|---|---|---|---|---|---|
| 0.915 | 0.838 | 0.833 | 0.244 | 197.697 | 0.000 |

The greatest independent variables that significantly had influences on Integration are manufacturing practices ($\beta$ = 0.532, p = 0.000), knowledge transfer with standardized beta values of 0.444 (p=0.000) and Organizational Capabilities ($\beta$ = 0.070, p = 0.079), . The result of each independent variables relating Integration is shown in Table 4.23.

**Table 4.23: Influence of Independent Variables on Integration**

| Dependent Variables | Independent Variable | Beta | P |
|---|---|---|---|
| Integration | Manufacturing Practices | 0.532 | 0.000 |
| | Knowledge Transfer | 0.444 | 0.000 |
| | Organizational Capabilities | 0.070 | 0.079 |

From the results obtained it shows manufacturing practices, knowledge transfer and organizational capabilities significantly contribute to Integration. It may be due to manufacturers and firms addressed some important elements of manufacturing practices, knowledge transfer and organizational capabilities on order to lead and drive for core manufacturing capabilities in term of Integration.

#### 4.5.2.2 Testing of Hypothesis 9.

Hypothesis 9 (H9) seeks to determine whether the three independent variables will significantly explain the variance of core manufacturing capabilities.

Hypothesis 9 (H9) : The three independent variables will significantly explain the Variance of Acuity.

The testing procedure utilized is the multiple regression analysis and the results are shown in Table 4.24. The result shows that the multiple regression analysis coefficients (R) of the three independent variables in core manufacturing capabilities were 0.886 and the R Square ($R^2$) 0.785. The result suggest that 78.5% of the variance ($R^2$) has been significantly explained by the group of three independent variables, as shown by the F value of 139.577 $p<0.01$ and its sustaining alternative hypotheses 9 (H9). This result means the three independent variables contribute 78.5% to the core manufacturing capabilities. However, the rest percentage is cover by another independent variables which have not been discussed in this study.

**Table 4.24 : Aggregate Effect of the Independent Variables on Acuity**

| R | R Square | Adjusted R Square | Std. Error of The Estimate | F Value | Sig. F |
|---|---|---|---|---|---|
| 0.886 | 0.785 | 0.779 | 0.262 | 139.577 | 0.000 |

The greatest independent variables that significantly had influences on Acuity are manufacturing practices ($\beta = 0.381$, $p = 0.000$), knowledge transfer with standardized

beta values of 0.553 (p=0.000) and Organizational Capabilities (β = 0.029, p = 0.521), .
The result of each independent variables relating Acuity is shown in Table 4.25.

**Table 4.25: Influence of Independent Variables on Acuity**

| Dependent Variables | Independent Variable | Beta | P |
|---|---|---|---|
| Acuity | Manufacturing Practices | 0.381 | 0.000 |
| | Knowledge Transfer | 0.553 | 0.000 |
| | Organizational Capabilities | 0.029 | 0.521 |

From the results obtained it shows manufacturing practices, knowledge transfer and organizational capabilities significantly contribute to Acuity. It may be due to manufacturers and firms addressed some important elements of manufacturing practices, knowledge transfer and organizational capabilities on order to lead and drive for core manufacturing capabilities in term of Acuity.

**4.5.2.3 Testing of Hypothesis 10.**

Hypothesis 10 (H10) seeks to determine whether the three independent variables will significantly explain the variance of core manufacturing capabilities.

Hypothesis 10 (H10) : The three independent variables will significantly explain the
Variance of Control.

The testing procedure utilized is the multiple regression analysis and the results are shown in Table 4.26. The result shows that the multiple regression analysis coefficients (R) of the three independent variables in core manufacturing capabilities were 0.893 and the R Square ($R^2$) 0.798. The result suggest that 79.8% of the variance ($R^2$) has been significantly explained by the group of three independent variables, as shown by the F value of 151.131 $p<0.01$ and its sustaining alternative hypotheses 10 (H10). This result means the three independent variables contribute 79.8% to the core manufacturing capabilities. However, the rest percentage is cover by another independent variables which have not been discussed in this study.

**Table 4.26 : Aggregate Effect of the Independent Variables on Control**

| R | R Square | Adjusted R Square | Std. Error of The Estimate | F Value | Sig. F |
|---|---|---|---|---|---|
| 0.893 | 0.798 | 0.792 | 0.275 | 151.131 | 0.000 |

The greatest independent variables that significantly had influences on Control are manufacturing practices ($\beta = 0.430$, $p = 0.000$), knowledge transfer with standardized beta values of 0.524 ($p=0.000$) and Organizational Capabilities ($\beta = 0.073$, $p = 0.100$), . The result of each independent variables relating Control is shown in Table 4.27.

**Table 4.27: Influence of Independent Variables on Control**

Dependent

| Variables | Independent Variable | Beta | P |
|---|---|---|---|
| Control | Manufacturing Practices | 0.430 | 0.000 |
| | Knowledge Transfer | 0.524 | 0.000 |
| | Organizational Capabilities | 0.073 | 0.100 |

From the results obtained it shows manufacturing practices, knowledge transfer and organizational capabilities significantly contribute to Control. It may be due to manufacturers and firms addressed some important elements of manufacturing practices, knowledge transfer and organizational capabilities on order to lead and drive for core manufacturing capabilities in term of Control.

**4.5.2.4 Testing of Hypothesis 11.**

Hypothesis 11 (H11) seeks to determine whether the three independent variables will significantly explain the variance of core manufacturing capabilities.

Hypothesis 11 (H11) : The three independent variables will significantly explain the
Variance of Agility.

The testing procedure utilized is the multiple regression analysis and the results are shown in Table 4.28. The result shows that the multiple regression analysis coefficients (R) of the three independent variables in core manufacturing capabilities were 0.893 and the R Square ($R^2$) 0.798. The result suggest that 79.8% of the variance ($R^2$) has been significantly explained by the group of three independent variables, as shown by the F value of 151.131 $p<0.01$ and its sustaining alternative hypotheses 11 (H11). This result means the three independent variables contribute 79.8% to the core manufacturing capabilities. However, the rest percentage is cover by another independent variables which have not been discussed in this study.

**Table 4.28 : Aggregate Effect of the Independent Variables on Agility**

| R | R Square | Adjusted R Square | Std. Error of The Estimate | F Value | Sig. F |
|---|---|---|---|---|---|
| 0.908 | 0.824 | 0.820 | 0.270 | 179.584 | 0.000 |

The greatest independent variables that significantly had influences on Agility are manufacturing practices ($\beta = 0.430$, $p = 0.000$), knowledge transfer with standardized beta values of 0.524 ($p=0.000$) and Organizational Capabilities ($\beta = 0.073$, $p = 0.100$), . The result of each independent variables relating Agility is shown in Table 4.29.

**Table 4.29: Influence of Independent Variables on Agility**

| Dependent Variables | Independent Variable | Beta | P |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Agility | Manufacturing Practices | 0.329 | 0.000 |
| | Knowledge Transfer | 0.628 | 0.000 |
| | Organizational Capabilities | 0.042 | 0.312 |

From the results obtained it shows manufacturing practices, knowledge transfer and organizational capabilities significantly contribute to Agility. It may be due to manufacturers and firms addressed some important elements of manufacturing practices, knowledge transfer and organizational capabilities on order to lead and drive for core manufacturing capabilities in term of Agility.

### 4.5.3 Hierarchical Multiple Regression Analysis

This section presents hypothesis testing concerning the interaction between training and manufacturing practices, knowledge transfers and organizational capabilities dimension in predicting the relationship of core manufacturing capabilities. To test the extent of much training moderate the relationship between independent variables and core manufacturing capabilities, Hierarchical Multiple Regression were carried out using independent variables. To test hypotheses 12 (H12), the independent variables were entered first into the regression, followed by moderator variables and the interaction terms. The method used to detect interaction term is discussed in detail in chapter 3. Table 4.30 shows the hierarchical regression equation on the study variables, while appendix L shows the complete results of hierarchical multiple regression analysis.

**Table 4.30 : Hierarchical Multiple Regression Equation**

$$Y_{INTEGRATION} = b_0+b_1X_1+ b_2X_2+ b_3 X_3+ b_4 X_4 +b_5 X_5+ b_6X_1 X_5+ b_7X_2 X_5+ b_8X_3 X_5+ b_9X_4 X_5+ e$$

$$Y_{ACUITY} = b_0+b_1X_1+ b_2X_2+ b_3 X_3+ b_4 X_4 +b_5 X_5+ b_6X_1 X_5+ b_7X_2 X_5+ b_8X_3 X_5+ b_9X_4 X_5+ e$$

$$Y_{CONTROL} = b_0+b_1X_1+ b_2X_2+ b_3 X_3+ b_4 X_4 +b_5 X_5+ b_6X_1 X_5+ b_7X_2 X_5+ b_8X_3 X_5+ b_9X_4 X_5+ e$$

$$Y_{AGILITY} = b_0+b_1X_1+ b_2X_2+ b_3 X_3+ b_4 X_4 +b_5 X_5+ b_6X_1 X_5+ b_7X_2 X_5+ b_8X_3 X_5+ b_9X_4 X_5+ e$$

| | |
|---|---|
| $b_0$ | = intercept |
| $b_1X_1$ | = linear effect of $X_1$ |
| $b_2X_2$ | = linear effect of $X_2$ |
| $b_3 X_3$ | = linear effect of $X_3$ |
| $b_4 X_4$ | = linear effect of $X_4$ |
| $b_5 X_5$ | = linear effect of $X_5$ |
| $b_6X_1 X_5$ | = moderator effect of $X_5$ on $X_1$ |
| $b_7X_2 X_5$ | = moderator effect of $X_5$ on $X_2$ |
| $b_8X_3 X_5$ | = moderator effect of $X_5$ on $X_3$ |
| $b_9X_4 X_5$ | = moderator effect of $X_5$ on $X_4$ |
| $b_{10}X_5 X_5$ | = moderator effect of $X_5$ on $X_5$ |

#### 4.5.3.1 Testing of Hypothesis 12 (H12)

The hypothesis testing concerns with the interaction between training and independent variables. To test the extend to which the training moderate the relationship between independent variables and the core manufacturing capabilities, hierarchical multiple regressions were carried out using independent variables. The independent variables were entered first into regression, followed by moderator variable and the interaction terms.

Hypothesis 12 (H12) : Training moderates the relationship between the three independent variables and core manufacturing capabilities.

Hypothesis 12 (H12) predicts the training moderate of the relationship between manufacturing practices, knowledge transfers and organizational capabilities to core manufacturing capabilities. The independent variables entered in the first step explained 83% of the variance of core manufacturing capabilities. There was no indication that training had any appreciable connection with manufacturing capabilities. The entry of the two- way interaction terms at step 3 increased $R^2$ by about 0.1% and the F value change 0.298 and $p<0.01$ and it is a possible moderating effect. Based on the following table, only one interaction was significant. The knowledge transfer x training ($\beta = 0.548$, $p= 0.668$). Therefore, H53 received weak support since only one-interaction term was significant.

As indicated by Hair (2006), to determine whether the moderator effect is significant, the researcher followed a three- step process, estimate the original (unmoderated) equation, estimate the moderated relationship (original equation plus moderator variables) and assess the change in $R^2$, if it statistically significant, then a significant moderator effect is present.

**Table 4.31: Results of Hierarchical Multiple Regression Evaluating the Core Manufacturing Capabilities**

| Step | Beta | P | $R^2$ | $R^2\Delta$ | F Δ | Sig. F Δ |
|---|---|---|---|---|---|---|
| **Step 1- Main effect** | | | | | | |
| Manufacturing Practices | 0.430 | 0.000 | 0.830 | 0.830 | 187.628 | 0.000 |
| Knowledge Transfer | 0.537 | 0.000 | | | | |
| Organizational Capabilities | 0.053 | 0.186 | | | | |
| **Step 2- Moderating effect** | | | | | | |
| Training | 0.156 | 0.001 | 0.846 | 0.015 | 11.448 | 0.001 |
| **Step 3- Two – way interactions** | | | | | | |
| MP x Training | -0.257 | 0.801 | 0.847 | 0.001 | 0.298 | 0.827 |
| KT x Training | 0.548 | 0.668 | | | | |
| OC x Training | -0.146 | 0.391 | | | | |

## 4.6 Summary of Findings

Table 4.32 summaries the results of hypotheses testing as discussed in the previous sections.

**Table 4.32: Summary of Hypotheses Testing**

| Hypotheses | Statements | Finding |
|---|---|---|
| (H1) | There is positive relationship between manufacturing Practices and core manufacturing capabilities. | Supported |
| (H2) | There is positive relationship between knowledge transfer and core manufacturing capabilities. | Supported |
| (H3) | There is positive relationship between Organizational Capabilities and core manufacturing capabilities. | Supported |
| (H4) | There is positive relationship between training and Manufacturing practices. | Supported |
| (H5) | There is positive relationship between training and knowledge transfer. | Supported |
| (H6) | There is positive relationship between training and Organizational Capabilities | Supported |
| (H7) | There is positive relationship between training and Manufacturing capabilities. | Supported |
| (H8) | There is positive relationship between manufacturing practices, knowledge transfer, organizational capabilities on Integration | Supported |
| (H9) | There is positive relationship between manufacturing practices, knowledge transfer, organizational capabilities on Acuity | Supported |
| (H10) | There is positive relationship between manufacturing practices, knowledge transfer, organizational capabilities on Control | Supported |
| (H11) | There is positive relationship between manufacturing practices, knowledge transfer, organizational capabilities on Agility | Supported |
| (H12) | Training moderates the relationship between the three Independent variables and core manufacturing capabilities | Partially Supported |

**4. 7 Summary Of Chapter**

This chapter presents the basic profile of the survey respondents such as the role of respondents, year of designation, type of industry. Several assumptions were examined such as normality, linearity, homoscedasticity and multicollinearity as applied in this study. The results of the main effects provide support for the hypothesis that manufacturing practices, knowledge transfer and organizational capabilities are positively associated with core manufacturing capabilities. Specifically, the study found that independent variables had a significant positive impact on core manufacturing capabilities. For multiple regression analysis it is indicated that the three variables predictor in explaining every criterion of core manufacturing capabilities. Finally, this study found that training had an interaction effect with knowledge transfer in predicting the core manufacturing capabilities.

# CHAPTER 5

# DISCUSSION

The chapter will discusses the discussion of the findings in term of correlation analysis, multiple regression analysis, and hierarchical multiple regression analysis.

## 5.1 Discussion of the Findings

This study is to identify empirically the core manufacturing capabilities in manufacturing companies, across industry in the northern region of Malaysia. The rationale of the study stems from the major consideration, that is, the emerging concern of share holders of the manufacturing companies and the directors of the companies in this industry in particular to develop core manufacturing capabilities. Having this in mind, one hundred and eight item questionnaire was developed to measure the core manufacturing capabilities (Swink & Hegarty, 1998; Haifeng, 2006; Li (2000).

The data was collected using postal summary method from random samples discussed in Chapter 3. One hundred and nine respondents participated in the study, and this accounted for 68% response rate.

Manufacturing Practices , Knowledge Transfer and Organization capabilities were the independent variables. The descriptive analysis based on the respondents' perception of core manufacturing capabilities in manufacturing companies showed that manufacturers took a lot of effort in manufacturing practices in achieved high degree of core manufacturing capabilities. However, knowledge transfer and organization capabilities also played important roles in contributing high degree of core manufacturing capabilities.

The findings of the study are presented to answer research questions and research objectives. The study examines the direct relationship between independent variables and the core manufacturing capabilities that are integration, acuity, control, and interaction effects of training on the relationship of independent variables and the core manufacturing capabilities. The research also discusses the role of moderating effect on the relationship between independent variables and core manufacturing capabilities. The following sections discuss the findings of each research objective.

### 5.1.1 Correlation Analysis

The first research objective is to determine the relationship of manufacturing practices, knowledge transfer and organization capabilities on manufacturing capabilities. The findings in this study show that, all the independent variables could bring significant positive relationship on core manufacturing capabilities. The correlation tables in the previous chapter indicate that all the three independent variables, knowingly as manufacturing practices included time-based management, management practices, team work, and manufacturing technology and knowledge transfer which included knowledge sharing, learning ability, and learning ability, and organization capabilities which included managerial commitment, systems perspectives, openness and experimentation, perceived relative advantage and perceived compatibility were significantly positively related to the core manufacturing capabilities in term of time based management, management pracrices, team work and manufacturing technology. These findings are supported by previous researchers who have studied in developing manufacturing capabilities (Swink & Hegarty, 1998; Haifeng, 2006; Li, 2000; Sohal, 1999; Bolden, 1997; Mullarkey, 2006). Besides that Systems perspectives, Openness and Experimentation and Perceived compatibility are insufficient in developing Integration, Control and Agility. Other than that, Systems perspectives and Openness and Experimentation are inappropriate for developing Acuity. This is not consistent with the predictions that Systems perspectives, Openness and Experimentation and Perceived compatibility will enhance time-based management, management practices, team work, and manufacturing technology. This outcome because the research are conducted in unstable economy situation and manufacturers and firm do not focused for these items in running their business.

The correlation coefficients between independent variables and the core manufacturing capabilities indicate the strength of the bivariate relationships among them. The correlation tables show that independent variables, manufacturing practices , knowledge transfer and organization capabilities most related integration, control, responsive, and agility. The correlation tables show that integration was the priority to choose by practitioners, following by acuity, control, agility. From the above discussion, we can recapitulate that in unstable economy the shareholder, managers and engineers more focus and develop a core manufacturing capabilities in term of integration, acuity, control, agility, to make sure their firm and company still in the right track.

### 5.1.2 Multiple Regression Analysis

The multiple regression analysis supports hypothesis 8 (H8), hypothesis 9 (H9), hypothesis 10 (10), and hypothesis 11 (H11). The hypotheses are concerned with the investigation of the simultaneous effects of the three independent variables on the core manufacturing capabilities. The result of hypothesis reveal that all the three independent variables, manufacturing practices, knowledge transfer and organization capabilities significantly explain the variance in of core manufacturing capabilities. In this respect, the results have provided sufficient evidence to infer that the three independent variables are significant determinants of core manufacturing capabilities in manufacturing companies.

From the results of the multiple regression analysis, both three independent variables, manufacturing practices, knowledge transfer and organization capabilities had a significant effect on core manufacturing capabilities. These findings are consistent with previous studies in the area of manufacturing capabilities (e.g. Sohal, 1999; Bolden, 1997; Li, 2000; Mullarkey, 1995; Haifeng, 2006) that suggest manufacturing practices, knowledge transfer and organization capabilities was shown to be important factors in enhancing and developing the core manufacturing capabilities. Manufacturing practices is necessary on core manufacturing capabilities. Without this approach, companies cannot survive their business. To develop the core manufacturing capabilities, it depends on manufacturing practices, knowledge transfer and organization capabilities.

It is clear that companies should be ready in their manufacturing practices to achieve the manufacturing capabilities. These practices are important for companies to develop the core manufacturing capabilities, which require sufficient capabilities. This finding confirms that companies' practices like time-based management, management practices, team work, and manufacturing technology able to perform the core manufacturing capabilities. These elements are desired to ensure that the core manufacturing capabilities run well and achieve the desired levels. Thus, it is clear that the manufacturing practices is crucial in develop integration, acuity, control, and agility.

Besides, the significant relationship of manufacturing practices on overall manufacturing capabilities, the results of this study indicate that knowledge transfer is a significant contributor in achieving core manufacturing capabilities. Based on the results, it is confirmed that the knowledge transfer is essential integration, acuity, control, and agility in core manufacturing capabilities. This finding is consistent to the earlier findings by previous studies, which highlight the important role of knowledge transfer for core manufacturing capabilities (Narver & Slater, 1990; Ferrari & Toledo, 2004; Slater & Narver, 1994). There are several elements of knowledge transfer that should be considered. To achieve the high degree of core manufacturing capabilities and win the other competitors, companies and firms must ready to share understanding with other parties, to carry out some knowledge using knowledge sharing, learning ability and knowledge management. Thus, the finding that knowledge transfer need to develop the core manufacturing capabilities has face validity.

A study by Sohal (1999), Bolden (1997), and Li (2000) found that time-based management, team work, team work, manufacturing technology , knowledge sharing, learning ability and knowledge management are sufficient in develop core manufacturing capabilities. This indicates the positive relationship between all this manufacturing practices items and knowledge transfer items and the core manufacturing capabilities.

Organizational capabilities also one of the important factors for company strike for competitive advantage (Voola, Carlson & West, 2004). According to Bhatt and Grover (2005), they state that Organizational Capabilities are all tangible or intangible firm specific processes and assets representing the firms' ability of coordination and deployment of resources in developing essential integration, acuity, control, and agility in core manufacturing capabilities.Functional skills and cultural perceptions impacting management of change and innovation (Molla, Deng, & Corbit, 2010). Literature discuss the pertaining of firm performance related to organizational capabilities corresponding to various tool (Caloghirou *et al*., 2004; Raman *et al*., 2006). Lin and Ho (2008) described that technological, organizational and environment factors have positive impacts while some studies found organizational learning capacity to be an important factor to be considered (Hult, 1998: Zahay & Handfield, 2004).

### 5.1.3 Hierarchical Multiple Regression Analysis

The third research objective is to examine the moderating effects of training on the relationships between manufacturing practices, knowledge transfer, organizational capabilities and manufacturing capabilities. As discussed in chapter 2, there is evidence to suggest that the relationship between independent variables and core manufacturing capabilities was moderated by training. This implies that training would interfere with the relationship between manufacturing practices, knowledge transfer and organizational capabilities on manufacturing capabilities. Training emerges as moderator of the relationship between independent variables and manufacturing capabilities. In this study, several moderating effects are found.

According to Dankbaar (1999), training has become the key element in a far- reaching process of restructuring which is currently under way in industry. Training has been considered as part of the 'assistance' or 'general support', throughout the research on manufacturing industry, it is well recognized that the manufacturing capabilities requires significant to the training (Sohal, 1999; Bolden, 1997; Saunders, 2000; March, 1999; MacNeil, 2000).

Analysis of the interaction terms of independent variables found that training yields greater synergies with knowledge transfer. The companies' decision in training and knowledge transfer is shown to be an important factor in develops core manufacturing capabilities. Companies that increase knowledge transfer gain significantly in the core manufacturing capabilities. Based upon the research finding, the effect of knowledge transfer on core manufacturing capabilities is greater for companies that had most training included in manufacturing companies. The knowledge transfer is very important in develops manufacturing capabilities.

# CHAPTER 6

# CONCLUSION AND RECOMMENDATIONS

This chapter discusses the conclusion and the recommendations for this study. The first section contains the implications of the study. It is followed by limitations, direction for future research, conclusions and lastly recommendations for this study.

## 6.1 Implications of the Study

The results of our study offer several implications to the developing core manufacturing capabilities. A number of theoretical and practical implications have merged from this study.

The findings on the main and interacting effects from this study have extended beyond the results of other previous studies and thus have contributed new information to the body of knowledge in manufacturing capabilities area. First, this study demonstrates the relationship of manufacturing practices, knowledge transfer and organization capabilities on manufacturing capabilities.

This study focuses on manufacturing practices, knowledge transfer and organization capabilities to bridge the gap in predicting and developing the manufacturing capabilities in the Malaysia. Based on correlation analysis, the result suggests that manufacturers with higher efforts manufacturing practices, knowledge transfer and organization capabilities are more likely to report more success in developing the core manufacturing capabilities. The second contribution is to study the comparison of develop manufacturing capabilities on manufacturing practices, knowledge transfers and organization capabilities in the either in normal economy or in economy down turn. Hence, this study adds to the manufacturing capabilities on the manufacturing practices, knowledge transfer, and organization capabilities with moderator variable in economy down turn.

Next, the results also highlight the importance of having strong factors for manufacturing capabilities. From the managerial point of view, the findings from this research suggest that companies need to concern manufacturing capabilities in term of integration, acuity, control, and  agility. This requires the companies' efforts to adopt related manufacturing practices, knowledge transfer and organization capabilities into their organization to enhance the manufacturing capabilities. The companies must considered time-based management, management practices, team work, and manufacturing technology to develop the high degree of manufacturing capabilities in driving their companies to compete with other competitors.

In terms of knowledge transfer, this study found that the companies must considered knowledge sharing, learning ability and knowledge management to develop the high degree of core manufacturing capabilities. Besides, this study also points out that multiple relationships help to focus and assess the important factors that must be focused in developing manufacturing capabilities. For instance, the companies should focus on knowledge transfer in developing the core manufacturing capabilities. Knowledge transfer will assist manufacturers in utilizing at optimum level due to knowledge attained from transfer technology. Therefore, companies become more competent and sustainable in any economy recession. This study found evidence to support the hypothesis. This reveal that knowledge transfer measures is an important function of firm cooperative action. The findings confirmed the studies by Ferrari and Toledo (2004), which knowledge characteristic plays the intermediary role and firm should pay more attentions for this part.

Manufacturers need to develop manufacturing practices, knowledge transfer and organization capabilities to ensure the success in developing manufacturing capabilities. This study show strong association for manufacturing practices, knowledge transfer and organization capabilities to develop manufacturing capabilities. This finding suggests that manufacturing practices, knowledge transfer and organization capabilities should be encouraged in developing manufacturing capabilities and training areas include training for new work structure, training for co-makership and new method and approaches for learning while working will provide significant and sustainable benefits for the manufacturing companies.

**6.2 Limitations**

This study had to face several limitations considered to be normal as many other empirical studies. First, the data and information had to be gathered from the manufacturing companies that are currently registered with the Federation of Malaysian Manufacturers across industry in the Northern Region of Malaysia, by investigating the perception on their experience of practicing the core manufacturing capabilities. However, we managed to collect 119 of the 320 samples. Therefore, it is difficult to say that the sample correctly represents all the major practices of core manufacturing capabilities and the result may not apply to other sectors in the economy.

Second, the present study focuses at one or the whole of manufacturing capabilities done by companies. Consequently, some companies perform only certain manufacturing capabilities. They were assumed to report the practices apply that were seen by apply all the manufacturing capabilities. Therefore, the companies, should be aware of the contribution of each factors on developing manufacturing capabilities.

Finally, a cross-sectional data was used in this study, which limits interferences with regards to causality between the independent variables and the dependent variables.

### 6.3 Direction for Future Research

This study has recognized and measure only four criteria for manufacturing capabilities which according to Swink and Hegarty (1998), these four manufacturing capabilities are the establish factors in the business environment. This study has examined the relationship between manufacturing practices, knowledge transfer and organization capabilities in developing manufacturing capabilities. In addition, training interferes in the relationship between the three independent variables and the manufacturing capabilities. Future research may be extend to include other variables that would account for the manufacturing capabilities, and widen the scope of the current research.

Furthermore, manufacturing capabilities considered for this research was at least one process or the whole manufacturing capabilities. There are several companies perform only certain process of manufacturing capabilities. Therefore, it could not cover all the important issues with regard for the manufacturing capabilities. It is suggested that a comparative study should be conducted between different sectors to determine whether there are significant in the differences sectors. Thus, using multiple data sources by different sectors will present how they develop manufacturing capabilities in their situation. This would further support the claim on generalizing manufacturing capabilities.

Finally, manufacturing capabilities takes a long period of time. Companies go through drastic changes and modification in the manufacturing capabilities. Therefore, to examine the effects, a longitudinal study is suggested. The advantage of longitudinal

study is that it can track changes over time. For an in-depth study, other types of studies can be used such as qualitative studies
( as opposed to quantitative data gathered through questionnaires) where data collected through observation or interviews, and another type of research involve in-depth in case study.

**6.4 Conclusions**

The study has met it objectives and has answered the research question. It has empirically investigated the independent variables, that are manufacturing practices, knowledge transfer, and organizational capabilities while taking into consideration the training as moderator is identified as the cause of develop manufacturing capabilities.

The first objective of this study is to determine whether the three independent variables relate to the core manufacturing capabilities. Our first conclusion was all the success factors have significant relationship with each criteria of core manufacturing capabilities. This is due to the manufacturers who did not focusing improvement in their operation. The second objective of this study is to determine the effects of the three independent variables on core manufacturing capabilities. Our second conclusion is that manufacturing practices explains the variance more than knowledge transfer and become a best predictor among the seven core manufacturing capabilities. The third objective of this study is to investigate the moderating effects of training on the relationship between manufacturing practices , knowledge transfer and organizational capabilities to core manufacturing capabilities. The final conclusion found that training only interacted with manufacturing practices and partially interacted to knowledge transfer and organizational capabilities for the success developing of core manufacturing capabilities.

In sum, the contribution of this study rests on the identification of manufacturing practices and knowledge transfer on core manufacturing capabilities and the role played by training as a moderator in the relationship between manufacturing practices and knowledge transfer and manufacturing capabilities experienced by northern region of Malaysia's manufacturers. Thus, the present study presents adequate theoretical justification for the use of manufacturing practices and knowledge transfer as predictor of variables and provides a more comprehensive assessment of the relationship between these variables.

### 6.5 Recommendations

The study has showing the relationship of manufacturing practices, knowledge transfer on manufacturing capabilities, determine the relationship of the two independent variables i.e. manufacturing practices and knowledge transfer on manufacturing capabilities, and examine the moderating effects of training on the relationships between manufacturing practices, knowledge transfer and manufacturing capabilities.

From this study, it provide a good information that can be used in guiding to develop core manufacturing capabilities. All these information was beneficial especially to Malaysian Investment and Development Authority(MIDA). From this study, it can provided an information to be a guideline in a mission of manufacturing sector to be an important contributor and being a land mark for being a competitive global country. All the information can be used in all variety of economy and Malaysia doesn't wait for a long time to take a plan to move forward.

Other than that, every state in Malaysia especially an industrial state, can used this information to continue focusing on enhancing the capabilities of manufacturing sector, to meet competitive global state and keep up their value chain using their resources-based view to grow. This guideline will help them to go faster than other competitors.

Besides that, this research also can help a Ministry of Finance to make a good policy and create a missions on Malaysia Plan to further move all sectors of economy especially manufacturing sector. From the policy, this study also help Federation of Manufacturing Malaysia (FMM) as a Factory Association of Malaysia to help give these information to all factory in Malaysia, including all manufacturing sector like electric and electronic, food and beverage, and  automotive. This information can be valuable to all this factory and firm to apply.

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APPENDIX A

**Manufacturing Capability Measures**

| Factors | Questions used | Sources |
|---|---|---|
| **Integratio n** | 1. Able to introduce and manufacture new products quickly<br>2. Able to quickly learn new skills and adopt new processes<br>3. Able to easily adjust processes to incorporate products design changes or special needs<br>4. Able to adjust smoothly to changes in product mix over the long term | Haifeng et. al. (2006)<br>Swink & Hegarty (1998)<br>Li (2000) |
| **Acuity** | 1. Able to assist internal groups in problem solving (e.g. in new product development, design for manufacturability, quality improvement, etc)<br>2. Able to assist customers in problem solving (e.g. in new product development, design for manufacturability, quality improvement, etc)<br>3. Able to furnish critical data on product performance to internal groups<br>4. Able to furnish critical data on product performance to external customers<br>5. Able to furnish critical data on process parameters to internal groups<br>6. Able to furnish critical data on process parameters to external customers<br>7. Able to furnish critical data on cost to internal groups<br>8. Able to furnish critical data on cost to external customers | Li (2000)<br>Swink & Hegarty (1998)<br>Haifeng et. al. (2006) |

| | | |
|---|---|---|
| | 9. Able to enhance sales and marketing by exhibiting technology, equipment, or production systems in a way that conveys the value or quality of manufacturing capabilities | |
| **Control** | 1. Able to understand manufacturing process capability limits and sources of variation<br>2. Able to monitor process outputs<br>3. Able to compare process output with desired outputs<br>4. Able to determine the causes of adverse effects in manufacturing outcomes<br>5. Able to remedy undesired variations in manufacturing outcomes | Swink & Hegarty (1998)<br>Li (2000)<br>Haifeng et. al. (2006) |
| **Agility** | 1. Able to efficiently produce wide ranges in the demanded volumes of products<br>2. Able to manufacture a variety of products, over a short time span, without modifying facilities<br>3. Able to accelerate or decelerate the rate of production quickly to handle large fluctuations in demand | Swink & Hegarty (1998)<br>Li (2000)<br>Haifeng et. al. (2006) |

APPENDIX B
**Manufacturing Practices Measures**

| Factors | Questions used | Sources |
|---|---|---|
| **Time-based management** | 1. Indicate the important given to delivery time<br>2. Indicate the important given to engineering | Sohal et. al. (1999)<br>Li (2000) |

| | | |
|---|---|---|
| | time<br>3. Indicate the important given to procurement<br>4. Indicate the important given to set-up time<br>5. Indicate the important given to throughput time<br>6. Indicate the important given to time to market<br>7. Indicate the important given to bottleneck identification | Bolden et. al. (1997) |
| **Management practices** | Supplier delivery to shop floor<br>Supplier certification<br>Set-up time reduction<br>Process changeover time reduction<br>Manufacturing resources planning<br>Just-in-time<br>Eectronic work order management<br>Electronic data interchange<br>Distribution resource planning | Sohal et. al. (1999)<br>Mullarkey et. al. (1995)<br>Haifeng et. al. (2006)<br>Bolden et. al. (1997) |
| **Team work** | Team mandates included quality<br>Team mandates included efficiency<br>Team mandates included cost control<br>Team mandates included safety<br>Team mandates included product improvement<br>Team mandates included customer service<br>Team mandates included hygiene | Sohal et. al. (1999)<br>Bolden et. al. (1997) |
| **Manufacturing technology** | Company use computer-controlled machinery<br>Company use programmable logic controllers<br>Company use computer controlled processes<br>Company use real-time process measurement<br>Company use real-time production monitoring<br>Company use bar coding<br>Company use multi-task machinery<br>Company use automated testing<br>Company use robotics<br>Company use automated warehousing technology | Sohal et. al. (1999)<br>Haifeng et. at (2006)<br>Bolden et. al. (1997) |

APPENDIX C

**Knowledge Transfer Measures**

| **Factors** | **Questions used** | **Sources** |
|---|---|---|
| Knowledge Sharing | 1. Share understanding among product development member of customer need,suppliers.<br>2. Continues intellectual work and product Development<br>3. Contact customer and understand needs of customer and customer satisfaction.<br>4. Commitment to inform,translate,and educate through listening and learning which increase job performance and quality of work in department. | Narver and Slater(1990);<br>Calantone(1996),<br>Hahn(1990)<br>Deshpande(1993)<br>Slater and Narver(1994)<br>Grey(1996) |
| Learning ability | 1. Ready to learn<br>2. Shows interest in acquiring the skills to learn<br>3. Involement in learning activities<br>4. Self-development<br>5. Independencent learning<br>6. Role interdependence<br>7. Interest in teamwork<br>8. Self motivated<br>9. Has achieved independence as a learner<br>10. Has developed a questioning approach<br>11. Demonstrates autonomy at a group and individual level | West P.(2000)<br>West P. & Burnes B. (2000)<br>Burnes B(2000) |
| Knowledge Management | 1. Employees shared knowledge inside the company through interaction<br>2. Employees shared knowledge with outsider<br>3. Skilled employees share their experience with customers in exhibitions or conference | Ismail and Sarif (2006)<br>Ferrari and Toledo (2004) |

| | | |
|---|---|---|
| | without any reward<br>4. Monetary rewards motivated the employees to share their knowledge.<br>5. Learning from the past experiences<br>6. Learning by the performance analysis<br>7. Learning by training | |

APPENDIX D
**Training Measure**

| Factors | Questions used | Sources |
|---|---|---|
| **Training for new work structure** | Basic skills (reading, writing etc.)<br>Leader training<br>Life skill (stress management)<br>Problem solving<br>Product knowledge<br>Quality skills<br>Technical skills | Sohal et. al. (1999)<br>Bolden et. al. (1997)<br>Saunders (2000) |
| **Training for co-makership** | Can master several skills<br>Can cope new process and product technology<br>Can function as team members<br>Can contribute and adopt new form of leadership<br>Effects and specialize in product development department<br>Can improve communication between product development and product department<br>New attitudes<br>New methods of international communication<br>New capabilities(knowledge,cultures,languages)<br>Can put into practices the concepts of strategic Sourcing<br>11. Can developt a structural towards continous improvement process which support strategic sourcing | Sohal et. al. (1999)<br>Bolden et. al. (1997)<br>Marsh (1999) |
| **New method and approaches for learning while working** | Introduce new methods using technologies<br>define and expense of teaching task<br>install open learning centres in manufacturing plants<br>use interactive CD-I or other multimedia system | Sohal et. al. (1999)<br>Bolden et. al. (1997)<br>MacNeil (2000) |

APPENDIX E

**Organization Capabilities Measures**

| **Factors** | **Questions used** | **Sources** |
|---|---|---|
| | ORGANIZATION LEARNING CAPABILITY | |
| Managerial Commitment | 1. My Firm frequently involves their staff in important decision-making process<br>2. My firm's management looks favorably on carrying out changes in any area to adapt and/or keep ahead of new environmental situations.<br>3. Employee learning capability is considered a key factor in my firm.<br>4. My firm rewarded work innovative ideas. | Einkelenboom(2011)<br>Eider & Igbaria(2001)<br>Kearns(2006)<br>Lai & Mahapatra(2004)<br>Meade & Liles(1997) |
| Systems Perspectives | 1 All employees have generalized knowledge regarding this firm's objectives.<br>2 All parts that make up my firm ( departments, sections, work teams and individuals) are well aware of how they contribute to achieving the overall objectives.<br>3 All activities that occur in business transaction processes are clearly defined<br>4 All parts that make up my firm are interconnected, working together in a coordinated fashion. | Meade & Liles(1997)<br>Valle-Cabrera (2005),<br>Teo *et al*.(2006)<br>Lee & Kim (2007), |
| Openness and Experimentation | 1. My firm promotes experimentation and innovation as a way of improving the work processes.<br>2. My firm follows up what other firms in the sector are doing, adopting those practices and techniques it believes to be useful and interesting.<br>3. Experiences and ideas provided by external sources ( advisors, customers, training firms, etc. ) are considered a useful instrument for my firm's learning<br>4. Part of my firm's culture is that employees can express their opinions and make suggestions | Hult & Ferrell(1997)<br>Jerez-Gomez *et al*(2005)<br>Lin & Lee(2005) |

| | | |
|---|---|---|
| | regarding the procedures and methods in place for carrying out tasks. | |
| INNOVATIVE CAPABILITY | | |
| Perceived relative advantage | 1. Provide better products or service<br>2. Enhance business efficiency<br>3. Increase profit capability<br>4. Enhance staff productivity<br>5. Reduce cost of operation management | Fruhling & Siau(2007)<br>Hsu(2006)<br>Chang & Lee(2008)<br>Rogers (2003) |
| Perceived compatibility | 1. Is acceptable to corporate culture and value system<br>2. Does not contradict the current internal technology<br>3. Accord with demand<br>4. Is supported by the existing infrastructure | Lin, Chen and Chiu (2010)<br>Sia, Teo, Tan, & Wei (2004)<br>Verhoef & Langerak, (2001) |

**THE RELATIONSHIP OF MANUFACTURING PRACTICES, KNOWLEDGE TRANSFER.ORGANIZATIONAL CAPABILITIES TOWARDS MANUFACTURING CAPABILITIES: MODERATING EFFECT OF TRAINING IN NORTHERN REGION OF MALAYSIA**

The information given in this questionnaire will remain strictly confidential.

Dear respondent,

It is not necessary to identify your name or company. However, if you would like for us to send you feedback, you may fill the following section or you may attach your business card.

Thank you for your cooperation.

Name : ______________________________________________

Job title: ______________________________________________

Address of company:

______________________________________________________________________

________

______________________________________________________________________

**PART I**

In this part we would like to obtain information about your company.

**Company Profile**

1. Which of the followings best describes the company's main sector of business:

☐ Agriculture, Forestry & Fishing ☐ Manufacturing

☐ Mining & Quarrying ☐ Construction

☐ Services ☐ Others: Please specify ________________________________

2. Is the company a ____________________________

☐ Malaysian owned ☐ Foreign owned

☐ Multi National Company ☐ Joint Venture

☐ Others: Please specify ____________

3. Size of the company (approximate number of employees)

☐ Less than 5 ☐ 5-50

☐ 51-150 ☐ More than 150

**Department Information**

1. You are in Department?(Example: Department: Engineering)

__________________________________

2. How long have you work for your company?

_________________ years (estimate)

☐ Less than 1 year ☐ 1- 5 years

☐ 6 – 10 years ☐ More than 10 years

**<u>Part II</u> MANUFACTURING PRACTICES**

Using the table below, please rate the level of your firm application on the manufacturing practices. Circle your answer.

| | Task | Degree of application<br>5. Fully applied<br>4. Partially applied<br>3. Less applied<br>2. Not applied<br>1. Not applicable | | | | |
|---|---|---|---|---|---|---|
| | TIME-BASED MANAGEMENT | | | | | |
| 1 | indicate the importance given to delivery time | 5 | 4 | 3 | 2 | 1 |
| 2 | indicate the importance given to engineering time | 5 | 4 | 3 | 2 | 1 |
| 3 | indicate the importance given to procurement | 5 | 4 | 3 | 2 | 1 |
| 4 | indicate the importance given to set-up time | 5 | 4 | 3 | 2 | 1 |
| 5 | indicate the importance given to throughput time | 5 | 4 | 3 | 2 | 1 |
| 6 | indicate the importance given to time to market | 5 | 4 | 3 | 2 | 1 |
| 7 | indicate the importance given to bottleneck identification | 5 | 4 | 3 | 2 | 1 |
| | MANAGEMENT PRACTICES | | | | | |
| 1 | supplier delivery to shop floor | 5 | 4 | 3 | 2 | 1 |
| 2 | supplier certification | 5 | 4 | 3 | 2 | 1 |
| 3 | set-up time reduction | 5 | 4 | 3 | 2 | 1 |
| 4 | process changeover time reduction | 5 | 4 | 3 | 2 | 1 |
| 5 | manufacturing resources planning | 5 | 4 | 3 | 2 | 1 |
| 6 | just-in-time | 5 | 4 | 3 | 2 | 1 |
| 7 | electronic work order management | 5 | 4 | 3 | 2 | 1 |
| 8 | electronic data interchange | 5 | 4 | 3 | 2 | 1 |
| 9 | distribution resource planning | 5 | 4 | 3 | 2 | 1 |
| | TEAM WORK | | | | | |
| 1 | team mandates included quality | 5 | 4 | 3 | 2 | 1 |
| 2 | team mandates included efficiency | 5 | 4 | 3 | 2 | 1 |
| 3 | team mandates included cost control | 5 | 4 | 3 | 2 | 1 |
| 4 | team mandates included safety | 5 | 4 | 3 | 2 | 1 |
| 5 | team mandates included product improvement | 5 | 4 | 3 | 2 | 1 |
| 6 | team mandates included customer service | 5 | 4 | 3 | 2 | 1 |
| 7 | team mandates included hygiene | 5 | 4 | 3 | 2 | 1 |
| | MANUFACTURING TECHNOLOGY | | | | | |
| 1 | company use computer-controlled machinery | 5 | 4 | 3 | 2 | 1 |
| 2 | company use programmable logic controllers | 5 | 4 | 3 | 2 | 1 |
| 3 | company use computer controlled processes | 5 | 4 | 3 | 2 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | company use real-time process measurement | 5 | 4 | 3 | 2 | 1 |
| 5 | company use real-time production monitoring | 5 | 4 | 3 | 2 | 1 |
| 6 | company use bar coding | 5 | 4 | 3 | 2 | 1 |
| 7 | company use multi-task machinery | 5 | 4 | 3 | 2 | 1 |
| 8 | company use automated testing | 5 | 4 | 3 | 2 | 1 |
| 9 | company use robotics | 5 | 4 | 3 | 2 | 1 |
| 10 | company use automated warehousing technology | 5 | 4 | 3 | 2 | 1 |

**<u>PART III</u> KNOWLEDGE TRANSFER**

Using the table below, please rate the commitment level of your company in applying the knowledge. Circle your answer

| | Task | Degree of application<br>5. Fully applied<br>4. Partially applied<br>3. Less applied<br>2. Not applied<br>1. Not applicable | | | | |
|---|---|---|---|---|---|---|
| | KNOWLEDGE SHARING | | | | | |
| 1 | the employees have SPM certificate | 5 | 4 | 3 | 2 | 1 |
| 2 | the employees have Diploma certificate | 5 | 4 | 3 | 2 | 1 |
| 3 | the employees have bachelor degree certificate | 5 | 4 | 3 | 2 | 1 |
| 4 | the employees have vocational certificate | 5 | 4 | 3 | 2 | 1 |
| | LEARNING ABILITY | | | | | |
| 5 | employees shared knowledge inside the company through interaction | 5 | 4 | 3 | 2 | 1 |
| 6 | skilled employees share their experience with customers in exhibitions or conference without any reward | 5 | 4 | 3 | 2 | 1 |
| 7 | monetary rewards motivated the employees to share their knowledge. | 5 | 4 | 3 | 2 | 1 |
| 8 | learning from the past experiences | 5 | 4 | 3 | 2 | 1 |
| 9 | learning by the performance analysis | 5 | 4 | 3 | 2 | 1 |
| 10 | learning by training | 5 | 4 | 3 | 2 | 1 |
| 11 | encourage experienced workers to transfer their knowledge to less experiences workers | 5 | 4 | 3 | 2 | 1 |
| 12 | capture and use knowledge obtained from other private companies (e.g. competitors, customers or suppliers) | 5 | 4 | 3 | 2 | 1 |
| 13 | off-site training | 5 | 4 | 3 | 2 | 1 |
| 14 | dedication of time to capture and share knowledge | 5 | 4 | 3 | 2 | 1 |
| 15 | use information technology | 5 | 4 | 3 | 2 | 1 |
| | KNOWLEDGE MANAGEMENT | | | | | |
| 16 | provide informal training related to knowledge acquisition and sharing | 5 | 4 | 3 | 2 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | share knowledge through the physical organization of workplace | 5 | 4 | 3 | 2 | 1 |
| 18 | share knowledge through written documentation | 5 | 4 | 3 | 2 | 1 |
| 19 | creates a value system or culture to promote knowledge sharing | 5 | 4 | 3 | 2 | 1 |
| 20 | encourage workers to participate in project teams with external experts | 5 | 4 | 3 | 2 | 1 |
| 21 | use partnerships or strategic alliances to acquire knowledge | 5 | 4 | 3 | 2 | 1 |
| 22 | has policies or program intended to improve worker retention | 5 | 4 | 3 | 2 | 1 |

**PART IV TRAINING**

Using the table below, please rate the commitment level of your company in applying the training. Circle your answer.

| | Task | Degree of application<br>5. Fully applied<br>4. Partially applied<br>3. Less applied<br>2. Not applied<br>1. Not applicable | | | | |
|---|---|---|---|---|---|---|
| | TRAINING FOR NEW WORK STRUCTURE | | | | | |
| 1 | basic skills (reading, writing etc.) | 5 | 4 | 3 | 2 | 1 |
| 2 | leader training | 5 | 4 | 3 | 2 | 1 |
| 3 | life skill (stress management) | 5 | 4 | 3 | 2 | 1 |
| 4 | problem solving | 5 | 4 | 3 | 2 | 1 |
| 5 | product knowledge | 5 | 4 | 3 | 2 | 1 |
| 6 | quality skills | 5 | 4 | 3 | 2 | 1 |
| 7 | technical skills | 5 | 4 | 3 | 2 | 1 |
| | TRAINING FOR CO-MAKERSHIP | | | | | |
| 8 | master several skills | 5 | 4 | 3 | 2 | 1 |
| 9 | can cope new process and product technology | 5 | 4 | 3 | 2 | 1 |
| 10 | can function as team members | 5 | 4 | 3 | 2 | 1 |
| 11 | can contribute and adopt new form of leadership | 5 | 4 | 3 | 2 | 1 |
| 12 | understand and analyse process they are working and develop idea for improvement | 5 | 4 | 3 | 2 | 1 |
| 13 | effects of specialization in product development department | 5 | 4 | 3 | 2 | 1 |
| 14 | can improve communications between product development and production department | 5 | 4 | 3 | 2 | 1 |
| 15 | Adopt new attitudes | 5 | 4 | 3 | 2 | 1 |
| 16 | Adopt new methods of international communication | 5 | 4 | 3 | 2 | 1 |
| 17 | Adopt new capabilities(knowledge of other cultures and languages) | 5 | 4 | 3 | 2 | 1 |
| 18 | can put into practice the concepts of strategic sourcing | 5 | 4 | 3 | 2 | 1 |
| 19 | can developt a structural towards continous improvement | 5 | 4 | 3 | 2 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | process which support strategic sourcing | | | | | |
| NEW METHOD AND APPROACHES FOR LEARNING WHILE WORKING | | | | | | |
| 20 | Introduce new methods using new technologies | 5 | 4 | 3 | 2 | 1 |
| 21 | define and expanse of teaching tasks | 5 | 4 | 3 | 2 | 1 |
| 22 | open learning centres in manufacturing plants | 5 | 4 | 3 | 2 | 1 |
| 23 | use interactive CD(CD-I) or other multimedia systems | 5 | 4 | 3 | 2 | 1 |

**<u>PART VI</u> ORGANIZATION CAPABILITY**

Using the table below, please indicate your perception on the following capability of your company. Circle your answer.

| | Statements | Degree of implementation<br>5. High implementation<br>4. Average implementation<br>3. Uncertain<br>2. Low implementation<br>1. No implementation | | | | |
|---|---|---|---|---|---|---|
| ORGANIZATION LEARNING CAPABILITY ( Managerial Commitment) | | | | | | |
| 1 | My Firm frequently involves their staff in important decision-making process | 5 | 4 | 3 | 2 | 1 |
| 2 | My firm's management looks favorably on carrying out changes in any area to adapt and/or keep ahead of new environmental situations. | 5 | 4 | 3 | 2 | 1 |
| 3 | Employee learning capability is considered a key factor in my firm. | 5 | 4 | 3 | 2 | 1 |
| 4 | My firm rewarded work innovative ideas. | 5 | 4 | 3 | 2 | 1 |
| ( Systems Perspectives) | | | | | | |
| 1 | All employees have generalized knowledge regarding this firm's objectives. | 5 | 4 | 3 | 2 | 1 |
| 2 | All parts that make up my firm ( departments, sections, work teams and individuals) are well aware of how they contribute to achieving the overall objectives. | 5 | 4 | 3 | 2 | 1 |
| 3 | All activities that occur in business transaction processes are clearly defined | 5 | 4 | 3 | 2 | 1 |
| 4 | All parts that make up my firm are interconnected, working together in a coordinated fashion. | 5 | 4 | 3 | 2 | 1 |
| ( Openness and Experimentation) | | | | | | |
| 1 | My firm promotes experimentation and innovation as a way of improving the work processes. | 5 | 4 | 3 | 2 | 1 |
| 2 | My firm follows up what other firms in the sector are doing, adopting those practices and techniques it believes to be useful and interesting. | 5 | 4 | 3 | 2 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | Experiences and ideas provided by external sources ( advisors, customers, training firms, etc. ) are considered a useful instrument for my firm's learning | 5 | 4 | 3 | 2 | 1 |
| 4 | Part of my firm's culture is that employees can express their opinions and make suggestions regarding the procedures and methods in place for carrying out tasks. | 5 | 4 | 3 | 2 | 1 |
| | Innovation capabilities ( Perceived relative advantage) | | | | | |
| 1 | Provide better products or service | 5 | 4 | 3 | 2 | 1 |
| 2 | Enhance business efficiency | 5 | 4 | 3 | 2 | 1 |
| 3 | Increase profit capability | 5 | 4 | 3 | 2 | 1 |
| 4 | Enhance staff productivity | 5 | 4 | 3 | 2 | 1 |
| 5 | Reduce cost of operation management | 5 | 4 | 3 | 2 | 1 |
| | Perceived compatibility | | | | | |
| 1 | Is acceptable to corporate culture and value system | 5 | 4 | 3 | 2 | 1 |
| 2 | Does not contradict the current internal technology | 5 | 4 | 3 | 2 | 1 |
| 3 | Accord with demand | 5 | 4 | 3 | 2 | 1 |
| 4 | Is supported by the existing infrastructure | 5 | 4 | 3 | 2 | 1 |

**PART VI MANUFACTURING CAPABILITY**

Using the table below, please indicate your perception on the following capability of your company. Circle your answer.

| | Statements | Degree of implementation<br>5. High implementation<br>4. Average implementation<br>3. Uncertain<br>2. Low implementation<br>1. No implementation | | | | |
|---|---|---|---|---|---|---|
| | IMPROVEMENT | | | | | |
| 1 | able to impel human resource to higher levels of effort and effectiveness | 5 | 4 | 3 | 2 | 1 |
| 2 | able to increase and apply process understanding | 5 | 4 | 3 | 2 | 1 |
| 3 | able to identify and remove non-value adding activities | 5 | 4 | 3 | 2 | 1 |
| | INNOVATION | | | | | |
| 4 | able to identify problems inside the organization | 5 | 4 | 3 | 2 | 1 |
| 5 | able to identify problems outside the organization | 5 | 4 | 3 | 2 | 1 |
| 6 | able to identify process needs inside the organization | 5 | 4 | 3 | 2 | 1 |
| 7 | able to identify process needs outside the organization | 5 | 4 | 3 | 2 | 1 |
| 8 | able to generate and evaluate new ideas which meet organizational objectives | 5 | 4 | 3 | 2 | 1 |
| 9 | able to apply new technologies or methods to solve problems | 5 | 4 | 3 | 2 | 1 |
| | INTEGRATION | | | | | |
| 10 | able to introduce and manufacture new products quickly | 5 | 4 | 3 | 2 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | able to quickly learn new skills and adopt new processes | 5 | 4 | 3 | 2 | 1 |
| 12 | able to easily adjust processes to incorporate products design changes or special needs | 5 | 4 | 3 | 2 | 1 |
| 13 | able to adjust smoothly to changes in product mix over the long term | 5 | 4 | 3 | 2 | 1 |
| | ACUITY | | | | | |
| 14 | able to assist internal groups in problem solving (e.g. in new product development, design for manufacturability, quality improvement, etc) | 5 | 4 | 3 | 2 | 1 |
| 15 | able to assist customers in problem solving (e.g. in new product development, design for manufacturability, quality improvement, etc) | 5 | 4 | 3 | 2 | 1 |
| 16 | able to furnish critical data on product performance to internal groups | 5 | 4 | 3 | 2 | 1 |
| 17 | able to furnish critical data on product performance to external customers | 5 | 4 | 3 | 2 | 1 |
| 18 | able to furnish critical data on process parameters to internal groups | 5 | 4 | 3 | 2 | 1 |
| 19 | able to furnish critical data on process parameters to external customers | 5 | 4 | 3 | 2 | 1 |
| 20 | able to furnish critical data on cost to internal groups | 5 | 4 | 3 | 2 | 1 |
| 21 | able to furnish critical data on cost to external customers | 5 | 4 | 3 | 2 | 1 |
| 22 | able to enhance sales and marketing by exhibiting technology, equipment, or production systems in a way that conveys the value or quality of manufacturing capabilities | 5 | 4 | 3 | 2 | 1 |
| | CONTROL | | | | | |
| 23 | able to understand manufacturing process capability limits and sources of variation | 5 | 4 | 3 | 2 | 1 |
| 24 | able to monitor process outputs | 5 | 4 | 3 | 2 | 1 |
| 25 | able to compare process output with desired outputs | 5 | 4 | 3 | 2 | 1 |
| 26 | able to determine the causes of adverse effects in manufacturing outcomes | 5 | 4 | 3 | 2 | 1 |
| 27 | able to remedy undesired variations in manufacturing outcomes | 5 | 4 | 3 | 2 | 1 |
| | AGILITY | | | | | |
| 28 | able to efficiently produce wide ranges in the demanded volumes of products | 5 | 4 | 3 | 2 | 1 |
| 29 | able to manufacture a variety of products, over a short time span, without modifying facilities | 5 | 4 | 3 | 2 | 1 |
| 30 | Able to accelerate or decelerate the rate of production quickly to handle large fluctuations in demand | 5 | 4 | 3 | 2 | 1 |
| | RESPONSIVE | | | | | |
| 31 | able to accommodate raw material substitutions or variations | 5 | 4 | 3 | 2 | 1 |
| 32 | able to change product sequencing/loading in response to machine/equipment problems | 5 | 4 | 3 | 2 | 1 |
| 33 | able to rearrange the order in which parts are fed into the manufacturing process, because of changes in parts and raw material deliveries or changes in customer delivery | 5 | 4 | 3 | 2 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | requirements | | | | | |
| 34 | able to expedite or reroute shipments to accommodate special circumstances without loss time | 5 | 4 | 3 | 2 | 1 |

**PART VI**

To improve manufacturing capabilities towards manufacturing practices,knowledge and training, are there any other advices you would like to share with us. Please write as many comments possible in the provided space

**THANK YOU FOR YOUR TIME AND COOPERATION**

APPENDIX G : FACTOR ANALYSIS

**KMO and Bartlett's Test**

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .559 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 224.194 |
| | df | 6 |
| | Sig. | .000 |

**Communalities**

| | Initial | Extraction |
|---|---|---|
| involve | 1.000 | .318 |
| favorably | 1.000 | .134 |
| learn | 1.000 | .896 |
| rewarded | 1.000 | .853 |

Extraction Method: Principal Component Analysis.

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 2.202 | 55.053 | 55.053 | 2.202 | 55.053 | 55.053 |
| 2 | .964 | 24.102 | 79.155 | | | |
| 3 | .742 | 18.555 | 97.710 | | | |
| 4 | .092 | 2.290 | 100.000 | | | |

Extraction Method: Principal Component Analysis.

**Component Matrix(a)**

| | Component |
|---|---|
| | 1 |
| involve | .564 |
| favorably | .367 |
| learn | .947 |
| rewarded | .924 |

Extraction Method: Principal Component Analysis.
a 1 components extracted.

**Rotated Component Matrix(a)**

a Only one component was extracted. The solution cannot be rotated.

# APPENDIX H : MULTIPLE REGRESSION ANALYSIS

**Variables Entered/Removed(b)**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | orggg, cMP, cKTT(a) | . | Enter |

a All requested variables entered.
b Dependent Variable: manc_agility

**Model Summary(b)**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .908(a) | .824 | .820 | .27030 |

a Predictors: (Constant), orggg, cMP, cKTT
b Dependent Variable: manc_agility

**ANOVA(b)**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Regression | 39.361 | 3 | 13.120 | 179.584 | .000(a) |
| | Residual | 8.402 | 115 | .073 | | |
| | Total | 47.763 | 118 | | | |

a Predictors: (Constant), orggg, cMP, cKTT
b Dependent Variable: manc_agility

**Coefficients(a)**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | -1.609 | .311 | | -5.172 | .000 |
| | cMP | .393 | .083 | .329 | 4.737 | .000 |
| | cKTT | .819 | .091 | .628 | 8.972 | .000 |
| | orggg | .042 | .041 | .042 | 1.016 | .312 |

a Dependent Variable: manc_agility

**Casewise Diagnostics(a)**

| Case Number | Std. Residual | manc_agility | Predicted Value | Residual |
|---|---|---|---|---|
| 30 | 3.087 | 4.00 | 3.1657 | .83429 |
| 60 | 3.071 | 4.00 | 3.1699 | .83009 |
| 90 | 3.071 | 4.00 | 3.1699 | .83009 |

a Dependent Variable: manc_agility

**Residuals Statistics(a)**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 2.5231 | 4.4914 | 3.6555 | .57755 | 119 |
| Std. Predicted Value | -1.961 | 1.447 | .000 | 1.000 | 119 |
| Standard Error of Predicted Value | .030 | .083 | .048 | .012 | 119 |
| Adjusted Predicted Value | 2.5347 | 4.4762 | 3.6543 | .57856 | 119 |
| Residual | -.54704 | .83429 | .00000 | .26684 | 119 |
| Std. Residual | -2.024 | 3.087 | .000 | .987 | 119 |
| Stud. Residual | -2.038 | 3.185 | .002 | 1.007 | 119 |
| Deleted Residual | -.55480 | .88825 | .00116 | .27788 | 119 |
| Stud. Deleted Residual | -2.067 | 3.321 | .005 | 1.023 | 119 |
| Mahal. Distance | .423 | 10.212 | 2.975 | 2.025 | 119 |
| Cook's Distance | .000 | .177 | .010 | .027 | 119 |
| Centered Leverage Value | .004 | .087 | .025 | .017 | 119 |

a Dependent Variable: manc_agility

APPENDIX I : HIERARCHICAL MULTIPLE REGRESSION ANALYSIS

**Variables Entered/Removed(b)**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | cORG, cKTT, cMP(a) | . | Enter |
| 2 | cTRA(a) | . | Enter |
| 3 | OCXT, MPXT, KTXT(a) | . | Enter |

a All requested variables entered.
b Dependent Variable: cMC

**Model Summary(d)**

| 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 | .911(a) | .830 | .826 | .24696 | .830 | 187.628 | 3 | 115 | .000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | .920(b) | .846 | .840 | .23645 | .015 | 11.448 | 1 | 114 | .001 |
| 3 | .920(c) | .847 | .837 | .23867 | .001 | .298 | 3 | 111 | .827 |

a Predictors: (Constant), cORG, cKTT, cMP
b Predictors: (Constant), cORG, cKTT, cMP, cTRA
c Predictors: (Constant), cORG, cKTT, cMP, cTRA, OCXT, MPXT, KTXT
d Dependent Variable: cMC

**ANOVA(d)**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 34.331 | 3 | 11.444 | 187.628 | .000(a) |
| | Residual | 7.014 | 115 | .061 | | |
| | Total | 41.344 | 118 | | | |
| 2 | Regression | 34.971 | 4 | 8.743 | 156.368 | .000(b) |
| | Residual | 6.374 | 114 | .056 | | |
| | Total | 41.344 | 118 | | | |
| 3 | Regression | 35.022 | 7 | 5.003 | 87.831 | .000(c) |
| | Residual | 6.323 | 111 | .057 | | |
| | Total | 41.344 | 118 | | | |

a Predictors: (Constant), cORG, cKTT, cMP
b Predictors: (Constant), cORG, cKTT, cMP, cTRA
c Predictors: (Constant), cORG, cKTT, cMP, cTRA, OCXT, MPXT, KTXT
d Dependent Variable: cMC

**Coefficients(a)**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | -1.234 | .295 | | -4.189 | .000 |
| | cMP | .477 | .076 | .430 | 6.255 | .000 |
| | cKTT | .651 | .083 | .537 | 7.869 | .000 |
| | cORG | .058 | .044 | .053 | 1.330 | .186 |
| 2 | (Constant) | -1.560 | .298 | | -5.234 | .000 |
| | cMP | .415 | .075 | .373 | 5.500 | .000 |
| | cKTT | .634 | .079 | .523 | 7.986 | .000 |
| | cORG | -.037 | .050 | -.034 | -.732 | .466 |
| | cTRA | .232 | .069 | .156 | 3.383 | .001 |
| 3 | (Constant) | -.824 | 2.938 | | -.281 | .780 |
| | cMP | .618 | .810 | .556 | .762 | .447 |
| | cKTT | .160 | 1.074 | .132 | .148 | .882 |
| | cORG | .057 | .134 | .052 | .421 | .674 |

| | | | | | |
|---|---|---|---|---|---|
| cTRA | .081 | .661 | .054 | .122 | .903 |
| MPXT | -.048 | .192 | -.257 | -.253 | .801 |
| KTXT | .108 | .250 | .548 | .430 | .668 |
| OCXT | -.023 | .027 | -.146 | -.862 | .391 |

a Dependent Variable: cMC

**Excluded Variables(c)**

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics |
|---|---|---|---|---|---|---|
| | | | | | | Tolerance |
| 1 | cTRA | .156(a) | 3.383 | .001 | .302 | .634 |
| | MPXT | .303(a) | 3.353 | .001 | .300 | .166 |
| | KTXT | .283(a) | 3.396 | .001 | .303 | .194 |
| | OCXT | .209(a) | 2.453 | .016 | .224 | .194 |
| 2 | MPXT | .030(b) | .046 | .963 | .004 | .003 |
| | KTXT | .225(b) | .282 | .778 | .027 | .002 |
| | OCXT | -.140(b) | -.839 | .403 | -.079 | .049 |

a Predictors in the Model: (Constant), cORG, cKTT, cMP
b Predictors in the Model: (Constant), cORG, cKTT, cMP, cTRA
c Dependent Variable: cMC

**Residuals Statistics(a)**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 2.6182 | 4.5219 | 3.7185 | .54479 | 119 |
| Std. Predicted Value | -2.020 | 1.475 | .000 | 1.000 | 119 |
| Standard Error of Predicted Value | .032 | .096 | .060 | .014 | 119 |
| Adjusted Predicted Value | 2.6404 | 4.5077 | 3.7183 | .54437 | 119 |
| Residual | -.54005 | .55182 | .00000 | .23148 | 119 |
| Std. Residual | -2.263 | 2.312 | .000 | .970 | 119 |
| Stud. Residual | -2.390 | 2.437 | .000 | 1.006 | 119 |
| Deleted Residual | -.60263 | .61313 | .00016 | .24896 | 119 |

| | | | | | |
|---|---|---|---|---|---|
| Stud. Deleted Residual | -2.443 | 2.494 | -.001 | 1.018 | 119 |
| Mahal. Distance | 1.195 | 18.248 | 6.941 | 3.564 | 119 |
| Cook's Distance | .000 | .083 | .010 | .019 | 119 |
| Centered Leverage Value | .010 | .155 | .059 | .030 | 119 |

a Dependent Variable: cMC