CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides discussion on the relevant issues and literature of the study. First, it discusses the changing business environment and strategy in Section 2.1. This is followed by a discussion on Integrated Manufacturing Practices (IMP) in Section 2.2. Each dimension of IMP such as Just In Time (JIT) philosophy, Total Quality Management (TQM) philosophy and Advanced Manufacturing Technology (AMT), as well as the concept of IMP itself, are discussed in this section. Then, Section 2.3 discusses the role of management accounting systems (MAS). It starts with a discussion on the evolution of management accounting to show how management accounting techniques change over time, followed by a discussion on the usefulness of MAS information. Subsequently, the discussion on business performance is presented in Section 2.4. Finally, Section 2.5 identifies research gaps based on the above review of the literature. Specifically, this chapter reviews previous literature that is used as the foundation of this study.

2.1 Changing Business Environment and Strategy

2.1.1 The Effect of Competitive Environment

Advancement in technology, availability of a variety of new products, more competitive prices and efficient marketing channels by competitors have transformed the business environment into a rapidly changing and dynamic business environment. These factors have contributed significantly to the competitive environment faced by organisations all over the world, including Malaysia. The market competition faced by organisations has a major impact on the operation and survival of businesses. Therefore, managers should be aware of the degree of competition faced by the firms before planning the control systems in their organisations. The work of Khandwalla (1972) is among the earliest empirical studies that examined the effects of competition on control systems. He empirically examined the relationships between the different types of competition (price, product, and distribution) and controls in manufacturing companies. Based on a sample of 92 manufacturing companies, the results of the study showed that there was a positive association between competition and the use of sophisticated management controls even though there were differences among the three types of competition regarding their relationship with the usage of management controls. Product competition had a much larger positive effect on their usage while distributive competition appeared to have a modest positive impact. Price competition appeared to have little impact on their usage of management controls. The positive relationship between competition and control implies that as competition intensifies, the expected benefits from the application of these controls tend to outweigh their costs.

Using similar types of competition and the data from 96 manufacturing companies, Khandwalla (1973) revealed that, in general, competition was positively related with all four types of top management authority and controls, namely, decentralisation of decision making authority, use of sophisticated management controls, selectivity in the delegation of authority and use of controls. When the type of competition was assessed individually, product competition had the strongest impact on all authority and controls. Marketing or distributive competition was positively related with only two of the variables – delegation of authority and use of controls. Price competition appeared to have little impact on overall top management authority and the control structure. These findings are similar with the earlier study.

Mia and Clarke (1999) examined the relationship between the intensity of market competition and business unit performance, with managerial use of the information provided by MAS as a mediating variable. Personal interviews using a structured questionnaire with 61 business unit managers of Australian large manufacturing firms were conducted to obtain the data. The results of the study provided evidence that managers' use of the MAS information mediates the relationship between intensity of market competition and business unit performance. The results also revealed that when the intensity of market competition increases, managerial use of the MAS information also increases; and the increasing managerial use of the MAS information leads to improved business unit performance. Therefore, it can be argued that companies that make better use of the MAS information in facing competition in the market will perform better.

Similarly, Hoque (2011) also showed that the intensity of market competition causes firms to change their MACS, and this change results in improved organisational

performance. The result from the survey of 34 Australian strategic business units implies that the greater the competition, the greater the need for sophisticated management controls that could provide managers with high quality information for better decision making, so that organisational performance could be enhanced. This finding is also similar to the study of Khandwalla (1972; 1973) that competition influences the use of management controls.

In contrast, Patiar and Mia (2008) found that market competition and the use of MAS information only has a significant combined effect on non-financial performance, but not on financial performance. The sample consisted of 112 survey responses from departmental managers in 56 large hotels and resorts in Australia. Even after controlling for the demographic variables of the respondents, the results still remain the same. However, when assessing the direct effect of market competition and MAS information on performance, it was found that market competition has a negative and significant effect on financial performance whereas MAS information has a positive and significant effect on financial performance. Hence, it can be concluded that a competitive environment leads to a decline in financial performance but the use of MAS information by managers improves financial performance.

The impact of competition on the adoption of certain practices has also been studied. For example, Das et al. (2000) showed that international competition influenced the U.S. manufacturing firms to improve their supply chain management, quality training, quality resources and evaluation, and customer commitment. International competition also acted as a moderator in the relationship between quality practices and customer satisfaction performance, as well as between high involvement work practices and firm performance for the 290 companies surveyed. Using different measures of competition,

Chong and Rundus (2004) studied the impact of market competition on the relationship between TQM practices and the organisational performance of large manufacturing firms located in Melbourne, Australia. The survey of 89 firms indicates that the higher the degree of market competition, the more positive the relationship between TQM practices of customer focus and organisational performance, as well as between TQM practices of product design and organisational performance. The findings suggest that firms with a high level of competition should adopt TQM because their combination will improve organisational performance.

More recently, Ax et al. (2008) examined the impact of competition on the adoption of target costing. Using a web-based survey on a single industry, they found that competition did influence member firms of the Association of Swedish Engineering Industries to adopt target costing. Furthermore, the results also suggest that perceived environmental uncertainty (PEU) moderates the positive relationship between competition and target costing. However, the negative relationship between PEU and the adoption of target costing was not significant and could be due to the smaller sample size (57 respondents).

The review of these studies indicates that the competition faced by organisations affects the control systems adopted. Organisations adopt these systems to cope with the escalating competition. For example, the findings of Khandwalla (1972; 1973) suggest that organisations tend to use more sophisticated management controls when the competition is more intense. Similarly, Mia and Clarke (1999) demonstrated that the intensity of market competition leads to a higher usage of MAS information by managers. The competitive environment also influences firms to adopt certain practices as their control systems. For example, Das et al. (2000) showed that international

competition improves organisations' supply chain management, quality practices and customer commitment. The findings of Chong and Rundus (2004) and Ax et al. (2008) also suggest that organisations should adopt TQM and target costing when they face increasing levels of competition. Thus, in the current study, the competition level is expected to positively influence firms to adopt integrated manufacturing practices in an attempt to gain competitive advantage.

2.1.2 Strategy

In response to the escalating competition, organisations need to consistently evaluate their strategy and continue to find the appropriate strategy in order to sustain and remain competitive. In order to achieve these goals, the strategy adopted by organisations should suit the nature of their businesses. This organisational strategy may also determine the management control system practices by organisations. In this section, the general main strategy typologies and related empirical studies will be discussed.

2.1.2.1 Strategy Typologies

A review of studies in strategy shows that different taxonomies exist to explain different types of strategy. For instance, Miles and Snow (1978) introduced prospectors, analysers, defenders, reactors strategy; Porter (1980) initiated the concept of product differentiation, cost leadership, focus strategy; entrepreneurial, conservative by Miller and Friesen (1982); and build, hold, harvest, divest by Gupta and Govindarajan (1984).

a. Miles and Snow (1978)

Miles and Snow's (1978) strategy typologies consist of four strategy perspectives: prospectors, defenders, analysers and reactors. They characterised prospectors as consistently looking for market opportunities, stress innovation and flexibility, changing product line frequently, attempt to be the pioneer in the market, and they normally exist in an uncertain environment. In organisational settings, both marketing and research and development departments normally fall under this category. In contrast, defenders undertake little product or market development, have smaller product range, work in a stable environment, and emphasise tight control of operations, especially on price, quality, delivery, and service. Finance, production and engineering departments play a critical role for defenders strategy. Analysers take a middle stand by combining both the strongest characteristics of prospectors and defenders. Reactors strategy has no consistent strategy and is not viable in the long run. Organisations are normally forced into this strategy when the distinctive competences, organisational structures, and management processes required by a particular strategy are not developed. Organisations with this strategy have a weakness in their general management.

b. Porter (1980)

For organisations to gain competitive advantage, Porter (1980) classified organisational strategy into three types: product differentiation, cost leadership and focus. The product differentiation strategy aims at producing a unique product or offering a service that is distinct from the competitors. Differentiation could be achieved through product

innovation and intensive research and development activities. Differentiation may increase brand loyalty and the customers might be willing to pay premium prices. The cost leadership strategy focuses on achieving the lowest possible cost relative to competitors through economies of scale, elimination of waste, productivity and efficiency improvements, and tight cost control. The products and services provided are similar to its competitors. Unlike product differentiation and cost leadership, the focus strategy aims to serve a specific target, and not the industry as a whole. For example, a market segment that needs special attention in order to achieve efficiency and effectiveness compared to its rivals. As a result, the organisation may achieve either differentiation or a cost leadership strategy or both for that narrow market segment. The focus strategy is useful to attack the competitor's weakest point.

c. Miller and Friesen (1982)

Miller and Friesen (1982) classified firms into two types: conservative and entrepreneurial. They view innovation as an important part of strategy. The conservative firms regard innovation as costly and disruptive to production efficiency. In contrast, entrepreneurial firms will try to gain competitive advantage by continually innovating and being willing to take risks.

d. Gupta and Govindarajan (1984)

Gupta and Govindarajan (1984) proposed the build and harvest strategy. A build strategy aims to improve the market share while a harvest strategy aims at maximising

short-term profit and cash flow. Therefore, firms with a build strategy focus on external industry characteristics to secure the market relative to their competitors. They must be superior to their competitors. Because firms with a build strategy focus on the external environment, they will face greater environmental uncertainty and, thus, greater risks. A harvest strategy, however, looks at the internal operation efficiency to increase short-term profit and improve cash flow. Hence, the environment is less uncertain and is low risk.

In addition to the build and harvest strategy, there are two more types of strategic mission: hold and divest. For firms that already achieve a high market share, implementing a hold strategy is more appropriate in order to maintain the market share and obtain a reasonable return on investment. The divest mission is only applicable if firms plan to cease operation.

2.1.2.2 Strategy and Distinctive Competence

Miles and Snow (1978) suggest that different types of strategy are suitable for different functions. Snow and Hrebiniak (1980) examined relationships among strategy, distinctive competence, and organisational performance in four industries (plastics, semiconductors, automotive, and air transportation). The findings from a questionnaire survey of 247 managers in 88 companies indicate that all four organisational strategies suggested by Miles and Snow (1978) were being pursued in each industry with defenders and prospectors dominating the three industries except the semiconductor industry. Consistent with Miles and Snow (1978), the results also suggest that top managers of defender organisations in all four industries consistently perceived general

management, financial management, production, and applied engineering as their strengths, while prospector's strengths were in general management, product research and development, financial management, and basic engineering. The study also found that the analyser strategy could not be differentiated by distinctive competencies as easily as the defender and prospector. Top managers of analyser organisations perceived general management, financial management and production as a strength in three of the four industries, applied engineering in two of the industries, and marketing/selling in one industry, which contradicts the earlier expectation. However, consistent with expectation, reactors were found to have no strong or consistent pattern of distinctive competence.

Hambrick (1983) also explored differences in the functional attributes of prospectors and defenders. The functional attributes were segregated into three types: entrepreneurial, engineering and competitive. Among the entrepreneurial attributes, product R&D/sales and marketing expenses/sales were greater for prospectors than for defenders while forward integration was greater for defenders than for prospectors. Among the engineering attributes, defenders had higher gross assets/employees, higher value added/employees, higher average compensation rates and lower direct costs than prospectors. Thus, defenders tend to be more automated and efficient than prospectors. Defenders and prospectors did not show a significant difference in backward integration, process R&D expenditure, and capacity utilisation. Among the competitive attributes, defenders provided a better average service than prospectors. The price and quality did not differ between prospectors and defenders. Overall, these functional differences between defenders and prospectors were in line with Miles and Snow's (1978) propositions.

Gupta and Govindarajan (1984) studied the relationship between business unit strategy, managerial characteristics, and effectiveness at strategy implementation from the general managers of 58 strategic business units within firms headquartered in Massachusetts, Connecticut, and the state of New York. The study reveals that greater marketing/sales experience, greater willingness to take risk, and greater tolerance for ambiguity lead to effectiveness in the case of build business unit strategy but not for harvest business unit strategy. From the findings of this study, it can be argued that the build strategy seems to be similar to the prospector strategy as suggested by Miles and Snow (1978).

The differences in strategy implementation of organisations are also reflected in their employees' behaviour. Slocum, Cron, Hansen and Rawlings (1985) compared effective and ineffective plateaued salespersons in two companies implementing different business strategies. In this study, salespersons were considered as plateaued if they had not been promoted or had a lateral job change in at least five years. The result from 499 salespersons of two companies showed that there were significantly more plateaued salespersons employed in the defender company than in the analyser company. In defender firms, plateaued and non-plateaued employees were differentiated in terms of job history, job attitudes, work environment, job satisfaction, career stage, definition of success, and career-related attitudes. Plateaued employees had greater job tenure, were more satisfied with their immediate supervisors, work environment, and placed less emphasis on professional success than non-plateaued employees. In analyser firms, plateaued employees were older, had longer tenure in their jobs, and were less likely to leave the company and relocate than the non-plateaued employees. Even though no differences were found in job satisfaction, career stage, or definition of success between these two groups, significant differences existed between these groups in terms of job

attitudes and work environment. Since there were more plateaued salespersons employed in the defender company than in the analyser company, it can be concluded that employees in the defender company are not willing to take risk and experience a lesser extent of career advancement as compared with employees in the analyser company. Therefore, the findings of this study support the characteristics of strategy as proposed by Miles and Snow (1978).

Miller and Friesen (1982) stressed the importance of strategy in product and service innovation. Using a questionnaire survey of 52 Canadian business firms in Montreal, their study only focused on innovation in product lines, product designs and services offered. As expected, they found that conservative firms experience low differentiation, market homogeneity, unconscious strategy and face low environmental hostility level. In contrast, entrepreneurial firms face significantly higher degrees of environmental hostility, organisational differentiation, heterogeneity and technocratisation, consciousness of strategy, and a higher rate of growth in sales. Contextual variables such as structural, information processing, decision making and environment affect the firms' decision whether to adopt a conservative or an entrepreneurial strategy. Consequently, this strategy influences the determinants for product innovation. From the characteristics of entrepreneurial strategy as suggested by the results of this study, it indicates that entrepreneurial strategy is similar to the prospector and build strategy, and that the conservative strategy is similar to the defender and harvest strategy.

In another study that used Miller and Friesen's (1982) strategy typology, Karagozoglu and Brown (1988) also suggested that conservative firms emphasise stability, efficiency, risk avoidance, little innovation, standardised products and cost minimisation strategies while entrepreneurial firms focus on flexibility, risk taking, high

degree of innovation, unique products and rapid product change. Due to these characteristics, the results based on the survey of 54 Oregon manufacturing firms from 23 industries showed that conservative firms were unable to cope with turbulent environments. In contrast, entrepreneurial firms were found to be compatible with unpredictable environments but incompatible with stabile environments. These results are consistent with Miller and Friesen (1982) who suggested that entrepreneurial firms face higher degrees of environmental uncertainty as opposed to conservative firms.

Williams, D'Souza, Rosenfeldt and Kassaee (1995) investigated the relationship between business strategy, manufacturing strategy and firm performance in a mature industry. They define business strategy in terms of the level of differentiation while manufacturing strategy includes both technology and market orientation. Using data from 85 business units of broad woven cotton fabric mills in the U.S., which is classified as a mature industry, they found a significant positive relationship between both dimensions of manufacturing strategy and the business unit's level of differentiation. This suggests that an attempt has been made to complement business strategy with manufacturing strategy in the textile industry. For business units with a high level of differentiation, more emphasis on innovative manufacturing processes, product quality and variety of product offerings, and a decrease in the level of capacity slack maintained. In terms of the relationship between manufacturing strategy and business unit performance, only the level of sophistication of the quality assurance programmes and product quality were found to be positively associated with business unit performance. The results of this study also imply that the differentiation strategy is somewhat similar to the prospector, build and entrepreneurial strategy because this strategy places greater emphasis on innovation and has a diverse product range.

Based on the review above, it can be concluded that even though different taxonomies exist to explain different types of business strategies, these strategies seem to share similar characteristics. At one end, defender, low cost, conservative and harvest strategy are characterised as having little product or market development, smaller product range, emphasise tight control of operations, especially on price, quality, delivery, and service, risk avoidance and work in a stable environment. At the other end, prospector, differentiation, entrepreneurial and build strategy have the characteristics of having diverse and innovative products, rapid change of product line, always look for market opportunities, stress innovation and flexibility, are risk takers and able to work in an uncertain environment.

2.1.2.3 Strategy and Control Systems

The strategy adopted by firms is argued to influence the type of control system in the firms (e.g.: Hambrick, 1981; Simons, 1987; Jermias and Gani, 2004; Cadez and Guilding, 2008). Further, it has been asserted that firms that achieve the fit between strategy and the control system will gain better performance (e.g.: Frey and Gordon, 1999; Jermias and Gani, 2004; Boulianne, 2007). In this section, the empirical studies that examined the association between the above typologies and control systems will be reviewed.

Simons (1988) examined the relationship between tight budget goals and firm performance with the effects of business strategy and internal structural characteristics. Based on the survey of 86 Canadian manufacturing firms from various industries, the evidence suggests that prospector firms report tighter budgets than defender firms. The

relationship between budget goal tightness and performance is positive for both prospector and defender firms with a stronger relationship existing for prospector firms that follow proactive product/market strategies. A similar relationship was also observed between budget tightness and internal structural characteristics (monitoring and reporting controls, and formula-based remuneration). However, the relationship for formula-based remuneration is stronger for defenders than for prospectors. Thus, firm strategy influences the tightness of budget goals, performance and internal structural characteristics.

Simons (1990) conducted a two-year field study on two firms adopting different strategies within the same industry. He examined the top managers' use of formal control systems in implementing firm's strategy to achieve competitive advantage. Consistent with Miles and Snow, the findings indicate that prospector firms review strategic planning intensively, financial goals are established by every business unit and subject to review and meetings, the focus of budget is on strategy, tactics and subject to revisions, programmes limited to R&D, and bonus payment is based on subjective evaluation. In addition, the top managers of prospector firm focus on product innovation and marketing tactics rather than price and efficiency to compete and exploit new product development in an attempt to increase market share or explore new markets. They make planning and budgeting highly interactive and tactical. In contrast, defender firms review strategic planning occasionally, financial goals are set by top management and communicated down to subordinates, budgets are prepared to meet financial goals and no revision is done, product and process related programmes are monitored intensively, and bonus payment is based on both personal goals and contribution to generate additional profit. Top managers of defender firms devote less time to the firm's management control systems that are not related to strategic uncertainties such as long

term planning. Profit planning and budgeting are not interactive because the environment is relatively stable. The study of Simons (1988; 1990) suggests that prospector firms emphasise control systems more than defender firms.

Dansky and Brannon (1996) examined the relationship between strategic orientation and TQM practices in home health care organisations in the U.S. The findings revealed that organisations with an analyser strategy were most likely to be involved in quality improvement activities, followed by organisations with a prospector strategy. In addition, an inverse relationship exists between defender and TQM practices. Therefore, it can be argued that prospector and analyser firms concentrate on quality as a means to gain a competitive advantage.

Sim and Teoh (1997) examined the relationships between business strategy, environment, and control system attributes in Australia, Singapore and Malaysia. The findings suggest that there were significant relationships between strategy types and environmental characteristics and control system attributes in the three countries. Prospectors faced with a more dynamic, hostile or heterogeneous environment would require greater control systems with built-in flexibility and broader scope for informal communication. This finding applied equally across the three countries. Thus, consistent with Miles and Snow's (1978) propositions, this study supports the contention that the prospector strategy is more suitable in uncertain environments. Subsequently, prospector firms use a higher degree of control system to cope with the uncertainty of the environment, thus, consistent with the findings of Simons (1988; 1990).

A similar finding on the association between prospector and the use of control systems is further evidenced by Naranjo-Gil and Hartmann (2007) who investigated the extent

and direction of strategic change in 103 Spanish public hospitals. Specifically, they studied the use of the management accounting system in mediating the relationship between the composition of the top management team (TMT heterogeneity) and strategic change. The study found that the relationship between TMT heterogeneity and the extent of strategic change is more positive for organisations moving towards prospector positions, than for organisations moving towards defender positions. Furthermore, they found that both broad scope and interactive use of MAS have significant positive relationships with strategic change for the prospector group.

A recent study by Kober, Ng and Paul (2007) indicates that the strategy adopted by an organisation changes with the changes in the organisation. They studied the interrelationship between management control system (MCS) mechanisms and strategy. Two research questions were tested by way of the triangulation method. Documentation reviews, interviews with senior managers, and a questionnaire survey of a public sector entity over the three time periods revealed changes in strategy over the time periods studied. Initially, the firm implemented a reactor strategy. However, upon formation, its strategic mission changed to the defender strategy, which places greater emphasis on providing high-quality services in a cost-effective manner. Consequently, the strategy of prospector by penetrating new markets and differentiating itself from competitors started to emerge in the formation period and continued to evolve in the post-formation period. The study also supports a two-way interrelationship between MCS and strategy. MCS mechanisms used in an interactive manner help to facilitate a change in strategy and, when a change in strategy occurs, the MCS mechanisms change to match a change in strategy. Thus, the MCS both shapes, and is shaped by, strategy.

From the above review of the literature, it can be argued that the prospector strategy is more related to the use of control systems. One possible explanation could be due to the characteristics of the prospector strategy, which attempts to be the pioneer in the market and gain a competitive advantage through frequent introduction of innovative products. Thus, organisations with prospector strategy need an effective control system for monitoring and control purposes. In addition, the ability of prospector firms to survive in an uncertain environment also requires them to have an effective control system to cope with such an environment.

2.1.2.4 Strategy and Performance

As mentioned earlier, the strategy that the firms adopt could also affect organisational performance. Consistent with Miles and Snow (1978), Snow and Hrebiniak (1980) also showed that the reactor strategy is associated with poor financial performance, whereas the other three strategies are positively associated with performance. However, when the data were analysed according to industries, reactors in the plastics, semiconductor, and automotive industries consistently performed well below the average financial performance of the four strategy types, but not in the case of the air transportation industry where reactors not only performed above the average level for all four strategies, they outperformed both defenders and prospectors. The results are consistent with the notion that reactors are generally not viable in competitive industries but more feasible for protected industries.

Hambrick (1983) used data from the Profit Impact of Market Strategies (PIMS) to explore the effectiveness of the strategic types in different environments. The results

revealed that significant differences in the performance of prospectors and defenders depend on the nature of the environment and the performance measure used. Contrary to Snow and Hrebiniak (1980), the result from the t-tests showed that defenders consistently outperform prospectors on return on investment (ROI) for each environment except the mature-innovative environment. Defenders also outperform prospectors on cash flow on investment (CFOI) within each environment. On the other hand, prospectors only outperform defenders on market share change in innovative industries. However, in multivariate regression, both prospectors and defenders were negatively associated with both ROI and CFOI in a mature non-innovative environment. It was the analyser, which gained the superiority in such an industry. Therefore, the relationship between strategy typologies and performance could be influenced by other factors such as type of industry, the nature of the environment and type of performance measure as suggested by Snow and Hrebiniak (1980), and Hambrick (1983).

Another study that examined the link between strategy and performance is that of Parnell (1997), who surveyed 219 computer related equipment manufacturing firms. Consistent with Miles and Snow (1978), the responses indicate that reactor firms performed significantly lower than others for both return on assets (ROA) and revenue growth, while balancer firms achieved significantly higher ROA and revenue growth than others. These relationships between strategy and performance are stronger when the composite strategy measured is used rather than based solely on the top executive perception. The high consensus business group, where respondents share similar assessments of strategy, also outperformed the low consensus group.

Dahlan, Md Auzair and Wan Ibrahim (2007) surveyed whether business strategy and external environment moderate the relationship between tight budgetary control and

firm performance in Indonesian manufacturing firms. Based on the response from 61 top managers, the results indicate that a positive relationship between tight budgetary control and firm performance existed for prospector firms. However, the hypothesis of a negative relationship between tight budgetary control and performance for defender firms was not supported. In addition, external environment did not act as a moderator in the relationship.

Using Porter's (1980) classification of strategy, Govindarajan (1988) surveyed 121 strategic business unit (SBU) general managers from firms listed on the Fortune 500. He examined the relationship between SBU competitive strategies and three administrative mechanisms (budget evaluative style, decentralisation and locus of control). The findings suggest that low emphasis on meeting a budget and high managerial internal locus of control are associated with high performance in SBUs with product differentiation strategy, and no support was found in the relationship between SBU strategies, decentralisation and effectiveness. In addition, the alignment of these three administrative mechanisms resulted in superior performance, especially in business units focussing on differentiation strategy. These findings imply that the effectiveness of strategy implementation varies between business units. Therefore, different business units need to employ different strategies that are suitable to their operations in order to gain higher performance.

Prajogo and Sohal (2006) examined the fit of TQM practices in mediating the relationship between organisation strategy and organisation performance. The results from a survey of 194 middle/senior managers from Australian firms suggest that TQM is positively and significantly related to differentiation strategy, and that it only partially mediates the relationship between differentiation strategy and three performance

measures (product quality, product innovation, and process innovation). However, differentiation strategy is significantly and positively related to all three performance variables. In contrast, cost leadership strategy does not have a significant correlation with any of the three performance variables. The result of this study is similar with Dansky and Brannon (1996) who found that prospector firms are significantly related with TQM; and that of Govindarajan (1988) who suggest that differentiation strategy is significantly related with performance.

The relationship between conservative and entrepreneurial strategy with performance has also been studied. For example, Chenhall and Morris (1995) examined this relationship together with the combined effect of organic processes and management accounting systems. The survey data from 72 firms suggested that the interaction of organic decision and communication processes with the use of management accounting systems in enhancing performance is stronger in firms with an entrepreneurial strategy than firms with a conservative strategy. This study also found that the association between enhanced performance and organic processes for entrepreneurial firms only holds when MAS was extensively used, but not when MAS was used less extensively.

Li, Zhang and Chan (2005) also examined the relationship between entrepreneurial strategy and performance. In addition, their study included the contingency effect of external environments and internal firm competences. The survey results from 184 new technology ventures in Beijing High Technology Experimental Zone in China indicate that environmental uncertainty and marketing competence moderate the relationship between entrepreneurial strategy and performance. In other words, the relationship between entrepreneurial strategy and performance is positive when the environment is highly uncertain. The positive relationship between entrepreneurial strategy and

performance is also found in new ventures with great marketing competence. Therefore, these results implicate that the effectiveness of entrepreneurial strategy in improving organisational performance is contingent on a firm's internal and external factors. Firms should consider these factors to benefit from an entrepreneurial strategy.

The findings of the above study suggest that the implementation strategy does have an impact on organisational performance. Among the strategy typologies, prospector, differentiation and entrepreneurial strategy are found to be more related to increased performance. However, there are other factors that could mitigate this relationship, such as type of industry, nature of environment and the use of control systems.

As discussed earlier, the strategy adopted by organisations could influence the adoption of management practices and control systems used by these organisations. In the next section, the management practices or manufacturing techniques that are frequently adopted to cope with the changes in manufacturing environment, IMP, will be discussed.

2.2 Integrated Manufacturing Practices

In this section, the three main components of IMP: JIT, TQM and AMT will be discussed. First, the JIT philosophy and its prior studies will be reviewed, followed by the discussion on TQM and AMT, respectively.

2.2.1 The JIT Philosophy

2.2.1.1 Definition

JIT is a philosophy based on the idea of producing the necessary products in the necessary quantities at the necessary time (Sugimori et al., 1977), while at the same time, eliminating waste in operations to ensure continuous improvement. The idea of JIT was originally developed by the Toyota Motor Company in Japan due to the lack of natural resources in the country. The idea was then formalised into a management system when Toyota attempted to meet the precise demand of customers with minimum delay. Taiichi Ohno, a vice president of Toyota was responsible for the development of JIT (Sugimori et al., 1977). During the early 1970s, this approach began to attract wide attention in Japan, and by the mid 1970s many Japanese companies had adopted this approach. At that time, the approach was called the "Toyota Manufacturing System". JIT is the U.S. term to describe the Toyota manufacturing system. The JIT philosophy began to attract significant attention from the West in the late 1970s when American manufacturing industries were faced with a lack of competitiveness compared to Asian and European manufacturers. Today, it is widely recognised as one of the world's most efficient manufacturing operations (Russell and Taylor III, 1995).

According to Foster and Hongren (1987), JIT is a philosophy that focuses on four important aspects: the elimination of all activities that do not add value to a product or services, a commitment to a high level of quality, a commitment to continuous improvement in the efficiency of an activity, and emphasis on simplification and increased visibility to identify activities that are non value added. JIT primarily relies on

improving operations through reducing lot sizes and inventories. Excess inventories could increase cycle time and operating expenses, which, consequently, will reduce the profitability level.

Foster and Hongren (1987) also state that JIT is normally adopted in two functional areas: purchasing and production. JIT purchasing is meant for retailers, wholesalers, distributors, and manufacturing companies, while JIT production is solely for manufacturing companies. Thus, manufacturing companies can adopt both JIT purchasing and production in their operations.

In the manufacturing context, JIT philosophy is based on the concept of delivering raw materials and producing products just as needed and demanded. The focus is on minimising raw material, work-in-process, and finished goods inventory with the aim of reducing inventory costs and inefficiencies such as machine breakdowns and inspection backlogs in the manufacturing cycle. JIT implementation elements are designed to eliminate these productivity problems. For example, Fullerton et al. (2003) listed ten practices or elements that are considered representative of a comprehensive JIT implementation. The elements are focused factory, reduced set-up times, group technology, total preventive maintenance, multifunctional employees, uniform workload, *kanban*, total quality control, quality circles, and JIT purchasing. Listed below are several JIT elements used in previous studies (Foster and Hongren, 1987; Russell and Taylor III, 1995; Fullerton et al., 2003) comprising both JIT purchasing and production.

Setup time is the time required to set up the machines. JIT operation is designed to reduce the time and costs incurred in changing tools and fixtures from producing one

product to another. Therefore, preventive maintenance needs to be rigorous and regularly scheduled. Operators are responsible for the maintenance of the machines at all times.

Similarly, the production line will be stopped if work in process is found to be defective. However, there are no buffer inventories available in JIT production to overcome this problem. Therefore, quality control is crucial to ensure that all materials, parts and work in process inventories are of high quality.

Another important JIT element is *kanban*. *Kanban* is the Japanese word for card. Each card contains specific information such as the part number, type of part, quantity, and preceding and subsequent workstations. In the JIT environment, the *kanban* system is used to 'pull' the necessary parts, materials or products when needed in the production process. It is also known as the 'pull system', as a result of demand-driven environment.

As mentioned earlier, the emphasis of JIT is on simplification. Thus, non-value added activities that occur in the production processes would be eliminated. JIT firms have usually restructured the layout of their plant by placing greater emphasis on streamlining material handling between successive workstations.

As the JIT system only requires the necessary materials just as they are needed, the number of suppliers and size of deliveries will be reduced. JIT firms must establish a close relationship with suppliers and develop a strong and long-term working relationship with them. Only reliable suppliers are retained.

These changes in purchasing and production activities also affect the accounting systems adopted by JIT firms. For example, operating costs such as handling of materials and indirect labour can be classified as direct costs because they can be directly traced to a single production line. Moreover, by eliminating the warehouse function, the warehouse cost pool and its allocation base is no longer available. This will affect the composition in cost pools and choice of allocation bases. The dollar value of materials or number of deliveries may be the appropriate allocation bases for JIT systems. The use of variance analysis has also become less important in JIT firms because these firms focus on reducing total operating costs not individual cost such as purchase price, labour and overhead costs.

However, in an attempt to eliminate inefficiencies in the manufacturing processes, the JIT system, which was initially designed to minimise inventory level, subsequently leads to continuous improvement for the manufacturing system as a whole. As such, implementation of the JIT philosophy will have a profound impact on an organisation.

2.2.1.2 The Effect of JIT Implementation

Sugimori et al. (1977) discussed the JIT concept and its implementation in Toyota. After the implementation of this system, Toyota experienced the highest labour productivity among automotive industries for major countries, extremely high turnover rate of working assets, and increased workers participation in the production improvement. The work by Sugimori et al. (1977) is one of the earliest works on the JIT system. Subsequently, the literature on JIT started to grow.

Among the empirical studies, Crawford, Blackstone, and Cox (1988) represent the earliest published work. Their study involved a survey of 39 companies in the U.S. to identify implementation and operating problems faced by early JIT adopters. The study reported on the reasons for adopting JIT, the associated benefits and also the implementation and operational problems experienced by these companies. The main reasons reported for adopting JIT were to regain a competitive position, to increase profit, to reduce cost, and to improve quality. These companies also gained benefits from implementing JIT. Among the implementation benefits were a reduction in inventory level, lead time, production and warehouse space, and overall manufacturing costs, as well as increased product quality and profit margin. These benefits, thus, led to a significant increase in the competitive position of these companies. However, these firms also experienced some problems in implementing JIT. Cultural resistance to change represented the major problems, followed by lack of resources in terms of training and education, lack of top management support, and performance measurement. In addition, some operational problems such as inability to meet daily schedule, excessive scrap, lack of supplier support, poor forecasting, data accuracy and machine breakdowns were also faced by these early adopters of JIT. They suggested that the future adoption of JIT should emphasise education and training, total quality control and preventive maintenance, and involvement of multi-departments in the early phases of the implementation process.

Gilbert (1990) conducted similar studies on the implementation of JIT among manufacturing companies in the U.S. He focused on how small or medium-size companies (SME) can be successful in their JIT implementation efforts. Data from 134 companies indicates that these firms started to gain the benefits of JIT implementation and product quality appeared to be the most important aspect for plant operation in a JIT

environment. The significant operational changes faced by these companies were a major reduction in inventory level and a change from make-to-stock to make-to-order operations. However, in general, these companies were still at the infancy stage of JIT implementations. They just started to utilise the most important JIT elements.

JIT is synonymous with quality. Youssef (1994) investigated 165 manufacturing firms from three industries (industrial machinery equipment, electronic and electric machinery equipment, and transportation equipment) in the U.S. He revealed that intensity levels of JIT differ significantly in all dimensions of quality. The group with the highest JIT intensity outperformed other groups with lower JIT intensity on product quality, vendor quality, design and engineering quality, manufacturing workmanship, and overall quality. In addition, the study also showed that the intensity of JIT is highly associated with overall quality. The results of the study imply that JIT does impact on quality, thus, providing support to the study of Crawford et al. (1988), and Gilbert (1990).

Even though the concept of JIT was introduced three decades ago, "JIT has remained popular in practice and is still widely utilised in firms around the globe" (Mackelprang and Nair, 2010, p. 283). This is due to the importance of JIT among practitioners. The use of JIT could help them to reduce costs and improve product quality. Furthermore, in the academic field, the research on JIT remains significant, especially in operations management research (Mackelprang and Nair, 2010).

2.2.2 The TQM Philosophy

2.2.2.1 Definition

TQM is an integrative philosophy of management for continuously improving the quality of products and processes to achieve customer satisfaction by eliminating waste, improving quality, doings things right the first time, developing skills and reducing product costs. Thus, the customer is the focus of all the efforts to improve the product and process quality. Initially, it was limited to factory floors, but it is now applicable to all areas of organisation (Dean and Snell, 1991). The basic philosophy of TQM is applicable to any type of organisation: manufacturing or service, small or large, public or private. As such, it has a wider applicability than JIT principles, which are primarily suited to more repetitive production with steady demands.

TQM philosophy is based on the premise that an organisation must build quality into its products and processes. To materialise this objective, it requires involvement of all levels of employees in the organisation. Top management should initiate the commitment to achieve and maintain quality and this should be followed by subordinates from all levels of the organisation and across all areas and functions. As employees are responsible for the quality, they are allowed to participate in the TQM process. The employees may give feedback about quality by identifying and providing solutions for quality problems. This approach is also known as the employee involvement programme. Statistical control methods, such as control charts, can assist employees to identify quality problems, their causes, and how to solve them.

Another method is called the Taguchi method, introduced by Dr. Genichi Taguchi to produce high quality products and process design at minimal costs. This "is achieved with product uniformity around a target value for a quality characteristic rather than being achieved if the value of the quality characteristic simply conforms to specifications" (Russell and Taylor III, 1995, p. 127). The Taguchi loss function, which measures the associated costs from poor quality, such as warranty costs and rework, becomes the basis for this stance.

There are certain costs that are important in the implementation of TQM throughout the organisation. These costs are termed as costs of quality (COQ). COQ consists of four major components: prevention costs, appraisal costs, internal failure costs and external failure costs. The first two types of cost are associated with the effort to achieve good quality products, while the latter are concerned with poor quality products that do not conform to specification. Some of these costs are not easy to measure (e.g. the cost of loss of sales). Others are measured using indices or ratios such as labour index, cost index, sales index and production index.

In implementing TQM, organisations should also maintain a close relationship with their suppliers. The focus is on quality rather than price. The organisations should work interdependently with suppliers to improve their quality. This is a normal scenario for organisations that implement TQM and only have a few suppliers.

In a broader concept, the focus on quality to ensure continuous improvement has been widely recognised in organisations around the globe. Several awards have been introduced to promote a trend towards quality management. In Japan, The Deming Application Prize that was created in 1957 aims to recognise organisations that

successfully apply companywide quality control based on statistical quality control. In the U.S., the Malcolm Baldrige National Quality Award, which was established in 1987, has identified seven (7) broad dimensions to qualify for the award. The dimensions are: leadership, information analysis, strategic quality planning, human resource management, quality assurance of products and processes, quality results, and customer satisfaction. In order to sustain and gain continuous improvement in overall business performance, an organisation must apply these dimensions continuously. Improved market share, better financial performance, and better employee satisfaction and performance indicate the success of the implementation of TQM. Other awards include the Award for Excellence in Productivity Improvement, provided by the Institute of Industrial Engineers since 1980 to recognise companies that have achieved a competitive advantage through productivity and quality programmes, and the President's Award, which was established in 1988 to recognise quality within the U.S. government.

2.2.2.2 The Effect of TQM Implementation

According to Kaynak (2003), the empirical research in TQM began with developing instruments to measure TQM practices. For example, Saraph, Benson and Schroeder (1989) outlined eight (8) critical factors of quality management that were found to be valid and reliable. The measures are: the role of management leadership and quality policy, role of quality department, training, product/service design, supplier quality management, process management, quality data and reporting, and employee relations. In a similar vein, Garvin (1983) compared TQM practices in Japanese and U.S. firms.

McCabe (1996) reported a study of U.K. companies from different industries that had already implemented TQM. The results showed that the majority had achieved greater success against performance indicators than was the average for their respective industries. In Malaysia, Idris, McEwan and Belavendram (1996) surveyed 247 ISO 9000 registered manufacturing companies in 1995. Their results showed that the electrical and electronic engineering industry in Malaysia has widely adopted TQM and the main benefits that resulted were improved customer satisfaction, teamwork, productivity, communication, and efficiency.

Choi and Eboch (1998) empirically examined the relationship between TQM practices and customer satisfaction through plant performance as a mediating variable. Based on a survey of 339 automotive and electrical manufacturers located in Ohio, the results showed that TQM practices have a strong impact on customer satisfaction and a moderate impact on plant performance. As a mediating variable in this study, plant performance was found to have no significant impact on customer satisfaction. One possible explanation for the insignificant result could be the loose coupling between plant performance and customer satisfaction. Managers may have a conflict in their action to increase plant performance while at the same time trying to satisfy the customer.

From a different perspective, Hendricks and Singhal (2001) examined the effect of various firm characteristics (firm size, capital intensity, firm diversification, maturity, and timing) on TQM implementation. Using a sample of 435 award winners, they found that smaller firms tend to get more benefit from TQM as compared to larger firms. Lower capital-intensive and more focused firms appear to benefit more from TQM rather than higher capital-intensive and diversified firms. Independent award winners,

which are given by organisations (more mature), are found to demonstrate more effective TQM implementation than supplier award winners, which are selected by customers (less mature). Finally, the study found no significant differences between the performance of earlier and later implementers of TQM. The results of the study indicate that firm characteristics can moderate the benefits of TQM implementation. Managers must consider all factors to ensure successful TQM implementation.

In Spain, Martinez-Lorente, Sanchez-Rodriguez and Dewhurst (2004) surveyed 442 of the largest industrial companies. In contrast to the findings of Hendricks and Singhal's study, they found that companies that adopted TQM have a higher sales turnover and more employees, which suggests that company size is an important factor in deciding whether to adopt TQM or not. The study also found that the importance of quality is another factor to be considered when the companies decide to apply TQM. The study also investigated the relationship between information technology (IT) and TQM. The results showed that more advanced companies introduced both IT and TQM. IT is found to have an impact on TQM. In other words, when IT is employed intensively, the perceived impact on TQM is greater. In terms of performance, companies that adopted TQM have better operational and quality performance but not profitability on sales turnover and profit per employee.

The benefits of TQM implementation were further observed by Rao, Youssef and Stratton (2004). They conducted a case study analysis on the Film and Converting Group Plant in Salisbury, U.S., that had been experiencing significant losses in its operation since 1981. The management decided it would cease operation if the company could not break-even by the end of 1990. TQM was then introduced into the company to address the problem. Three years after the implementation of the TQM programme,

significant changes in overall quality and performance were observed. Product returns were reduced from above 7% of sales to less than 1%, rework inventory was decreased from over 1 million pounds to less than 150,000 pounds, in addition, there were gains in new products and customers, sales and profits. The decision to shut down the operation was no longer relevant. Hence, the benefits of TQM implementation are not limited to stable organisations, but can also be applicable to high-risk organisations.

2.2.3 Advanced Manufacturing Technology

2.2.3.1 Definition

In the manufacturing environment, AMT is an integral part of manufacturing information systems. It uses computer-based technologies to integrate manufacturing processes. AMT comprises various components. The brief descriptions of the components are discussed below based on several studies (Russell and Taylor III, 1995; Meredith, 1987; Kotha and Swamidass, 2000; Koc and Bozdag, 2009).

Numerical Control (NC) is a machine tool that is controlled by numerical commands punched on tape. If the machine tool is attached directly to the computers and controlled electronically, it is called Computer Numerical Control (CNC). When the computer is centralised and directing the operations of a number of machines, it is then called Direct Numerical Control (DNC).

Computer Aided Design (CAD) is the use of a computerised software package to support the drawing and design function by creating new products, and modifying

existing products, etc. Computer Aided Manufacturing (CAM) is the use of computers to support manufacturing engineering activities and to aid in the management, control, and operations of manufacturing through a direct or indirect interface with the human and physical resources of the organisation. Computer aided test and inspection performs tests and inspections of incoming and in process materials. Computer Aided Process Planning (CAPP) helps engineers to design the production process faster.

Automated materials handling concerns the movement of materials from storage to various production processes. The materials are loaded and unloaded onto and from machines, and back to storage from shipping by using automated devices. Examples of automated material handling systems are forklifts, cranes, conveyors, and robotic and automated guided vehicle systems.

Robotic is a programmable manipulator to accomplish manufacturing tasks. Generally, there are two types of robots. The sophisticated and reprogrammable robots are able to handle various tasks such as welding, material transfers, machine loading, painting and assembly. The simplistic robots or also known as ‘pick and place’ robots can only perform simpler tasks such as transferring items from one place to another.

Automated packaging refers to the use of a computer and automated system for the packaging of materials, whereas automated storage relates to the use of a computer for the storage of materials such as raw materials, inventory, rework and scrap, tools, fixtures, and spare parts, under a certain degree of automation for a specific period of time.

Flexibility is an important characteristic of AMT. It refers to the ability to produce a wide variety of products, to introduce new products and modify existing products quickly in order to satisfy customer needs (Russell and Taylor III, 1995). A Flexible Manufacturing System (FMS) is a system in which two or more machines with automated material handling capabilities that are controlled or programmed by computers, is capable of both multiple path acceptance of raw materials and multiple path delivery of a finished product. In other words, FMS results from physically connecting DNC machines with an automated material handling system.

Material Requirements Planning (MRP) is a computerised inventory control and production planning system with the objective of ensuring that only the lowest possible inventory level is maintained at a time but that it is available when it is needed. Manufacturing Resource Planning (MRP II) is an interconnected computer system or information system to control, coordinate and integrate the entire manufacturing system from order entry through scheduling, inventory control, production, distribution, finance, accounting, accounts payable, etc. To simplify, MRP II is an improved version of MRP that plans all the resources needed to run a business. It is also applicable to the service sector. Thus, it has a broader scope than MRP.

In modern business environments, where information technology is crucial to ensure the smooth flow of operations, the use of a Wide Area Network (WAN) and Local Area Network (LAN) become more important. WAN refers to the use of computers among the firms to communicate with each other, whereas LAN refers to the use of computers in the firms to communicate with each other. It is an internal or non-public communications system that allows various devices to be connected to the network to communicate with each other over a certain distance.

2.2.3.2 The Effect of AMT Implementation

Jaikumar (1986) compared FMS implementation in Japan and the U.S. By conducting a study on 35 FMS firms in the U.S. and 60 in Japan, in year 1984, he concluded that the main reason contributing to the unsuccessful implementation in the U.S. was due to the lack of flexibility. He also examined 22 FMS installations at seven Japanese firms and showed that FMS really brings more benefits than conventional systems. Among the benefits are reducing the number of workers, boosting average uptime, ability to run reliable untended operations, better quality products, reduce inventories and achieve their ROI targets. The benefits of FMS installations far outweigh their costs.

Parthasarthy and Sethi (1992) developed several propositions to gain higher performance in an AMT environment. They focused on the relationships between technology, strategy and structure. They argued that superior performance could be achieved if the business strategy of AMT firms emphasise the scope and speed flexibility, quality leadership but not cost leadership. They also proposed that AMT will be best operated in team based organisational structures and when shop floor employees have diversified skills, among others.

Noori (1997) conducted a comprehensive case study of 19 manufacturing firms in Malaysia in the year 1994. The firms represented automotive, telecommunications and home electronics industries. The results suggest that flexible technologies in newly industrialised countries such as Malaysia are more matured and outmoded than industrialised countries. This scenario is due to the availability of low cost labour and

high AMT implementation costs. The adoption of AMT by these firms was successful and they are planning to invest more in the future. The firms also perceived that quality, manufacturing skills and fast delivery were the most important internal factors to succeed, whereas research and development, product design and manufacturing skills were perceived as less important. As for external success factors, training managers was rated as the most important factor. The need for external assistance increases as technology becomes more sophisticated.

Tracey, Vonderembse and Lim (1999) empirically examined the link between strategy and manufacturing operations to achieve competitive advantage. The responses from 474 managers from various manufacturing firms in the U.S. indicate that there was a positive relationship between AMT and competitive capabilities as well as between manager's participation in strategy formulation and competitive capabilities. Specifically, AMT impacted on delivery capabilities, price offered and product line breadth whereas manager's participation impacted product line breadth significantly. The positive relationship was also observed between competitive capabilities and performance as measured by customer satisfaction and market performance. This implies that managers who implement AMT successfully and are involved in strategy formulation may increase product flexibility, which, in turn, improves performance.

Kotha and Swamidass (2000) investigated the relationships between strategy, AMT and performance in the U.S. manufacturing firms. Nineteen AMT items were grouped into four factors: information exchange and planning technology, product design technology, high-volume automation technology and low-volume flexible automation technology. Using survey responses from 160 firms, they found that high-volume automation technology was not associated with cost leadership strategy. All four factors, except

low-volume flexible automation technology, were positively associated with a product differentiation strategy. However, this factor was not associated with product differentiation strategy when the entire sample of the firms was used. Further analysis on this factor when the sample was stratified on the profitable firms, the positive association between low-volume flexible automation technology and differentiation strategy existed. Similarly, all four AMT factors were found to be associated with the differentiation strategy in firms with high growth. This study also showed that the fit between strategy and AMT use were associated with improved performance.

Youssef and Al-Ahmady (2002) studied the relationship between FMS and quality management practices in aerospace, electronics, industrial equipment, metal products and the automotive industry in the U.S. They found that FMS significantly affects all aspects of quality management practices under study (importance of quality as strategic objective, marketing and consumer related quality, cost of quality, total employee involvement, and quality tools). The findings of this study and that of Noori (1997) imply the importance of quality management practices in AMT implementation. These two practices are indeed interrelated.

AMT is also applicable for small firms. Jaikumar (1986) observed that small and medium-sized (SME) firms in Japan also successfully implemented FMS. He indicates that the effective use of this system by the small firms in Japan is partly due to the efficiency in labour. Meredith (1987) conducted case study analyses on two firms in Ohio and Illinois. He showed that small firms could also benefit from AMT adoption. He further listed several factors that may contribute to the success of small firms in an AMT environment. Factors such as organisational inertia, long-term planning,

competitive basis, human resource stability and technology implementation were identified as their success factors.

Dangayach and Deshmukh (2005) classified AMT into three types: direct, indirect and administrative. Direct AMT refers to technology used on the factory floor to cut, join, reshape, transport, store or modify materials, such as CNC, DNC, robotics and FMS. Indirect AMT relates to the technology used to design products and schedule production like CAD, MRP and MRP II. Administrative AMT technology is used to give administrative support to the factory and integrate its operations with other departments, such as ERP and ABC. Using these classifications, they conducted an exploratory survey on 122 Indian SME manufacturing firms comprising automobile, electronics, machinery and process sectors. The results indicate that firms in the automobile and electronics sectors invested more in indirect AMT whereas firms in the machinery and process sectors invested more in administrative AMT. The study also provided evidence on the importance of competitive priorities in AMT firms. Similar to Noori (1997), these firms rated quality as the most important factor, followed by delivery, cost and flexibility.

In Malaysia, Isa and Foong (2005) examined the level of AMT adoption among Malaysian manufacturing firms. The findings from 110 small to large firms showed that MRP and CAD were the most extensively used AMT components, while DNC was the least used AMT component. The computer integrations were extensively used in quality control and materials planning, followed by production scheduling and maintenance, and materials handling and quality control. Component manufacturing and assembly used the least computer integration. In addition, the relationship between AMT adoption and management accounting practices was also examined. The results suggest that firms

that adopt AMT tend to use standard, process, activity-based and marginal costing systems. Thus, firms with a high level of AMT adoption have extensively used the new costing methods such as ABC, with a mixture of the traditional costing systems, such as standard and process costing systems. AMT firms were also found to place greater emphasis on the non-financial measures of performance and innovative management reports such as suppliers' performance and benchmarking reports. These findings imply that AMT adoption requires changes in the operations of the organisations in terms of the cost structure and information needs of managers.

Abdul Rahman (2008) explored the buyer-supplier relationship (BSR) in the acquisition and implementation of AMT in Malaysia. The survey data from 147 manufacturing firms representing small, medium and large firms, indicate that BSR has a significant positive relationship with both types of performance (technology and implementation). Firms that established close relationships with suppliers tend to achieve a higher performance level due to the ability to integrate resources and activities in the process of acquiring and implementing AMT.

Koc and Bozdag (2009) studied the impact of AMT practices on firm performance in SME manufacturing firms in Turkey. The responses from 102 firms revealed that these firms used AMT in their operations, especially the use of local area networks (LAN), CAD and computer aided manufacturing (CAM). The results also revealed that six of the manufacturing parameters have a significant impact on performance. Product design performance, fixture utilisation, setup and production planning performance were found to have a positive impact, while capacity utilisation and finished product inventory were found to have a negative impact on firm performance.

Thus, based on the evidence provided by the previous studies above (Jaikumar, 1986; Meredith, 1987; Dangayach and Deshmukh, 2005; Isa and Foong, 2005; Abdul Rahman, 2008; Koc and Bozdag, 2009), the current study also intends to include all manufacturing firms in the analysis regardless of size. Size no longer represents a barrier to entry for AMT (Jaikumar, 1986).

2.2.4 Integrated Manufacturing Practices

2.2.4.1 Definition

Among all the advanced manufacturing practices, JIT, TQM and AMT are the most frequently adopted practices. Dean and Snell (1991) categorised these three practices as "Integrated Manufacturing", which represents a new paradigm for manufacturing. These three practices may complement one another. Dean and Snell (1991) made a comparison between integrated and conventional manufacturing practices in three dimensions, namely, the production stages, the functional departments and the manufacturing goals. The integration of these three manufacturing practices "involve a streamlined flow of automated, value-added activities converting raw materials into finished goods, uninterrupted by moving, storage, or rework" (Dean and Snell, 1991, p. 779). All functions are connected electronically, with a focus on continuous improvement in cost, quality, and lead time. Table 2.1 depicts the comparison between integrated and conventional manufacturing, as suggested by Dean and Snell (1991).

Table 2.1: Comparison of Integrated and Conventional Manufacturing

Dimensions	Conventional Manufacturing	Integrated Manufacturing
Stages	Successive value-added stages are buffered by moving, storing, and inspecting parts. Tests and rework are often necessary. Work-in-process inventory is used to decrease interdependence between stages. Activity that adds no value predominates.	Stages are integrated in terms of time, space, and information. AMT integrates stages electronically, JIT inventory control eliminates work-in-process inventory, and TQM reduces rework, test, and inspection. Value-added activities predominate. Machines are grouped to reduce moves between stages.
Functions	Functional responsibilities are clearly differentiated. People are not concerned with problems in other functions. Functions use different information systems and databases.	Continuous improvement (TQM) requires cross-functional problem-solving, focus on internal customers. AMT promotes common databases. Throughput time reduction (JIT inventory control) requires collaboration across functions.
Goals	Firms see themselves as trading off cost, quality, and lead time. Employees in each function strive to achieve only one goal, at the expense of other functions' goals.	Firms see goals as compatible rather than in opposition, especially when reducing lead time. Good quality costs less. Functions strive to improve on all goals simultaneously; AMT and TQM facilitate this process.

(Source: Dean and Snell, 1991)

As the aim of the JIT system is to reduce the inventory level, the main benefit of the JIT system is the major reduction in inventory storage costs. However, JIT cannot work with poor quality materials, parts and processes, which can lead to many defects at any stage of the production process, because there is no reserve inventory available if the production process stops immediately. As such, the JIT system can only be applied with high quality materials and processes at all stages. To achieve this, organisations should

implement quality management at all levels of the organisation and supplement it with advanced technology to ensure the smooth flow of the production process. Youssef (1994) also revealed that integrating JIT with other time-based technologies such as TQM explains the significant relationship with quality. Hence, the simultaneous implementation of JIT, TQM and AMT may lead to an improvement in productivity.

2.2.4.2 The Effect of IMP Implementation

The review of literature suggests that only Dean and Snell (1991; 1996), and Snell and Dean (1992; 1994) examined the use of integrated practices simultaneously. Dean and Snell (1991) examined the moderating effects of organisational inertia in the relationship between integrated manufacturing and job design, while Snell and Dean (1994) extended the study by investigating the moderating effects of jobs and organisational inertia in strategic compensation for integrated manufacturing. Whereas Snell and Dean (1992) studied the relationship between integrated manufacturing and human resource management, Dean and Snell (1996) empirically examined the strategic use of integrated manufacturing.

The main focus of Dean and Snell (1996) was to explore the relationship between integrated manufacturing and performance. From the responses of 92 manufacturing firms in the U.S., they found that the overall set of integrated manufacturing was not significantly related to performance, and that only TQM had a significant positive relationship with performance. The study also found that the relationship between integrated manufacturing and performance was not moderated by competition, except for AMT/complexity. However, the study found support for the moderating effect of

manufacturing strategy (quality, delivery flexibility, scope flexibility, and cost) on the relationship between integrated manufacturing and performance. Specifically, AMT was found to significantly and positively interact with quality strategy, and significantly and negatively interact with cost strategy. Similarly, the relationship between TQM and performance was also negatively moderated by cost strategy. These findings imply that the performance of AMT firms are higher if implemented with a manufacturing strategy focusing on quality, rather than cost. However, when manufacturing strategy was used as a dependent variable, AMT had a significant negative relationship with quality strategy and TQM was found to be positively related with quality, delivery and scope flexibility strategy. None of the integrated manufacturing was related with low-cost strategy.

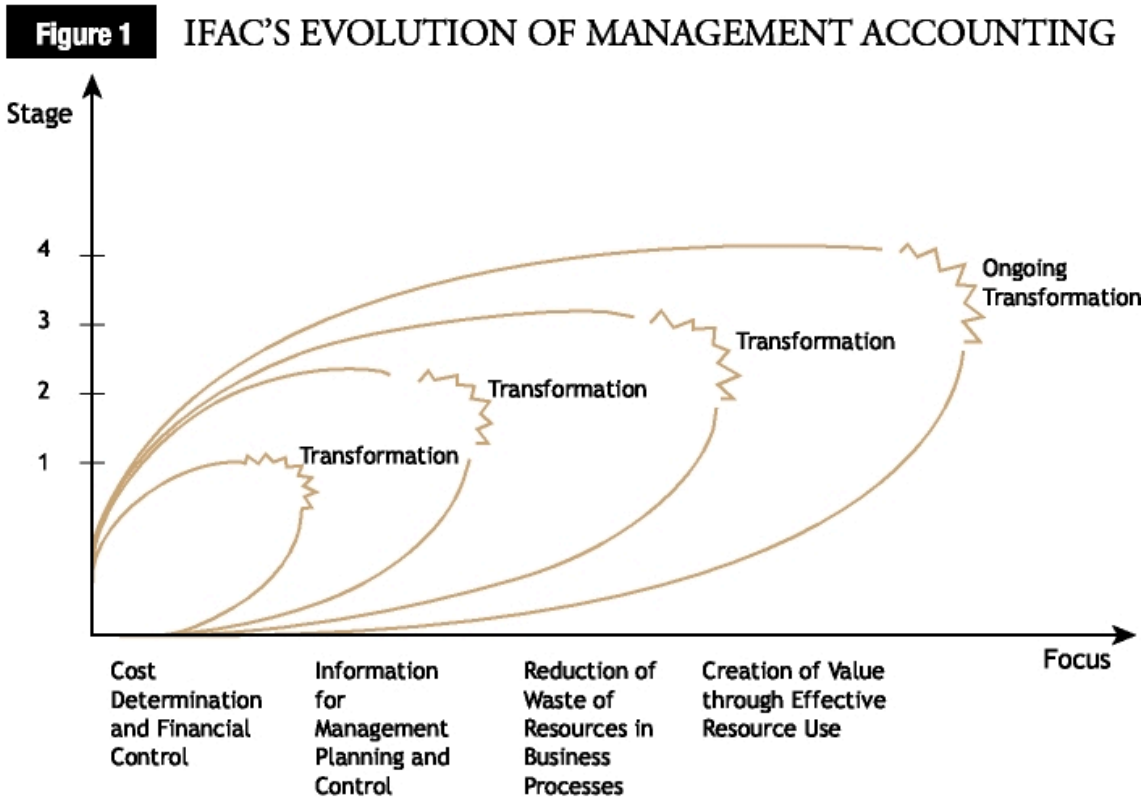
2.3 Management Accounting Systems

The adoption of world class, integrated manufacturing practices such as JIT, TQM and AMT requires the use of MAS information that could facilitate their implementation. For example, JIT's focus on continuous improvement by eliminating non-value added activities would require an information system that can provide and evaluate the information on quality, setup times, defects, rework, and throughput time for monitoring and decision making. The MAS should also provide the essential information for management control purposes. As asserted by Chenhall and Langfield-Smith (1998, p. 243), "strategic priorities should be supported by appropriate and effectively implemented manufacturing processes and information systems, including those providing management accounting information".

2.3.1 The Evolution of Management Accounting

It has been argued that management accounting needs to change with the changes in organisation and the business environment (e.g.: Kaplan, 1984; Mia and Clarke, 1999; and Isa, 2007). There has been increasing interest concerning the relevance of management accounting. For example, Johnson and Kaplan (1987) published a book, '*Relevance Lost: the Rise and Fall of Management Accounting*', which focuses on this issue. They argued that management accounting systems need to change if they are to provide appropriate support to managers in the new business environment. They further argued that management accounting systems that were originally developed after the First World War are now obsolete. Currently, the forces of globalisation and the advancement in technology have transformed the business environment into a more complex and sophisticated environment. To suit the changes, the management accounting systems practiced by organisations should also be modified in order to provide useful information for better decision making value and provide an integrated perspective of the organisation's strategic, operational and financial decisions.

To better understand the roles and function of the management accounting information system, in 1998, the International Federation of Accountants (IFAC) developed four sequential stages in the evolution of management accounting, as depicted in Figure 2.1.



(Source: IFAC, 1998)

Figure 2.1: IFAC's Evolution of Management Accounting

Stage 1 - Cost determination and financial control

Prior to 1950, the focus of management accounting was on cost determination and financial control with the use of budgeting and cost accounting techniques. Management accounting was seen as a technical activity to achieve organisational objectives, and was concerned more with internal factors such as production capacity. The main source of data was from financial statements, which included Income Statements, Balance Sheet and Cash Flow Statements. The use of methods such as ratio analysis, financial statement analysis, budgeting and other cost accounting techniques was predominant in this period.

Stage 2 - Information for management planning and control

From 1950 to 1965, the focus shifted to the provision of information for management planning and control. Management accounting was seen as a management activity. It involved staff support to line management through the provision of information for planning and control purposes. The aim was to enable the management team to plan, control and take the best course of action in their decision making processes. In this stage, management controls focused on manufacturing and internal administration rather than strategic and environmental aspects.

The use of management accounting techniques that could support decision analysis and responsibility accounting was introduced. Hence, the introduction of traditional methods such as standard costing, cost-volume-profit (CVP), break-even analysis, transfer pricing and performance measurement was increased during this period.

Stage 3 - Reduction of resource waste in business processes

From 1965 to 1985, the focus was on reducing waste of the resources used in business processes, process analysis and cost management technologies. Waste in resources was made possible through the elimination of 'non value added activities'. During this period, management accounting techniques included JIT, Activity Based Costing (ABC), TQM, Economic Order Quantity (EOQ), inventory valuation methods such as Last In First Out (LIFO), First In First Out (FIFO), Management Resource Planning (MRP) and multiple regressions.

Stage 4 - Creation of value through effective use of resources

From 1985 to 1995, attention shifted to the generation or creation of value through the effective use of resources and technologies, which examined the drivers of customer value, shareholder value and organisational innovation.

Relatively modern management accounting methods such as Target Costing, Balanced Scorecard, Value Chain Analysis and Strategic Management Accounting were prevalent during this period.

Even though the management accounting evolution can be distinguished into four recognisable stages, the techniques used in previous phases continued to be used in later stages. Thus, these four stages are not mutually exclusive.

The IFAC's evolution of management accounting portrays the changes in management accounting practices and techniques over time. The management accounting has been changed to provide relevant and accurate information for planning and decision making purposes. The changes in management accounting are needed to suit with the changing business environment.

2.3.2 Definition of Management Accounting Systems

MAS information refers to the information provided by management accounting systems in an organisation (Chenhall and Morris, 1986). For the past few decades, the use of MAS in an organisation has been very limited. MAS has been traditionally viewed as having a narrow scope because it is expected to only provide information on financial, historical and internal information (Mia, 1993). However, as discussed previously in the evolution of the management accounting section, MAS have been changing to adapt to the new environment, which is more competitive. In order to remain competitive, managers need to have accurate information about the needs of the organisations. Therefore, the need for MAS that could provide adequate information about the major impact on a company's performance is crucial.

MAS information has been defined in several ways. For example, Chenhall and Morris (1986) defined MAS design as including the characteristics of information such as

scope, timeliness, level of aggregation, and integration, which are perceived as useful. Mia and Clarke (1999) defined MAS as a system that provides information to managers for benchmarking and monitoring purposes. In assessing the use of MAS in the hotel industry, Mia and Patiar (2001) defined MAS as including the information on effectiveness of sales promotion, pricing of products and services, referrals, customer satisfaction and profitability of operating departments.

The work of Chenhall and Morris (1986) can be considered as the most prominent study in this area. According to Chenhall and Morris (1986), the scope of information includes the aspect of focus, quantification and time factor. While a traditional MAS focuses on internal information within the organisation, financial information and information that is based on historical data, the new MAS provides a broader scope concentrating on external, non-financial and future-oriented information. This transformation is necessary to overcome the claims made by Johnson and Kaplan (1987), among others, that MAS information is obsolete and should be changed in order to adapt to a new business environment.

The timeliness of MAS information refers to the ability to respond immediately to the needs of an organisation, a department or manager. This includes both the frequency and speed of reporting. When the information is reported in a timely manner, it will lead to efficient control systems and an effective decision making process. For example, when there is an error in the operation or defect in material, the timely reporting can detect the problems immediately and prevent them from occurring in the next production process. Thus, it will save cost and ensure high quality products.

Aggregation consists of various forms. It may refer to the provision of raw or unprocessed input, periods of time, areas, or summation in formats in analytical or decision models such as CVP and discounted cash flow (DCF) analyses. Aggregated information may assist managers in the planning process, especially in conditions of high uncertainty.

Integration concerns the interaction of different sections within a subunit. The decisions made by one unit may affect other units. It focuses on precise targets for activities as well as their interdependence and reporting within the subunit.

2.3.3 The Usefulness of MAS Information

Even though scholars have argued about the relevancy of MAS information in providing accurate information for decision making (e.g.: Kaplan, 1983; 1984; Johnson and Kaplan, 1987), as claimed by IFAC, management accounting has been changing to rectify this issue. Therefore, prior literature on the usefulness of MAS information needs to be reviewed. Chenhall and Morris (1986) examined the impact of structural decentralisation, perceived environmental uncertainty (PEU), and organisational interdependence on MAS design. Data from 68 manufacturing companies in Sydney were gathered through interviews based on a structured questionnaire. The results showed that decentralisation was associated with a preference for aggregated and integrated information. Decentralised managers prefer to be evaluated on performance measures which are aggregated to reflect their responsibility. In addition, in a decentralised working environment, the diversity of activities is normally higher. Therefore, in order to coordinate the increased diversity of operating decisions,

integrated information would be helpful.

The study also found that PEU was associated with broad scope and timeliness. Managers who perceive the environments as uncertain for planning and control may rely on broad scope information provided by MAS. A broad scope MAS will provide information related to external environments, which may be economic such as market share, or non-economic such as demographic factors, as well as predicting the occurrence of possible future events. Managers in uncertain environments also need to respond quickly to unpredictable situations. As such, timely information is very useful. Organisational interdependence was found to be associated with broad scope, aggregated and integrated information.

Mia (1993) investigated if the use of MAS information mediates the relationships between managers' PEU and their performance, as well as between managers' PEU and their job satisfaction. Based on completed questionnaires from 70 managers representing various functional departments, the results indicate that MAS information acts as a mediator in the relationship between managers' PEU and their performance. Thus, as the managers' PEU increases, they use more MAS information, which leads to an improvement in their performance. However, MAS information does not act as a mediator in the relationship between managers' PEU and their job satisfaction. Possible reasons could include other factors such as salary, bonus, promotion, working conditions or because interpersonal relationships may be more important in mediating the relationship. In fact, this study found the relationship between managers' PEU and their job satisfaction is direct and inverse. In other words, managers' PEU has been found to be negatively related to job satisfaction. As the managers' PEU increases, they will be less satisfied with their job. From the study of Chenhall and Morris (1986), and

Mia (1993), it is evident that MAS information is useful when the environment is uncertain. The results are also consistent with the findings from Sim and Teoh (1997) that the environment uncertainty influences firms to use control systems.

MAS information also has been used to investigate its usefulness to different departments. Mia and Chenhall (1994) examined the role of broad scope information provided by MAS in enhancing managerial performance in different functional areas. Using a sample of 29 marketing and 46 production managers from manufacturing companies employing 1000 or more employees, they found that the association between the use of broad scope MAS and managerial performance was stronger in the marketing department than the production department. Marketing activities are found to face greater task uncertainty than production activities. Production activities involve more certain tasks. Thus, consistent with the study by Chenhall and Morris (1986), and Mia (1993), managers will use more broad scope MAS information in conditions of high uncertainty. In addition, Mia and Chenhall (1994) extended previous studies by showing that different activities moderate the association between managers' use of broad scope MAS information and their performance.

In contrast, Bouwens and Abernethy (2000) showed that only a little difference is found in MAS use between production and sales managers facing similar amounts of customisation or interdependence. In addition, they found that broad-scope information is not important for operational decisions. These findings are based on the sample of 170 business unit managers, production and sales managers, from 85 business units comprising both manufacturing and service companies in the Netherlands. In this study, customisation did not affect MAS directly, but indirectly through the mediating effect of interdependence.

Similarly, Mia and Patiar (2001) studied managers' use of MAS in Brisbane and Gold Coast hotels in Australia. The initial analysis from a survey of 19 general managers and 16 department managers indicated that both the general managers and department managers use MAS information equally in making long-term decisions. The use of MAS information to make short-term decisions also appears to be the same for both the general managers and department managers except for the information on referrals, where the department managers use the information on referrals for short-term decisions more than the general managers. However, when the comparison is made within the two groups, the general managers appear to significantly use more of the information on the effectiveness of sales promotion, pricing of products and services, referrals, and the profitability of operating departments for long-term decision making. Furthermore, general managers are found to be more satisfied with the frequency of MAS information which is available to them. General managers also place more emphasis on financial than on non-financial performance indicators in evaluating department managers' performance. Thus, the use of MAS also differs between managers. These results indicate that the information needs between managers is important in designing MAS in the hotel industry.

MAS information is also useful for strategic action by managers. For example, Naranjo-Gil and Hartmann (2006) investigated how top management teams (TMTs) use MAS for strategy implementation. The responses from 92 TMT members in general hospitals in Spain indicated systematic differences between TMTs in their use of MAS and its effects on strategy implementation. The level of professionalism in the top management team is positively related to the interactive use of MAS and the use of non-financial MAS information, and negatively related to the diagnostic use of MAS and the use of

financial MAS information. In other words, when TMTs have a more professional (administrative) orientation, they make more interactive (diagnostic) use of MAS, and the use of non-financial (financial) information. Moreover, the level of professionalism in the top management team is neither related to the use of MAS for performance evaluation, nor to the use of MAS for resource allocation. Subsequently, the use of financial and non-financial MAS information, the interactive use of MAS, and the use of MAS for resource allocation support cost strategy implementation. The study also shows that professional TMTs tend to implement a flexible strategy rather than a cost strategy.

Recently, Boulianne (2007) showed that the use of broad scope accounting information systems design (AIS) is associated with higher performance for prospector and defender firms. Based on the survey and secondary data analysis of 88 Canadian business units, the result supports the contention that managers of these firms use more external, non-financial and future-oriented information for decision making.

Despite several criticisms on the relevancy of MAS information, the review of prior literature indicates that MAS information is still useful in assisting managers in their daily operations. A possible explanation could be because of the ability of new MAS to cope with the changes in the new business environment. For example, the focus of MAS has been changed from narrow scope to broader scope, which could provide sufficient and relevant information to make managerial decisions.

2.3.4 MAS Information and Integrated Manufacturing Practices

The implementation of JIT, TQM and AMT requires significant changes in the operation of an organisation. These changes should be reflected in the organisation's MAS to provide the necessary information for decision making and control purposes (Fullerton and McWatters, 2002). Sim and Killough (1998) investigated whether manufacturing practices such as TQM or JIT achieve higher performance when they are accompanied by particular management accounting systems (performance goals, performance measures and workers' performance-contingent rewards). Using a sample of 83 U.S. electronic plants, they found that performance gains can arise from complementarities between TQM or JIT and performance goals and performance-contingent rewards. The result indicates that MAS should be designed contingent upon the type of production system. As such, it indicates that reliance on inappropriate management accounting systems appears to be an important reason why some firms have not experienced performance gains from implementing TQM or JIT.

Hoque and Alam (1999) carried out a case study at DTL Limited, a New Zealand construction company to examine the relationship between TQM and MAS. They found that as a company adopts new management practices such as TQM, it may lead to changes in the company's internal control mechanisms, such as management accounting and reporting processes. The MAS in the company became more decentralised, project-oriented, focussed on both financial and non-financial information, and included greater involvement of accountants.

In advanced technology environments, Isa (2007) examined the effect of AMT on management accounting and control systems (MACS) change of Malaysian manufacturing firms. In this study, MACS is defined as including five main MACS components: planning, controlling, costing, directing and decision making. Based on the data from both survey and interviews, the results suggest that changes in AMT directly affect changes in MACS. Thus, it can be concluded that the adoption of AMT, which requires changes in the manufacturing processes and cost structures, would affect the information needs of manufacturing firms and result in a higher level of MACS changes.

MAS information is also argued to be more critical in a JIT environment than in its counterparts due to the lack of slack and cushioning in such an environment (Mia, 2000). He evaluated the impact of JIT adoption and the information provided by the MAS on organisational profitability. The respondents were financial controllers from 55 Australian manufacturing firms and the data were gathered through a questionnaire survey and personal interviews. The finding indicates that JIT adopter firms that received a higher amount of MAS information earned a higher ROI compared to those JIT adopter firms that received a lower amount of MAS information. Thus, the use of information provided by MAS can help JIT firms to gain higher performance.

Recently, Mia and Winata (2008) classified JIT as one of the strategies to achieve competitive advantage. Based on a survey of 76 business units' general managers of manufacturing firms in Australia, they examined whether JIT is directly related with managers' use of information and communication technology (ICT), or indirectly related through the managers' use of broad scope MAS information. The results indicate

that the relationship between JIT application and managers' use of ICT is indirect. JIT application was found to be positively associated with managers' use of broad scope information, which, in turn, is positively associated with the use of ICT. The direct relationship between JIT application and managers' use of ICT is not significant.

To date, little attention has been given to understand how and to what extent MAS can satisfy management needs for information that supports an advanced manufacturing environment. The research on the contribution of MAS information in this environment is still scarce. Therefore, there is a need to examine the effects of JIT, TQM and AMT implementation on the managers' use of MAS information. The result of the current study will add to the existing literature on the use of MAS in an advanced manufacturing environment.

With the exception of Isa (2007) who examined the effect of MACS change in terms of planning, controlling, costing, directing and decision making in AMT firms, the review of prior literature also reveals that no published study has examined the relationship between AMT and MAS. It is the aim of this study to address the above gap on the relationship between AMT implementation on the use of MAS information by managers.

2.4 Business Unit Performance: The Role of IMP and MAS

2.4.1 Definition

Business unit performance normally refers to organisational or firm performance. The performance of the firms can be measured in several ways. Generally, the firm performance can be categorised into financial and non-financial measures. Traditionally, the performance is measured using financial indicators such as cost and profitability analyses only. However, the advancement in technology and changes in operations require the use of non-financial indicators such as productivity and quality.

The importance of non-financial measures of performance in modern manufacturing was highlighted by Kaplan (1983). Since then, non-financial measures have become more widely used. According to Foster and Horngren (1987), JIT firms depend less on financial measures and more on personal observations and non-financial measures. Banker, Potter, and Schroeder (1993) surveyed 362 workers from 40 manufacturing plants situated in the U.S. They found that the provision of information to shop floor workers and employee morale are positively related to the implementation of JIT, quality, and teamwork practices. The results of the study indicate that the availability and use of productivity measures were related to the implementation of JIT and TQM.

Schalkwyk (1998) surveyed 37 partners of four out of the "big six" audit firms' London offices. He concluded that organisations should change their system of performance measures if they want to successfully apply TQM. It must not depend on financial aspects only. It should consider aspects related to quality and customers. In this context,

a performance measurement system should include objectives related to satisfying internal customers instead of pushing information to them from top down.

Fullerton and McWatters (2002) surveyed top manufacturing executives at 253 U.S. firms in 1997. The aim of the study was to empirically examine the relationships between the level of JIT practices and the role of performance measures and incentive systems. The results showed that the use of non-traditional performance measures such as bottom-up measures, product quality and vendor quality, as well as incentive systems of employee empowerment and compensation rewards for quality production are related to the degree of JIT practices implemented.

Non-financial performance measures are also used by manufacturing firms that pursue a flexibility strategy. Abernethy and Lilis (1995) suggested that the focus of these firms shifts from using financial indicators for performance measurement to a broader set of measures that include both qualitative and quantitative indicators. In Malaysia, Isa and Foong (2005) also showed that firms with a higher level of AMT adoption used the non-financial performance measurements, such as customer delivery, quality, manufacturing flexibility and innovation more extensively than firms with a low level of AMT adoption. Similarly, Isa and Tay (2008) examined the relationship between JIT practices and performance in Malaysian manufacturing firms. Based on the sample of 76 respondents, they found that four JIT practices (quality sample check, inspection of inventory by suppliers before delivery, delivery goods based on company's production schedule and supplier access to production schedule) positively affected performance as a whole. While three JIT practices (quality sample check, inspection of inventory by suppliers before delivery, and delivery goods based on company's production schedule) were positively related to non-financial performance; only a single JIT practice

(supplier access to production schedule) was positively related to financial performance. Therefore, the findings suggest that JIT practices are significantly related to both financial and non-financial performance. Based on the above discussions, the current study will employ both financial and non-financial measures to measure performance.

2.4.2 Integrated Manufacturing Practices and Performance

As mentioned in the previous section, IMP is defined in this study as including three frequently adopted practices in manufacturing firms: JIT, TQM and AMT. Thus, this section will review prior literature on the relationship between these three practices, either stand alone or in combination, and performance.

Previous studies that examined the direct relationship between JIT implementation and performance show mixed results. For example, Balakrishnan, Linsmeier and Venkatachalam (1996) examined 46 U.S. firms during the period 1985-1989. They found that there were no differences in ROA between JIT and non-JIT firms. However, when the sample was stratified as high and low customer concentration and different cost structures, JIT firms with low customer concentration showed significantly higher ROA than non-JIT firms. These findings indicate that both internal and external factors such as customer concentration and cost structure affect a firm's ROA response to JIT adoption. However, Kinney and Wempe (2002) used a sample of 201 JIT adopters and matched non-adopters during the period 1982-1993 to examine the relation between financial performance and JIT. They extended the study by Balakrishnan et al. (1996) by using a similar matched pair research design, and found that the ROA of the JIT firms were significantly less compared to the non-JIT firms when tested after three post

JIT adoption years.

The findings of Callen et al. (2000) also support the positive association between JIT and performance. They examined a sample of 60 manufacturing plants in Canada that adopted JIT between 1985 and 1989. The results showed that JIT plants used significantly less work-in-process and finished goods inventories than non-JIT plants. They also found that operating profit margins and contribution margin ratios are significantly higher in JIT plants than non-JIT plants. In addition, JIT plants also have significantly smaller variable and total costs (but not fixed costs) than non-JIT plants. These findings indicate that JIT is associated with greater productivity in inventory usage, lower costs and higher profits.

Similarly, in Japan, Matsui (2007) showed that JIT production systems contributed to an increase in the competitive performance of 46 Japanese manufacturing plants. In addition, the study also suggested that JIT production interrelates with other operations such as organisational behaviour, human resources, quality management practices, information systems, technology development activities, and manufacturing strategy implementation.

Fullerton et al. (2003) found a new contributing factor for the direct relationship between JIT and performance when they studied 253 U.S. firms in 1997 from both a cross-sectional and longitudinal perspective. In the cross-sectional study, the study found that firms that implement higher degrees of JIT manufacturing practices are more profitable than their counterparts. Specifically, the degree to which waste-reducing production practices, such as reduced setup times, preventive maintenance programmes, and uniform workloads, are implemented has a positive relationship with firm profitability. However, the implementation of a greater degree of JIT quality practices

was found to decrease sample firm profitability, whereas the JIT unique measure demonstrates no significant relationship with profitability.

In the longitudinal study, the results showed that the JIT quality and JIT unique indicators offer more statistical validity to the model than the JIT manufacturing indicator, which contrasts with the cross-sectional results. JIT unique practices such as *kanban* and JIT purchasing were found to be the strongest factors for increasing marginal returns to long term JIT investment. These results suggest that the benefits of these JIT practices are only realised over time due to their higher implementation costs.

Thus, the inconsistent results in the previous studies on the relationship between JIT implementation and performance warrant further investigation. Recently, Mackelprang and Nair (2010) conducted a meta-analysis investigation on the relationship between JIT and performance based on an in-depth analysis of JIT research from 1992 to 2008. They found that even though JIT manufacturing practices had a positive relationship with aggregate performance, not all individual JIT practices had a positive impact on the different types of performance indicator. The results also suggest that several relationships between JIT and performance are subject to moderating factors. The study of Mackelprang and Nair (2010) also indicates that research on JIT is still relevant in the current business environment and globalisation despite the introduction of more modern techniques and practices. It also suggests that JIT is a technique that focuses on continuous improvement and could co-exist with more advanced manufacturing technologies.

Similar to JIT, the research on the relationship between AMT and performance also indicates inconclusive findings. While Dean and Snell (1996) showed that AMT was

not related with performance, Jaikumar (1986) and Kotha and Swamidass (2000), for instance, found otherwise. These inconclusive findings also call for further examination.

In contrast with the research on JIT and AMT, prior studies that examined the relationship between the practices of TQM and performance always produced favourable results. As discussed previously in the preceding section, Dean and Snell (1996) found that only TQM was positively related with performance, while AMT and JIT were not. Hendricks and Singhal (1997) used a sample of 463 firms that won quality awards in the U.S. from 1983 to 1993. The study found that firms that have won quality awards outperform a control sample on operating income-based measures. The result indicates that implementing effective TQM programmes improves the operating performance of the firms. However, it should be noted that quality awards seem to be given to those firms that demonstrate better performance. The evidence showed that there was not much improvement in operating income before winning the quality awards.

Kaynak (2003) investigated the relationships among TQM practices and identified the direct and indirect effects of these practices on the various performance levels (operating, market and financial). Using cross-sectional mail survey data collected from 214 firms operating in the U.S., the study found that the extent to which companies implement TQM has a positive relationship with firm performance. Specifically, the study found that supplier quality management, product/service design, and process management directly affect operating performance, while management leadership, training, employee relations, and quality data and reporting indirectly affect operating performance. The positive effect of TQM practices on market and financial performance is achieved through the mediating effect of operating performance. Even

though previous studies found support for the relationship between TQM and performance, it is important to investigate this relationship in different settings with different measures of TQM and performance.

Based on the reviews above, past studies that examined the integration between each dimension of integrated manufacturing and performance seem to suggest inconclusive results. The review of the literature also showed that although numerous studies have examined the relationship between individual manufacturing practices and performance, only a few studies have examined the relationship between a set of manufacturing practices and performance. The findings of these studies also produced mixed results. For example, Dean and Snell (1996) found that the whole set of integrated manufacturing was not related to performance. Only TQM was positively related to performance. Flynn et al. (1995) studied the relationship between JIT and TQM by using data on 42 plants in three U.S. industries, namely, electronics, transportation components, and machinery. They found that integrating JIT and TQM provides more improvement in performance. JIT enables organisations to produce more output with a lower level of inventory. At the same time, TQM practices help in providing quality that allows production with a minimum level of inventory and implementing production schedule.

Similarly, Sriparavastu and Gupta (1997) studied the effects related to using both JIT and TQM by surveying 153 U.S. manufacturing personnel from the middle and top management levels. They concluded that using JIT adds value to an organisation. However, implementing TQM in both the organisation and suppliers alongside JIT increases that value. Combining JIT and TQM together is found to significantly enhance quality and productivity levels, employee involvement, management commitment,

suppliers' participation, and reduction in costs. It is noted that organisations employing the systems together receive more quality certificates than others. The results indicate that not only financial performance measures are used in measuring JIT and TQM implementation, but also non-financial measures.

A more recent study of Dal Pont et al. (2008) also found that JIT and TQM positively impacted operational performance when they surveyed 266 manufacturing plants in nine countries (Austria, Korea, Finland, Germany, Japan, Italy, the U.S., Sweden, and Spain). They also found that JIT and TQM mediated the relationship between human resource management and operational performance.

2.4.3 Management Accounting Systems and Performance

Based on contingency theory, it is argued that there is no universally appropriate accounting information system that applies equally to all organisations in all circumstances. Furthermore, the effectiveness of certain managerial techniques to achieve the ultimate outcome or organisational goal is contingent on the organisation's context and structure (Lawrence and Lorsch, 1967; Waterhouse and Tiessen, 1978; 1983; Otley, 1980; among others). In contingency-based management accounting research, it is suggested that the use of appropriate information could assist firms to achieve the desired performance target. Relevant and accurate information leads to more effective managerial decisions, which will subsequently improve organisational performance. In today's advanced business environment, managers need to make faster strategic decisions, which would require more broadly based, timely, integrated and aggregated information in order to achieve better performance.

As discussed previously in the previous section, the use of MAS information in organisations is evident to assist firms in enhancing organisational performance. For example, Chenhall and Morris (1995) found that the association between organic processes and improved performance for entrepreneurial firms only exists when MAS was extensively used, but not when MAS was used less extensively. Sim and Killough (1998) suggest that the complementarities between MAS and manufacturing practices such as TQM and JIT resulted in increased performance. Similarly, Mia (2000) also showed that a higher usage of MAS information in JIT firms contributes to higher organisational performance compared to firms that use a lower amount of MAS information. In addition, Mia and Clarke (1999) and Hoque (2011) found that the use of MAS information in intense market competition improves firm performance even though the study of Patiar and Mia (2008) suggests that the interaction effect of market competition and the use of MAS information only improves non-financial performance but not the financial performance of the hotel industry.

The above studies show that the use of MAS information could lead to improved performance. These results suggest that MAS information is still relevant and useful in fulfilling the information needs of managers. However, no research has been conducted to examine the use of MAS information in IMP firms that comprises three manufacturing practices. Therefore, it is interesting to investigate whether the use of MAS information plays an important role in assisting managers to improve organisational performance in the context of IMP.

2.5 Research Gap

Based on the above review of literature, several research gaps have been identified:

1. The evidence on the use of MAS information by managers in advanced manufacturing environment is rather limited and none has examined the use of MAS information in IMP firms. Thus far, only Sim and Killough (1998), Hoque and Alam (1999), Mia (2000), Isa (2007) and Mia and Winata (2008) have investigated the use of MAS information in advanced manufacturing environment. However, these studies examined the use of MAS information in respect of the individual implementation of IMP components. For example, Sim and Killough (1998) looked at MAS in JIT and TQM firms; Hoque and Alam (1999) examined MAS in TQM firms; Mia (2000), and Mia and Winata (2008) investigated the use of MAS in JIT firms; and Isa (2007) examined the change in MACS in AMT firms. None of these studies has simultaneously examined the use of MAS in an integrated manufacturing environment comprising three manufacturing practices. Therefore, it is the aim of this study to examine the use of MAS information in IMP firms. In addition, the review of the literature shows no study has been conducted to examine whether MAS information mediates the relationship between IMP and performance. Thus, this study attempts to fill this gap by investigating the mediating role of MAS information in this relationship.

2. In today's advanced business environment, competition is becoming more intense. Firms continuously look for ways to compete in order to survive in this environment. Considering the growing escalation of competition in the business

environment, this study also aims to examine the effect of market competition on the use of IMP. To date, the research on the effect of competition on the adoption of certain practices is still lacking compared to PEU, which has received greater attention. Similarly, the effect of business strategy on the adoption of IMP is very scarce. Thus far, only Dansky and Brannon (1996), Kotha and Swamidass (2000), and Prajogo and Sohal (2006) have examined the association between business strategy and the adoption of certain practices. In the manufacturing environment, prior studies have placed greater emphasis on manufacturing strategy rather than business strategy. Thus, this study attempts to fill the gap by examining the relationship between business strategy and the use of IMP.

3. Even though extensive literature has looked at the relationship between IMP (JIT, TQM and AMT) and performance (e.g.: Jaikumar, 1986; Hendricks and Singhal, 1997; Balakrishnan et al., 1996; Callen et al., 2000; Kotha and Swamidass, 2000; Kinney and Wempe, 2002; Fullerton et al., 2003; Kaynak, 2003; Mitsui, 2007), but most have focused on the relationship between the individual component, not the aggregate component, of IMP, with performance. Thus far, the review of published literature shows that only Dean and Snell (1996) has examined the relationship between the aggregate component of IMP and performance. However, the study has not examined the effect of MAS in the relationship between IMP and performance. In addition, very limited studies have been conducted in the context of developing country such as Malaysia. Therefore, this study will add to the scarce literature on aggregate IMP and performance.

2.6 Chapter Summary

This chapter contains a review of previous literature that is used as the foundation of the current study. Previous studies related to competition, strategy, integrated manufacturing practices, MAS and business performance are discussed in this chapter. This chapter also provides some insights into identifying gaps for the current study.