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THE USE OF BUSINESS STRATEGY IN ADVANCED MANUFACTURING ENVIRONMENT

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ABSTRACT

The advancements in manufacturing technologies and escalating competition in the market place require firms to constantly review and modify their strategy and the way they operate in order to survive and sustain their market positions. For manufacturing firms, adoption of more advanced manufacturing techniques such as integrated manufacturing practices (IMP) are vital for these firms to remain competitive. The implementation of these manufacturing practices may also relate to the business strategy adopted by the firm. Each organisation may adopt a different business strategy depending on the nature of business and the industry within which it operates. This study aims to investigate the relationship between business strategy and the use of IMP. The results of both survey and interviews of Malaysian manufacturing firms reveal that the relationship between prospector and the use of IMP is positive and significant, which provides evidence that prospector is the most appropriate strategy to be employed in advanced manufacturing environment adopting IMP.

Keywords: Business strategy, Prospector, Integrated manufacturing practices.

1. INTRODUCTION

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

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order to achieve these goals, the strategy adopted by organisations should suit the nature of their businesses. This organisational or business strategy could also influence the type of management control system practices by organisations (Hambrick, 1981; Simons, 1987; Jermias and Gani, 2004; Cadez and Guilding, 2008). According to (Langfield-Smith, 1997) the business strategy concerns how an organisation competes within the industry, and the way it positions itself in relation to rivals. Each organisation may adopt a different business strategy depending on the nature of business and the industry within which it operates. For example, a low cost strategy may be suitable for firms that focus on charging a lower price to their customers, whereas a product differentiation strategy may be more suitable if their concern is to produce a unique product that is different from other competitors. In today's business world, the business strategy is crucial for ensuring the success of an organisation. The adoption of a strategy that is not suitable to the nature of business could affect the ability of the firms to compete in a challenging business environment.

As for manufacturing firms, the rapid technological advancement has resulted in significant changes in their cost structures, processes and controls. In view of these changes, manufacturing firms need to revise their techniques to be able to compete with their rivals. One way is by adopting world class and more advanced manufacturing techniques such as Integrated Manufacturing Practices (IMP), which comprises three prominent techniques used in manufacturing firms: Just In Time (JIT), Total Quality Management (TQM) and Advanced Manufacturing Technology (AMT). These are integrated manufacturing techniques adopted by firms to reduce costs, improve quality, and speed up manufacturing processes, in order to ensure continuous improvements.

It is argued that the business strategy adopted by the firms might also influence the management decision to adopt particular manufacturing techniques. For example, (Dansky and Brannon, 1996), and (Prajogo and Sohal, 2006) suggested that business strategy influences the adoption of TQM; (Kotha and Swamidass, 2000) argued that business strategy is associated with AMT implementation. However, none of the published research has examined the influence of business strategy on the use of IMP as a whole. Therefore, the aim of this paper is to fill the gap by examining the relationship between business strategy and the use of IMP.

The remainder of this paper is organised in the following manner. Section 2 provides the development of research hypothesis. Section 3 discusses on the methodology used in the study. Section 4 provides a discussion on the results of the data analysis, both from a questionnaire survey and semi-structured interviews. Finally, discussion, limitations and conclusions are presented in Section 5.

2. DEVELOPMENT OF RESEARCH HYPOTHESIS

Several studies have found that manufacturing strategy influences the choice of manufacturing practices, or vice versa. For example, Swamidass and Newell (1987) argued that JIT is suitable with strategies emphasising cost, quality, and flexibility. Jaikumar (1986) indicated that AMT is not fully utilised if it is not implemented in a strategy that focuses on increased flexibility. Similarly, Parthasarthy and Sethi (1992) argued that the capabilities of AMT are best suited to strategies that emphasise flexibility, and will not be fully utilised when implemented as part of a low-cost strategy. Dean and Snell (1996) found that TQM is positively related with quality, delivery and scope flexibility strategies, while AMT is negatively related with quality strategy.

They also found that none of the integrated manufacturing practices are significantly related to low cost strategies. Similarly, business strategy may also influence the selection of manufacturing practices. However, the research examining the influence of business strategy on the adoption of manufacturing practices is very scarce. Thus far, only a few published studies have examined the relationship between business strategy and the adoption of certain manufacturing practices. For instance, (Dansky and Brannon, 1996) found that prospector and analyser were related to TQM. Prajogo and Sohal (2006) revealed that differentiation strategy is positively and significantly related to TQM. Similarly, due to diverse information processing needs of a differentiation strategy, Kotha and Swamidass (2000) showed that differentiation strategy is positively associated with the usage of several dimensions of AMT. Therefore, the implementation of IMP should be considered in view of an organisation's business strategy. It is expected that the business strategy adopted by manufacturing firms is related to the use of manufacturing practices. Specifically, similar to Dansky and Brannon (1996) this study also postulates that prospector strategy is related to the use of IMP due to its characteristic of consistently looking for product and market opportunities and its ability to work in flexible and uncertain environments. As IMP is normally associated with flexibilities and the objective implementation of IMP is to gain competitive advantage, it is expected that the prospector strategy is more likely to be applied in organisations adopting IMP.

H1: There is a positive relationship between the prospector strategy and the use of IMP.

3. METHOD

3.1 Sample and Data Collection

This study utilised a mixed method approach as the research design, which combines two types of data collection methods: questionnaire survey and semi-structured interview. The population of interest was all manufacturing firms operating in Malaysia. The sample of firms was selected from manufacturing firms listed in the Federation of Malaysian Manufacturers (FMM) Directory year 2009. The sample consisted of 1000 manufacturing firms randomly selected from the FMM Directory.

The survey data were analysed using Partial Least Square (PLS), which is a type of Structural Equation Modelling (SEM). One of the advantages of SEM is that it can examine multiple relationships simultaneously in one model at the same time (Hair Jr. *et al.*, 1998). This study used SmartPLS software as a method for data analysis.

3.2 Measurements of the Variables

3.2.1 Strategy

This study utilised Miles and Snow (1978) typology of strategy, namely, prospector, defender, analyser, and reactor, and used the instrument developed by (Parnell, 1997) to measure the strategy. In addition to four types of strategy introduced by Miles and Snow (1978); (Parnell, 1997) added another strategy archetype: the balancer. Similar to Parnell (1997), this study also adopted five types of strategy: prospector, defender, analyser, balancer, and reactor.

3.2.2. Integrated Manufacturing Practices

IMP comprises three practices: JIT, TQM and AMT. The measurement for IMP was adopted from Snell and Dean (1992). In addition, this study also adopted five items from Koc and Bozdag (2009) to measure AMT. The rationale for adding the measurement for AMT from Koc and Bozdag (2009) is to take into account the most advanced or latest technologies in AMT.

4. RESULTS AND DISCUSSION

4.1 Results of the Questionnaire Survey

The first phase of data collection method was done through a questionnaire survey. The quantitative approach of gathering information serves as the main tool of the data collection in this study. The objective of the questionnaire survey is to obtain data to test the hypothesis related to the relationships between strategy and the implementation of IMP.

4.1.1 Profile of Firms and Respondents

Table 1 indicates the sample firms representing various industries. More than a quarter (28.2%) of the sample firms were from electrical and electronic sector, followed by transport and automotive parts and components (15.5%), and rubber and plastic products (10%). Most of the sample firms (80%) have been in operation for more than 10 years and most of the firms are either locally owned (45.5%) or foreign owned (46.3%). Examination of firm size based on number of full time employees, total gross assets and annual sales turnover reveals that the sample firms comprised small to large companies.

Regarding the profile of the respondents, the majority (86.4%) of the respondents were male while 13.6% were female. Most of them (38.2%) were between 40 to 49 years old, followed by 31.8% respondents aged between 30 to 39 years, 18.2% aged 50 years and above, and 11.8% were between 20 to 29 years old. The majority of them (94.5%) were Malaysian, whereas 5.5% hold other nationalities such as Japanese, British, Filipino, German or Belgian.

The majority (90.9%) of the respondents had work experience in their present job of at least 3 years, and only 7.3% had work experience of less than 3 years. This information indicates that they were experienced personnel. As such, the information provided by them can be assumed to be reliable.

Table-1. Profile of Sample Firms and Respondents

Demographic Information	Categories	Frequency	Percentage
Type of Industry	Building materials/cement/concrete/ceramics/tiles	3	2.7
	Chemical and adhesive products	6	5.5
	Electrical and electronics products	31	28.2
	Food, beverage and tobacco	9	8.2
	Furniture and wood related products	1	0.9
	Gas and petroleum products	3	2.7
	Household products and appliances	2	1.8
	Iron, steel and metal products	9	8.2
	Machinery and equipment	3	2.7
	Paper, printing, packaging and labelling	3	2.7
	Pharmaceutical, medical equipment, cosmetics and		

Demographic Information	Categories	Frequency	Percentage
	toiletries	3	2.7
	Rubber and plastic products	11	10.0
	Textile, clothing, footwear and leather products	3	2.7
	Transport and automotive parts/components	17	15.5
	Others	5	4.6
	No information provided	1	0.9
Years in Operation	Less than 5 years	6	5.5
	5 to 10 years	15	13.6
	More than 10 years	88	80.0
	No information provided	1	0.9
Ownership Structure	Local (more than 50% local equity)	50	45.5
	Joint venture	8	7.3
	Foreign (more than 50% foreign equity):		
	- Anglo American	15	13.6
	- Asian	32	29.1
	- Others	4	3.6
	No information provided	1	0.9
Number of Full Time Employees	Not exceeding 150	27	24.6
	151 to 250	15	13.6
	251 to 500	24	21.8
	Above 500	43	39.1
	No information provided	1	0.9
Total Gross Assets	Less than RM50 million	31	28.2
	RM50 to RM100 million	18	16.4
	RM101 to RM150 million	14	12.7
	Above RM150 million	45	40.9
	No information provided	2	1.8
Annual Sales Turnover	Not exceeding RM25 million	16	14.6
	RM26 to RM50 million	11	10.0
	RM51 to RM100 million	24	21.8
	Above RM100 million	56	50.9
	No information provided	3	2.7
Gender	Male	95	86.4
	Female	15	13.6
Age	20 to 29 years	13	11.8
	30 to 39 years	35	31.8
	40 to 49 years	42	38.2
	50 years and above	20	18.2
Nationality	Malaysian	104	94.5
	Others	6	5.5
Length of service	Less than 3 years	8	7.3
	3 years and above	100	90.9
	No information provided	2	1.8

4.1.2 Hypotheses Testing: The Relationship between Strategy and Integrated Manufacturing Practices

This study proposed that prospector strategy has a positive effect on IMP implementation (H1). In addition, it is interesting to know, whether the other four archetypes (defender, analyser, balancer and reactor) used in this study also has a positive and significant effect on IMP implementation as each of the strategy archetypes may affect IMP differently.

The results for composite reliability (ρ_c), AVE, square root of AVE and latent variable correlations for prospector (Pr), defender (Dr), analyser (Ar), balancer (Br), reactor (Rr) and IMP are shown in Table 2. The composite reliability and AVE for all variables exceeded a minimum value of 0.70 and 0.50, respectively. The square roots of AVEs (shaded numbers on the leading diagonals) were higher than any pair of their correlations (the lower left of the off-diagonal) except for balancer strategy. The square roots of AVEs for balancer strategy (0.887) was lower than its correlation with analyser strategy (0.897). However, the difference was too small to conduct further tests on that factor for other evidence of discriminant validity (Das *et al.*, 2000). Das *et al.* (2000) also faced a similar situation where the AVE for one factor (0.33) was smaller than its squared correlation (0.43). However, no further tests were performed on the grounds that the difference was too small. Furthermore, Fornell and Larcker (1981) method of comparing AVE with correlations is a more stringent test for determining discriminant validity Das *et al.* (2000) and (MacKenzie *et al.*, 2005). Viewed collectively, the results show that all variables obtained sufficient validity and reliability.

Table-2. Composite Reliability, AVE, Square Root of AVE and Correlations (Strategy and Integrated Manufacturing Practices)

Construct	Composite Reliability	AVE	Ar	Br	Dr	IMP	Pr	Rr
Ar	0.914401	0.780775	0.883615					
Br	0.917574	0.787800	0.897448	0.887581				
Dr	0.831129	0.623365	0.471442	0.458376	0.789535			
IMP	0.866875	0.685845	0.345722	0.426436	0.320906	0.828158		
Pr	0.924514	0.803326	0.730814	0.810291	0.522401	0.489591	0.896285	
Rr	0.858124	0.668969	0.395175	0.408341	0.689015	0.325590	0.567732	0.817905

Note:

Ar = Analyser

Br = Balancer

Dr = Defender

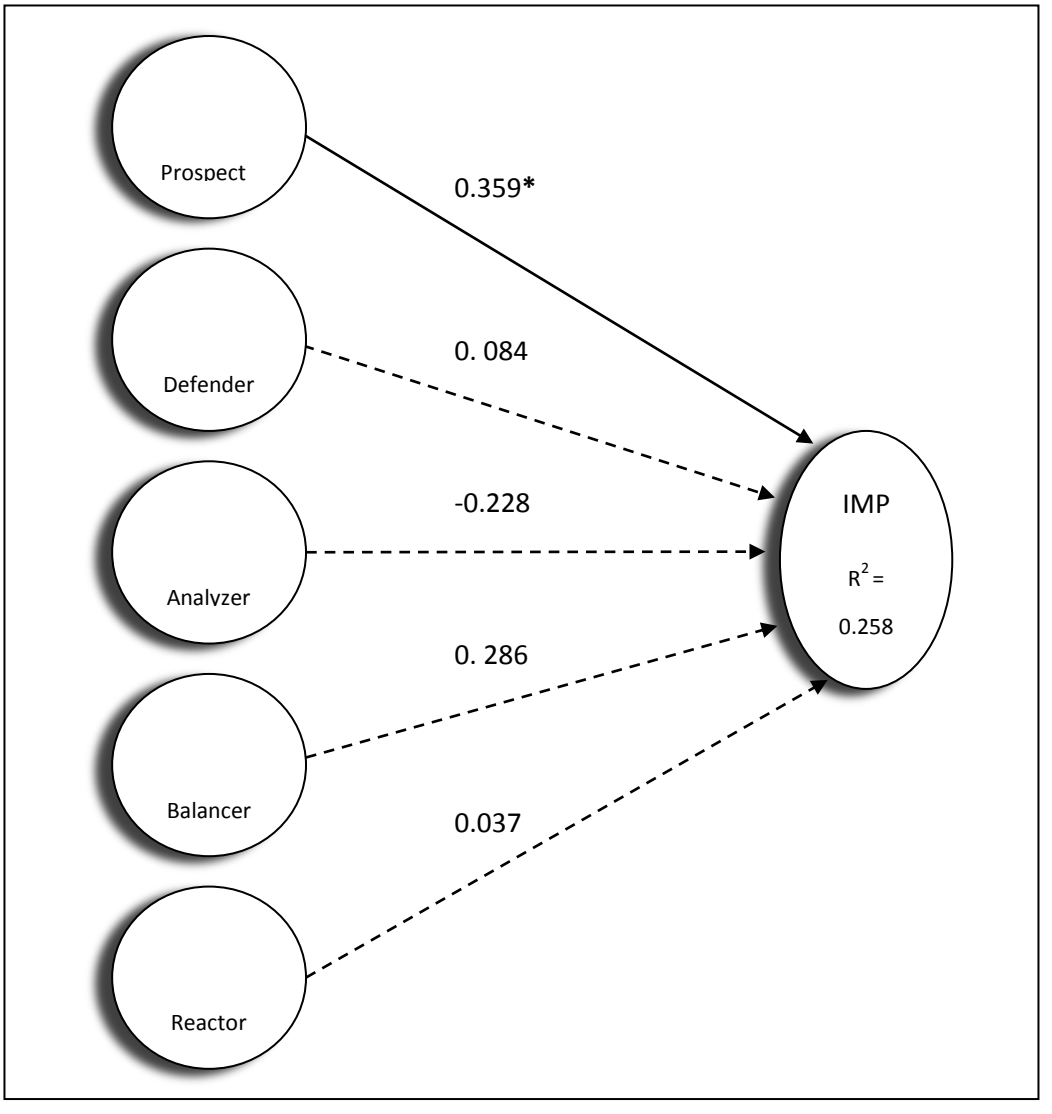
Pr = Prospector

Rr = Reactor

IMP = Integrated manufacturing practices

AVE = Average variance extracted

Figure-1. The Relationship between Strategy and Integrated Manufacturing Practices



** Significant at p<0.01

IMP = Integrated manufacturing practices

The next step is to test the effect of each of strategy archetypes on IMP by examining path coefficients, path significances and R^2 values for IMP. As depicted in Figure 1, only prospector strategy had a positive and significant impact on IMP, with β equals to 0.359, $p < 0.01$. This is consistent with (Miles and Snow, 1978) propositions that prospector strategy is more related to organisations that focus on innovation and flexibility such as IMP firms. The relationship between defender, balancer and reactor with IMP were positive but not significant ($p > 0.05$). The path coefficients from defender, balancer and reactor to IMP were 0.084, 0.286 and 0.037, respectively. In contrast, the relationship between analyser and IMP was negative and not significant ($\beta = -0.228$, $p > 0.05$). The combination of these strategies explained 25.8 per cent variation in IMP.

Miles and Snow (1978) show that different typologies exist to categorise different types of business strategy in organisations. They further suggest that different types of strategy are suitable for different functions and conditions. As discussed previously, strategy could also influence the type of control system adopted by organisations.

Similar to other types of organisations, manufacturing firms also need to find the appropriate strategy in order to sustain and remain competitive. The strategy adopted should suit the nature of their business. Similar to Dansky and Brannon (1996); Kotha and Swamidass (2000), and Prajogo and Sohal (2006), the findings of the current study suggest that the business strategy adopted by the firms influences the use of manufacturing practices. Specifically, only prospector strategy is related to the use of IMP. This result is expected due to the characteristics of the prospector strategy, which are consistently looking for product and market opportunities and able to work in a flexible and uncertain environment Miles and Snow (1978). In addition, the literature on manufacturing strategy also found that JIT is related to cost, quality, and flexibility strategies (Swamidass and Newell, 1987), AMT is suitable with strategies focusing on flexibility (Jaikumar, 1986; Parthasarthy and Sethi, 1992) and TQM is related to quality, delivery and scope flexibility strategies (Dean and Snell, 1996). Furthermore, as the objective of implementation of integrated manufacturing practices is to gain competitive advantage, the prospector strategy is more likely to be applied in organisations adopting integrated manufacturing practices.

4.2 Results of the Semi-Structured Interviews

The second phase of data collection involved semi-structured interviews. The aim of the semi-structured interviews was to obtain further insights and gather in-depth information concerning the issues pertaining to strategy and IMP in manufacturing firms in Malaysia.

4.2.1 Sample Profile

The prospective respondents for the semi-structured interviews were selected from the survey respondents. Those survey respondents who provided their contact details and were located in the Klang Valley were identified. Since the main purpose of the interview is to supplement the survey findings and due to time constraints, only ten respondents from manufacturing firms operating in the Klang Valley were chosen. Isa (2005) also interviewed ten respondents to support her survey findings.

Table 3 depicts the profile of the interviewees and the sample firms. As shown in Table 3, the participants held various positions. Two of them were Production Managers, three were managers in charge of various departments, while the remaining five were Engineer, Accountant, Senior Manager, Factory Controller and Head of Manufacturing Department. They were selected because of their broad knowledge of the overall operation of the firms. Furthermore, all of them had more than ten years working experience in the current firms. Thus, based on their positions and working experience with the firms, it can be concluded that the participants have the expert knowledge on issues related to the research problems of this study, and are capable of providing accurate and reliable information on the operation of the firms as a whole. With the exception of one participant, the rest of them were male. Most of them (7) were between 30 to 39 years old, while three were aged between 40 to 49 years.

Table-3. Profile of Interviewees and Sample Firms

Interviewee	Designation	Working Experience (years)	Gender	Age	Type of Industry	No. of Employees
1	Engineer	15	Male	39	Electrical and electronic products	400
2	Accountant	13	Female	36	Machinery and equipment	130
3	Manager, Finishing Unit	20	Male	47	Iron, steel and metal products	400
4	Senior Manager	12	Male	36	Building materials, cement, concrete, ceramics and tiles	300
5	Factory Controller	13	Male	36	Food and beverage	914
6	Manager, Moulding Division	15	Male	39	Electrical and electronic products (parts)	600
7	Production Manager	22	Male	39	Rubber and plastic products	600
8	Production Manager	18	Male	44	Tobacco	230
9	Manager, Occupational Safety and Health	18	Male	43	Household products and appliances	1,250
10	Head of Manufacturing Department	13	Male	37	Transport and automotive parts/components	1,200

In order to obtain various information, opinions and perceptions, the participants were selected from manufacturing firms representing various industries. In addition, similar to the survey, the sample firms comprised a combination of small, medium and large firms.

4.2.2 The Interview Findings: Strategy and Integrated Manufacturing Practices

The findings from the survey indicate that there is a positive relationship between strategy and the use of IMP, particularly, suggesting that the prospector strategy is positively related with the use of IMP. Further information was sought during the interviews to support these findings.

A review of the responses of the interviews revealed that these firms adopt different types of strategy. The strategies vary from those that focus on innovation and technology, market opportunities and introduction of new product (prospector/ differentiation), to strategies that emphasise a high profit margin and low cost (defender/cost). However, the majority of the respondents indicated that their firms adopt the prospector/differentiation strategy. As one of the interviewees responded, "Of course, we also consider the costs but primarily, our focus is on product innovation". They believe that focussing on innovation and advancement in technologies assists them to survive in the competitive environment. There are also firms that employ a

combination of strategies. One firm adopts a diversified strategy that requires multi-skilled employees and machine flexibility.

The majority of the interview participants (eight interviewees) also agreed that the types of strategy adopted are influenced by the types of industry, product line and business unit. According to the Engineer from the electrical and electronic firm (Interviewee 1), a strategy that focuses on innovation is more suitable for fast moving products. He further added that the adoption of a certain strategy also depends on the technology curve for those products. The Factory Controller from the food and beverage company (Interviewee 5) also believed that types of industry, product line and business unit influence the adoption of a certain strategy, regardless of whether the firm is a market leader or not. He stressed that the strategy that his firm adopts depends on the products that they produce. Since they have a range of product categories, they currently adopt different strategies. Interviewees 6 and 7 opine that different industries, product line and business units require different types of competition. Therefore, they need different strategies depending on the type of competition that they face. Other respondents also asserted that different industries, product line and business units have different types of strategy because the strategy adopted by a firm depends on the competitors, product costs, current economic situation as well as fulfilling customers and the board of directors' requirements.

With the exception of two participants (Interviewees 2 and 10), others agreed that business strategy influences the use of JIT, TQM and AMT. As for Interviewee 10, he believes that IMP is a must regardless of the strategy that the firm adopts as IMP is necessary to ensure continuous improvement. Those who agreed that business strategy influences the use of IMP gave various opinions. The Manager from an Indian based company opines that the company would find the best way to utilise resources and maximise firm performance. One way is through the adoption of IMP that suits the business strategy adopted by the firm. The respondent from a Switzerland based company gave a different view. According to him, the business strategy that the company adopts requires them to satisfy customers' needs. In fulfilling the consumer and retailer's demands, especially in terms of packaging, size, colour etc., the company needs to use IMP because of its flexibility and quality.

Regarding the type of strategy that is more suitable for the use of IMP, almost all respondents agreed that strategies that focus on innovation, quality and change product line frequently (prospector) are more suitable for the use of IMP because this strategy requires flexibility, fast response, stable and reliable system. The Production Manager from the Swiss based company responded:

> "…..because new innovation must be of high quality and enter the market as fast as possible before other competitors introduce their innovations. Therefore, innovation requires TQM and high technology for speedier production processes"

Even though all of the respondents suggested that the prospector strategy is more suitable for the use of IMP, two of them (Interviewees 6 and 10) also recognised that all types of strategy are actually suitable for the use of IMP because IMP is good and applicable for all.

Thus, from the discussion on the interview results above, it can be concluded that the business strategy adopted by manufacturing firms influences the use of IMP. Specifically, the prospector

strategy is more related with the use of IMP. The results are consistent with the findings from the survey.

5. DISCUSSION, LIMITATIONS AND CONCLUSION

The aim of this study is to examine the relationship between strategy and the use of IMP. In this study, strategy is defined as business strategy and utilised Miles and Snow (1978) typology of strategy. The results from the questionnaire survey suggest that the business strategy adopted by manufacturing firms in Malaysia does influence the use of IMP. Further analysis on the impact of individual strategy on the use of IMP shows that among the five archetypes of strategy, only prospector strategy is significant and positively related with the use of IMP. This result is further supported by the opinions obtained from interviews. The majority of the respondents indicated that their firms adopted the strategy that focuses on innovation and technology, market opportunities and new products introduction (prospector) due to the characteristic of the strategy that could assist firms to survive in a competitive environment. This strategy is also suitable for fast moving products. Most of them also agreed that business strategy influences the use of IMP. Firms adopt a certain strategy to satisfy customers and gain competitive advantage. In doing so, manufacturing firms require the use of IMP because of its flexibility and quality, especially in terms of product specifications such as packaging and size. The respondents also indicated that strategies that focus on innovation, quality and change product line frequently (prospector) are more suitable for the use of IMP because this strategy requires flexibility, a fast response, and a stable and reliable system, while, at the same time, maintaining and controlling quality.

There are several limitations to the study that need to be highlighted. First, the sample was drawn only from manufacturing firms operating in Malaysia. The strategy adopted and the implementation of IMP may be different in other countries. Therefore, the findings from this study cannot be generalised to other countries. Future studies could extend this research for other countries.

Second, since this study used the business unit as the unit of analysis, only one respondent was selected from each firm. The responses given by him/her might be biased and not represent the actual scenario. Furthermore, the respondents hold different positions such as Production Manager, Accountant, Financial Controller, Engineers and other managers. Therefore, their nature of work and responsibilities were different. Consequently, their perceptions of strategy and IMP might also be different.

Third, the scales employed in this study were based on individuals' perceptions. Therefore, they may not reflect objective reality. Future studies could replicate the current study by utilising different methodologies such as case studies. In addition, the use of cross sectional data in the current study might be bias and not represent the actual situations. Thus, adopting a longitudinal approach might produce more meaningful results.

Apart from these limitations, the results of the study have implications for theory and practice. For example, numerous studies (Jaikumar, 1986; Swamidass and Newell, 1987; Parthasarthy and Sethi, 1992) examined the link between manufacturing strategy and practices. However, with the exception of Dansky and Brannon (1996), Kotha and Swamidass (2000), and Prajogo and Sohal (2006), studies examining the link between the business strategy and manufacturing practices are

very limited. Therefore, the findings from this study could provide some insights into the relationship between the business strategy and manufacturing practices.

Moreover, the results of the study show that the business strategy adopted by firms could also influence the use of certain manufacturing practices. In this study, it shows that the prospector strategy, which focuses on innovation and flexibility, is more related to the use of IMP. Thus, it could provide an insight into the type of strategy that is more suitable for the use of IMP.

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