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Contingency Factors Influencing MAS Design of Manufacturing Firms in Malaysia

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ABSTRACT

From a contingency framework, this paper empirically examines the relationship between decentralization, advanced manufacturing technology (AMT) and market competition on the adoption of sophisticated management accounting system (MAS) design among manufacturing firms in Malaysia. Using a structured questionnaire and regression analysis, data from 137 manufacturing firms from Malaysia show that the sophistication of MAS adopted is significantly and positively related with AMT adoption and market competition. The findings suggests that the adoption of sophisticated MAS design is parallel with the adoption of advanced manufacturing innovations and is able to assist firms to cope with the changes in the business environment. However, a positive but insignificant relationship was observed in the relationship between decentralization and MAS design. These results have contributed to the management accounting change literature by suggesting that attempts by the MAS designers to improve the timeliness and the scope of the information are of particular relevance to the managers of the firm.

Keywords: Contingency theory; management accounting system design

INTRODUCTION

Management accounting system (MAS) design has been a topic of continuous interest among researchers in view that appropriately designed MAS is crucial in enabling corporate management to have access to relevant information to make effective decisions to stay competitive (Chenhall & Morris 1986; Mahfar & Normah 2004; Tuanmat & Smith 2011; Zakaria 2015). As noted by Laitinen (2014) and Zakaria (2015), the MAS design of a manufacturing firm often changes with the rapid changes in its market environment in order to cater for the changes in information needs for strategic decisions making. Malaysia is a developing country with a very dynamic and rapidly changing environment. As a consequence, manufacturing firms in Malaysia are constantly adopting innovative manufacturing technology (Smith, Abdullah & Razak 2008) and re-strategizing (Mahfar & Normah 2004) to sustain their competitiveness, locally and internationally; and thus, would require more relevant information for strategic decision making purposes. Many opined that companies should adopt sophisticated MAS (Hyvonen 2005; Angelakis, Theriou & Floropoulos 2010). However, according to Tillema (2005), sophisticated MAS might not guarantee enhanced performance unless the MAS design could provide the needed information that adds value to the business. As a result, past studies have indicated that the appropriateness of a MAS design is often contingent on the business context and the environment that the company operated in (Gerdin 2005; Tillema 2005; Adbel Kader & Luther 2008; Zakaria 2015).

This paper extends the empirical research on MAS design by investigating whether the adoption of sophisticated MAS is significantly influenced by decentralization, the changes in the adoption of advanced manufacturing technology and the intensity of market competition. These variables are identified as the contingency factors, indicating that these factors are able to affect a manufacturing firm's MAS design (Adbel-Kader & Luther 2008) especially in a developing nation such as Malaysia. Managers would require more relevant information to make decisions as the business environment changes rapidly. Besides, as the government pours in effort to develop and expand the manufacturing firms in Malaysia, there is a need to investigate whether the changes in organizational structure has an impact on the MAS design. On the other hand, as manufacturing technology continues to advance, there is also a need to identify whether advanced manufacturing technology affects the MAS design in Malaysia and whether the best MAS design is able to assist firms to cope with the intensity of the market competition. Thus, this study will adopt the contingency-based approach with the objective of investigating the relationship between decentralization, the adoption of advanced manufacturing technology and the intensity of market competition with the MAS design among manufacturing firms in Malaysia.

The findings from this research will enhance the understanding of contingent factors that could influence the MAS design among manufacturing firms in Malaysia. Besides, this study will also provide further evidence on the contingent factors that could influence the MAS design from the perspective of a developing country. Furthermore, this study will also assist companies to understand the need to adopt the appropriate MAS design in order to obtain relevant information for decision making purposes.

The remainder of the paper is organized as follows. In the next section, the concept of MAS design and the independent variables are explored. Following this, the contingency model is developed with a set of testable hypothesis. In the subsequent sections, the research method is described and the findings and conclusions are outlined.

Management Accounting System (MAS)

The definition of MAS has expanded over the years from one that focuses purely on providing useful, accurate and timely information for decision making to one that embraces a much broader scope of information, including both the internal and external information (Chenhall 2003). As for the purpose of this research, the definition of MAS will be adopted from the study of Rahman, Omar and Abidin (2003). It states that MAS are systems used to generate simple, timely, accurate and relevant information to meet the needs of the managers within a firm.

According to Chenhall and Morris (1986), the MAS design consists of four dimensions; namely scope, integration, aggregation and timeliness. In the first dimension known as the 'scope of MAS', it is known to be referred to three descriptions and they are 'the dimensions of focus, quantification and time horizons' of the MAS (Tillema, 2005, p. 102). The first description 'focus' refers to whether the MAS design should produce information that focuses on internal or external events of the organization. The second description 'quantifications' are concerning whether the information is quantified in financial or non-financial terms. The last description 'time horizon' refers to whether the information obtained concern historical data or future data (Chenhall & Morris 1986).

In the next dimension, integration, ensures that information is shared among departments as decision making and departmental performance can affect one another. In the third dimension, aggregation concerns with the provision of information summary either in terms of area of interest, period of time or formal decision models (Chenhall & Morris 1986). Lastly, timeliness concerns with the frequency and speed of the reporting. These four dimensions are used to assist firms to adopt the appropriate MAS design in order to obtain relevant information that is needed by managers to make decisions and to achieve organization's goals (Chenhall & Morris 1986; Gerdin 2005). The four dimensions will also be used to measure the MAS variable in this research; whereby the higher the mean score of the four dimension, the higher the adoption of sophisticated MAS design is.

Decentralization and MAS

Stergiou, Ashraf and Uddin (2013) noted that the structure of the organization influences the amount of control that a manager has in order to extract effort from the labor force. Thus, in order to make strategic decisions, the MAS design is contingent on the organizational structure that firm adopts as this could affect the efficiency of the work flow, the information flow and the control system (Otley 1980; Chenhall 2003; Adbel-Kader & Luther 2008; Hoque 2011). For the purpose of this study, the definition of decentralization will be adopted from Lawrence and Lorsch (1967), as cited in Chenhall 2003), whereby the organization is differentiated in terms of the decision making autonomy given to sub-unit managers and one of the mechanisms used is through decentralization.

Through a review of past literature, various researchers have reported contradicting results on the relationship between decentralization and the adoption of sophisticated MAS design. Adbel-Kader and Luther (2008) and Hoque (2011) have provided empirical results to show that decentralization has a positive relationship with the adoption of sophisticated MAS design in UK and Australia. Chenhall and Morris (1986) suggested that more sophisticated MAS is needed in a decentralized structure in order to ensure all planning, controlling and decision making activities at all levels are exerted with sufficient accurate information. However, interestingly, Chenhall and Morris (1986) also further noted that only the aggregation of information and the integration of information are important for managers in a decentralized structure, but the scope of information and the timeliness of the information are essential for managers working in both centralized and decentralized business structures. This suggests that firms could remain centralized if their focus is mainly to obtain larger scope and more timely information. However, Gul and Chia (1994), as cited in Soobaroyen and Poorundersing (2008), found that only managers working in a decentralized business structure with high levels of uncertainty would require large scope of information. The differences in the above findings could be due to different business environment and economic situation that the firms are in.

Thus, this study mainly focuses on manufacturing firms in Malaysia in order to identify whether the manufacturing firms centralized or decentralized as Malaysia continues to progress. Besides, Adbel-Kader and Luther (2008) noted that firms decentralized as environmental uncertainty increases due to international expansion. Thus, as firms expands, environmental uncertainty increases and this causes firms to decentralize and a more sophisticated accounting system is needed as to ensure that proper cost and control measures are in place in order to obtain relevant information for the top managements to make strategic decisions. Thus, this research will explore the changes in business structure with the changes in MAS design in Malaysia's context.

Advanced Manufacturing Technology and MAS

From a review of literature, it is noted that there are two general views on the impact of technology on the MAS design in the firm. The first view is taken from the perspective of the technological advancement stage of a country in comparison with other countries

(Wikewardena & Zoysa 1999; Hyvonen 2005). In the research conducted by Wikewardena and Zoysa (1999), the researcher found that the Japanese had introduced a more sophisticated MAS to their manufacturing firms compared to their Australian counterparts as they are more technological intensive, making them a dominant leader in the global competitiveness. Subsequently, Hyvonen (2005) conducted a similar research and found similar results that the advancement in technology of a nation has a positive impact on usage of sophisticated MAS design in the manufacturing sector of the nation as they need more relevant cost data for decision making purposes. These results suggest that, as per other progressing and developed nations, as Malaysia progresses, the advancement in technology will continue to bring about the adoption of more sophisticated MAS design.

The second view is taken from the perspective of differing product processes and designs (Haldma & Laats 2002; Abdel-Kader & Luther 2008; McLean, McGovern & Davie 2014) which is also known as the manufacturing technology. Otley (1980) has long identified manufacturing technology as a contingent factor that could impact the MAS design due to the differences in the operation methods and product design, causing different cost measurement tools to be adopted; and thus, different MAS design. This view was subsequently supported by Haldma and Laats (2002) and McLean et al. (2014); whereby they also found a positive relationship between adoption of advanced manufacturing technology and adoption of sophisticated MAS design.

Thus, as the manufacturing technology advances, this puts a constrain on the accounting system, prompting firms to adopt more sophisticated MAS in order to accommodate the changes in their cost structures and to ensure the precision of each cost calculation (Haldma & Laats 2002; Abdel Kader & Luther 2008; McLean et al. 2014; Ahmad & Zabri 2015). This has caused the firm to focus on the interpretation of the information generated from their MAS in order to ensure relevant information are provided on a timely basis to assist managers at all levels and be more careful in planning and controlling their activities in order to survive and compete effectively in the market (Abdel-Kader & Luther 2008; Ahmad & Zabri 2015). Likewise, technology is also found to be one of the factors that could impact the MAS design among Malaysian firms (Azizi Ismail 2007; Ahmad & Zabri 2015). Thus, this research will explore the relationship between the adoption of advanced manufacturing technology and the design of the MAS among manufacturing firms in Malaysia.

Market Competition and MAS

Tuanmat and Smith (2011) and Ahmad and Zabri (2015) have identified that market competition is one of the main factors that could affect the MAS design in a firm as market and financial deregulations increase both in the local and international market. This has resulted in active competitors, increasingly diverse customer demands and shorter product life cycle. As a result of the competitive market, O'Conner, Vera-Munoz and Chan (2011), Hoque (2011), Abdel-Maksoud, Abdallah and Youssef (2012) and Zakaria (2015) have found that firms need to pay special attention to their MAS designs in order to obtain relevant information needed to make decisions; and to subsequently adopt the best fit of MAS design that will be able to produce such information for the management of the firm. This will enable firms to support their goals of accessing and exploiting market opportunities and resources more efficiently and rapidly both globally and locally (O'Conner et al. 2011). This is essential as the traditional MAS is oriented towards measuring earnings and has been criticized for its inability to reflect the realities of the global market (Abdel-Maksoud et al. 2012).

In Malaysia, Smith et al. (2008) and Ahmad and Zabri (2015) found that the intensity of the market competition could affect the MAS design of the firm. The researchers found that the respondents adopted a particular system in relation to the competition factor faced by the organization (Smith et al. 2008); such as cost competitiveness, quality improvement and wastage reduction. The demands for lower cost and improved quality products have placed firms in intense competition and this could be achieved by adopting the appropriate MAS design (Smith et al. 2008, Adbel-Kader & Luther 2008). Thus, there is a need to further examine whether manufacturing firms in Malaysia are able to cope with the intensity of market competition by adopting more sophisticated MAS design. Thus, this research will explore the relationship between the intensity of the market competition and the MAS design among manufacturing firms in Malaysia.

Theoretical Framework

The contingency approach to management accounting states that there is no one universally best accounting system that could be applied to all organizations (Khandwalla 1977; Otley 1980). Thus, following this concept, it is suggested that the best MAS design depends on the context, the situation and the type of information needed to make a specific decision in the manufacturing firm (Adbel Kader & Luther 2008; O'Connor et al. 2011; McLean et al. 2014). Through a review of literature, we found various studies that adopted contingency theory to explain the relationship between the variables. Adbel-Kader and Luther (2008) and Halma and Laats (2002) used contingency theory to explain the relationship between the adoption of advanced manufacturing technology with the management accounting system (MAS) design among manufacturing firms in UK and Estonia; while Cadez and Guilding (2008) used contingency theory to investigate the relationship between market orientation and strategic management accounting. However, despite the conceptual and empirical research done, there is still a need for empirical evidence to explain the effect of these factors in the context of manufacturing firms in Malaysia. To address

these issues, this study will examine the relationship between decentralization, advanced manufacturing technology and market competition and the MAS design. Thus, the research model is depicted as below:

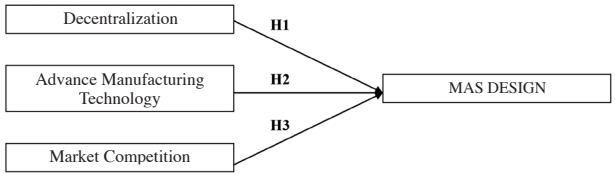

FIGURE 1. Theoretical framework of this study

Adbel-Kader and Luther (2008) and Stergiou et al. (2013) further noted a positive relationship between decentralization and the adoption of sophisticated MAS design as to ensure all controlling and decision making activities are done with sufficient relevant information. Besides, Soobaroyen and Poorundersing (2008) also noted that the transfer of responsibilities from centralized management to lower level management should be paired with the appropriate flow of useful information and infrastructure to enable strategic decision making purposes. Thus, as firms expand, there is a need for more formal planning and control system through a decentralized structure (Hoque 2011; Stergiou et al. 2013). Thus, as firms in Malaysia continue to expand, there is a need to explore the MAS design with the changes in the business structure among manufacturing firms in Malaysia. Thus, the first hypothesis is formed as:

H1: Decentralization is positively associated with the adoption of sophisticated management accounting system (MAS) among manufacturing firms in Malaysia.

Smith et al. (2008), McLean et al. (2014) and Ahmad and Zabri (2015) noted that managers often determine the MAS design in order to obtain relevant cost and control information to support the production run by the organization's manufacturing technology. This suggests that firms with higher level of manufacturing technology would need more sophisticated MAS to assist the managers to determine the production cost and to provide more useful information for the top management. However, Haldma and Laats (2002) noted no distinctive difference in the MAS design with different production technologies. Thus, in order to identify whether advanced manufacturing technology affects the MAS design in Malaysia, the second hypothesis is formed as:

H2: The adoption of advanced manufacturing technology is positively associated with the adoption of sophisticated management accounting system (MAS) among manufacturing firms in Malaysia.

On the other hand, Cadez and Guilding (2008), O'Conner et al. (2011) and Ahmad and Zabri (2015) have noted that the intensity of the market competition does impact the sophistication of the adopted MAS as firms would need more relevant and timely information in order to make more strategic decisions as market competition intensifies and the business environment becomes increasingly dynamic. Besides, it is found that local and international market competitions have intensified over the past five years for manufacturing firms in Malaysia (Tuanmat and Smith 2011; Ahmad & Zabri 2015). Thus, it is essential to further understand the effect of the intensity of market competition in the context of manufacturing firms in Malaysia and subsequently its impact on the MAS design in the firm. This is crucial because, as market competition intensifies, the sophistication of the MAS design also increases as the computation of costs and performance measurements are expected to be more accurate and relevant. Thus, in order to identify whether the market competition affects the MAS design in Malaysia, the third hypothesis is formed as:

H3: The intensity of market competition is positively associated with the adoption of sophisticated management accounting system (MAS) among manufacturing firms in Malaysia.

METHODOLOGY

SAMPLE AND DATA COLLECTION METHOD

This research will employ questionnaires which are developed by adopting measurements from previous study in order to enhance the reliability and validity of the variables (Abdel-Kader & Luther 2008; Tuanmat & Smith 2011; Ahmad & Zabri 2015). Section A aims to identify the general information of the organization. Meanwhile in Section B, we identify the types of information required by the management according to the four dimensions of the management accounting system (MAS) design stated by Chenhall & Morris (1986). The final section of the questionnaire aims to collect information for the independent variables.

The sample and respondents used in this research are accounts or finance manager in manufacturing firms in Malaysia which were selected from the Federation of Malaysian Manafactures (FMM) directory. This is because this industry is the most influential contributor to the Malaysian economy (Rahman et al. 2003; Mahfar & Omar 2004) and it is considered an information-intensive sector as production technology and machines are advancing rapidly and is exposed to the constant development in the manufacturing technology such as newer production cost structure (Smith et al. 2008). FMM directory is used as it is currently the largest private sector economic organization in Malaysia, representing over 2,500 manufacturing companies of various sizes. 200 firms from Selangor,

Negeri Sembilan and Melaka state were chosen for this study and five addresses were used for pilot survey and the rest were used as the main survey population. Selangor state was selected as it represents the highest percentage of manufacturing firm in the country while Melaka state and Negeri Sembilan state were selected as they are neighborhood stakes which have numerous industrial parks. Of the 200 questionnaires sent out, 140 returned questionnaires were obtained, out of which 137 questionnaires were usable. Descriptive analysis was used to analyze the population's background information while multiple regression analysis was used to test H1, H2 and H3.

Instrumentation The measurement of variables used in this survey was adopted from the research instruments of earlier studies, such as Chenhall and Morris (1986), Gordon Narayanan (1984) and Smith et al. (2008), as to enhance the validity and reliability of the measures. The measurement of the variables is summarized in Table 1.

Findings and Discussion

Reliability Analysis and Confirmatory Factor Analysis

Reliability test and confirmatory factor analyses were conducted as to ensure the reliability and validity of the measurement. Cronbach alpha statistics for decentralization was 0.765, advanced manufacturing technology was 0.798, market competition was 0.737, and MAS design was 0.853; thus, indicating satisfactory internal reliability for each of these variables (Nunnally (1978), as cited in Adbel Kader and Luther (2008)). Subsequently, confirmatory factor analysis using maximum likelihood (ML) estimation was used to test the validity of the construct. From the initial findings of CFA, the model yielded many offending estimates as the regression weights were not within the acceptable range of 0 and 1. This resulted in a non-fit model. Therefore, careful checks were made to the model by deleting these values. All of the 137 responses were evaluated and all measures had a full response. The results were further evaluated using Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). The respecified model fitted the data well (NFI = 0.806, CFI = 0.912, RMSEA = 0.068). Thus, the new model will be used in the multiple regression analysis.

Descriptive Statistics and Analysis

A general review of the profile of the respondent revealed that majority of the respondents were from Melaka (40.9 percent) while 35.8 percent of respondents were from Selangor and 23.4 percent were from Negeri Sembilan. Besides, 54.7 percent (75 respondents) were accounts or finance managers, 20.4 percent (28 respondents) were accounts executives, 13.1 percent (18 respondents) were directors, general managers and chief finance officers while the remaining respondents (11.7 percent) were cost accountants. Further analysis also noted that the highest number of sample companies were from the food and beverage industry (17.5 percent), followed by electrical and electronics (16.8 percent), other industry (14.6 percent), machinery and equipment (12.4 percent), wood based firms (11.7 percent) and rubber products (10.2 percent).

According to Chenhall and Morris (1986), the need for sophisticated MAS increases as the need for these four dimensions of MAS information by the management increases. According to the results from Table 2, the total mean score for the dimension of MAS is 4.02, noting that manufacturing firms in Malaysia require more timely and relevant information in order to make strategic decisions. As for decentralization, the descriptive analysis revealed a mean score of 3.62, noting that over half of the respondents engaged in decentralization. As for the adoption of advanced manufacturing technology, the descriptive analysis revealed a mean score of 3.55, stating that manufacturing firms in Malaysia do adopt

TABLE 1. Contingent variable construct

Variable	Source of construct	Construct description
Management accounting system (MAS)	Chenhall and Morris (1986)	Consists of nine questions identified from Chenhall and Morris (1986), indicated on a five-point scale to test the scope, timeliness, aggregation and the integration of information needed by managers. These items will be used to measure the sophistication of the MAS design adopted by manufacturing firms in Malaysia.
Decentralization	Gordon and Narayanan (1984)	Consists of five questions to indicate, on a five-point scale, the degree of authority assigned to the senior manager. Gordon and Narayanan (1984) adopted most of the survey questions from Khandwalla (1972).
Advanced manufacturing technology	Smith, Abdullah and Razak (2008)	Consists of eight technologies to be indicated on a five-point scale of the degree of technology usage in the firm.
Intensity of market competition	Gordon and Narayanan (1984)	Consists of seven questions, indicated on a five-point scale of the degree of intensity faced by the firm in the local and international markets. Gordon and Narayana (1984) adopted most of the questions from Khandwalla (1972).

TABLE 2. Descriptive statistics of the dimensions of MAS and independent variables

The dimensions of MAS	Mean	Std. Deviation
Scope of information	4.04	0.73
Integration of information	4.00	0.90
Aggregation of information	3.81	0.88
Timeliness of information	4.21	0.64
Overall MAS design	4.02	0.62

Notes: Scale of 1-5: 1 is 'never', 2 is 'rarely', 3 is 'sometimes', 4 is 'often', 5 is 'always'.

	Independent and Dependent Variables					
	Mean	Std. Deviation	Minimum	Maximum	Skewness	Kurtosis
Decentralization	3.62	0.98	1.00	5.00	-0.291	-0.716
Advanced Manufacturing technology	3.55	0.92	1.00	5.00	-0.393	-0.115
Market Competition	4.05	0.70	1.33	5.00	-0.575	0.597

advanced manufacturing technology in their production, and a mean score of 4.05 for market competition suggested that manufacturing firms in Malaysia do face intense competition in the business environment.

Subsequently, Pearson correlation test was conducted and Table 3 shows that all the relationships between the variables were positive and significant.

Multicollinearity test was performed and Table 4 shows the result. The results revealed that a VIF value of less than 1.50 for all tests and a tolerance value of less than 0.90 for all tests; thus, showing that there are no multicollinearity issues among the independent variables.

The multiple regression model for the relationship between decentralization, the adoption of advanced manufacturing technology and market competition and the adoption of sophisticated MAS design produced R value = 0.521, R2 value = 0.272 and the adjusted R2 = 0.249. According to the ANOVA table, the results show that the independent variables can statistically predict the dependent variable [$F(4, 132) = 12.302$, $p < .05$]. This shows that the regression model is a good fit of the data.

H1 examines the relationship between decentralization and the adoption of sophisticated MAS design among manufacturing firms in Malaysia. Table 4 shows an insignificant but positive relationship between decentralization and the adoption of sophisticated MAS design ($t = 0.543$, $p = 0.588$). Thus, H1 is rejected. The insignificant findings could be explained by Gerdin (2005), who noted that firms that decentralize adopt more traditional MAS design than sophisticated MAS design. One of the plausible explanations could be that manufacturing firms in Malaysia adopt a company-wide management accounting system (MAS) design; whereby the MAS design is implemented on the firm as a whole instead of according to a particular context faced by individual departments (Gerdin 2005). When the firm implements a company-wide MAS system, the frequency and details of the firm's financial plans and measurement system, such as the development and pricing of new products, the hiring and firing of managerial personnel, budgeting decisions and the selection of large investments, are imposed by the top management on subunits; while only the operational information is subjected to the subunit's discretion. As a result, behavior formalization occurs and this in itself is an efficient means of control for the company (Waterhouse and Tiessen 1978). Thus, they do not require sophisticated MAS design to act as a control mechanism (Gerdin 2005). This is known as the substitution effect (Gerdin 2005). This could have caused a difference in the findings as adopting a company-wide MAS design will encourage a centralized structure. This view is further supported by Drazin and Van de Wan, 1985 (as cited in Gerdin (2005)). Khadwalla (1972) further noted that decisions such as pricing and budgeting decisions are crucial to the success of the firm and requires the top management's attention. In such cases, a more centralized MAS design is much preferred.

H2 examines the relationship between the adoption of advanced manufacturing technology and the adoption of sophisticated MAS design among manufacturing firms in Malaysia. Table 4 shows a positive and significant

TABLE 3. Correlation table

	Decentralization	Advanced Manufacturing Technology	Market Competition	MAS Design
Decentralization	1.000			
Advanced Manufacturing Technology	0.400**	1.000		
Market Competition	0.331**	0.455**	1.000	
MAS design	0.202**	0.409**	0.369**	1.000

** Correlation is significant at 0.01 level.

TABLE 4. Results of regression of MAS design on Advanced Manufacturing Technology and Market Competition

Models	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t value	p value	Tolerance	VIF
(Constant)	2.066	0.317		6.513	0.000		
Decentralization	0.031	0.057	0.045	0.543	0.588	0.796	1257
Advance Manufacturing Technology	0.187	0.064	0.260	2.945	0.004*	0.709	1.411
Market Competition	0.184	0.081	0.194	2.275	0.025*	0.755	1.324

Note: * = $p < 0.05$

relationship ($t = 2.945$, $p = 0.004$) between the adoption of advanced manufacturing technology and the adoption of sophisticated MAS design. Therefore, H2 is supported. The strong positive relationship is consistent with the past researchers such as Azizi Ismail (2007), Smith et al. (2008) and McLean et al. (2014) who noted that it is essential for firms to adopt the appropriate MAS design in order to obtain relevant cost and control information in making strategic decisions. Besides, the motivation to adopt more sophisticated MAS design could also be due to most of the manufacturing firms are striving to achieve various ISO certificates and the OEM (original equipment manufacturer) status as a result of the volatile economic environment and increasing customized demands (Chen and Li Li 2013). In order to achieve such status, firms are attracted to adopt more advanced manufacturing technologies in order to cope with the business changes (Chen and Li Li 2013). A more sophisticated MAS design is needed to ensure that the top management receives relevant information for decision making purposes as the traditional MAS design is unable to effectively help managers to identify relevant costs and manage their resources. It is also concluded that manufacturing firms in Malaysia are able to cope with manufacturing technological changes with the changes in MAS design.

H3 examines the relationship between the intensity of the market competition and the adoption of sophisticated MAS design among manufacturing firms in Malaysia. Table 4 shows a positive and significant relationship ($t = 2.275$, $p = 0.025$) between the intensity of the market competition and the adoption of sophisticated MAS design. Therefore, H3 is also supported. The results on the relationship between market competition and MAS design has subsequently provided empirical evidence to further support the findings by Cadez and Guilding (2008) and O'Connor et al. (2011) in the context of the manufacturing sector in Malaysia. Besides, Abdel-Maksoud et al. (2012) noted that firms have found that the intensity of the market competition has increased as globalization, privatization and industry modernization initiatives increase in the country. They subsequently found high level of adoption of the sophisticated MAS design among the respondents; concluding that high levels of market intensity leads to high level of adoption of the sophisticated MAS design in order for firms to obtain relevant information for decision making purposes (Cadez and Guilding 2008; Abdel-Maksoud et al. 2012).

Conclusion and Recommendation

This research has found that manufacturing firms in Malaysia are adopting sophisticated MAS design due to their needs for larger scope of information, aggregated information, integrated information and timely information increase. This has interesting implications for the change management as firms begin to adopt more sophisticated MAS design that could provide such information for strategic decision making purposes. This is because a more sophisticated MAS design is able to cope with the business and technological changes and produces relevant information needed by the managers. This reflects the acceptance to change as the firms find that the current MAS design is unable to produce essential information for decision making purposes.

This research has also provided empirical results on the positive relationships between the adoption of advanced manufacturing technology, the intensity of market competition and the adoption of sophisticated MAS design as suggested by past literature. It is found that the adoption of sophisticated MAS is able to help manufacturing firms in Malaysia to cope with the changes in the manufacturing technology and the intensity of the market competition. This is because the adoption of sophisticated MAS is able to provide relevant information needed for cost and control purposes (Smith et al. 2008; McLean et al. 2014); and this is essential as the manufacturing technology advances, it enables the firms to make accurate pricing and budgeting decisions that could impact the firm's success. However, decentralization was not found to have a positive relationship with the adoption of sophisticated MAS design. This could also be due to the ambiguity in identifying whether the personnel's position is classified as top level manager or as a lower level manager in a firm.

This research is subjected to a number of limitations. Firstly, the sample size is drawn from the FMM directory and limited to 200 samples only. Thus, it may not be able to fully represent the whole population of manufacturing firms in Malaysia as it only accounts for firms that

registered under FMM. As a result, any generalization of the study's results to non-members of the FMM, non-manufacturing firms and service organizations would need to be done with extra caution. Data collected from the organization are not longitudinally but only at one point in time. Thus, this research will not be able to include any time-lag changes in the MAS design.

This study would suggest that future research could be done to include firms from service sector and other sectors. This is in line with Malaysia's aim of making the service sector the driver of Malaysia's economic growth. It is essential to include service firms in the future studies in order to further understand the MAS design in the service sector. Lastly, future research could also include other variables from organizational theory such as the organizational culture, the country's economy and political situation, etc. Through this, there will be a wider research on the impact of different variables on the adoption of sophisticated MAS design in the context of manufacturing firms in Malaysia.

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