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# **The Impact of Product innovation on Performance: The Influence of Uncertainty and Managerial Accounting**

## **Information Systems**

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### **Abstract:**

This paper reports on a survey of Taiwanese high-tech firms, using a path analysis to examine the effects of managerial accounting information systems (MAIS) on the relationship between product innovation and organizational performance. Two of the major characteristics suggested by Chenhall and Morris (1986), broad scope and timeliness, are systematically related to the subject matter of this study, thus, employing these two characteristics to explore the connection between MAIS, product innovation and organizational

performance. We find that product innovation has a positive effect on organizational performance through the use of MAIS, and find the extent of this positive effect is more significant in business environments marked by high levels of uncertainty. This study provides evidence to understand whether product innovation requires more extensive use of MAIS in highly uncertain environments and whether the use of MAIS can improve organizational performance. The results also help practicing managers realize the importance of MAIS in modern organizations and the benefits of using MAIS to the organization. Finally, we remind managers engaging in product innovation practices that they should place importance on the use of MAIS, because traditional cost control systems no longer help in solving the problems that are specific to the current, modern business environment.

**Keywords-** Information Systems; Managerial Accounting;

## **1. Introduction**

As global competition intensifies, technological advancement accelerates, and product life cycles shorten, innovation is increasingly becoming an important quality in the pursuit of business excellence and an important competitive strategy. When businesses employ differentiation strategies, product innovation is the key focal point. This not only benefits the company's market share, and the growth of its sales and profits, but it also makes it more difficult for competitors to imitate it. Therefore, there is a positive relationship between product innovation and organizational performance. (Dougherty and Bowman, 1995; Hultink and Robben, 1999; Song and Parry, 1999).

An increase in environmental uncertainty and in the risk attached to innovation activities results in changes in the organizational design, development strategy, and manufacturing technology of firms (Baines and Langfield-Smith, 2003). Today, businesses require more relevant and timely information which is now recognized as one of the most powerful tools to substantially influence the wealth of corporations (Mangaliso, 1995). In order to respond to the changed environment, useful management accounting information can help managers reach informed economic decisions and can motivate its users to aim toward and strive for organizational change (Horngren, 1995). When businesses fail to establish an appropriate accounting information system, they are not able to capitalize on pertinent information, such as that relevant to market shares, consumer tastes, competitor behavior, and technological advancement. Such a shortcoming contributes to ineffective resource management and a gradual decline in organizational performance. In this case, innovation projects always fail and provide no returns to the firm. This not only wastes precious business resources but also creates no benefit to businesses. Hence, in the context of a highly uncertain business environment, managers need to possess more timely and key information related to the external environment.

Chenhall and Morris (1986) indicate that managerial accounting information systems (MAIS) provide a broader scope of information that organizations need to succeed in a more timely

manner. Based on their definition, a broad scope MAIS provides information related to features of the external environment which may be economic or non-economic (such as total market sales, market share, consumer tastes, competitors' actions and technological advances); provides a non-monetary measurement of these external environmental characteristics and provides an estimate of the likelihood of future events occurring (Susanto, Meiryani, 2018). In addition, a timeliness of MAIS can provide timely information on request, report systematically collected information, and provide rapid feedback on decisions. This information can help to correct insufficiencies of the information regarding innovation activities which is available to managers, assist with the objective of devising differentiation strategies, coordinate the change of organization design, and provide greater non-financial information resulting from the increasing use of advanced manufacturing technology (Baines and Langfield-Smith, 2003). This study argues that managers need the information provided by well-designed MAIS in the context of the innovation process to achieve an enhanced organizational performance. The MAIS exert an important influence on the relationship between product innovation and organizational performance. The growing impact of product innovation on organizational performance and the increasingly frequent use of MAIS in modern organizations make this study very important and relevant to the practice of innovation.

There is very little research available on this topic. Previous studies mostly explore the effect of innovation on organizational performance. Because of rising global competition, managers are facing an increasingly uncertain environment and the use of information systems increasingly influences innovation and organizational performance. Since there are few studies exploring the relationship between MAIS and product innovation, this study extends the conclusion of previous research and argues that the use of MAIS in product innovation positively affects organizational performance by investigating managerial behavior in the Taiwanese high-tech industry, and further argues that the extent of this positive effect is more significant in business environments marked by high levels of uncertainty. We believe that exploring this theme further develops research into product innovation and MAIS. The results of this study will aid in understanding why product innovation requires more extensive use of MAIS in highly uncertain environments and why the use of MAIS can improve organizational performance. The results also help practicing managers realize the importance of MAIS in modern organizations and the benefits of using MAIS to the organization.

## **2. Literature Review and Hypotheses**

### ***2.1 Product innovation and organizational performance***

Product innovation is defined as a unique characteristic, which makes a given product different from existing products on the market (Bisbe and Otley, 2004). In the current strongly competitive business environment, innovation has become both the dominant quality that businesses pursue in their search for excellence and the leading factor resulting in product differentiation. From the viewpoint of consumers, product innovation as being the "first" in the market in a given product category is carried out to give consumers more benefits (Rochford and Linda, 1991; Calantone, Vickery and Droge, 1995). In terms of market performance, product innovation improves market share, sales revenues, sales growth, and the achievement of profit targets (Hultink and Robben, 1999; Song and Parry, 1999).

Therefore, product innovation creates continuous profit, thereby improving the related performance measures of an organization. Moreover, a more innovative environment results in the increased use of advanced manufacturing technology, such as computer-aided design, computer-integrated manufacturing, and just-in-time systems. The use of these technologies results not only in increased quality, but also in more satisfied customers. These changes lead to more efficient operations, and in turn increase the profits of the companies. Thus, this study argues that product innovation has a positive effect on organizational performance. The following hypothesis is proposed.

**H<sub>1</sub> : There is a positive relationship between product innovation and organizational performance.**

## ***2.2 Managerial accounting information systems (MAIS)***

MAIS are one subsystem of business information systems (Gul and Chia, 1994). Based on Chenhall and Morris's (1986) definition, MAIS were designed according to the perceived usefulness of four information characteristics: broad scope, timeliness, aggregation, and integration. Moreover, there are four measures of innovation: the number of innovations, the level of innovativeness (the novelty or newness of the technological aspect), the speed of innovation, and being the "first" in the market (Prajogo and Sohal, 2006). The first two of these measures are related to the "broad scope" characteristic of MAIS. The other two measures are related to the "timeliness" characteristic of MAIS. A broad scope MAIS includes a non-monetary measurement of many of these external environmental characteristics. It also provides an estimate, possibly in probabilistic terms, of the likelihood of future events occurring. In addition, a timely MAIS provides timely information on request, systematically collects and frequently reports on information regarding the latest and most important events, and provides rapid feedback regarding prior decisions (Susanto, Meiryani, 2018).

A broad scope MAIS can help to increase the frequency of innovations by making managers well aware of market changes and allowing them to adequately understand customer demand (Susanto, 2016). A broad scope MAIS also provides non-financial information that can remedy problems caused by product innovation. The process of product innovation is thus made more efficient, which, in turn, increases the chances of success of these innovations. In order to accelerate innovation and make a firm's products the "first" in the market, a timely MAIS can give managers timely information regarding news of changes in the market, of consumer demand, and of competitor activities. Using this information, managers are able to choose the optimal time to introduce products in order to achieve the goal of being "first" to the market.

Product innovation is an uncertain process. Each new product development process presents a unique set of problems, and organizations need information to resolve uncertainties as they emerge. The main role of management control systems in product development is to supply the information required to reduce uncertainty (Davila, 2000). During the innovation process, the increased use of advanced manufacturing technology, such as computer-aided design, computer-integrated manufacturing and just-in-time systems, results in the increased use of advanced MAIS, such as activity-based management, life cycle costing and target costing, to ensure the continuous improvement of manufacturing processes (Baines and

Langfield-Smith, 2003). Additionally, MAIS, compared to traditional financially-based accounting practices, also allow employees to focus on meeting differentiation goals, such as innovation, quality and customer service, as they highlight the need for an innovation strategy. In order to achieve new product development and more efficient production processes, an organization cannot be restricted by traditional accounting measures, but needs to make use of a broader set of non-financial measures to evaluate the value-added activities in the manufacturing of products. Furthermore, with product life cycles getting shorter, the timeliness of an MAIS provides managers with timely information relevant to changes in consumer tastes, to market developments and to competitor activities (Chenhall and Langfield-Smith, 1998; Davila, 2000). This allows managers to respond quickly and meet both consumer requirements and market demand. Therefore, product innovation benefits from the use of MAIS. The following hypothesis is proposed:

**H<sub>2</sub> : There is a positive relationship between product innovation and the use of MAIS.**

The proper use of information systems (IS) allows a business to scan, filter, and transmit relevant information speedily to its relevant personnel whenever it is needed (Wang, 2003). Such systems help the organization focus on tracking important organizational and environmental variables, and they coordinate with the organizational structure to respond to the information processing requirements imposed by environmental constraints; therefore, the use of IS enhances business performance. Correspondingly, providing a great deal of broad scope information makes it possible to encourage managers under conditions of severe competition to consider more non-financial information, making the processes involved in product innovation more efficient, thereby increasing the chances of success of innovation activities. Moreover, as more connections and coordination are needed among individual departments, MAIS supply the relevant information about departmental communication and cooperation within the organizational structure that makes business operations more efficient (Chenhall and Morris, 1986; Abernethy and Guthrie, 1994). As product life cycles progressively shorten, timely information helps managers to get information relevant to making timely decisions, to seize profitable opportunities, and to enhance business performance. Thus, the following hypothesis is proposed:

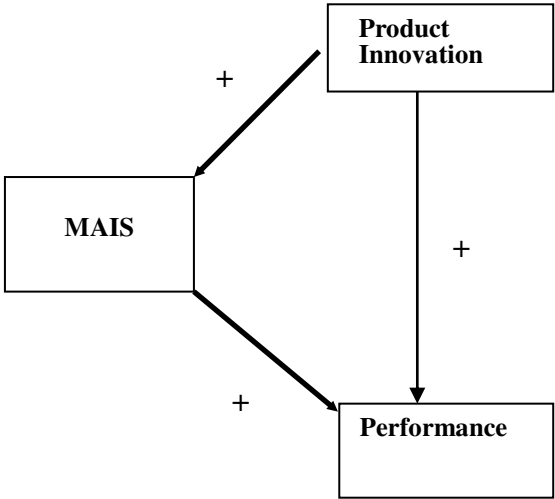
**H<sub>3</sub> : There is a positive relationship between the use of MAIS and organizational performance.**

Based on the inferences underlying Hypothesis 2, MAIS reduce the impact of the factors of uncertainty in the innovation process, they include the multiple dimensions of non-financial measures that make business operations more efficient, they focus on customer-centered information to facilitate the satisfaction of customer requirements, and they provide integrated information to assist in inter-departmental coordination and to increase inter-departmental operational efficiency. These advantages can be employed to achieve innovation more easily. Moreover, MAIS, by providing timely information, help managers involved in the innovation process make wise decisions more quickly, and respond more quickly to the preferences and demands of customers in an effort to pinpoint the moment at which they would be most likely to make a profit. Thus, the more frequently firms engage in innovation activities, the more MAIS are needed.

In addition, based on the reasoning behind Hypothesis 3, MAIS can help managers working in a competitive environment to consider multi-dimensional information and to coordinate inter-departmental operations, resulting in the increased efficiency of business operations. With the shortening of product life cycles, by providing timely information, MAIS help managers make timely decisions and take advantage of opportunities to make a profit. Consequently, MAIS assist in improving organizational performance. Based on this, we can infer that product innovation through the use of MAIS enhances organizational performance. The following hypothesis is thus proposed. This study advances the model as in Figure 1 describing the relationships among product innovation, MAIS and organizational performance.

**H4: Product innovation through the use of MAIS enhances organizational performance.**

**Figure 1 The model of the relationships among Product Innovation, MAS, and Organization Performance**



**2.3 The effects of environmental uncertainty**

As environmental uncertainty increases, competition among products is becoming more severe and the tastes of consumers are increasingly fickle, resulting in the importance of innovation as a competitive strategy. By means of innovation, businesses can improve the quality of their products, meet customer requirements, reduce imitation by their competitors, and increase profits. Thus, businesses facing higher environmental uncertainty demand high rates of product innovation. Baines and Langfield-Smith (2003) indicate that as the environment becomes dominated by increasingly more demanding customers and as competitors respond to such customer demands in increasingly sophisticated ways, a firm may focus more on developing a differentiation strategy that emphasizes more product innovation, quality, etc.

Perceived environmental uncertainty (PEU) refers to managers’ cognitive uncertainty about

the factors that are external to their firms. These factors, including competitor actions, manufacturing technologies and market demand, have been identified as important variables affecting the extent to which managers require MAIS information (Gul, 1991). Managers facing higher levels of PEU require more MAIS information to cope with the uncertainty and make appropriate decisions. Conversely, under conditions of lower PEU, the use of MAIS, which in this case would provide too much complex and unnecessary information, causes information overload and may even be dysfunctional in terms of organizational performance (Gul, 1991). Thus, environmental uncertainty affects the relationships among such factors, innovation, organizational performance, and the use of MAIS.

Management control systems, in the context of the innovation process, are viewed as sources of information that are used to close the gap between “the information required to perform a task and the amount of information already possessed”, and as effective tools to manage and reduce uncertainty because they supply the data needed (Davila, 2000). Therefore, if businesses face high environmental uncertainty, the innovation process requires a broad scope MAIS to supply a great deal of the essential relevant information. In this way, managers are able to control their complex environment and make wise decisions with regard to reducing the risks attached to uncertainty. Chenhall and Morris (1986) also indicate that managers facing uncertain situations are likely to find that they need to respond rapidly to unpredictable change and, as a consequence, find timely information particularly useful. Therefore, under conditions of high environmental uncertainty, innovation processes make MAIS essential to obtaining more timely information, helping managers make timely decisions.

When businesses face high environmental uncertainty, the frequency of developing new products increases and the demand for timely and relevant information rises (Souder and Moenaert, 1992). These factors strengthen the link between product innovation and MAIS. On the other hand, under conditions of low environmental uncertainty, developments in both the market and the technology are brighter and clearer, and market and technology change is slower, which reduces the urgency of the demand for product innovation, in turn leading to a decrease in the demand for broad scope and timely information. The ultimate result is the weakening of the relation between product innovation and the use of MAIS.

Moreover, a broad scope and timely MAIS provides relevant information to assist managers in making effective decisions and integrating information to coordinate inter-departmental operations under conditions of high PEU. Such MAIS also help the innovation process operate more efficiently, maintain market share, and increase profitability. When managers can't get hold of key and timely information, they are not able to make appropriate decisions, thus losing customers and opportunities to make a profit; consequently, the organizational performance worsens. Gul (1991) mentions that MAIS contribute to performance under high PEU conditions. However, in the opposite situation resulting from a fairly predictable competitive environment and market demand, MAIS providing managers with sophisticated information may be dysfunctional and hamper performance. Therefore, under conditions of high environmental uncertainty, there is a stronger positive effect of the use of MAIS on enhancing organizational performance. The following hypotheses are proposed. The integration of the relationships among contextual variables has been explored, and the model is presented in Figure 2.

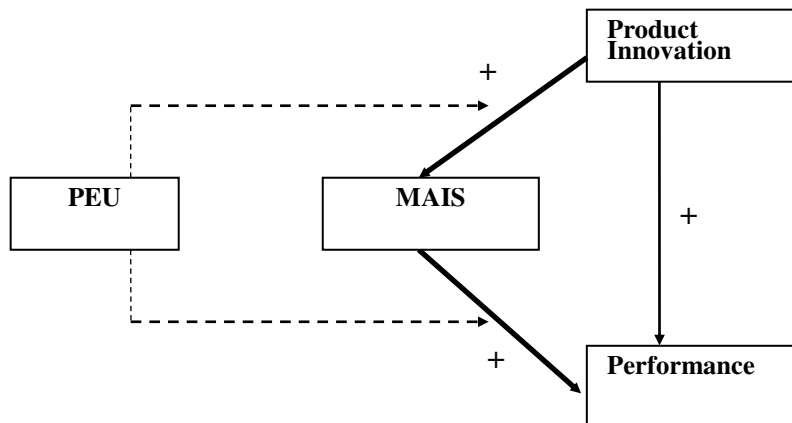
**As environmental uncertainty increases,**



**H5-1 : The positive relationship between product innovation and the use of MAIS will be stronger.**

**H5-2 : The positive relationship between the use of MAIS and organizational performance will be stronger.**

**Figure 2 The model of the relationships among PEU, Product Innovation, MAS and Organizational Performance**



### **3. Method**

#### **3.1 Sample**

The innovation capacity and competitiveness in the high-tech industry have contributed considerably to the Taiwanese economy, so the topic discussed here is specifically appropriate to the Taiwanese high-tech industry. We consider firms in electronics-related industries listed on the Taiwan Stock Exchange (TSE) and the Over-the-Counter Market (OTC) to make up the study population, and we randomly select 150 examples from it. We consult prospectuses of public offerings and issuances as well as annual reports of the 150 firms, in which can be found lists of the departments of each firm. Next, a questionnaire is mailed to 600 managers found by reviewing these lists; they are responsible for, among others, the research and development, marketing, production, finance, accounting, and administrative management departments of the 150 firms. A total of 600 questionnaires are sent out from July to November 2013. Two weeks after the mailing, each manager was telephoned and encouraged to complete the questionnaire. A total of 135 responses were received, of which 9 were unusable, resulting in 126 useable responses, corresponding to a recovery rate of 21%. The average age of the 126 valid respondents is 42.6 years, and they had spent an average of 7.85 years at their current position.

#### **3.2 The measures of variables**

### **(1) *Managerial accounting information systems (MAIS)***

The instrument measuring MAIS is the same as that used in previous MAIS-related studies (e.g., Chenhall and Morris, 1986; Mia and Chenhall, 1994; Chia, 1995; Bouwens and Abernethy, 2000). The instrument includes a total of 10 items, of which the first through the sixth items are used to measure the extent to which broad scope MAIS is utilized, and the seventh through the tenth items are used to measure the extent to which timeliness MAIS is utilized. This measurement is based on a seven-point Likert scale ranging from “not at all useful” to “most useful”.

### **(2) *Product innovation***

Product innovation refers to improving existing products or the frequency with which are launched new products. It is measured using an instrument developed by Bisbe and Otley (2004). The measurement items include (1) the frequency of new product launches; (2) modifications to already existing products; (3) the frequency with which new products are first-to-market, and (4) whether the percentage of new products in the product portfolio of a given firm is higher than the industry average.

### **(3) *Organizational performance***

Organizational performance is defined on the basis of the use of financial and non-financial indicators to evaluate the overall performance of an organization. The measurement instrument of used was developed by Govindarajan (1984), and includes measurements of the financial dimension, such as the growth rates of sales and profits, returns on investment, and profit margins. It also measures the non-financial, customer-related dimension, such as customer satisfaction ratings, the number of new customers, the rate of customer retention, and the increase in the rate of market share.

### **(4) *Perceived Environmental Uncertainty (PEU)***

In accordance with previous research (Gordon and Narayanan, 1984), environmental uncertainty is understood as the degree to which there is a focus on the lack of information on environmental factors, the inability to assign probabilities with confidence to how the environment might affect success or failure, and the impossibility of knowing the outcome of a decision, especially how much the organization stands to lose if the decision is incorrect. The measure of environmental uncertainty, which is adapted from Gordon and Narayanan’s well-established instrument, consists of ten items reflecting managers’ self-evaluations that measure the overall environmental uncertainty businesses are facing. Previous studies call this measure “perceived environmental uncertainty” because it judges the perceived external environment by means of managers’ self-evaluations.

## **3.3 *Research methodology***

Path analysis is a method employed to investigate and quantify the effect of variables occurring earlier on variables occurring later. It is also used to test whether a causal model

fits real data. After these research data are standardized, a regression model and correlation analyses are used to compute the values of the path coefficients which describe the relationships among research variables. In addition to testing the effects of environmental uncertainty on the relationship between product innovation and MAIS, and on that between MAIS and organizational performance, we split environmental uncertainty into two subsamples at the median (43). The cases with a level of environmental uncertainty higher than the median are labeled high PEU ( $n_1 = 63$ ), and those lower than the median are labeled low PEU ( $n_2 = 63$ ). Next, a path analysis is run separately for each subsample, and then differences in path relationships between the two subsamples are compared. By doing this, the effect of environmental uncertainty on the relationships between these variables is brought to light.

#### 4. Research Results and Analysis

Table 1 presents descriptive statistics for each variable in the study, and Table 2 contains a correlation matrix. Table 1 shows a Cronbach alpha of 0.8629 for product innovation, 0.9324 for MAIS, 0.8974 for organizational performance, and 0.7579 for PEU, indicating satisfactory internal reliability for these measurements. Thus, the items within each variable are highly correlated with one another. The high levels of reliability also provide confidence that the items in each variable measure a single construct. Table 2 indicates the correlation between product innovation and organizational performance is positive and significant (0.406,  $p < 0.01$ ), which coincides with the findings of Govindarajan (1984). Product innovation also shows a significant and positive relationship with MAIS (0.393,  $p < 0.01$ ), which, in turn, has a significantly positive effect on organizational performance (0.509,  $p < 0.01$ ). These results are consistent with the expectations of  $H_1$ ,  $H_2$ , and  $H_3$ .

**Table 1 Descriptive statistics (n = 126)**

Variable	Mean	Standard deviation	Cronbach's $\alpha$
Product innovation	22.6259	4.3463	0.8629
MAIS	52.1756	9.7863	0.9324
Organizational performance	32.1895	5.3481	0.8974
PEU	43.9459	6.5903	0.7671

**Table 2 Correlation matrix (n = 126)**

Variable	PEU	Product innovation	MAIS
Product innovation	0.349**		
MAIS	0.422**	0.384**	
Organizational performance	0.364**	0.416**	0.528**

\*\* significant at  $p < 0.01$  (two-tailed tests).

#### 4.1 The effect of MAIS on product innovation and organizational performance

Table 3 shows the results of the path analysis performed on three research variables: MAIS, product innovation and organizational performance. Table 3 reveals the relationship among these three variables, and it provides an understanding of how MAIS affect the relationship between product innovation and organizational performance.

The path coefficient of the relationship between product innovation and organizational performance is positive and significant ( $P_{31} = 0.234$ ,  $p < 0.01$ );  $H_1$  is therefore supported. In addition, the path coefficient of the relationship between product innovation and MAIS is positive and significant ( $P_{21} = 0.383$ ,  $p < 0.01$ ), as is that between MAIS and organizational performance ( $P_{32} = 0.133$ ,  $p < 0.01$ ); therefore  $H_2$  and  $H_3$  are supported, which is consistent with the conclusions of previous research (Dougherty and Bowman, 1995; Hultink and Robben, 1999; Song and Parry, 1999). The results presented in Table 3 provide evidence that product innovation not only directly affects organizational performance, but also indirectly does so through the effect of the use of MAIS on organizational performance,  $H_4$  is thus supported.

**Table 3 Results of path analysis (n = 126)**

Path	Value of path coefficient	t	p-value
MAIS/Product innovation ( $P_{21}$ )	0.383	4.736	0.000**
Organizational performance/MAIS ( $P_{32}$ )	0.133	4.959	0.000**
Organizational performance/Product innovation ( $P_{31}$ )	0.234	2.989	0.003**

\*\* significant at  $p < 0.01$ .

#### 4.2 The effect of environmental uncertainty

Path analyses for the high and low PEU subsamples are run, the results of which are separately shown in Table 4 and Table 5. The path coefficient for the relationship between product innovation and MAIS for the high PEU subsample is positive and significant ( $P_{21} = 0.478$ ,  $p < 0.01$ ), but that for the low PEU subsample is not significant ( $P_{21} = 0.182$ ,  $p > 0.1$ ). A Z-test is used to compare the differences between the correlation coefficients for product innovation and MAIS for both subsamples. The results, listed in Table 6, show an apparent difference ( $p < 0.1$ ) between the coefficients for the two subsamples. This result also implies that the positive link between product innovation and MAIS is stronger for the high PEU subsample. Therefore,  $H_{5-1}$  supported.

According to the path relationship between MAIS and organizational performance, the resultant path coefficient is also positive and significant for the high PEU subsample ( $P_{32} = 0.295$ ,  $p < 0.01$ ), but it is not significant for the low PEU subsample ( $P_{32} = 0.095$ ,  $p > 0.1$ ). We again run a Z-test to compare the differences between the correlation coefficients for MAIS and organizational performance for both subsamples. The results, listed in Table 6, show a significant difference ( $p < 0.05$ ) between the coefficients for the two subsamples; therefore,  $H_{5-2}$  is supported. These findings are consistent with the results of Gul (1991), Mia

(1993), and Mia and Chenhall (1994). To summarize the above findings, product innovation requires a higher level of assistance from MAIS in the case of high PEU, and it is more likely to increase organizational performance under conditions of higher PEU.

**Table 4 Results of path analysis (high PEU subsample, n<sub>1</sub> = 63)**

Path	Value of path coefficient	t	p-value
MAIS/Product innovation (P <sub>21</sub> )	0.468	4.156	0.000**
Organizational performance/MAIS (P <sub>32</sub> )	0.285	2.811	0.009**
Organizational performance/Product innovation (P <sub>31</sub> )	0.481	4.321	0.000**

\*\* significant at p < 0.01.

**Table 5 Results of path analysis (low PEU subsample, n<sub>2</sub> = 63)**

Path	Value of path coefficient	t	p-value
MAIS/Product innovation (P <sub>21</sub> )	0.172	1.346	0.153
Organizational performance/MAIS (P <sub>32</sub> )	0.085	0.710	0.451
Organizational performance/Product innovation (P <sub>31</sub> )	0.406	3.453	0.001**

\*\* significant at p < 0.01.

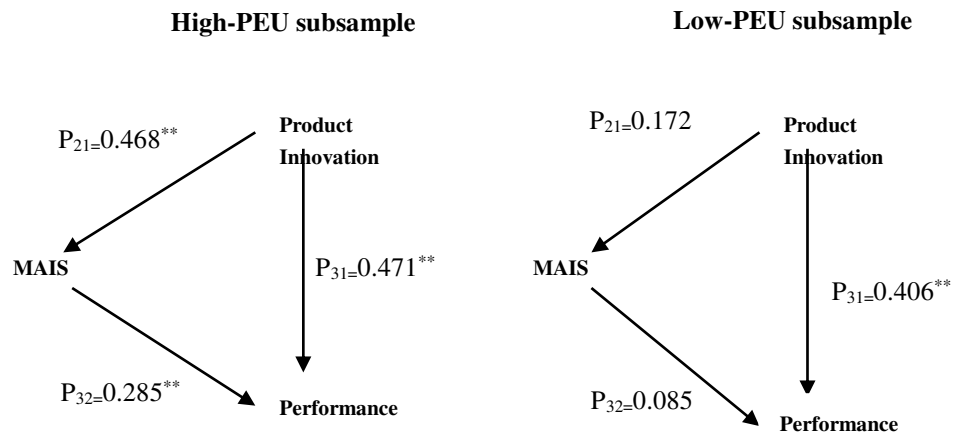
**Table 6 Results of the test of the difference between the correlation coefficients of high PEU and low PEU cases**

Variable	High PEU	Low PEU	Z test on two set of correlation coefficients
Product innovation/MAIS	0.468 (n <sub>1</sub> =63)	0.172 (n <sub>2</sub> =63)	p = 0.0654 <sup>†</sup>
MAIS /Organizational performance	0.515 (n <sub>1</sub> =63)	0.161 (n <sub>2</sub> =63)	p = 0.0245*

\* significant at p < 0.05., † significant at p < 0.1.

For the cases of both high and low PEU, the relationships among product innovation, MAIS, and organizational performance are presented in Figure 3. Figure 3 shows that the direct paths between product innovation and organizational performance in both high and low PEU cases are significant and positive. Through these analyses we find that, when PEU is high, the direct and indirect effects resulting from the use of MAIS are both significant; however, the direct effect is significant, whereas the indirect one is not, when PEU is low.

**Figure 3 Path analysis by PEU subsamples: \*\* significant at p < 0.01. (two-tailed tests)**



## 5. Conclusions

In the current context marked by global competition, quickly advancing technology, and shortening product life cycles, businesses are facing increasingly high levels of environmental uncertainty, under which conditions managers need broader and more timely information. Cost accounting systems, which only emphasize analyzing variance, aggregating costs and accounting for inventory, are not able to handle the current fickle competitive environment. MAIS, by providing broad scope and timely information, significantly impact the innovation process and organizational performance. This study explores the impact of MAIS on the relationship between product innovation and organizational performance on the basis of a survey of managers in the Taiwanese high-tech industry. The results show that not only does product innovation have a direct effect on organizational performance but also an indirect one through the use of MAIS. With environmental uncertainty increasing, MAIS has a more significant influence.

Broad scope MAIS provide multi-dimensional, non-financial information to solve the problems caused by innovation activities and customer-focused information to easily meet customer requirements. In addition, they provide integrated information to aid communication and coordination between departments, which makes business operations more efficient, thus increasing the likelihood of success of innovation activities and decreasing the uncertainty in the innovation process. Moreover, in order to accelerate the pace of innovation and help products be the “first” to market, an MAIS providing timely information allows managers to systematically get news about market dynamics, the demands of customers, and the activities of competitors, which can be used in the innovation process by managers to make timely decisions.

We found that product innovation impacts organizational performance through the use of MAIS, thus solving the managerial problem of an insufficiency of relevant information, helping in the implementation of the objective of differentiation strategies, coordinating changes in organizational structure. Because the use of MAIS decreases the uncertainty of the innovation process, the advantages of MAIS are more pronounced under conditions of high environmental uncertainty. When PEU levels are low, in the sense that competitive

activity and market demand are fairly predictable, providing managers with sophisticated information may be dysfunctional and hamper performance.

There have been many studies exploring the effect of product innovation on organizational performance; however, little research has investigated the benefits of the use of MAIS on product innovation and performance. We explore in detail the relationships between product innovation and MAIS and document the significant impact of MAIS on innovation with empirical evidence. We believe these results make the literature on the relationship between product innovation and organizational performance more complete. They also remind managers engaging in product innovation practices that they should place importance on the use of MAIS.

There are limitations to this study that should be considered. The research data comes from a questionnaire sent to managers in the high-tech industry, and was not easily obtained; in particular, the low response rate needs to be taken in account and may impact the generalizability of the conclusions. Clearly, a greater number of responses would lend more credibility to the outcomes of the analysis. An additional limitation of this research is the assumption of unidirectional relationships between the variables. It is possible that some relationships exist in the opposite direction or are reciprocal. Moreover, a factor not considered by this modeling technique is that the relationships between the variables may not be linear, or that the relationships exhibit linearity only within a limited range. These types of relationships could be evaluated through additional survey studies that utilize more complex quantitative analysis.

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