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Research on Correlation between Information Technology Involvement, Market Orientation, Innovative Activities Implementations and Firm Performances in Taiwan's Science Industrial Park

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Abstract: This study explored the influence of market orientation and information technology involvement concerning the implementation of innovative activities, as well as the influence of innovative activities implementation on firm performance in Taiwan's Science Industrial Park. The results showed that market orientation and information technology involvement have a significant impact on the level of innovative activities implementation. The level of innovative activities implementation has a strong influence on firm performance. Enterprises aiming to enhance their firm performance should strengthen their implementation of innovative activities, market orientation culture and information technology involvement.

Key words: Information technology involvement, market orientation, innovative activities, firm performance

INTRODUCTION

The high-tech industries have been the pillar of the Taiwanese economy. According to the standards set out by the Ministry of Finance in the structures and classifications of import/export products, the industries with high-value added products, complex technologies and high investments in technical competences and R and D expenses are classified as high-tech industries. These industries include chemicals, machinery, electronics and transportation vehicle manufacturing. With the advancements in technologies and shortening of high-tech product life cycles, it is critical to shorten the lead-time for product developments and introductions. Faced with intense competitions, many high-tech companies have been pondering on how to incorporate information technology and market orientation involvement into innovative activities and hence enhance performances via the implementations of innovative activities.

Studies show that the implementations of innovative activities have impacts on firm performances (Deshpande and Farly, 2004; Mole and Worrall, 2001; Yamin *et al.*, 1999; Gopalakrishnan, 2000; Baker and Sinkula, 1999a). Meanwhile, information technology involvement is beneficial to the implementations of innovative activities (Turban *et al.*, 2004; Lee and Runge, 2001; Johannessen *et al.*, 1999; Dibrell *et al.*, 2008). A market-oriented corporate culture is also helpful to the

implementation of innovative activities (Liu *et al.*, 2003; Kohli and Jaworski, 1990; Deshpande *et al.*, 1993; Gatignon and Xuereb, 1997; Slater and Naver, 1995; Hurley and Hult, 1998; Han *et al.*, 1998). However, few empirical studies incorporate information technology involvement and market orientation into innovative activities in the examination of its influence on firm performances. Therefore, this study explores the influence of market orientation and information technology involvement concerning the implementation of innovative activities, as well as the influence of innovative activities implementation on firm performance. The major research objectives were: (1) to explore the influence of the degrees of market orientation on information technology involvement; (2) to examine the influence of the degrees of market orientation and information technology involvement on the degrees of implementations on innovative activities; (3) to investigate the influence of the degrees of market orientation and information technology involvement on firm performances; (4) to delve into the influence of the degrees of implementation of innovative activities on firm performances and (5) to provide recommendations for high-tech companies in performance improvements based on research findings.

Narver and Slater (1990) divided market orientation into three dimensions as follows: (1) customer orientation dimension: full understanding of the needs of targeted customers and predictions of the changes in such needs

under changing market conditions; (2) competitor orientation dimension: analysis on existing and potential competitors in order to form a basis of responding strategies and (3) cross-function coordination dimension: coordination of corporate-wide resources to create value for customers. Kohli and Jaworski (1990) suggested that market intelligence is the important element of market orientation. An organization should comprehensively collect market intelligence in association with the current and future needs of customers. The collated market intelligence should be distributed to various divisions so that they can respond accordingly. To create value in a highly competitive and changing marketplace, it is necessary to keep an open mind and continuously gather all kinds of information that could be of potential use. Hunt and Morgan (1995) also proposed that market intelligence is the key element of market orientation. Market orientation refers to the systematic collection of information related to competitors or customers. Market knowledge can be established with information analysis so that such knowledge can form the basis of confirmation, understanding, creation, selection, execution and correction of strategies. Narver and Slater (1990) examined market orientation from the cultural perspectives. Kohli and Jaworski (1990) investigated market orientation in the context of behavior. Hurley and Hult (1998) argued that although it is possible to explore market orientation from varying angles in the context of an organization, the most meaningful approach is based on organizational cultures. This is because market orientation can only deliver its promises as part of the organizational culture. This paper chooses to tackle the issue with the cultural perspectives developed by Narver and Slater (1990) and divides market orientation into three dimensions, i.e., customer orientation, competitor orientation and cross-function coordination.

Roberts (1996) defined information technology as all the hardware and software tools to acquire, apply, display, store and communicate information. O'Brien (1995) indicated that information technology is the computers-based information technology that applies technologies in software, hardware, telecommunication, database management and information processing. Porter and Miller (1985) suggested that information technology should include all the information created and used by firms, as well as the technologies to process information. This includes computers, communication technologies, data recognition equipment, factory automation, other hardware and software and relevant services. Based on literature reviews, Li (2006) defined information technology as all the resources and efforts an organization invests to achieve the management functions

performed by information technology. Sakaguchi and Dibrell (1998) pointed out that the degrees of information technology involvement can be measured with investments and trainings. Information technology investment is measured with quantitative indicators regarding budgets, hardware and software facilities. Trainings in information technology refer to the levels of trainings to the users of information technology. Miller and Doyle (1987) suggested that the involvement in information technology should take into the following three elements: (1) an understanding of the importance of information technology to a company; (2) investments required in hardware, software and personal to benefit from the use of information technology and (3) staff training based on the needs of developers and users. This paper refers to relevant literature (Nonaka *et al.*, 1996; Miller and Doyle, 1987; Sohal *et al.*, 2001; Duffy, 2000; Sakaguchi and Dibrell, 1998; Li, 2006) to decompose information technology involvement into four dimensions, i.e. perceptions of employs, investments in hardware and software, personal training and the degrees of information technology application.

Scholars have varying views on the definitions and contents of innovative activities. Robbins (2005) suggested that innovations are new ideas, applicable to the development or improvement of products, processes and services. Robbins and Coulter (2005) indicated that innovations are the flow to transform creative ideas into useful products, services or work methods. Tsai (1997) proposed that innovations can be considered in four dimensions: (1) products dimension: innovations measured with the number of new products (Kelm *et al.*, 1995; Kochhar and David, 1996), (2) processes dimension: Johannessen and Dolva (1994) and Scott and Bruce (1994) stated that innovations is a process, emphasizing the assessment of innovation by using a series of procedures and (3) products and processes dimension: a dual dimension taking both products and processes into consideration should be adopted to define innovations, according to Sandvik and Sandvik (2003), Dougherty and Bowman (1995) and Lumpkin and Dess (1996) and (4) multiple dimension: innovations not only with a focus on technical elements and management innovations not to be overlooked, according to Moore (2004), Robbins (2005) and Fariborz (1991). They argued that innovative activities should include the technological innovations in relation to products, processes and facilities and the management innovations in association with systems, policies, projects and services. Daft (1978) classified innovative activities into the follows: (1) innovative activities of the management structures, including the innovations in strategies and organizational composites

and (2) technical innovative activities, including the innovations in products, technologies, workflows and product creativity. Johne (1999) divided innovative activities into: (1) market innovative activities: the definition of new markets and the methods to offer best services; (2) product innovative activities: the validation of new products and the methods to develop best products and (3) manufacturing process innovative activities: the verification of new internal operations and the method to achieve best efficiency. North and Smallbone (2000) classified innovative activities into the innovations in products, markets, marketing techniques and management. Chacke (1988) categorized innovative activities into: (1) product innovative activities: R and D of new and creative products; (2) procedure innovative activities: the adoption of new production methods and (3) organizational innovative activities: development of new organizational structures and patterns. Tien *et al.* (2007) reviewed relevant literature and group innovative activities into technical, market, management and cultural dimensions. This study refers to Tien *et al.* (2007) to classify innovative activities into four dimensions, i.e. technical innovative activities, market innovative activities, management innovative activities and cultural innovative activities.

Shrader (2001) used profit margins and sale growth rates to measure firm performances. Chow *et al.* (2003) measured firm performances with long-term profitability, growth in sales or earnings and financial strengths. Tippins and Sohi (2003) evaluated firm performances with profit margins, returns on investments, customer retentions and sales growth. Kirca *et al.* (2005) referred to overall performances, profit margins, sales and market shares as performance indicators. Baer and Frese (2003) chose to use the achievement rates of corporate targets as a subjective measure of performances. Baker and Sinkula (1999a) measured firm performances with sales, market shares and profit margins. Slater and Narver (2000) appraised corporate performances with returns on investments and sales growth. Pelham (2000) measured corporate performances with firm effectiveness, growth/shares and profitability. Based on literature reviews, this study evaluates firm performances with profit margins, returns on investments, customer retentions and sales growth, according to Tippins and Sohi (2003).

Baker and Sinkula (1999b) pointed out that a highly market-oriented organization actively collects information relevant to customers and responds to the market accordingly. Desai *et al.* (2001) argued that to discover market opportunities and more efficiently respond to customers, organizations have strong motivations to seek information technology solutions to tackle market issues.

Information technology involvement empowers companies to effectively process market information. To sum up, this study proposes the following hypothesis:

- **H₁:** The higher the market orientation, the more significant and positive influence it exhibits on information technology involvement

Turban *et al.* (2004) indicated that information technology involvement can improve productivity and enhance innovation capabilities. Lee and Runge (2001) suggested that information technology involvement has positive influence on the improvement of innovative activities. Johannessen *et al.* (1999) pointed out that information technology betters the internal communications, changes the efficiency of existing operational flows and benefits the implementation of innovative activities. Dibrell *et al.* (2008) argued that information technology involvement is positively correlated with the innovations of products and manufacturing processes. To summarize the above literature review, this study proposes the following hypothesis:

- **H₂:** The higher information technology involvement, the more significant and positive influence it creates on the degrees of implementation of innovative activities

Liu *et al.* (2003) suggested that market-oriented organizations have better degrees of implementation of innovative activities. Kohli and Jaworski (1990) indicated that market orientation can be regarded as an innovation in its own right. Market-oriented companies are dedicated to innovations in order to respond to market demands. Deshpande *et al.* (1993) pointed out that market orientation is beneficial to the implementation of innovative activities. Gatignon and Xuereb (1997) argued that under the highly uncertain market conditions, market orientation helps to drive innovative activities because the collection of customers-related information mitigates the uncertainties. Slater and Narver (1995) suggested that market orientation enhances innovation capabilities and influences the development results of new products. Hurley and Hult (1998) proposed that market-oriented organizations apply new concepts and take new actions to respond to market demands and enhance innovative activities. Han *et al.* (1998) demonstrated that market orientation affects innovative activities and the degrees of innovative activities have influence on firm performances. Based on the above literature review, this study proposes the following hypothesis:

- **H₃**: The higher market orientation, the more significant and positive influence it has on the degrees of implementation of innovative activities

Baker and Sinkula (1999b) and Farrell (2000) proposed that market orientation can enhance customers' satisfaction and enhance firm profitability with an understanding of customers' demands. Pelham (2000) indicated that the degrees of market orientation are positively correlated with the benefits of marketing, sales growth and earnings margins. Singuaw *et al.* (1998) suggested that highly market oriented companies actively gather and use market information to meet customers' needs. Matsuno *et al.* (2002) indicated that market orientation and organizational performances are positively correlated. Ruekert (1992) argued that the degrees of market orientation and organizational performances are significantly and positively correlated. According to Matsuno and Mentzer (2000), the degrees of market orientation have significantly and positive influence on organizational performances. Hooley *et al.* (2000) found that the performances of highly market oriented companies are superior to those of low market oriented companies. On the basis of the above literature review, this study proposes the following hypothesis:

- **H₄**: The higher market orientation, the more significant and positive influence it boasts on firm performances

Davenport and Grover (2001) suggested that information technology involvement enhances the capabilities in automation, tracking and control, knowledge management, generalization and accumulation, massive processing, analysis and handling. Therefore, it is beneficial to firm performances. Krishnan *et al.* (1999) pointed out that an increasing number of companies provide information-technology-based services to customers in order to upgrade the quality of products and services, enhance customers' satisfaction, corporate profitability and financial performances. Bharadwaj (2000) proposed that information technology can improve work contents so that managers can process more information. The application of information technology helps to enhance firm performances. Devaraj and Kohli (2003) suggested that information technology can effectively better organizational performances. Sander and Premus (2002) indicated that the use of information technology can lower costs, shorten product cycle times and upgrade product quality. It is a positive influence to performance improvements. Anderson *et al.* (2003) found that information technology involvement exhibits positive

influence on organizational performances. Dewan and Min (1997) argued that there is a positive correlation between investments in information technology and firm performances. To sum up the above literature review, this study proposes the following hypothesis:

- **H₅**: The higher information technology involvement, the more significant and positive influence it reports on firm performances

North and Smallbone (2000) indicated that the better the implementations of innovative activities, the better firm performances are. Neely and Hii (1998) regarded innovations as a prerequisite to the improvement of organizational performances. Dietzenbacher (2000) proposed that innovation performances have influence on organizational competitiveness. Only with constant innovations can the sustainability of an organization be assured. Baker and Sinkula (1999a) suggested that highly innovative companies perform better in revenues, market shares and profit margins. Deshpande and Farley (2004) and Mole and Worrall (2001) suggested that there is a positive correlation between innovative activities and the improvement of organizational performances. Yanuin *et al.* (1999) referred to the manufacturers in Australia to examine the influence of management innovations, technological innovations and product innovations on organizational performances. Their study showed that the companies with heavy innovative activities perform better than those with weak innovative activities. Gopalakrishnan (2000) argued that the companies who start innovative activities early report better financial performances. To summarize the above literature review, this study proposes the following hypothesis:

- **H₆**: The higher the degrees of implementation of innovative activities, the more significant and positive influence it creates on firm performances

MATERIALS AND METHODS

This study aims to explore the relationships among the degrees of market orientation, information technology involvement, the degrees of innovative activities implementations and firm performances. Figure 1 shows the research structure.

Research hypotheses: To summarize the literature review, this study proposes the following hypothesis:

- **H₁**: The higher the market orientation, the more significant and positive influence it exhibits on information technology involvement

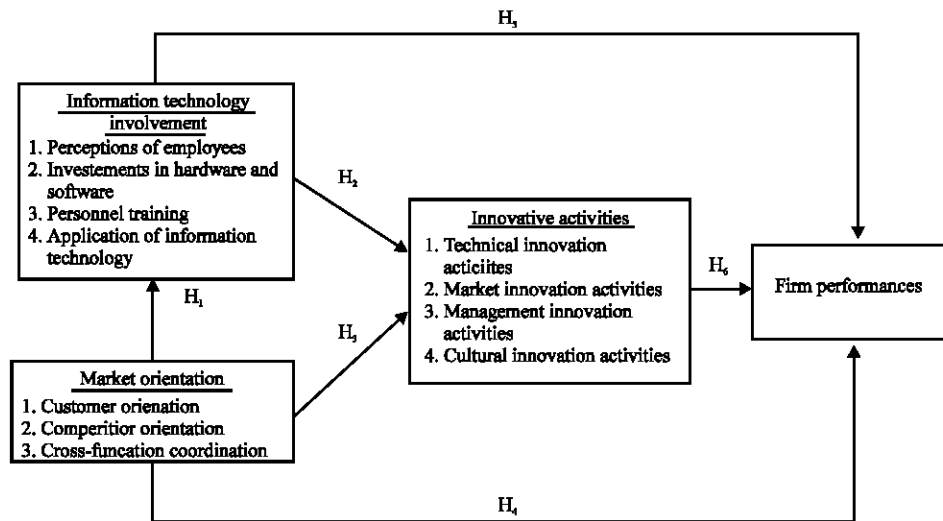


Fig. 1: Research framework

- H_2 : The higher information technology involvement, the more significant and positive influence it creates on the degrees of implementation of innovative activities
- H_3 : The higher market orientation, the more significant and positive influence it has on the degrees of implementation of innovative activities
- H_4 : The higher market orientation, the more significant and positive influence it boasts on firm performances
- H_5 : The higher information technology involvement, the more significant and positive influence it reports on firm performances
- H_6 : The higher the degrees of implementation of innovative activities, the more significant and positive influence it creates on firm performances

Questionnaire collections and data analysis: This study sampled the manufacturers in Taiwan’s Hsinchu Science Industrial Park and Southern Taiwan Science Industrial Park. The surveyed industries included the integrated circuits industry, computer and peripherals industry, telecommunication industry, electro-optical industry, automation industry and biotechnology industry. The questionnaire respondents were senior managers of the sampled companies. The questionnaires were anonymous and distributed to 572 companies at the beginning of October 2009. A total of 92 samples were collected from the senior managers of 92 high-tech companies by December 2009, of which 84 were valid (basic information of the companies shown in Table 1). The items were designed based on the feedback from scholars and experts and literature reviews. Nunnally (1978) suggested

Table 1: Basic information of the companies

Data items	Times
Industry	
Integrated circuits	27
Computer and peripherals	10
Telecommunication	11
Electro-optical	17
Automation	10
Biotechnology	9

Table 2: Reliability values for all variables in this study

Questionnaire dimensions	Cronbach’s α
Information technology	
Perceptions of employees	0.936
Investments in software and hardware	0.958
Personnel training	0.930
Degrees of information technology application	0.911
Market orientation	
Customer orientation	0.915
Competitor orientation	0.912
Cross-funcion coordination	0.912
Innovative activities	
Technical innovative activities	0.866
Market innovative activities	0.837
Management innovative activities	0.936
Cultural innovative activities	0.937
Firm performances	0.889

that a reliability of above 0.7 is acceptable for any exploratory study. All the reliability variables in this paper were above 0.7 so they were deemed reliable. Table 2 shows the reliable values of individual variables. SPSS were used for data processing in order to perform a variance analysis (ANOVA).

Variable measurements: The measured variables are the degrees of market orientation, the degrees of information technology involvement, the degrees of implementation of innovative activities, industries and company scales. Below is a description of these measurements.

Measurement of the degrees of market orientation: This study refers to the three dimensions developed by Narver and Slater (1990) as the research variables for market orientation. Based on the literature review, this study generalizes the activities required for market orientation as follows:

- **Customer orientation dimension:** Six measurements: Systematic evaluations of customers' satisfactions; Primary goal is to achieve customer satisfaction; the provision of comprehensive after-sale services; commitment to customers; gathering of relevant information to keep abreast of customers' demands; the continuous offering of products and services to create value for customers
- **Competitor orientation dimension:** Four measurements: Regular meetings of senior managers to discuss strengths and weaknesses of competitors; the collection of information from multiple resources regarding competitors as a reference for different divisions; rapid responses to the activities of competitors; continuous seeking of target market segments in order to create competitive advantages
- **Cross-function coordination dimension:** Five measurements: Sharing of information and intelligence among different divisions concerning customers; cross-function integration in accordance with overall corporate strategies; regular visits by senior managers to key customers; sharing of resources among departments; significant contributions from varying departments to bring values to customers

The measurement is based on Likert 5 scales; 5: Strongly agree, 4: Agree, 3: Fair, 2: Disagree and 1: Strongly disagree.

Measurement of the degrees of information technology involvement: This study reviews relevant literature and defines information technology involvement with four dimensions, i.e., perceptions of employees, investments in hardware and software, personnel training and application of information technology. Below is a description of the contents of each dimension:

- **Perceptions of employees:** Three measurements: Corporate support for information technology involvement; shared visions regarding the importance of information technology; employees' acceptance of information technology
- **Investments in hardware and software:** Three measurements: The availability of budgets for information technology; sufficient investments in software; sufficient investments in hardware

- **Personnel training:** Four measurements: Whether the training and education employees receive in information technology are sufficient; whether employees are able to master the use of information technology; whether the company has sufficient personnel in information technology; whether the company provides comprehensive teaching materials and users' manuals
- **Application of information technology:** Four measurements: The application of information technology to assist operations; the utilization of information technology to establish comprehensive communication networks with customers and suppliers; the use of information to deliver important information to employees and the employment of information technology to process gathered data into useful information

The measurement is based on Likert 5 scales; 5: Strongly agree, 4: Agree, 3: Fair, 2: Disagree and 1: Strongly disagree.

Measurement of the degrees of the implementation of innovative activities: The measurements for innovative activities in this paper are based on the measurements developed by Tien *et al.* (2007) for the evaluation of innovative activities and with a reference to opinions of scholars and experts and a literature review. Innovative activities are divided into technical innovative activities (3 activities), market innovative activities (3 activities), management innovative activities (5 activities) and cultural innovative activities (5 activities). Below is a description of the contents of each activity:

- **Technical innovative activities:** Three activities: The development of new technologies or equipment to enhance product qualities or reduce costs; the improvement of existing technologies or equipment to better product qualities or lower costs; the introduction of new technologies or equipment to enhance product qualities or decrease costs
- **Market innovative activities:** Three activities: The application of new technologies or operational procedures to cater to customers' demands so as to enhance customers' satisfaction; the changes of operational flows to meet customers' demands so as to enhance customers' satisfaction; the development of different types of products to address customers' demands so as to enhance customers' satisfaction
- **Management innovative activities:** Five activities: The introduction of new management systems to enhance order-taking capacities; the training for the use of new technologies and equipment; the improvement of operational flows to meet customers'

demands; the training of employees to accept new operational concepts; the effective utilization of R and D budgets

- **Cultural innovative activities:** Five activities: The encouragement of innovations by employees; the encouragement of opinions or suggestions from employees; the discussions between managers and employees regarding how to improve work methods or techniques; sharing of work experience between colleagues; the availability of resources or assistance to employees

The measurement is based on Likert 5 scales; 5: Strongly agree, 4: Agree, 3: Fair, 2: Disagree and 1: Strongly disagree.

Measurement of firm performances: This study refers to the four measurements proposed by Tippins and Sohi (2003) to evaluate firm performances. These indicators include the following: (1) over the past three years, the company's profit margins are relatively high compared to its peers; (2) over the past three years, the company's sales growth is relatively high compared to its peers; (3) over the past three years, the company's return on investment is relatively high compared to its peers; (4) over the past three years, the percentage of repeated customers is relatively high for the company. The measurement is based on Likert 5 scales; 5: Strongly agree, 4: Agree, 3: Fair, 2: Disagree and 1: Strongly disagree.

RESULTS AND DISCUSSION

Correlation between degrees of market orientation and information technology involvement: This study divides the degrees of market orientation (customer orientation,

competitor orientation and cross-function coordination) into two groups (high levels of implantations and low levels of implementations). The next step is to examine whether the average scores of these two groups (high levels and low levels) are significantly different in terms of their information technology involvement (i.e., perceptions of employees, investments in hardware and software, personnel training and application of information technology). Table 3 shows the variance analysis results concerning the influence of market orientation on the degrees of information technology involvement. The finding supports H₁: The higher the market orientation, the more significant and positive influence it exhibits on information technology involvement.

Correlation between information technology involvement and innovation management activities: This study divides the degrees of information technology involvement (i.e., perceptions of employees, investments in hardware and software, personnel training and applications of information technology) into two groups (high levels of implantations and low levels of implementations). The next step is to examine whether the average scores of these two groups (high levels and low levels) are significantly different in terms of their respective innovative activities (technical innovative activities, market innovative activities, management innovative activities and cultural innovative activities). Table 4 shows the variance analysis results concerning the influence of information technology involvement on the degrees of implementations of innovative activities. The finding supports H₂: The higher information technology involvement, the more significant and positive influence it creates on the degrees of implementation of innovative activities.

Table 3: Variance analysis of the influence of the degrees of market orientation on the degrees of information technology involvement

SOV	Perceptions of employees				Investments in hardware and software				Personnel training				Application of information technology			
	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value
Customer orientation	3.65	4.22	13.62	0.000*	3.01	3.77	15.96	0.000*	3.15	3.79	16.04	0.000*	3.31	3.95	18.62	0.000*
Competitor orientation	3.63	4.22	14.87	0.000*	2.84	3.84	31.39	0.000*	2.99	3.85	34.42	0.000*	3.23	3.98	27.10	0.000*
Cross-function coordination	3.70	4.25	13.94	0.000*	2.93	3.90	32.68	0.000*	3.07	3.90	35.78	0.000*	3.35	3.99	20.59	0.000*

[#]: Low: The average score in market orientation lower than 4; High: The average score in market orientation higher than 4; *p<0.05

Table 4: Variance analysis of the influence of the degrees of information technology involvement on the degrees of implementation of innovative activities

SOV	Technical innovative activities				Market innovative activities				Management innovative activities				Cultural innovative activities			
	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value
Perceptions of employees	3.80	4.22	8.06	0.006*	3.60	4.07	8.91	0.004*	3.48	4.03	10.24	0.002*	3.35	4.04	13.52	0.000*
Investments in hardware and software	3.91	4.40	15.78	0.000*	3.67	4.32	27.64	0.000*	3.60	4.27	24.24	0.000*	3.54	4.31	25.93	0.000*
Personnel training	3.92	4.33	10.73	0.002*	3.62	4.32	34.03	0.000*	3.49	4.32	45.69	0.000*	3.43	4.34	41.80	0.000*
Application of information technology	3.89	4.30	10.69	0.002*	3.60	4.24	26.19	0.000*	3.50	4.21	28.35	0.000*	3.43	4.23	28.78	0.000*

[#]: Low: The average score in information involvement lower than 4; High: The Average score in information involvement higher than 4; *p<0.05

Table 5: Variance analysis of the influence of the degrees of market orientation on the degrees of implementation of innovative activities

SOV	Technical innovative activities				Market innovative activities				Management innovative activities				Cultural innovative activities			
	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value	Low [#]	High [#]	F-value	p-value
Customer orientation	3.70	4.33	26.28	0.000*	3.49	4.20	30.25	0.000*	3.46	4.11	19.41	0.000*	3.44	4.09	14.88	0.000*
Competitor orientation	3.73	4.31	20.81	0.000*	3.48	4.19	29.18	0.000*	3.33	4.16	36.54	0.000*	3.27	4.16	32.03	0.000*
Cross-fnction coordination	3.86	4.29	11.62	0.001*	3.58	4.21	24.67	0.000*	3.43	4.20	33.21	0.000*	3.29	4.25	46.64	0.000*

[#]: Low: The average score in market orientation lower than 4; High: The average score in market orientation higher than 4; *p<0.05

Correlation between market orientation and innovative activities:

This section examines the influence of market orientation (i.e., customer orientation, competitor orientation and cross-function coordination) on the degrees of implementation of innovative activities (technical innovative activities, market innovative activities, management innovative activities and cultural innovative activities). This study divides the degrees of market orientation into two groups (high levels of implantations and low levels of implementations). The next step is to examine whether the average scores of these two groups (high levels and low levels) are significantly different in terms of their innovative activities. Table 5 shows the variance analysis results concerning the influence of the degrees of market orientation on the degrees of implementation of innovative activities. The finding supports H₃: The higher market orientation, the more significant and positive influence it has on the degrees of implementation of innovative activities.

Correlation between market orientation and firm performances:

This study divides the degrees of market orientation (customer orientation, competitor orientation and cross-function coordination) into two groups (high levels of implantations and low levels of implementations). The next step is to examine whether the average scores of these two groups (high levels and low levels) are significantly different in terms of their firm performances. Table 6 shows the variance analysis results concerning the influence of market orientation on firm performances. The finding supports H₄: The higher market orientation, the more significant and positive influence it boasts on firm performances.

Correlation between information technology involvement and firm performances:

This study divides the degrees of information technology involvement (i.e., perceptions of employees, investments in hardware and software, personnel training and application of information technology) into two groups (high levels of implantations and low levels of implementations). The next step is to examine whether the average scores of these two groups

Table 6: Variance analysis of the influence of the degrees of market orientation on firm performances

SOV	Firm performances			
	Low [#]	High [#]	F-value	p-value
Customer orientation	3.09	3.83	26.43	0.000*
Competitor orientation	2.94	3.89	53.84	0.000*
Cross-fnction coordination	3.14	3.87	27.32	0.000*

[#]: Low: The average score in market orientation lower than 4; High: The average score in market orientation higher than 4; *p<0.05

Table 7: Variance analysis of the influence of the degrees of information technology involvement on firm performances

SOV	Firm performances			
	Low [#]	High [#]	F-value	p-value
Perceptions of employees	3.16	3.72	10.22	0.002*
Investments in hardware and software	3.27	3.99	27.16	0.000*
Personnel training	3.23	3.96	29.96	0.000*
Application of information technology	3.20	3.89	24.31	0.000*

[#]: Low: The average score in information involvement lower than 4; High: The average score in information involvement higher than 4; *p<0.05

(high levels and low levels) are significantly different in terms of their firm performances. Table 7 shows the variance analysis results concerning the influence of information technology involvement on firm performances. The finding supports H₅: The higher information technology involvement, the more significant and positive influence it reports on firm performances.

Correlation between degrees of implementation of innovative activities and firm performances:

This study divides the degrees of implementation of innovative activities (i.e., Technical innovative activities, market innovative activities, management innovative activities and cultural innovative activities) into two groups (high levels of implementations and low levels of implementations). The next step is to examine whether the average scores of these two groups (high levels and low levels) are significantly different in terms of their firm performances. Table 8 shows the variance analysis results concerning the influence of market orientation on firm performances. The finding supports H₆: The higher the degrees of implementation of innovative activities, the more significant and positive influence it creates on firm performances.

Table 8: Variance analysis of the influence of the degrees of implementations of innovative activities on firm performances

SOV	Firm performances			
	Low [#]	High [#]	F-value	p-value
Technical innovative activities	3.01	3.71	13.26	0.000*
Market innovative activities	3.05	3.81	25.97	0.000**
Management innovative activities	3.21	3.82	16.93	0.000*
Cultural innovative activities	3.03	3.88	39.82	0.000*

[#]: Low: The average score in innovation management lower than 4; High: The average score in innovation management higher than 4; *p<0.05

CONCLUSIONS

Few empirical studies incorporate information technology involvement and market orientation into innovative activities in the examination of its influence on firm performances. Therefore, this study explores the influence of market orientation and information technology involvement concerning the implementation of innovative activities, as well as the influence of innovative activities implementation on firm performance in Taiwan's Science Industrial Park. It also develops a theoretic model for these relationships based on a literature review. According to the statistical values from Table 3 to 8, the results show that: (1) The degrees of market orientation exhibit significant and positive influence on information technology involvement; (2) The degrees of market orientation and information technology involvement report significant and positive influence on the degrees of implementation of innovative activities; (3) The higher information technology involvement and market orientation, the more significant and positive influence it reports on firm performances and (4) the degrees of implementation of innovative activities have significant influence on firm performances. Thus, in order to enhance firm performances, companies should employ a market-oriented culture (customer orientation, competitor orientation and cross-function coordination) and focus on information technology involvement (perceptions of employees, investments in hardware and software, personnel training, application of information technology). Efforts should also be made to strength innovative activities (technical innovative activities, market innovative activities, management innovative activities, cultural innovative activities).

This study only examines high-tech manufacturers in Taiwan. It is suggested that future studies can perform empirical analyses on other industries or other countries and incorporate more advanced and sophisticated statistical methods in order to derive more comprehensive findings.

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