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New Product Development Time Performance: Investigating the Effect of Market Orientation, Organizational Integration and Innovation Capabilities

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Abstract

The aim of this study is to investigate the effect of market orientation, organizational integration and innovation capabilities on new product development time performance in Taiwanese ICT industry. New product development plays a crucial role in ICT industry, which involves the application of nanotechnology research to develop ICT components and parts. New product needs time-to-market success requires that NPD team members often work with a functional group (internal organization), customers and suppliers (external organization). To understand the mediate effect of organizational integration and innovation capabilities between market orientation and new product development time performance, we propose a research framework, and have conducted empirical research in NPD projects on new products that have successfully launched in the Taiwanese ICT industry. The results suggest managers in ICT industry should focus on organizational integration at first, and then combine their innovational capabilities for the new product time-to-market to sustain the competitive advantage.

Key words: *New product development time performance, market orientation, organizational integration, innovation capabilities, ICT industry*
JEL Classification: *C 19, G13, G 14*

1. Introduction

NPD plays a crucial role in the semiconductor industry, which involves the application of nanotechnology research to develop semiconductor components and parts. New product market success requires that NPD team members often work with a functional group (internal organization), customers and suppliers (external organization). To understand the mediate effect of organizational integration (OI) between market orientation and new product market success, we have surveyed a collection of articles, have attempted to propose a research model, and have conducted empirical research in NPD projects on new products that have successfully launched in the Taiwanese semiconductor industry.

Market orientation has attracted ever-increasing interest since the publication of seminal works (Koli and Jaworski, 1990; Narver and Slater 1990). The role of market orientation as an antecedent of new product development has been extensively documented in the literature (Atuahene-Gima, 1995; Baker and Sinkula, 2005; Grinstein, 2008; Ledwith and O'Dwyer, 2009; Rodriguez-Pinto et al., 2011). Therefore, market orientation is a strategically valuable resource for successful NPD. The importance of organizational integration has also grown dramatically, as noted by the increase in the number of articles in scholarly journals that focus on organizational integration as an independent or dependent variable (Millson and Wilemon, 2002; Tessarolo, 2007). And a great deal of research has found that organizational integration has a positive effect on new product performance (Adler, 1995; Luca and Atuahene-Gima, 2007; Willson and Wilemon, 2002). In recent years, some research has derived a relationship between market orientation and organizational integration (Braunscheidel and Suresh, 2009; Frohlich and Westhrook, 2001; Rosenzweig et al., 2003; Stevens, 1989). In this article, we try to link market orientation, organizational integration, innovation capability and new product development time performance to examine the casual-cause relationship of those variables.

Modern managers face challenges in the management of product development, including how to transform technology into acceptable products and services for the consumer market economically and in a timely manner. The semiconductor industry strives to improve product development procedures by reducing the lead time, adopting matrix methods (e.g., concurrent engineering) and time compression technology, and using more tools and technologies; however, this still cannot guarantee achieving successful product commercialization (Balbontin et al., 2000). Research shows that new products have a high failure rate, especially in the consumer market (Brockhoff, 1999; Crawford, 1987; Urban and Hauser, 1993). To facilitate the success of new product market success, an important question arises: Should the semiconductor industry employ market orientation to enhance organizational integration and innovation capability to achieve new product development time performance? That is, how does market orientation influence organizational integration, which in turn leads to time

performance? This article develops a research model to gain a better understanding of the impact of market orientation, organizational integration and innovation capability on new product development time performance and to emphasize the mediate effect on organizational integration and innovation capability. We test our research model by applying structural equation modeling based on the partial least squares (PLS) methodology. The application of PLS-SEM has expanded in a variety of research in recent years (Hair et al., 2011). Specifically, we employed the SmartPLS (Ringle et al., 2005), which allows the simultaneous testing of hypotheses whilst enabling single- and multi-item measurement and the use of both reflective and formative scales (Fornell & Bookstein, 1982).

2. Literature Review

The NPD team is a project team that is reassigned from a functional department to the product department. The members of the product development team are systematically linked to the functional department through the matrix structure. The organizational integration in this study is the overall integration (OI) proposed by Millson and Wilemon (2002, 2006), including external integration (EI) and internal integration (II). There are two different product development teams: (1) function specialists permanently assigned to the product development team; and (2) mid-level management assigned directly to product development. In the literature on product development, internal organizational integration is highlighted. Interdepartmental integration is important for product development (Adler et. al., 1989; Cooper, 1979; Souder, 1987; Ziger and Modesto, 1990; Kahn, 1996); however, there is a lack of a definition of this concept for reference. Interdepartmental integration is deemed an interactive or communication-related activity in some reports (Dougherty et al., 1987; Griffin and Hauser, 1993). Research has shown that a market orientation and internal organizational integration (interdepartmental integration) can positively influence product development performance. Implementing market orientation will readily lead to improvement in the NPD performance across all departments in an organization (Kahn, 1996). Braunscheidel and Suresh (2009) propose the relationship between market orientation and organizational integration and demonstrated that a high level of market orientation may exhibit both internal and external organizational integration. The firm is oriented in market culture and organization (internally or externally integrated), and the result supported by the case studies proposes that market orientation positively influences internal and external organizational integration (Braunxcheidel and Suresh, 2009). Thus, we hypothesis a positive effect of market orientation on both internal and external organizational integration practices:

H1: Market orientation positively influences organizational integration.

Millson and Wilemon (2002) study the medical equipment, electronic instrument, and construction equipment industry to understand the impact of external and internal

environments on organizational integration and product development, and the impact of organizational integration and product development on market success. They conclude that the impact of external integration on market success is more significant than the impact of internal integration and overall integration.

Gatignon and Xuereb (1997) state that a market-oriented culture would help to improve performance and that it is beneficial for marketing activity and product development; in particular, ability in the areas of development and product launch is crucial. Han et al. (1998) and Baker and Sinkula (1999b) report that a market-oriented culture aids organizational innovation and product success and improves organizational performance. According to Deshpandé and Farley (1999), market orientation involves cross-functional procedures and activity to create and satisfy customers through continuous demand evaluation. Baker and Sinkula (1999) report that a market-oriented culture helps individuals and departments within an organization work on projects together, leading to an impressive outcome. The positive effect of cross-functional collaboration on product innovation performance is well-documented in the literature (Griffin and Hauser 1996; Luca and Atuahene-Gima 2007; Luo et al., 2006; Song and Parry, 1997a). The logic is that cross-functional collaboration ensures that marketing, technical, and other functional capabilities are combined to develop a product that satisfies customer needs. Cross-functional collaboration accomplishes this goal by improving the efficiency of knowledge use and allowing for quality decision making in new project teams (Madhavan and Grover 1998). External organization, however, is related to the ability to gain further information by involving external entities in the development process through network relationships. These entities are usually suppliers (e.g., Hartley et al., 1997; Petersen et al., 2005) and customers (e.g., Campbell and Cooper, 1999; Griffin and Hauser, 1993). Supplier integration has led to significant performance improvement and competitive advantages for firms (Ragatz et al., 1997). Thus, we hypothesize a positive, causal/associative relationship between both types of organizational integration with new product market success:

H2: organizational integration positively influences innovation capability.

H3: organizational integration positively influences time performance.

Many studies have explored innovation capability influence the organizational performance (Brown and Eisenhardt, 1995; Griffin and Hauser, 1996; Johnson and Filippini, 2009; Song and Parry, 1997; Song et al, 1998; Swink and Song, 2007). And innovation capability positively influence the time performance (Johnson and Filippini, 2009; Petersen et al, 2003; Rosengberg, 1982) Therefore, we propose the following assumptions:

H4: innovation capability positively influences time performance.

3. Methodology

3.1 Research Method

To measure the time performance, the two questions we used, with seven-point Likert-type scales, were taken from the literature (Atuahene-Gima, 1995; Griffin and Page, 1996; Im and Workman Jr., 2004). To measure market orientation, (Atuahene-Gima, 1995) three previously mentioned components – the market intelligence generation, market intelligence dissemination, and responsiveness to market intelligence strategy – were used to measure market orientation. The scale consisted of seventeen items concerning the market intelligence generation, market intelligence dissemination, responsiveness to market intelligence. The organizational integration taps into the NPD project. We employed the measures used by Millson and Wilemon (2002). The scale consisted of four items concerning the degree of cooperation between NPD team members and customers, four items concerning the degree of cooperation between NPD team members and suppliers, and four items concerning the degree of cooperation between NPD team members and functional groups. For the empirical analysis, all items were measured on a seven-point Likert-type scale including choices between two extremes: "strongly disagree" and "strongly agree;" point 7 on this scale indicated strong agreement with a statement, and point 1 indicated strong disagreement with a statement. We employed the measures used by Johanson and Filippini (2009). The scale consisted of six items concerning the degree of innovation capability.

This survey included two types of measures, formative and reflective. Market orientation and new product market success were modeled as formative constructs. The three components of market orientation and the dimension of new product market success were considered as formative variables because the corresponding items cover diverse activities that the organization may or may not perform.

The PLS structural equation modeling (Fornell and Cha, 1994) was applied to test the relationships among the constructs. We specifically employed the SmartPLS (Ringle et al., 2005), which allows the simultaneous testing of hypotheses whilst enabling single- and multi-item measurement and the use of both reflective and formative scales (Fornell and Bookstein, 1982). A PLS model is usually analyzed and interpreted in two stages (Hulland, 1999). In the first stage, the measurement model is tested by performing validity and reliability analysis on each of the measures of the model. In the second stage, the structural model is tested by estimating the paths between the constructs in the model, determining their significance and the predictive ability of the model. This sequence is followed to ensure that reliable and valid measures of the constructs are determined before conclusions about the nature of the construct relationships are drawn (Hulland, 1999).

3.2 Data

In this study, to test the hypotheses of our research model, data were gathered using a mail-survey methodology. The target population of this study referenced the Taiwanese semiconductor industry. We selected the semiconductor industry to be the survey objectives because of its quickly evolving new technology and competitive characteristics. Specifically, the Taiwanese semiconductor industry has excellent product performance the world over and has the leading position in the global semiconductor market. To keep this competitive advantage in the world, NPD activities keep playing a critical role in Taiwanese semiconductor industry. The survey list was selected from the Taiwan Semiconductor Industry Yearbook for 2013. A pilot test of the questionnaire was conducted through a mail survey; we sent 200 questionnaires to semiconductor firms in December of 2013, and we received 16 usable responses in January of 2014. The reliability and validity are satisfied. In the spring of 2014, a mail survey was conducted to collect data from NPD project managers who worked in the Taiwanese semiconductor industry. A total of 800 questionnaires (each questionnaire included an introductory letter) was sent to semiconductor firms in April of 2014, and we received 247 valid responses. The total response rate is 30.88%. Self-selection bias is the most important problem associated with a low response rate in survey research (Wilson, 1999). The procedure, as recommended by Armstrong and Overton (1977), compared early (first-quartile) respondents with late (fourth-quartile) respondents. No significant differences were found among the constructs examined in this study. This result suggests that non-response bias was not a major problem.

4. Results and Discussion

We analyzed the data using structural equation modeling. Given (1) our small sample size for the data (43 respondents), (2) the mixed model that we tested (i.e., market orientation and new product market success are formative indicators, and the other constructs are reflective), and (3) the presence of identification constraints (due to the formative indicators) we were unable to use a covariance-based approach (MacCallum and Browne, 1993) and thus selected the PLS approach, specifically using SmartPLS software. The outputs from the PLS software were used first to test the measurement model and then to test the fit and performance of the structural model. The results for the two stages of analysis suggested by Anderson and Gerbing (1988) are as follows:

Stage1: The measurement model: reliability and validity of the measures

The measures used for the constructs are assessed as follows: first, the composite reliability of the measures is listed in Table 1, in which the composite reliability is greater than .70 for all constructs. Second, the convergent validity is assessed by the average variance extracted (AVE); a standard output from PLS. Measures with AVE .50 or higher are said to

exhibit convergent validity (Chin, 1998). The AVEs reported in Table 1 all exceed .50 exclude market orientation (AVE = .47), confirming that all measures demonstrate satisfactory convergent validity. Discriminate validity is established from the latent variable correlation matrix. This matrix has the square root of AVE for the measures on the diagonal, and it has the correlations among the measures as the off-diagonal elements. The matrix must be constructed from the PLS output. Discriminate validity is determined by looking down the columns and across the rows and it is deemed satisfactory if the diagonal elements are larger than the off-diagonal elements. The discriminate validity is demonstrated, as these conditions are satisfied (shown in Table 1).

Table 1: Reliability and the Latent Variable Correlation Matrix: Discriminant Validity

	Cronbach's alpha	Composite reliability	AVE	1	2	3	4
Time Performance	**.**85	.93	.87	**.92**			
Market Orientation	.90	.92	.47	.58	**.69**		
Organizational Integration	.96	.96	.69	.71	.68	**.83**	
Innovation Capability	.84	.89	.59	.73	.64	.76	**.77**

Note: Bold numbers on the diagonal show the square root of AVE.

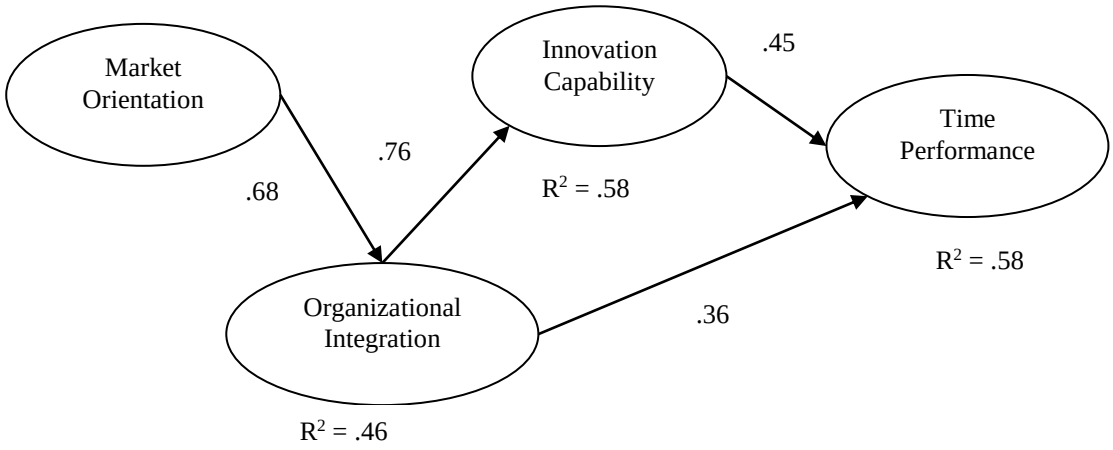
Stage2: Testing the structural model: path coefficients and predictive ability

The PLS method used to estimate the sample correlation coefficient method did not provide a goodness of fit index (GFI), in which the path coefficients and R^2 values are mainly indicators that judge the suitability of the measured models (Chin, 1998). R^2 values provide an indication of the predictive ability of the independent variables. Time performance, organizational integration and innovation capability with R^2 values of .58, .46 and .58, respectively, are considered to provide adequate evidence of the predictive ability of the model (shown in Figure 1). Additionally, path coefficients are reported in Figure 1. Of the three hypotheses concerning the direct relationships between market orientation and organizational integration, organizational integration and innovation capability, organizational integration and time performance – H1 to H3 – are supported (H1, $\beta = .68$, $p < .001$; H2, $\beta = .76$, $p < .001$; H3, $\beta = .36$, $p < .001$). The hypothesis considering the links between internal organizational integration and external organizational integration is supported (H4, $\beta = .45$, $p < .001$). The hypotheses about the relationships between internal organizational integration and new product market success and external organizational integration are verified. The confirmation of H5 ($\beta = .17$, $p < .001$) and H6 ($\beta = .11$, $p < .001$) imply that, as in the case of market orientation, internal organizational integration and external organizational integration do affect time performance.

The key PLS outputs for this analysis are as follows. First, R^2 values reported in Figure 1 provide an indication of the predictive ability of the independent variables. Hulland (1999) examines the R^2 values ranges from a low of 12 per cent (Cool et al., 1989) to a high of 64 percent (Birkinshaw et al., 1995). The R^2 value (.46, .58, .58) for the endogenous construct on

organizational integration, innovation capability and new product development time performance is higher than .12. Second, path coefficients are also reported in Figure 1. PLS, a distribution-free technique uses the bootstrapping re-sampling technique to determine the significance of the paths. The results reveal that all the links in the model are significant at the 0.1% level.

Figure 1: Result



5. Conclusions and Recommendations

In summary, first, firms in the semiconductor industry deploying the market orientation strategy to integrate organization can lead to new product time performance. NPD team members should ensure that they can reach the same goals, have team spirit and be in harmony with customers and suppliers. An NPD team and their customers and suppliers can avoid creating problems for each other so that timely NPD results could be achieved and they can work smoothly together to develop a new product. Second, firms have the innovation capability can directly achieve new product time performance. Third, firms integrate organization can achieve new product time performance. To speed the new product development, a firm in the semiconductor industry could get time performance as NPD team members cooperate more with customers and suppliers. NPD team members should ensure that they can create mutual new product goals, and act cohesively with customers and suppliers. NPD teams, customers and suppliers should avoid creating problems for each other and work smoothly together to develop new products to achieve NPD results in a timely manner.

We suggest further research that studies the effects of customers, suppliers and function groups integration on different performance dimensions separately would improve our understanding of the relative contributions of organizational integration to different NPD efforts and to achieving product market success.

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References

Ahn, J., Lee, D., and Lee, S. 2006, Balancing Business Performance and Knowledge Performance of New Product Development. *Long Range Planning*, 39, 525-542.

Armstrong, J.S., and Overton, T.S. 1977, Estimating Non-Response Bias in Mail Surveys. *Journal of Marketing Research*, 14, 396-402.

Atuahene-Gima, K., and Wei, Y. 2011, The Vital Role of Problem-Solving Competence in New Product Success. *Journal of Product Innovation Management* 28, 81-98.

Birkinshaw, J., Morrison, A, And J. Hulland, 1995, Structural and Competitive Determinants of a Global Integration Strategy, *Strategic Management Journal*, 16, 637-655.

Chin, W.W. 1998, The Partial Least Square Approach for Structural Equation Modeling, 295-366, in: Modern methods for business research. Edited by G. A. Marcoulides, New Jersey: Lawrence Erlbaum Associates.

Cool, K., I. Dierickx, and D. Jemison, 1989, Business Strategy, Market Structure and Risk-Return Relationships: A Structural Approach. *Strategic Management Journal*, 10, 507-522.

Gemser, G., and Leenders, M.A.A.M. 2011, Managing Cross-Functional Cooperation for New Product Development Success, *Long Range Planning*, 44, 26-41.

Johnson, W., and Filippini, R. 2009, Internal vs. External Collaboration in Product Development: What Works. *Research-Technology Management* 52(3), 15-17.

Lawson, B., and Samson, D. 2001, Developing Innovation Capability in Organisations: a Dynamic Capabilities Approach. *International Journal of Innovation Management*, 5(3), 377–400.

Millson, M. R., and D. Wilemon, 2002, The Impact of Organizational Integration and Product Development Proficiency on Market Success. *Industrial Marketing Management* 31, 1-23.