

Examining the Relationship Between Information Acquisition, Entrepreneurial Opportunity Recognition, and Innovation Performance in the High Technology Sector in Taiwan

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The purpose of study was to investigate the relationships between information acquisition, entrepreneurial opportunity recognition, and innovation performance in the high technology sector in Taiwan. The results suggest that both information acquisition and entrepreneurial opportunity recognition positively contribute to individual-level and firm-level innovation performance. Information acquisition and entrepreneurial opportunity recognition were significantly positively correlated. Finally, information acquisition accounted for more variance than entrepreneurial opportunity recognition in both individual-level and firm-level innovation performance.

Key words: Information Acquisition, Entrepreneurial Opportunity Recognition, Innovation

A thorough review of the innovation performance, entrepreneurship, and organizational learning literatures has suggested that information acquisition (IA) and entrepreneurial opportunity recognition (EOR) are critical factors that should be considered in the process of innovation. While capital investments in research and development have typically been associated with innovation for larger firms, small to medium sized enterprises (SMEs) often lack such resources and may need to consider these other factors to enhance innovation performance. Information acquisition, one of the constructs of organizational learning, refers to the ability to obtain information and knowledge from internal and external sources, and entrepreneurial opportunity recognition refers to the ability to recognize opportunities to develop new markets, products, and services. However, these literatures have separately discussed the IA and EOR variables in relation to innovation performance (Brown & Eisenhardt, 1995; Shane & Venkataraman, 2000).

Lopez, Peon and Ordas (2005) have pointed out that the linkage between organizational learning and business performance, such as innovation has been mentioned and assumed in the innovation performance and organizational learning literatures, but little empirical evidence supports this perspective. Moreover, the innovation performance literature has also overly focused on organizational-level innovation performance, such as product innovation performance and firm-level entrepreneurship activities, which include strategic renewal, venturing and innovation (Brown & Eisenhardt, 1995; Zahra, 1996). In fact, both organization learning and entrepreneurial opportunity recognition are based on individual-level efforts that can contribute to organizational-level innovation performance (Dixon, 1992; Huber, 1991; Ozgen, 2003; Shane & Venkataraman, 2000). In addition, most research on EOR has been focused on examining the factors that influence EOR and has primarily used the EOR construct as a dependent variable (Ardichvili, Cardozo & Ray, 2003; Gaglio & Katz, 2001; Orwa, 2003; Ozgen, 2003; Shane & Venkataraman, 2000).

Although the linkage between the organizational learning and EOR literatures can contribute to theories and practices in both fields, little research has examined the relationship between organizational learning (and its related constructs, IA) and EOR (Dutta & Crossan, 2005; Lumpkin & Lichtenstein, 2005). Therefore, to address the gaps in the existing literatures, the overall purpose of this study was to examine the relationships between information acquisition, entrepreneurial opportunity recognition, and innovation performance at two-levels, the individual-level and the organizational-level. In this study, information acquisition and entrepreneurial opportunity recognition represented the independent variables, and innovation performance represented the dependent variable.

Theoretical Framework

This research has drawn upon Dixon's (1992) conceptualization of information acquisition, one of the constructs of organizational learning. Extending Huber's (1991) framework, Dixon reconceptualized five elements of information acquisition and their processes and subprocesses. Dixon's reconceptualization has further elaborated on the information acquisition construct. For Dixon, information acquisition refers to the organization's information processing to utilize and value different information sources in organizations. According to Dixon (1992),

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information acquisition contains internal acquisition and external acquisition. The researchers also adopted Ozgen's (2003) measure of entrepreneurial opportunity recognition. Measurement of innovation performance was adapted from Simsek's (2002) firm-level entrepreneurship, which includes three dimensions: innovation, strategic renewal, and venturing. The individual-level innovation performance was adapted from Scott and Bruce's (1994) instrument of individual innovative behavior in workplace. Figure 1 represents the theoretical model from which the following research hypotheses have been developed.

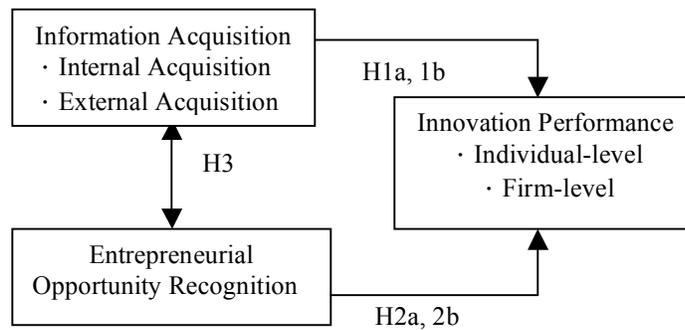


Figure 1. Theoretical Framework

Information acquisition and innovation performance

Organizations not only need to recognize new environmental events but must also better understand how to respond to the environment (Gnyawali & Stewart, 2003; Schaefer & Harvey, 2000). The way an organization adapts to environmental uncertainties is by acquiring knowledge and information from the environment. Daft, Sormunen and Parks (1998) found that top managers of high performance organizations tend to engage in more information collection and processing than the managers of low performance organizations. Brockman and Morgan's (2003) study indicates that an organization's acquisition of new information is positively associated with new product innovation performance. In addition, Soh (2003) emphasized the effects of networking alliances on information acquisition and new product performance. Soh (2003) found that strategic alliances contribute significantly to diverse external information acquisition about external innovations. Jones and Craven (2001) indicate information acquisition activities in SMEs lead to better organizational learning and innovation performance. As a result, it is hypothesized that the greater the information acquisition strategies or activities, the greater the innovation performance.

Hypothesis 1a: A higher level of information acquisition activities will lead to individual-level innovation performance.

Hypothesis 1b: A higher level of information acquisition activities will lead to firm-level innovation performance.

Entrepreneurial opportunity recognition and innovation performance

Danneels (2002) has examined five high-tech firms' product innovation processes, and points out that a firm's competencies related to technology and customer information are necessities for product innovation. Danneels stresses that the creation of new products requires the combination of potential customers and potential technology. In other words, product innovation needs a firm's resources related to current technology and customers. Shane (2000) has explored eight enterprises through in-depth case studies and states that entrepreneurial opportunity recognition means the individuals have the ability to recognize new knowledge to exploit new products and technology, including knowledge of markets, knowledge of ways to serve markets, knowledge of customer problems, and knowledge of technology. Therefore, it is hypothesized that entrepreneurial opportunity recognition may lead to better deciphering and understanding of the new knowledge or technology for innovation.

Hypothesis 2a: A higher level of entrepreneurial opportunity recognition will lead to individual-level innovation performance.

Hypothesis 2b: A higher level of entrepreneurial opportunity recognition will lead to firm-level innovation performance.

Information acquisition and entrepreneurial opportunity recognition

Ozgen (2003) indicates that, "entrepreneurs identify opportunity through learning from various external sources" (p. 71). Ozgen (2003) stresses that information flow plays a critical role in evaluating entrepreneurs' mindsets for identification and recognition of opportunities. The accessing of internal and external sources helps an individual become exposed to update new information to perceive new market or technology opportunities. Ozgen

(2003) states, “since knowledge acquisition has a significant role in creating opportunities, having access to both external and internal sources of information, as well as keeping industry-specific knowledge up to date with extensive reading through industry-related journals, magazines and specialized books, attending advanced training programs, instructional seminars and professional workshop may provide of knowledge” (p. 72). Ozgen’s (2003) concept of information flow towards new opportunities is somewhat similar to Huber (1991) and Dixon’s (1992) definition of information acquisition. However, Dixon’s (1992) definition of information acquisition is more detailed in its components. Dixon’s (1992) framework of information acquisition includes external acquisition and internal acquisition. External acquisition is comprised of: *borrowing, searching, grafting* and *collaborating*. Internal information acquisition includes: *congenital, experiential, experimenting, continuous process improvement, and critical reflection*. The processes and subprocesses that Dixon (1992) refers to in her definition of information acquisition is more comprehensive than Ozgen’s (2003) information flows.

Social networks have also been discussed as one of the factors influencing entrepreneurial opportunity recognition (Ardichvili, Cardozo, & Ray, 2003; Orwa, 2003; Ozgen, 2003; Singh, 1998). Social networks indicate that potential or possible information resources can be accessed through interpersonal networks. That is to say, people who use more social networks are exposed to more opportunities, and recognize more opportunities. One of Dixon’s (1992) dimensions of internal acquisition is grafting, which refers to grafting new members, acquisition, and mergers. Hence, actively contacting multiple external environmental information sources and social networks might provide people with the ability to recognize the changes and discover new entrepreneurship opportunities in the industry.

Further, one of the subconstructs and subprocesses of information acquisition is congenital learning, which means the initial information and experiences individuals or organizations possess and know are inherited from one’s past (Dixon, 1992; Huber, 1991). Researchers have examined whether prior information, for example, education background and work experiences, contribute to the scheme of opportunity recognition process (Ardichvili, Cardozo, & Ray, 2003; Orwa, 2003; Ozgen, 2003; Shane, 2000). Recently, Lumpkin and Lichtenstein (2005) have pointed out that the opportunity recognition is the iterative process that involves insights developed, information collected and considered, and knowledge creation. That is, aspects of the information acquisition concept might potentially overlap with entrepreneurial opportunity recognition. Although entrepreneurial opportunity recognition and information acquisition are slightly different from each other, they may have an influence on each other. Therefore, it is hypothesized that there may be a relationship between the two concepts.

Hypothesis 3: Information acquisition and entrepreneurship recognition will be positively correlated.

Research Design and Setting

Based upon Dixon’s (1992) processes and subprocesses of information acquisition, a new survey instrument was developed to measure information acquisition. The instrument also incorporated measures drawn from several other sources to assess entrepreneurial opportunity recognition (Ozgen, 2003), individual-level innovation performance (Scott & Bruce, 1994), and firm-level innovation performance (Simsek, 2002). A survey-based research design was employed to validate information acquisition, entrepreneurial opportunity recognition, individual innovation performance, and firm innovation performance measures in the high technology sector in Taiwan.

Small and medium enterprises’ (SMEs) contribution to national economies has been recognized in European and Asian countries, such as the UK and Taiwan in past decade (Jones & Macpherson, 2005). Entrepreneurship and organizational learning are critical competitive advantages in SMEs that serve as sources of strategic renewal (Jones & Macpherson, 2005). However, SMEs studies have tended to focus on European countries as targets. Therefore, this study shifted the focus to an Asian country, Taiwan, and specifically explored SMEs as the sample. SMEs account for 80% of Taiwan’s business, and they are increasingly transforming from labor-intensive industries to knowledge-intensive learning and innovative industries, especially the high technology sector. Since high technology industries often face dynamic and fierce competition, they are required to constantly innovate to meet the changing competitive environment (George, Zahra, Wheatley & Khan, 2001). Hsinchu Science Park is the place where most high technology firms are located in Taiwan. Consequently, eleven high technology firms in Hsinchu Science Park in Taiwan were purposefully selected to serve as research sites for this study. Product developers, designers, engineers, and marketing personnel were the sample selection targets identified for this study within these 11 research sites. A total of 123 participants from these 11 sites represented the sample. Of the 192 participants, a total of 123 participants from these 11 sites completed this survey. The response rate for this study was 64%.

Sample

One hundred and ten of the participants were male (89.4%), and 13 of them were females (10.6%). Thirty five (28.5%) participants responded that the main product of their organization was liquid crystal display products, 34 (27.6%) participants indicated personal computer products, and 30 (24.4%) acknowledged their firms were in the communication products. Twenty four (19.5%) participants indicated other products.

Instrumentation

An English version of the full questionnaire was developed. The questionnaire contained information acquisition, entrepreneurial opportunity recognition, individual-level innovation, firm-level innovation measures, and demographic items. Expert examination and a sequential forward-back-translation approach (Bates & Khasawneh, 2005) were conducted for this cross-cultural instrument to ensure that the instrument was appropriate for the Taiwanese context and had face validity. The reliability and validity of the Chinese-translated version of the survey has been previously described (Wang & Ellinger, 2006). The construct validity of the questionnaire was examined by item-to-total correlation and factor analysis. In the information acquisition instrument validation analysis, the construct validity results indicated that Dixon's theoretical framework was mostly empirically supported. Also the results of factor analysis on entrepreneurial opportunity recognition, individual-level innovation, and firm-level innovation measures were exactly the same as the Ozgen's (2003), Scott and Bruce's (1994), and Simsek's (2000) instrument. The internal consistency coefficients of items in the instrument's scales range between 0.69 and 0.95 as measured by Cronbach's α . The instrument seems to be reliable.

Results and Findings

To investigate the contribution of information acquisition, and entrepreneurial opportunity recognition to levels of individual and firm innovation performance, hierarchical regression analysis was used. That is, relevant control variables, work experience in industry, out of office time spent on work-related learning, number of employees, and annual revenue were entered into the regression first, followed by the respective independent variables to estimate the additional contribution of these information acquisition or entrepreneurial opportunity recognition variables to the dependent variables, individual-level and firm-level innovation performance. In the regression model I, only control variables that are significantly correlated to independent variables were entered.

Information acquisition and innovation performance

To examine the contribution of information acquisition to individual-level innovation performance (H1a), information acquisition was entered into the regression model after the work experience in industry and number of employees. There was a 37% increment in the total variance explained when the information acquisition variable was added to the regression model (Model 2 of Table 1). The total variance explained, including the 6% by the two control variables, was 43% ($F_{3/119} = 30.13, p < .001$). Both work experience in industry and number of employees were not significant to the individual-level innovation performance in both regression model 1 and 2 (Table 1), although they were related in the correlation table (Table 1). Only the information acquisition variable was significant to individual-level innovation performance ($\beta = .65$).

Table 1. *Information Acquisition as a Predictor of Individual-Level Innovation Performance*

Predictors	Model 1	Model 2
	β	β
Work experience in industry	0.17	0.10
Number of employees	0.15	-0.04
Information acquisition		0.65***
R ²	0.06	0.43
ΔR^2		0.37
F	3.78	30.13

$p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Next, to examine the contribution of information acquisition to firm-level innovation performance (H1b), information acquisition was entered into the regression model after number of employees and annual revenue. Table 2 indicated that the total variance explained, including the 7% by the two control variables, was 50% ($F_{3/119} = 40.00$,

$p < .001$). Inclusion of two control variables, information acquisition added another 43% of variance explained. In Table 2 model 2, only the information acquisition variable was significant to firm-level innovation performance ($\beta = .71$). Apparently, information acquisition plays a critical role to both individual-level and firm-level innovation performance. Therefore, hypothesis 1a and 1b were both supported.

Table 2. *Information Acquisition as a Predictor of Firm-Level Innovation Performance*

Predictors	Model 1	Model 2
	β	β
Number of employees	0.15	-0.37
Annual revenue	0.18	0.51
Information acquisition		0.71***
R ²	0.07	0.50
ΔR^2		0.43
F	4.37	40.00

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Entrepreneurial opportunity recognition and innovation performance

First, the researchers examined the contribution of entrepreneurial opportunity recognition to individual-level innovation performance (H2a). Entrepreneurial opportunity recognition was entered into the regression model after the work experience in industry and number of employees. There was a 35% increment in the total variance explained when the entrepreneurial opportunity recognition variable was added to the regression model (Model 2 of Table 3). The total variance explained, including the 6% by the three control variables, was 42% ($F_{3/119} = 28.41$, $p < .001$). Two control variables were not significant to the individual-level innovation performance in both the regression model 1 and 2 (Table 3), although they were related in the correlation table. Only the entrepreneurial opportunity recognition variable is significant to individual-level innovation performance ($\beta = .62$).

Table 3. *Entrepreneurial Opportunity Recognition as a Predictor of Individual-Level Innovation Performance*

Predictors	Model 1	Model 2
	β	β
Work experiences in industry	0.17	0.04
Number of employees	0.15	0.05
Entrepreneurial opportunity recognition		0.62***
R ²	0.06	0.42
ΔR^2		0.35
F	3.78	28.41

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 4. *Entrepreneurial Opportunity Recognition as a Predictor of Firm-Level Innovation Performance*

Predictors	Model 1	Model 2
	β	β
Number of employees	0.15	0.06
Annual revenue	0.18	0.08
Entrepreneurial opportunity recognition		0.62***
R ²	0.07	0.43
ΔR^2		0.36
F	4.37	30.10

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Next, to examine the contribution of entrepreneurial opportunity recognition to firm-level innovation performance (H2b), entrepreneurial opportunity recognition was entered into the regression model after number of employees and annual revenue. Table 4 indicates that the total variance explained, including the 7% by the two control variables, was 43% ($F_{3/119} = 30.10, p < .001$). Inclusion of two control variables, entrepreneurial opportunity recognition added another 36% of variance explained. In Table 4 model 2, only the entrepreneurial opportunity recognition variable was significant ($\beta = .62$). Apparently, entrepreneurial opportunity recognition plays a critical role to both individual-level and firm-level innovation performance. Therefore, hypothesis 2a and 2b were both supported.

Information acquisition and entrepreneurial opportunity recognition

In the correlation table, the information acquisition variable and entrepreneurial opportunity recognition variable were significantly positive correlated ($r = .60, p < 0.01$). Hence, hypothesis 3 was supported.

Under the same control variables (Table 1 and Table 3), information acquisition and entrepreneurial opportunity recognition respectively accounted for 37% and 35% of the variance when individual-level innovation performance was the dependent variable. In other words, information acquisition has a slight relative importance to individual-level innovation performance than entrepreneurial opportunity recognition. On the other hand, information acquisition and entrepreneurial opportunity recognition respectively accounted for 43% and 36% of the variance when firm-level innovation performance was the dependent variable (Table 2 and Table 4). The same, information acquisition has a relative importance to firm-level innovation performance than entrepreneurial opportunity recognition. The results also shed light on the fact that information acquisition appears to be more important for both individual-level and firm-level innovation performance.

Table 5 indicates that information acquisition and entrepreneurial opportunity recognition variables together account for 52% of the variance of individual-level innovation performance, and 58% of the variance of firm-level innovation performance. The results again confirmed the researchers' hypotheses that information acquisition and entrepreneurial opportunity play critical roles in both individual-level and firm-level innovation performance. That is, information acquisition and entrepreneurial opportunity recognition are critical indicators that contribute to innovation performance.

Table 5. *Information Acquisition & Entrepreneurial Opportunity Recognition as Predictors of Individual-Level & Firm-Level Innovation Performance*

Predictors	Individual level	Firm level
	β	β
Information acquisition	0.41***	0.50***
Entrepreneurial opportunity recognition	0.40***	0.35***
R ²	0.52	0.58
F	65.77	82.67

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Discussion and Conclusion

The purpose of this study was to examine the relationships between information acquisition, entrepreneurial opportunity recognition, and individual-level and firm-level innovation performance. A unique aspect of this study is that the researchers integrated information acquisition and entrepreneurial opportunity recognition together to explore the possible correlation between these two variables and their effects on both individual-level and firm-level innovation performance, which has not been previously done in the scholarly literatures.

The management and workplace learning literatures speculate that knowledge based capabilities and innovation are increasingly becoming critical factors for organizations to pursue and maintain competitive advantage in the modern world. Based on the hypotheses testing in the findings reported here, the findings confirmed the researchers' hypotheses that both entrepreneurial opportunity recognition and information acquisition significantly contribute to both individual-level and firm-level innovation performance. The data from 123 employees in the Taiwan high technology sector indicated that, in addition to financial resources, information acquisition and entrepreneurial opportunity recognition contribute significantly to both individual-level and firm-level innovation performance. The results suggest that workplace learning and innovation performance in Taiwan high technology is highly dependent on information acquisition, one of the constructs of organizational learning. Moreover, entrepreneurial opportunity recognition and information acquisition are significantly positively related. However, compared to entrepreneurial

opportunity recognition, information acquisition explained more variance on firm-level innovation performance. On the other hand, information acquisition also has slightly relative importance to individual-level innovation performance than entrepreneurial opportunity recognition. In other words, information acquisition contributes more than entrepreneurial opportunity recognition to both individual-level and firm-level innovation performance. It is perhaps that an organization's information acquisition processes, including internal and external acquisition, all rely on an organization's members' recognition, integration, and elaboration on the potential usefulness of information, and may make the information acquisition process an organizational routine. It is not only one organization member's effort but also an entire organization's efforts. Unlike entrepreneurial opportunity recognition, which may depend more on an individual's precise information scanning process.

The study also demonstrated that though annual revenue, number of employees, and work experience in industry have positive correlations on innovation performance, this effect disappears both after regression and after the variances of entrepreneurial opportunity recognition and information acquisition were accounted for. It is likely that information acquisition and entrepreneurial opportunity recognition may determine innovation performance not annual revenue or organizational size or work experience.

In summary, the results of this study tentatively suggest a significant implication for developing theories to account for SMEs' organizational learning, entrepreneurship, and innovation. That is, based upon the review of these related but disparate literatures, the hypotheses testing of this conceptual framework offers contributions to the organizational learning, entrepreneurship, innovation, human resource development, and SME literature bases.

Limitations

The purposeful selection of key contacts and their respective identification of participants for this study represented limitations in sampling and prevent generalizability. Since this study used only 11 Taiwan high technology firms as the research sites, the outcomes of research cannot be generalized to all of the firms in the high technology industry in Taiwan and other industries, such as the manufacturing industry or the biotechnology industry. The findings the researchers derived from the study are only applicable to the specific high technology firms in this study. It is possible that different results might have been obtained if the researchers selected other high technology firms to be a part of the sample. Lastly, the study assumed a Western literature based instrument could be tested in an Asian country through cross-cultural instrument translation. Despite rigorous adherence to the cross-cultural translation process, it is also possible that a translated instrument could have slightly impacted the study. It may be possible that different results might be obtained if this study selected different industries or other Western countries as samples.

Implications for HRD and Future Research

From a pragmatic perspective, learning at the individual, group, and organization levels is becoming a critical imperative in organizations, including SMEs. HRD professionals are being increasingly challenged to help develop learning infrastructures. Therefore, understanding how to maximize such processes, specifically the acquisition of internal and external information and knowledge sources, may enable human resource professionals to engage at more strategic levels to promote learning. Moreover, these findings may have implications for training and developing entrepreneurs and others within the organization to be more sensitive to specific external and internal sources of knowledge to augment learning as well as heighten entrepreneurial opportunity recognition. Furthermore, given the importance of innovation and entrepreneurship in SMEs, the findings may be useful for government initiated and encouraged national human resource development for developing skills and enhancing productivity of human resources in SMEs.

This study serves as a foundation for future research. In particular, exploring how other constructs associated with organization learning are related to IA, EOR, and innovation performance is critical. Further, focusing on different industries and cultural contexts, such as the biotechnology industry, may help to further confirm the information acquisition instrument's reliability.

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