



# Entrepreneurial opportunity recognition: an empirical study of R&D personnel

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## Abstract

**Purpose** – The purpose of this paper is to examine the antecedents of, and the relationships between, entrepreneurial opportunity recognition, and individual-level innovation performance.

**Design/methodology/approach** – Questionnaire data were collected from 268 senior R&D project team members (response rate 64.58 percent) along with 83 R&D managers who evaluated their employees' innovative behaviors in one science park in Taiwan.

**Findings** – The results show that an individual's self-efficacy, prior knowledge, social networks, and perception about the industrial environment on opportunities all had positive effects on entrepreneurial opportunity recognition. Also entrepreneurial opportunity recognition contributed significantly to individual-level innovation performance.

**Research limitations/implications** – The findings show that perception about the industrial environment on opportunities variable was the most important predictor among all four of the antecedents of entrepreneurial opportunity recognition. That is, individual characteristics and traits cannot fully explain the entrepreneurial opportunity recognition process. Because the data were limited to high technology industry, future studies need to validate these findings in other industries.

**Practical implications** – Findings of this study suggest that to increase R&D employee's innovation performance, it is critical for high technology firms to invest in developing and enhancing employees' entrepreneurial opportunity recognition ability.

**Originality/value** – The process of entrepreneurial opportunity recognition has been viewed as a black box. Although the literature has explored various antecedents that influence entrepreneurial opportunity recognition, there is limited empirical research that has examined the linkage between entrepreneurial opportunity recognition and potential outcome variables.

**Keywords** Entrepreneurship, Innovation, Performance, High technology, Taiwan, Entrepreneurialism

**Paper type** Research paper



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## 1. Introduction

Compared to other industries, the high technology industry often faces increased competition and a rapidly changing industrial environment. Such industrial environmental characteristics provide possible new entrepreneurial opportunities and innovative insights that may enable firms to keep up with technological advances and respond to new market needs (Michalski, 2006). Governments in developed nations generally view the high technology industry as the primary industry that promotes national economic growth (Link and Scott, 2010; Park, 2005). With the Taiwanese government's intervention on innovation at the national level, the high technology industry in Taiwan is increasingly transforming from labor to knowledge intensive, with a focus on learning and innovation (Lee and Wang, 2003). Hempel and Chang (2002) acknowledged that Taiwan has transformed to become an important source for high-technology design and manufacturing in the world. As a result, innovation has become the major corporate strategy of the high technology industry in Taiwan (Breznitz, 2006).

Scholars have tended to investigate innovation issues from an entrepreneurship perspective (Koellinger, 2008). The entrepreneurship literature has long recognized entrepreneurship as a potential means to maintain and promote competitive advantages and innovation performance (De Carolis and Saporito, 2006). Schumpeter (1934) has pointed out that entrepreneurship is the way to innovation. In the entrepreneurship literature, innovation is one important criteria used to evaluate an organization's entrepreneurial activity performance (Zahra, 1996). That is, scholars have equated entrepreneurship with innovation.

The prime entrepreneurial activity contains not only new product innovation but also the recognition of new markets and opportunities, such as customers' needs. In other words, innovation involves the process of creating new ideas and recognizing new market opportunities. Eckhardt and Shane (2003) have indicated that the dominant theory in entrepreneurship focuses on investigating the role and process of opportunity recognition in entrepreneurial activities. Recently, researchers have emphasized the importance of entrepreneurship not only to encourage the development of new business but also the recognition and pursuit of new entrepreneurial opportunities (De Carolis and Saporito, 2006; Fillis, 2006). Before making any innovation decision, individuals need to be able to precisely and accurately identify so called "new opportunities", otherwise, it may cause financial loss. Based on Shane and Venkataraman's (2000) study, this study defines entrepreneurial opportunity recognition as a process whereby individuals identify, recognize, and discover potential opportunities to create and develop new business, ventures, markets, and technology. An individual's insights and ability to recognize profitable opportunities may enable him or her to see and exploit potential industrial opportunities that other competitors are not aware of. Therefore, the capacity of high technology firm-level innovation resides in its employee's entrepreneurial opportunity recognition capability.

## 2. Problem statement

Despite the emergence of entrepreneurial opportunity recognition as a core construct and independent research area within the entrepreneurship literature, the process of entrepreneurial opportunity recognition has long been viewed as a black box (Adcroft *et al.*, 2004; Corbett, 2007; Vaghely and Pierre-Andre, 2010). Although prior research has explicated how entrepreneurs engage in exploiting and identifying opportunities, the

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phenomenon is still poorly understood (Dutta and Crossan, 2005). There is also considerable disagreement among scholars regarding how individuals recognize opportunities (Shaw *et al.*, 2005). Therefore, scholars have drawn upon different social science disciplines, including economics, psychology, and sociology to create theoretical frameworks to explain the nature and process of opportunity recognition (Dimov, 2007).

In the entrepreneurial opportunity recognition literature, antecedents of entrepreneurial opportunity recognition have covered a wide range of factors from individual to external environmental factors. However, most research has merely put stress on discussing the individual factors (Park, 2005; Smith *et al.*, 2009). These studies have shared common insights in identifying major individual factors in the opportunity recognition process, including self-alertness, prior knowledge, self-efficacy, and social networks (Ardichvili *et al.*, 2003; Gaglio and Katz, 2001; Ozgen, 2003; Ozgen and Baron, 2007). Accordingly, current entrepreneurial opportunity recognition research has overly focused on the individual's cognitive mechanisms in relation to entrepreneurial opportunity recognition (Corbett, 2007). Few studies however have considered both individual and contextual factors in exploring the antecedents of entrepreneurial opportunity recognition (Lee and Venkataraman, 2006). This study has made a unique contribution by investigating both individual factors and one environmental factor as antecedents of entrepreneurial opportunity recognition.

Since researchers in this field have predominantly focused on investigating various antecedents that influence an individual's opportunity recognition, entrepreneurial opportunity recognition has been typically viewed as a dependent variable. Prior research has not paid sufficient attention to examining the linkage between entrepreneurial opportunity recognition and possible outcome variables, such as strategic renewal and innovation. Busenitz *et al.* (2003) have argued that entrepreneurship is a multi-faceted phenomenon and that the linkages and intersections among each domain in this field, such as entrepreneurial opportunity recognition and entrepreneurship performance, may contribute to a holistic understanding of entrepreneurship.

Moreover, the innovation and entrepreneurship literature has overly focused on firm-level innovation performance, such as product innovation performance and firm-level entrepreneurship activities, which include strategic renewal, venturing, and innovation (Day *et al.*, 2006; Doganova and Eyquem-Renault, 2009). Most prior entrepreneurship research has predominantly adopted the firm as the unit of innovation performance analysis and has overly focused on firm-level innovation performance (Ámo and Kolvereid, 2005). However, without the intention to seek out new opportunities and innovations by individuals, an organization would likely have difficulty initiating and achieving entrepreneurial and innovative activities.

Therefore, the overall purpose of this study was to examine the antecedents of, and the relationships between, entrepreneurial opportunity recognition and individual-level innovation performance. Unlike previous research, the antecedents included both key individual factors and one contextual factor.

### 3. Literature review and research hypotheses

Economic theory is the dominant theoretical perspective in entrepreneurship. Since entrepreneurial opportunity recognition is rooted in the entrepreneurship literature, it is necessary to understand the nature of entrepreneurial opportunity recognition from an economic perspective. Within economic theory, the entrepreneurship literature falls

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into two school of thought: neoclassical equilibrium theory and Austrian theory. Neoclassical equilibrium theory assumes that everyone can recognize all entrepreneurial opportunities, and it is an individual's risk-propensity that determines who becomes an entrepreneur (Khilstrom and Laffont, 1979). However, traditional neoclassical equilibrium theory fails to explain the framework of entrepreneurship and the existence of entrepreneurial opportunities (Eckhardt and Shane, 2003).

Austrian theory assumes that people cannot recognize all opportunities, and emphasizes that it is the imperfect market with information asymmetry that generates the information gap, and that opportunities do not appear in a well-packaged informational form (Venkataraman, 1997). Kirzner (1997) has indicated that the distribution of information in society influences the discovery of entrepreneurial opportunities, and that only a small subset of individuals are able to identify and recognize a particular opportunity in the market. In addition, the process of discovering opportunities depends on individual ability and willingness to discover them. For example, people may not be able or willing to pay attention to external environment changes, which may lead to loss of opportunity (Stevenson and Gumpert, 1985). Only those who recognize the existence of opportunities and value them can then earn profits from these new opportunities (Ardichvili *et al.*, 2003; Shane and Venkataraman, 2000; Shane, 2000). Under circumstances of information asymmetry, individuals with special insight and the knowledge to discover and recognize entrepreneurial opportunities tend to be successful, while there are others who are not able to recognize these opportunities or only see the risk of failure (Ulhoi, 2005). Since economic theory cannot fully explain entrepreneurial opportunity recognition, scholars have shifted the focus to two different social science disciplines: psychology and sociology, to create theoretical frameworks to explain the process of opportunity recognition. The entrepreneurial opportunity recognition process can be investigated from personal cognitive frameworks and social context.

Scholars have argued that entrepreneurial opportunity recognition is a process of discovery rather than a purposeful search for opportunity (Kirzner, 1997). Therefore, research from the psychology perspective has sought to explore why some people can recognize the entrepreneurial opportunity while others in the same corporate context lack the capability to perceive an opportunity. The majority of entrepreneurial opportunity recognition literature has focused on psychological variables, such as personality traits, that may influence individuals in exploiting opportunities (De Carolis and Saporito, 2006).

### *3.1 Entrepreneurial opportunity recognition and self-efficacy*

Self-efficacy is defined here as an individual's belief in and desire to effectively achieve certain targets and tasks (Krueger, 1998). An individual's attitudes reflect his or her desire to perceive potential opportunities. For example, individuals with prior successful experiences and high self-efficacy tend to demonstrate increased motivation to seek out opportunities (Hostager *et al.*, 1998; Park, 2005; Pech and Cameron, 2006). Empirical studies have demonstrated that higher self-efficacy leads to better recognition of entrepreneurial opportunities (Ozgen, 2003). Therefore, the researchers hypothesized that:

*H1-1.* R&D employees' self-efficacy will be positively associated with individual entrepreneurial opportunity recognition.

### *3.2 Entrepreneurial opportunity recognition and prior knowledge*

Prior knowledge impacts an individual's mental schema. Ronstadt (1988) coined the term "corridor principle", which means each individual's prior knowledge and experience idiosyncrasies are corridors that trigger recognition of the value of new opportunities. Shane and Venkataraman (2000) have suggested that information corridors and cognitive properties are two main factors that determine whether entrepreneurs discover particular opportunities. Both information corridors and cognitive properties put an emphasis on mental schemas, which frame an individuals' recognition of new opportunities. The information individuals possess can be viewed as prior knowledge and experience, whereas cognitive properties are dependent on the prior information one possesses. Empirical research has provided strong evidence that prior knowledge and experience are positively related to entrepreneurial opportunity recognition (Ozgen, 2003; Shane, 2000; Ucbasaran *et al.*, 2009). Recently, scholars have argued that entrepreneurial opportunity recognition is a kind of learning process that utilizes one's tacit knowledge (Dutta and Crossan, 2005; Lumpkin and Lichtenstein, 2005; Marvel and Lumpkin, 2007). Consequently, an entrepreneur's unique possession of knowledge enables him or her to identify certain opportunities that others neglect. Therefore, the researchers hypothesized that:

*H1-2.* R&D employees' prior knowledge will be positively associated with individual entrepreneurial opportunity recognition.

### *3.3 Entrepreneurial opportunity recognition and social networks*

Social network theory has been recently extended to the entrepreneurship field (Liao and Welsch, 2005; Williams and Lee, 2009). Social network theory has provided some answers to explain the relationships between individuals and entrepreneurial opportunity recognition (Busenitz *et al.*, 2003). It suggests that an individual's interpersonal networks, including weak-tie networks and strong-tie networks, facilitate the access to diverse information that benefits learning and information dissemination processes to further discover opportunities. Under uncertain environmental conditions, individual social networks bring more accurate information and resources, thus helping entrepreneurs identify entrepreneurial opportunities and information of value (Manev *et al.*, 2005). In addition, empirical research has demonstrated that both strong-tie and weak-tie networks have a positive impact on the entrepreneurial opportunity recognition process (Ardichvili *et al.*, 2003; Batjargal, 2007; Ozgen, 2003; Ozgen and Baron, 2007). Recently, Rae's (2006) qualitative study pointed out that social experiences and interpersonal networks aid entrepreneurial opportunity recognition ability thus further facilitating an entrepreneur's entrepreneurial learning process. Dimov (2007) also proposed that the social audience with which one interacts may affect the process of interpreting and integrating information to further help shape the initial opportunity conception. Thus, an individual's social networks provide resources to enhance the possibility of opportunity recognition and identification. As a result, the researchers hypothesized that:

*H1-3.* R&D employees' social networks will be positively associated with individual entrepreneurial opportunity recognition.

### *3.4 Entrepreneurial opportunity recognition and the external environment*

While individual factors have been highly emphasized as critical antecedents of entrepreneurial opportunity recognition, the impact of the external environment cannot

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be neglected in the entrepreneurship field (Ozgen, 2003; Singh, 1998). Stevenson and Gumpert (1985) pointed out that external pressures, technology, consumer economics, social values, political action, and regulatory standards may stimulate individuals to pursue opportunity recognition. Shane (2003) reviewed Schumpeter's (1934) study and concluded that there are three sources of entrepreneurial opportunities:

- (1) technological changes;
- (2) political and regulatory changes; and
- (3) social and demographic changes.

In addition, contextual factors such as external jolts and uncertainty influence an individual's motivation to pursue and discover new opportunities. That is, the entrepreneurial opportunity recognition process is a kind of recognition of the environmental threats and opportunities in the industry and general business environment (Krueger, 1998). However, there is still limited research that includes the environmental factor as an antecedent of entrepreneurial opportunity recognition since prior literature has tended to assume that the external environment entrepreneurs are involved in is static (Park, 2005). However, the external environment changes constantly, and an individual's entrepreneurial behavior is dynamically influenced and changed as the environmental context changes. Lee and Venkataraman (2006) indicated that it is the high level of uncertainty in constantly changing environments that requires individuals to put effort into recognizing entrepreneurial opportunities. Thus, entrepreneurial opportunity recognition cannot be solely explained by the individual's characteristics and traits. As a result, the researchers hypothesized that:

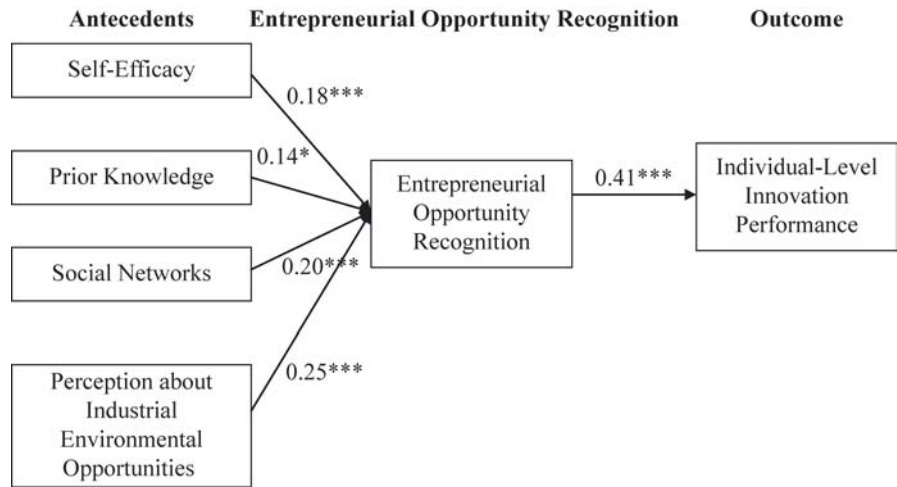
- H1-4.* R&D employees' perceptions about industrial environmental opportunities will be positively associated with individual entrepreneurial opportunity recognition.

### *3.5 Entrepreneurial opportunity recognition and individual-level innovation performance*

Based on the aforementioned antecedents of entrepreneurial opportunity recognition, it is one's unique motivation, prior knowledge, and social networks that may distinguish opportunity recognition capability. Therefore, it is critical to investigate the entrepreneurial opportunity recognition outcome variable at the individual-level. Entrepreneurial opportunity recognition puts an emphasis on an individual's recognition and exploitation of potential business ideas and opportunities, which can be viewed as an individual's entrepreneurial strategy in discovering resources to generate innovative outputs (Manev *et al.*, 2005). Employees who are able to see and act on potential opportunities in the industrial environment that competitors do not pay attention to can carve out a unique competitive advantage (Hostager *et al.*, 1998). Therefore, an individual's entrepreneurial opportunity recognition leads to a better deciphering and understanding of new knowledge or technology to increase new ideas. Thus, the researchers hypothesized that:

- H2-1.* Individual entrepreneurial opportunity recognition will be positively associated with individual-level innovation performance.

Accordingly, based upon the review of the literature and the hypotheses developed, Figure 1 presents the conceptual framework that underpinned this study.



**Notes:** Numbers indicates the regression coefficient  $\beta$  after control variables. Please refer to Table 3 and 4. In addition, adopting structural equation modeling without control variables yielded similar results: all antecedents are positively significant to entrepreneurial opportunity recognition and entrepreneurial opportunity recognition is positively significant to individual-level innovation performance

**Figure 1.**  
Conceptual model

#### 4. Research design and data collection

##### 4.1 Research context and sample

Data were collected from high technology firms in one Science Park in Taiwan. This sector and Science Park were selected because the literature indicated that innovation performance research tends to be conducted in the high technology sector in Taiwan (Huang and Lin, 2006). The R&D manager of each high technology firm listed in the 2008 Directory of the Association of Industries in the Science Park Directory of Taiwan were invited to participate in this study. Each participating R&D manager was asked to select three to five senior R&D project team members. The criteria for selecting these senior R&D project team members in each high technology firm included identifying individuals who had been working for more than three years in the R&D project teams of each firm. Individuals in R&D related positions tend to explore new entrepreneurial opportunities as they strive for innovation performance. The primary study resulted in 83 (30.29 percent response rate) high technology firms with 83 R&D managers evaluating their respective senior R&D project team members' innovative behaviors. As well, 268 (64.58 percent response rate) valid returned questionnaires were received from senior R&D project team members.

##### 4.2 Instrumentation

The researchers developed two sets of survey instruments from measures drawn from the existing literature: one instrument was designed for senior R&D project team members and the other was designed for R&D managers in each participating firm. The instrument for the senior R&D project team members included two sections: section 1 contained questions based on Ozgen's (2003) self-efficacy, prior knowledge, and social networks measures, Ozgen and Baron's (2007) entrepreneurial opportunity

recognition measure, and Zahra's (1993) perception about the industrial environment on opportunities measure. Responses were five-point Likert-type scales. Section 2 contained demographic items. The instrument for R&D managers included six items derived from Scott and Bruce's (1994) individual-level innovation performance measure. The R&D managers were asked to rate every senior R&D project team member's innovative behavior on a five-point Likert-type scale.

*Entrepreneurial opportunity recognition.* Ozgen and Baron's (2007) three-item scale was used to measure entrepreneurial opportunity recognition which measures the self-perceived alertness in recognizing opportunities (Cronbach's alpha = 0.80).

*Self-efficacy.* The four items measuring self-efficacy were adopted from Maurer and Pierce's (1998) self-efficacy measurement, which was also used in Ozgen's (2003) research. Ozgen (2003) pointed out that Maurer and Pierce's (1998) self-efficacy measure is widely acceptable because of its reliability and validity (Cronbach's alpha = 0.89).

*Prior knowledge.* The items measuring prior knowledge were derived from Ozgen's (2003) three-items measuring an individual's prior knowledge (Cronbach's alpha = 0.89).

*Social networks.* The items measuring social networks were adopted from Ozgen's (2003) three-item weak-ties measurement. Strong-ties have been examined as important social network sources but only for entrepreneurs (Anderson and Miller, 2003; Davidsson and Honig, 2003). Since the participants of this study were senior R&D project team members rather than entrepreneurs, strong-ties were not included in the social network measure (Cronbach's alpha = 0.77).

*Perceived industrial environment opportunities.* The items measuring an individual's perception of the industrial environment, especially regarding entrepreneurial opportunities, were adopted from Zahra's (1993) three-item environmental measure of entrepreneurial opportunities for industry growth, new product introduction, and technological innovation (Cronbach's alpha = 0.71).

*Individual-level innovation performance.* Although in theory it has been argued that objective data provides greater validity, organizations rarely release their employee's real R&D activity outcomes. Zhou and Shalley (2003) pointed out that having supervisor's rate the innovative behavior of their employees is the most common technique in the measurement of individual-level innovation performance. To increase the validity of managerial evaluation of employee R&D innovation performance, Scott and Bruce's (1994) six-item innovative behavior measure (Cronbach's alpha = 0.89) was adopted in this study. Scott and Bruce's (1994) innovative behavior measure was specifically designed for supervisors to rate employees who work in technology related areas, which is similar to this research context.

*Control variables.* On the basis of the reviewed literature, the researchers identified the following control variables in the data analyses. These variables included an organization's annual revenue and number of employees (Zahra, 1996), individual out-of-office time spent on work-related learning, and the length of employment in the high technology industry (Shane and Venkataraman, 2000).

## 5. Data analysis and results

### 5.1 Non-participant bias

To address the issue of non-participant bias, *T*-test comparisons of the participating and non-participating firms on number of employees ( $t = 1.23$ ,  $p = 0.21$ ) did not



reveal significant differences between the two groups. The researchers thus concluded that participating firms did not differ significantly from non-participating firms.

### 5.2 Psychometric properties of the instrument

First, an exploratory factor analysis with varimax rotation was conducted on all survey items. The results of the factor analysis indicated that the groupings of factors were exactly the same as the instrument factor analyses reported in the past research, and no items were deleted in this stage. Next, the researchers conducted a confirmatory factor analysis to evaluate the factor structure, and Cronbach's alpha values were used to rate the reliability of the instrument. The overall fit of the six-construct confirmatory factor model to the data suggested a good fit of the measurement scales ( $\chi^2 = 358.102$ ,  $df = 303$ ,  $p < 0.01$ ; Comparative Fit Index (CFI) = 0.986, the Tucker-Lewis Index (TLI) = 0.984; the Incremental Fit Index (IFI) = 0.987, the root mean square error of approximation (RMSEA) = 0.026). In addition, each of the standardized factor loadings was significant ( $p < 0.01$ ) and quite high (Table I). As indicated in Table I, the Cronbach's alpha internal consistency reliability estimates were all above Nunnally and Bernstein's (1994) recommended level of 0.70. Means, standard deviations, and correlations for all the variables are presented in Table II.

### 5.3 Hypotheses testing

Hierarchical regression analysis was conducted to examine the research hypotheses. That is, only demographic variables that were significantly correlated with dependent variables were entered into the regression first, followed by the respective independent variables. This analysis approach allowed for a clear estimate of the additional contribution of the independent variables toward the dependent variable after accounting for control variables.

*Entrepreneurial opportunity recognition and its antecedents.* In the hierarchical regression analysis with entrepreneurial opportunity recognition antecedents as predictors, it was important to check the collinearity among the four predictors. The VIF (variance inflation factor) was used to assess the problem of significant multicollinearity. The standard criterion for VIF is ten. The multicollinearity diagnostics indicated that the VIFs of the four independent variables, the antecedents of entrepreneurial opportunity recognition, fell in the range of 1.387 to 1.989, thus being less than ten. Drawing on the above-mentioned factor, the researchers confirmed that collinearity was not an issue.

In Model 2 of Table III, the four antecedents of entrepreneurial opportunity recognition, self-efficacy, prior knowledge, social networks, and perception of industrial environment opportunities were significant to entrepreneurial opportunity recognition, respectively ( $\beta = -0.18$ ;  $\beta = 0.14$ ;  $\beta = 0.20$ ;  $\beta = 0.25$ ). There was a 35 percent increment in the total variance explained when these four antecedents were added to the regression model. The total variance explained, including the 2 percent by the control variable work experience in the industry, was 37 percent ( $F_{5/262} = 31.19$ ,  $p < 0.001$ ). Therefore, *H1-1*, *H1-2*, *H1-3* and *H1-4* were all supported.

These four antecedents included three individual factors, self-efficacy, prior knowledge, and social networks, and one contextual factor, the perception of industrial environmental opportunities. The results reveal that this contextual factor had the highest regression coefficient ( $\beta = 0.25$ ) among all and was found to be the most important variable for predicting entrepreneurial opportunity recognition. The social network variable ( $\beta = 0.20$ ) was found to be the second most important of the

Item	Standardized loading	Cronbach's alpha
<i>Self-efficacy</i>		
1. I am strong enough to overcome life's struggles	0.767	0.87
2. I can handle the situations that life brings	0.806	
3. I often feels that I can do everything well	0.852	
4. I often feel like a success	0.753	
<i>Prior knowledge</i>		
1. I acquire information from mistakes that happen during work	0.797	0.80
2. I can bring information relating to my field to mind very quickly and easily	0.754	
3. My knowledge of my field is broad	0.723	
<i>Social networks</i>		
1. My contacts or discussions with potential or existing customers help me to recognize opportunities	0.763	0.83
2. My contacts or discussions with existing suppliers, distributors, or manufacturers help me to recognize opportunities	0.858	
3. My social and professional contacts help me to recognize opportunities	0.745	
<i>Perception about industrial environmental opportunities</i>		
1. There are many opportunities for new product innovation	0.852	0.82
2. The industry offers many opportunities for technological innovation	0.802	
3. There are many opportunities for growth in this industry	0.668	
<i>Entrepreneurial opportunity recognition</i>		
1. While going about routine day-to-day activities, I see potential new venture ideas all around me	0.768	0.80
2. I have a special "alertness" or sensitivity toward new venture opportunities	0.775	
3. "Seeing" potential new venture opportunities does not come very naturally to me. (Reverse score)	0.729	
<i>Individual-level innovation performance</i>		
1. Searches out new technologies, processes, techniques, and/or product ideas	0.780	0.92
2. Generates creative ideas	0.806	
3. Promotes and champions ideas to others	0.791	
4. Investigates and secures funds needed to implement new ideas	0.793	
5. Develops adequate plans and schedules for the implementation of new ideas	0.827	
6. Is innovative in work performance	0.844	

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**Table I.**

Standardized factor loadings and Cronbach's alphas

**Notes:** All estimates were significant at  $p < 0.01$ . CFI = 0.986; TLI = 0.984; IFI = 0.987; RMSEA = 0.026; and  $\chi^2 = 358.102$  with 303 degrees of freedom ( $p < 0.01$ )

antecedents of entrepreneurial opportunity recognition. As for the individual factors, social networks and self-efficacy ( $\beta = 0.18$ ) were the two most important predictors. In sum, both individual and contextual factors play a critical role in individual entrepreneurial opportunity recognition.

**Table II.**  
Means, standard deviations, and correlations for all variables

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Annual revenue	3.08	1.42	-									
2. Number of employees	3.44	1.55	0.07	-								
3. Out of office time spent on work – related learning	2.06	0.77	0.06	0.04	-							
4. Work experience in industry	2.43	0.80	-0.08	0.09	0.10	-						
5. Self-efficacy	3.65	0.66	0.14*	0.07	0.12*	0.02	-					
6. Prior knowledge	3.79	0.60	0.08	0.10	0.11	0.13*	0.60**	-				
7. Social networks	3.89	0.61	0.14*	0.13*	0.11	0.16*	0.50**	0.61**	-			
8. Perception about industrial environmental opportunities	3.76	0.59	0.19**	0.14*	0.02	0.05	0.39**	0.45**	0.48**	-		
9. Entrepreneurial opportunity recognition	3.16	1.76	0.20**	0.09	0.08	0.12*	0.46**	0.49**	0.50**	0.48**	-	
10. Individual-level innovation performance	2.91	1.68	0.19**	0.06	-0.01	0.16**	0.29**	0.37**	0.37**	0.29**	0.45**	-

**Notes:** \*  $p < 0.05$ ; \*\*  $p < 0.01$

Predictors	Entrepreneurial opportunity recognition	
	Model 1 $\beta$	Model 2 $\beta$
Work experiences in industry	0.12*	0.06
Self – efficacy		0.18**
Prior knowledge		0.14*
Social networks		0.20**
Perception about industrial environmental opportunities		0.25**
$R^2$	0.02	0.37
Adjusted $R^2$	0.01	0.32
$\Delta R^2$		0.35
$F$	4.05*	31.19**

**Table III.**  
Antecedents of entrepreneurial opportunity recognition as predictors of entrepreneurial opportunity recognition

Notes: \* $p < 0.05$ ; \*\* $p < 0.001$

*Entrepreneurial opportunity recognition and innovation performance.* Entrepreneurial opportunity recognition was entered into the regression model after the four control variables, annual revenue, number of employees, out-of-office time spent on work-related learning, and work experience in the high technology industry. There was a 15 percent increase in the total variance explained when the entrepreneurial opportunity recognition variable was added to the regression model (Model 2 of Table IV). The total variance explained, including the 8 percent by the four control variables, was 23 percent ( $F_{5/262} = 15.74, p < 0.001$ ). In regression model 2, only annual revenue ( $\beta = 0.14$ ), work experiences in industry ( $\beta = 0.14$ ), and entrepreneurial opportunity recognition ( $\beta = 0.41$ ) were significant to individual-level innovation performance. Hence, *H2-1* was supported.

**6. Discussion and conclusion**

*6.1 Antecedents of entrepreneurial opportunity recognition*

This study developed a comprehensive model through exploring both three individual factors and one environmental factor as antecedents of entrepreneurial opportunity

Predictors	Individual-level innovation performance	
	Model 1 $\beta$	Model 2 $\beta$
Annual revenue	0.23**	0.14*
Number of employees	0.03	0.00
Out of office time spent on learning	-0.04	-0.06
Work experience in industry	0.20**	0.14*
Entrepreneurial opportunity recognition		0.41**
$R^2$	0.08	0.23
Adjusted $R^2$	0.06	0.22
$\Delta R^2$		0.15
$F$	5.59**	15.74**

**Table IV.**  
Entrepreneurial opportunity recognition as a predictor of individual-level innovation performance

Notes: \* $p < 0.05$ ; \*\* $p < 0.001$

recognition. Most entrepreneurial opportunity recognition research has been limited to addressing this issue based on articulating individual factors alone as antecedents. This research thus extends the existing literature on investigating the antecedents of entrepreneurial opportunity recognition. Although prior conceptual research has pointed out several main individual factors in the opportunity recognition process, limited empirical research has confirmed these individual factors (Ozgen and Baron, 2007; Singh, 1998). The findings of this study have confirmed that an individual's characteristics, including self-efficacy, prior knowledge, and social networks are significant to entrepreneurial opportunity recognition. In addition, the study further examined the relative importance among these individual factors. The findings suggest that social networks and self-efficacy are the two most important predictors of an individual's entrepreneurial opportunity recognition. More specifically, such findings have confirmed Bhagavatula *et al.*'s (2010) empirical study which found that an individual's social networks are critical in the Asian business context.

Past conceptual literature from the psychology perspective investigating the black box of the entrepreneurial opportunity recognition process has tended to view self-efficacy as the most important antecedent (Gaglio and Katz, 2001). Ozgen's (2003) empirical study demonstrated that self-efficacy was the most important antecedent in entrepreneurial opportunity recognition. Unlike Ozgen's (2003) study which examined individual factors as parallel antecedents, Hostager *et al.*'s (1998) conceptual model provided another perspective on individual antecedents to entrepreneurial opportunity recognition. That study argued that it is an individual's prior knowledge and social networks as antecedents that influence his or her self-efficacy to recognize opportunities in the industrial environment. Such an opportunity recognition process provides feedback and becomes an individual's own knowledge and social network to benefit future entrepreneurial opportunity recognition. That is, self-efficacy, social networks, and prior knowledge are highly correlated in the entrepreneurial opportunity recognition process.

Although the findings of this study did not fully support Ozgen's (2003) empirical results, the difference on the regression coefficient between social networks and self-efficacy was relatively small. Furthermore, the correlation coefficients of self-efficacy and prior knowledge ( $r = 0.60$ ) and of self-efficacy and social networks ( $r = 0.50$ ) were significant, which indicated that these three individual antecedents are closely connected. Therefore, self-efficacy and social networks are two important antecedents of entrepreneurial opportunity recognition.

Second, another antecedent, the contextual factor on perception regarding industrial environmental opportunities, was also found to be significant to entrepreneurial opportunity recognition. In addition, the findings of this study point out that perception regarding industrial environmental opportunities is the most important predictor among all four of the antecedents of entrepreneurial opportunity recognition. Although entrepreneurial opportunity recognition antecedents range from individual to environmental factors, the impact of the external environment as a stimulator of individual entrepreneurial opportunity recognition has been neglected. The results here extend Schumpeter (1934) and Shane's (2003) viewpoint that external environment conditions, such as technological development, may encourage individuals to identify new entrepreneurial opportunities. In addition, it supports Lee and Venkataraman's (2006) argument that the existing literature has overly emphasized the importance of individual factors and that external context needs to be considered as an important variable in the opportunity recognition process for it may either enhance or stifle an

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individual's efforts toward recognizing entrepreneurial opportunities. Moreover, the study provides a significant contribution to the entrepreneurial opportunity recognition research in demonstrating that individual characteristics and traits cannot fully explain the entrepreneurial opportunity recognition process. An individual's entrepreneurial opportunities recognition is closely connected to the outside industrial context that one is involved in.

Finally, readers need to be cautious in interpreting these results on antecedents of entrepreneurial opportunity recognition. In addition to these individual and environmental factors, a nation's social and cultural characteristics also have critical influence on the development of entrepreneurial opportunity recognition. For example, cultures that prefer structure may stifle the entrepreneurial opportunity recognition process.

### *6.2 The outcome variable of entrepreneurial opportunity recognition*

The literature has acknowledged that entrepreneurial opportunity recognition leads to an organization's entrepreneurial results (Pech and Cameron, 2006). For example, empirical studies have demonstrated that an entrepreneur's entrepreneurial opportunity recognition has a positive impact on venture growth and innovation (Kickul and Walters, 2002; Sambasivan *et al.*, 2009). In addition, most empirical entrepreneurship studies have adopted entrepreneurs as research samples in exploring the opportunity recognition process. That is, scholars have acknowledged the importance of entrepreneurship in firm-level innovation performance. However, limited attention has been given to exploring the linkage between entrepreneurship and individual-level innovation in the scholarly literature.

Unlike prior research, this study focused on individual-level innovation performance as the outcome variable of entrepreneurial opportunity recognition. In addition, this study adopted R&D personnel in high technology firms as research samples, since it is not the organizations themselves but rather organizational members who perceive potential entrepreneurial opportunities. In other words, organizations need their members' opportunity recognition and insights to put into viable strategic entrepreneurship activities. Krueger (1998) has stressed that it is individual cognitive infrastructure that facilitates an organization's cognitive perception of entrepreneurial opportunity.

Building on the theme of internal capabilities, this study related exploring the internal capabilities of R&D employees to entrepreneurial opportunity recognition and linkages with innovation performance to uniquely fill this literature void. The results of this study indicate that entrepreneurial opportunity recognition is significant to individual-level innovation performance. Therefore, the findings of this study empirically extend the existing entrepreneurship literature by focusing on the impact of entrepreneurial opportunity recognition on innovation performance at the individual-level.

## **7. Implications for practice**

Entrepreneurial skills, such as entrepreneurial opportunity recognition have become more important in the modern business world, which has encouraged many colleges, universities and governmental agencies to develop and extend programs and curriculum to include knowledge around entrepreneurship education (Adcroft *et al.*, 2004; Binks *et al.*, 2006). The findings from this study have relevance for entrepreneurs,

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educators, managers, and human resource professionals. Specifically, the two most important predictors among the individual antecedents of entrepreneurial opportunity recognition were social networks and self-efficacy. Therefore, recognizing the importance of social networks by forming relationships with others who can share information and stimulate creative thinking about potential opportunities becomes a critical endeavor. Engaging with customers, suppliers, competitors, researchers and other practitioners can help individuals build their respective networks as well as access diverse information from the external environment that may benefit entrepreneurial opportunity recognition. For firms, managers and leaders can encourage employees to share knowledge and expertise with each other. It might also be appropriate to create communities of practice, internal or external to organizations, to enhance social networking practice which may better foster cooperation and information exchange. The provision of training that may assist employees with developing their social networking competence within the industry would also be a recommended practice. Thus, creating organizational contexts that enable individuals and teams to obtain and assimilate new entrepreneurial information will be an important task for entrepreneurs, managers, and leaders.

Further, it is critical for high technology firms to invest in developing and enhancing their employees' entrepreneurial opportunity recognition ability. Ozgen and Baron (2007) have indicated that training and education may assist employees with preparing their minds and increasing their ability to identify and detect potential entrepreneurial opportunities from the environment. Therefore, attention should be given to developing and designing learning, training, and development programs for current and future employees to achieve an adequate level of entrepreneurial opportunity recognition capability. Such training and development programs may develop employee industry-related knowledge schemas and educate them to be more sensitive to the entrepreneurial opportunities and information that resides within and without the workplace.

### **8. Limitations**

The researchers conducted the non-participant bias analysis using a *T*-test in comparing the number of employees between participating and non-participating firms. However, the test was based upon number of employees, a firm level as opposed to individual-level variable. Further, although the researchers assumed that each R&D manager randomly selected the senior R&D project team members in their organizations, potential differences between the employees of participant and non-participant firms may exist.

### **9. Recommendations for future research**

The findings from this study suggest several avenues for future research. First, this study investigated individual-level innovation performance and did not focus on the team- or firm-level. Future research may involve entrepreneurial team-level participants to investigate their innovation performance. Understanding how team-level or firm-level innovation performance impacts upon individual-level innovation performance may provide entrepreneurs, managers, and leaders with significant practical knowledge on facilitating entrepreneurial team innovation performance.

Moreover, future studies may incorporate both objective and subjective data to draw more reliable conclusions about the influence of entrepreneurial opportunity

recognition on individual-level innovation performance. That is, other objective measures assessing individual-level innovation performance may be considered for future research, for example, the number of new entrepreneurial ideas created, in addition to supervisors' evaluation of employees' innovative behaviors.

Since the high technology industry was the sample chosen for this study, the researchers adopted innovation as the index to measure the outcome variables. However, future research using different industries as the sample might consider using different outcome variables, such as organizational effectiveness. The outcome variables should accurately evaluate and measure entrepreneurship activities based upon the characteristics of the specific industry or organizations.

## References

- Adcroft, A., Willis, R. and Dhaliwal, S. (2004), "Missing the point? Management education and entrepreneurship", *Management Decision*, Vol. 42 Nos 3/4, pp. 512-21.
- Åmo, B.W. and Kolvereid, L. (2005), "Organizational strategy, individual personality and innovation behavior", *Journal of Enterprising Culture*, Vol. 13 No. 1, pp. 7-19.
- Anderson, A.R. and Miller, C.J. (2003), "Class matters": human and social capital in the entrepreneurial process", *Journal of Socio-Econ.*, Vol. 32, pp. 17-36.
- Ardichvili, A., Cardozo, R. and Ray, S. (2003), "A theory of entrepreneurial opportunity identification and development", *Journal of Business Venturing*, Vol. 18, pp. 105-23.
- Batjargal, B. (2007), "Internet entrepreneurship: social capital, human capital, and performance of internet ventures in China", *Research Policy*, Vol. 36 No. 5, pp. 605-18.
- Bhagavatula, S., Elfring, T., Van Tilburg, A. and Van de Bunt, G. (2010), "How social and human capital can influence opportunity recognition and resource mobilization in India and the handloom industry", *Journal of Business Venturing*, Vol. 25 No. 3, pp. 245-60.
- Binks, M., Starkey, K. and Mahon, C.L. (2006), "Entrepreneurship and the business school", *Technology Analysis & Strategic Management*, Vol. 18 No. 1, pp. 1-18.
- Breznitz, D. (2006), "Innovation and the state – development strategies for high technology industries in a world of fragmented production: Israel, Ireland, and Taiwan", *Enterprise and Society*, Vol. 7 No. 4, pp. 675-85.
- Busenitz, L., West, G.P. III, Shepherd, D., Nelson, T., Chandler, G.N. and Zacharakis, A. (2003), "Entrepreneurship research in emergence: past trends and future directions", *Journal of Management*, Vol. 29 No. 3, pp. 285-308.
- Corbett, A.C. (2007), "Learning asymmetries and the discovery of entrepreneurial opportunities", *Journal of Business Venturing*, Vol. 22, pp. 97-118.
- Davidsson, P. and Honig, B. (2003), "The role of social and human capital among nascent entrepreneurs", *Journal of Business Venturing*, Vol. 18, pp. 310-31.
- Day, J., Reynolds, P. and Lancaster, G. (2006), "Entrepreneurship and the small to medium-sized enterprise: a divergent/convergent paradox in thinking patterns between advisers and SME owner-managers", *Management Decision*, Vol. 44 No. 5, pp. 581-97.
- De Carolis, D.M. and Saporito, P. (2006), "Social capital, cognition, and entrepreneurial opportunities: a theoretical framework", *Entrepreneurship Theory and Practice*, Vol. 30 No. 1, pp. 41-56.
- Dimov, D. (2007), "Beyond the single-person, single-insight attribution in understanding entrepreneurial opportunities", *Entrepreneurship Theory and Practice*, Vol. 31 No. 5, pp. 713-31.



- Doganova, L. and Eyquem-Renault, M. (2009), "What do business models do? Innovation devices in technology entrepreneurship", *Research Policy*, Vol. 38 No. 10, pp. 1559-70.
- Dutta, D.K. and Crossan, M.M. (2005), "The nature of entrepreneurial opportunities: understanding the process using the 4I organizational learning framework", *Entrepreneurship Theory and Practice*, Vol. 29 No. 4, pp. 425-49.
- Eckhardt, J. and Shane, S.A. (2003), "Opportunities and entrepreneurship", *Journal of Management*, Vol. 29 No. 3, pp. 333-49.
- Fillis, I. (2006), "A biographical approach to researching entrepreneurship in the smaller firm", *Management Decision*, Vol. 44 No. 2, pp. 198-212.
- Gaglio, D.M. and Katz, J.A. (2001), "The psychological basis of opportunity identification: entrepreneurial alertness", *Small Business Economy*, Vol. 16 No. 2, pp. 95-111.
- Hempel, P.S. and Chang, C.D. (2002), "Reconciling traditional Chinese management with high-tech Taiwan", *Human Resource Management Journal*, Vol. 12 No. 1, pp. 77-95.
- Hostager, T.J., Neil, T.C., Decker, R.L. and Lorentz, R.D. (1998), "Seeing environmental opportunities: effects of intrapreneurial ability, efficacy, motivation, and desirability", *Journal of Organizational Change Management*, Vol. 11 No. 1, pp. 11-25.
- Huang, E. and Lin, S.-C. (2006), "How Ramp;D management practice affects innovation performance: an investigation of the high-tech industry in Taiwan", *Industrial Management & Data Systems*, Vol. 106 No. 7, pp. 966-96.
- Khilstrom, R. and Laffont, J. (1979), "A general equilibrium entrepreneurial theory of firm formation based on risk aversion", *Journal of Political Economy*, Vol. 87 No. 4, pp. 719-48.
- Kickul, J. and Walters, J. (2002), "Recognizing new opportunities and innovations: the role of strategic orientation and proactivity in internet firms", *International Journal of Entrepreneurial Behaviour & Research*, Vol. 8 No. 6, pp. 292-308.
- Kirzner, I. (1997), "Entrepreneurial discovery and the competitive market process: an Austrian approach", *Journal of Economic Literature*, Vol. 35, pp. 60-85.
- Koellinger, P. (2008), "Why are some entrepreneurs more innovative than others?", *Small Business Economy*, Vol. 31, pp. 21-37.
- Krueger, N. (1998), "Encouraging the identification of environmental opportunities", *Journal of Organizational Change Management*, Vol. 11 No. 2, pp. 174-83.
- Lee, J.H. and Venkataraman, S. (2006), "Aspirations, market offerings, and the pursuit of entrepreneurial opportunities", *Journal of Business Venturing*, Vol. 21, pp. 107-23.
- Lee, J.S. and Wang, J.-C. (2003), "Public policies for the promotion of an innovation-driven economy in Taiwan", *International Journal of Entrepreneurship and Innovation Management*, Vol. 3 No. 3, pp. 227-48.
- Liao, J. and Welsch, H. (2005), "Roles of social capital in venture creation: key dimensions and research implication", *Journal of Small Business Management*, Vol. 43 No. 3, pp. 345-62.
- Link, A.N. and Scott, J.T. (2010), "Government as entrepreneur: evaluating the commercialization success of SBIR projects", *Research Policy*, Vol. 39 No. 5, pp. 589-601.
- Lumpkin, G.T. and Lichtenstein, B.B. (2005), "The role of organizational learning in the opportunity recognition process", *Entrepreneurship Theory and Practice*, Vol. 29 No. 4, pp. 451-72.
- Manev, I.M., Gyoshev, B.S. and Manolova, T.S. (2005), "The role of human and social capital and entrepreneurial orientation for small business performance in a transitional economy", *International Journal of Entrepreneurship and Innovation Management*, Vol. 5 Nos 3/4, pp. 298-318.

- Marvel, M.R. and Lumpkin, G.T. (2007), "Technology entrepreneurs; human capital and its effects on innovation radicalness", *Entrepreneurship Theory and Practice*, Vol. 31 No. 6, pp. 807-28.
- Maurer, T.J. and Pierce, H.R. (1998), "A comparison of likert scale and traditional measures of self-efficacy", *Journal of Applied Psychology*, Vol. 83 No. 2, pp. 324-9.
- Michalski, T. (2006), "Radical innovation through corporate entrepreneurship from a competence-based strategic management perspective", *International Journal of Management Practice*, Vol. 2 No. 1, pp. 22-41.
- Nunally, J.C. and Bernstein, I.H. (1994), *Psychometric Theory*, 3rd ed., McGraw-Hill, New York, NY.
- Ozgen, E. (2003), "Entrepreneurial opportunity recognition: information flow, social and cognitive perspective", unpublished doctoral dissertation, Rensselaer Polytechnic Institute, Troy, NY.
- Ozgen, E. and Baron, R.A. (2007), "Social sources of information in opportunity recognition: effects of mentors, industry networks, and professional forums", *Journal of Business Venturing*, Vol. 22, pp. 174-92.
- Park, J.S. (2005), "Opportunity recognition and product innovation in entrepreneurial high-tech start-ups: a new perspective and supporting case study", *Technovation*, Vol. 25, pp. 739-52.
- Pech, R.J. and Cameron, A. (2006), "An entrepreneurial decision process model describing opportunity recognition", *European Journal of Innovation Management*, Vol. 9 No. 1, pp. 61-78.
- Rae, D. (2006), "Entrepreneurial learning: a conceptual framework for technology-based enterprise", *Technology Analysis & Strategic Management*, Vol. 18 No. 1, pp. 39-56.
- Ronstadt, R. (1988), "The corridor principle", *Journal of Business Venturing*, Vol. 3 No. 1, pp. 31-40.
- Sambasivan, M., Abdul, M. and Yusop, Y. (2009), "Impact of personal qualities and management skills of entrepreneurs on venture performance in Malaysia: opportunity recognition skills as a mediating factor", *Technovation*, Vol. 29 No. 11, pp. 798-805.
- Schumpeter, J.A. (1934), *Theory of Economic Development*, Harvard University Press, Cambridge, MA.
- Scott, S.G. and Bruce, R.A. (1994), "Determinants of innovative behavior: a path model of individual innovation in the workplace", *Academy of Management Journal*, Vol. 37 No. 3, pp. 580-607.
- Shane, S. and Venkataraman, S. (2000), "The promise of entrepreneurship as a field of research", *Academy of Management Journal*, Vol. 25 No. 1, pp. 217-26.
- Shane, S.A. (2000), "Prior knowledge and the discovery of entrepreneurial opportunities", *Organization Science*, Vol. 11 No. 4, pp. 448-69.
- Shane, S.A. (2003), *A General Theory of Entrepreneurship: The Individual-opportunity Nexus*, Edward Elgar, Northampton, MA.
- Shaw, E., Oandapos;Loughlin, A. and McFadzean, E. (2005), "Corporate entrepreneurship and innovation part 2: a role and process-based approach", *European Journal of Innovation Management*, Vol. 8 No. 4, pp. 393-408.
- Singh, R.P. (1998), "Entrepreneurial opportunity recognition through social networks", unpublished doctoral dissertation, University of Illinois at Chicago, Chicago, IL.
- Smith, B.R., Matthews, C.H. and Schenkel, M.T. (2009), "Differences in entrepreneurial opportunities: the role of tacitness and codification in opportunity identification", *Journal of Small Business Management*, Vol. 47 No. 1, pp. 38-57.

- 
- Stevenson, H.H. and Gumpert, D.E. (1985), "The heart of entrepreneurship", *Harvard Business Review*, Vol. 63 No. 2, pp. 85-94.
- Ucbasaran, D., Westhead, P. and Wright, M. (2009), "The extent and nature of opportunity identification by experienced entrepreneurs", *Journal of Business Venturing*, Vol. 24, pp. 99-115.
- Ulhøi, J.P. (2005), "The social dimension of entrepreneurship", *Technovation*, Vol. 25, pp. 939-46.
- Vaghely, I.P. and Pierre-Andre, J. (2010), "Are opportunities recognized or constructed? An information perspective on entrepreneurial opportunity identification", *Journal of Business Venturing*, Vol. 25 No. 1, pp. 73-86.
- Venkataraman, S. (1997), "The distinctive domain of entrepreneurship research: an editor's perspective", in Katz, J. and Brockhaus, R. (Eds), *Advances in Entrepreneurship, Firm, Emergence and Growth*, JAI Press, Greenwich, CT, pp. 119-38.
- Williams, C. and Lee, S.H. (2009), "Resource allocations, knowledge network characteristics and entrepreneurial orientation of multinational corporations", *Research Policy*, Vol. 38 No. 8, pp. 1376-87.
- Zahra, S.A. (1993), "Environment, corporate entrepreneurship, and financial performance: a taxonomic approach", *Journal of Business Venturing*, Vol. 8, pp. 319-40.
- Zahra, S.A. (1996), "Governance, ownership, and corporate entrepreneurship: the moderating impact of industry technological opportunities", *Academy of Management Journal*, Vol. 39 No. 6, pp. 1713-35.
- Zhou, J. and Shalley, C.E. (2003), "Research on employee creativity: a critical review and directions for future research", *Research in Personnel and Human Resources Management*, Vol. 22, pp. 165-217.

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