Novel Opportunity Exploitation: Impact of Personality, Environment and Uncertainty Avoidance Culture

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Abstract

This study shows that the joint effects of the entrepreneur's personality and an unpredictable environment, as well as the interaction effects of a low uncertainty avoidance culture, predict opportunity exploitation. Our study's findings are consistent with the emerging opportunity-exploiter nexus framework of Shane and Venkataraman, which posits that the rate and nature of entrepreneurial exploitation activities are jointly determined by the nexus of environmental factors that shape the emergence of opportunities and the supply of opportunity-seekers with the right entrepreneurial personalities to exploit such opportunities. Specifically, we found that entrepreneurs who display a high level of extroversion, agreeableness, openness to experience, conscientiousness, and non-neuroticism, have a greater propensity to exploit novel opportunities in unpredictable environments and low uncertainty avoidance cultures. A study involving 570 entrepreneurs from UK, Thailand, and South Korea reveals that the interaction effects between personality and environmental unpredictability is more pronounced in cultures with a low high degree of uncertainty avoidance.

Keywords:

Opportunity exploitation; personality; culture

INTRODUCTION

The ability to identify, evaluate and exploit opportunities has been recognized by researchers as an important driver for new venture creation (Shane and Venkataraman 2000). Among these three phases of opportunity discovery, opportunity exploitation is probably the closest and most crucial step towards actual business start-ups (Choi and Shepherd 2004). Our paper examines the influence of individual personality, the environment, and an uncertainty avoidance culture on an individual's propensity to exploit novel opportunities in the context of new-technology based firms (NTBF). While the majority of technology-based firms were founded on the basis of opportunity (Oakey and Cooper 1991) these firms may differ in terms of the novelty of the exploited opportunity. Some firms may introduce products or services that are totally new, while others may introduce refinements of existing ones. The question is how, and under what conditions, can entrepreneurs exploit novel business opportunities?

The existing literature emphasizes that the opportunities entrepreneurs exploit are based on prior knowledge (Shane 2000; Venkataraman 1997), and therefore the novelty of opportunities is closely related to the novelty of entrepreneurs' knowledge bases. Oakey and Cooper (1991) found that entrepreneurs of NTBFs exploited business opportunities based on their technical expertise and knowledge. Similarly, studies have shown that founders of technology-based firms tend to leverage on their prior technical and market knowledge when they exploit opportunities for start-ups (Autio and Lumme 1998; Wong et al. 2008). Drawing on the literature on the "Big Five" personality traits, we propose that, personality traits such as extroversion, agreeableness, conscientious, openness, and non-neuroticism are key determinants of their adeptness at exploiting novel knowledge.

Although many studies have examined the personality of entrepreneurs versus non-entrepreneurs, few, if any, of these studies have explored which personality types are more likely to start new businesses based on novel opportunities. We postulate that individuals who are extraverts, conscientious, open to experience, agreeable, and non-neurotic are more likely to found business based on new knowledge. However, the individual-opportunity nexus framework of entrepreneurship has established that opportunity exploitations are not made in a vacuum, but instead are influenced by the environment. Entrepreneurial exploitation activities are jointly determined by the nexus of environmental factors that shape the emergence of opportunities and the supply of opportunity-seekers with the right entrepreneurial personalities to exploit such opportunities. Unlike in predictable environments where customers demand standard products and services, in dynamic environments customer tastes are unpredictable and product-service technology is uncertain (Milliken 1987).

As such, environmental unpredictability presents an opening for entrepreneurs to identify new opportunities through elaborate information scanning and search. Unpredictable environmental conditions provide the impetus for entrepreneurs to spend a greater amount of their time and resources scanning the environment for information and cues. We argue that individuals with high extroversion, openness to experience, agreeableness, conscientiousness, and low neuroticism have a greater propensity than others to assess the environment, search for information, and thus identify new knowledge for opportunity exploitation.

Additionally, using the aggregate psychological trait explanation, we argue that the interaction effects between personality and environmental unpredictability on novel opportunity exploitation are more pronounced in a low uncertainty avoidance culture. A culture of low uncertainty avoidance may imply a lower percentage of risk-averse individuals within the

population, and is characterized by a high tolerant of ambiguity. Low uncertainly avoidance thus implies "willingness to enter into unknown ventures" (Hofstede 2001: 164). Such a culture will encourage individuals in an unpredictable environment who are extraverts, agreeable, open, conscientious, and non-neurotic to exploit novel opportunities for start-ups.

The study contributes in several ways. First, using an integrative framework that incorporates personal, environmental, and cultural factors, our study represents one of the first attempts in entrepreneurship research to elucidate the antecedents to entrepreneurs' opportunity exploitation behavior. Second, in recognition of the existing debate on the usefulness of differentiating entrepreneurs from non-entrepreneurs (Gartner 1988), and the call for scholars to focus on distinct groups of entrepreneurs (Sarasvathy 2004), we examined the antecedents to novel opportunity exploitation by entrepreneurs. Furthermore, our findings provide a more nuanced view of the association between personality and exploitation behavior by demonstrating the moderating influence of environmental uncertainty and a low uncertainty avoidance culture on the relationship between personality and novel opportunity exploitation. Third, our research underscores the need to adopt a contingency perspective when studying entrepreneurs' behavior since the impact of personality on entrepreneurs' propensities to exploit novel opportunities may depend on the level of unpredictability in the environment and the societal uncertainty avoidance culture. It is particularly in unpredictable environments and low uncertainty avoidance cultures that the personality effects are likely to strongly impact exploitation of novel opportunities. Taken as a whole, the study contributes to the emergent individual-opportunity nexus perspective, which views entrepreneurship as the exploitation of opportunities in the environment by opportunity-seeking individuals.

LITERATURE REVIEW

It is not sufficient to have new ideas; they must lead to "the successful product, assimilation and exploitation of novelty in society," through innovation (European Commission 1995, p. 9). The entrepreneur's ability to recognize and exploit novel opportunities for new venture creation is a source of competitive advantage, particularly in relatively unpredictable environments that require change for immediate survival (Freel and Robson 2004).

Past studies have identified the importance of prior knowledge in influencing entrepreneurs' propensities to exploit opportunities for new venture creation (Shane 2000; Venkataraman 1997). More specifically, these studies found that prior knowledge of customers needs greatly enhances an entrepreneur's ability to identify potentially valuable business opportunities that meet these needs. In a similar vein, recent evidence emphasizes the synonymity between novel opportunities and novel knowledge (Saemundsson and Dahlstrand 2005). Technical knowledge and market knowledge, two dimensions of the founders' knowledge base, have been established as important determinants of the extent of novelty of the opportunities entrepreneurs exploit (Autio and Lumme 1998). Novel market knowledge allows entrepreneurs to more effectively serve their markets (Shane, 2000) while novel technological knowledge creates the means for entrepreneurs to respond rapidly to competitors' advancements (Cohen and Levinthal 1990). Knowledge gained from previous work experience provides individuals with product and marketing ideas, networks of contacts (De Koning 1999) and an understanding of market needs (Ardichvili et al. 2003), and this serves as an important tool for exploiting novel opportunities. Individuals could also gain technical knowledge from their involvement in technological innovation activities in the workplace. The experience gained from experimenting with different innovative prototypes equips individuals with knowledge in product

and technical specifications, as well as the commercial opportunities of the innovation (Aldrich and Wiedenmayer 1993). Both technical and market knowledge give rise to sources of new ideas and opportunities (Tidd and Bodley 2002), which employees could capitalize for new venture creation (Wong et al. 2008). According to Autio and Lumme (1998), the novelty of opportunities ranges from low, when opportunities are based only on existing technical and market knowledge, to high, when opportunities are based on new technical and market knowledge.

Personality and novelty of opportunity exploited

Given the positive relationship between novel opportunities and novel knowledge, the question is what are the factors that influence an entrepreneur's propensity to exploit novel business opportunities based on novel knowledge? Entrepreneurs are not a homogenous population and there can be different types of entrepreneurs, distinguished by their growth orientation, motivation and type of business (Caird 1993). Similarly, entrepreneurs can also be differentiated by the types of opportunities that they exploit. However, little is known about the personal characteristics of entrepreneurs who have the capacity to exploit novel opportunities. Personal characteristics of entrepreneurs have been acknowledged as key determinants in the differentiation of categories of entrepreneurs (MacMillan et al. 1985). As Shaver and Scott (1991) eloquently put it: "Economic circumstances are important; social networks are important; entrepreneurial teams are important; marketing is important; finance is important; even public agency assistance is important. But none of these will, alone, create a new venture. For that we need a person, in whose mind all of the possibilities come together, who believes that innovation is possible, and who has the motivation to persist until the job is done". Our paper extends the ongoing research on entrepreneurial characteristics by focusing on the personality of entrepreneurs.

With the many entrepreneurial opportunities present in the market place and in view of the important role played by individuals in the entrepreneurial process, it is imperative to identify entrepreneurs with the personality to exploit novel opportunities. The traditional view of the entrepreneur as a decision maker, resource combiner, and risk-taker (Van Praag and Cramer 2001) suggests that entrepreneurial personality is a key determinant of the proclivity of entrepreneurs to exploit novel opportunities. *Extroversion*, a personality trait that facilitates the ability to establish networks with suppliers and customers increases the likelihood of entrepreneurs identifying and exploiting new knowledge for new venture creation. Similarly, entrepreneurs who are high *on agreeableness* are able to develop alliances with other individuals and garner support from stakeholders, who would be more willing to provide them with essential information when they critically scan the environment for novel market and technology knowledge. Moreover, entrepreneurs who are *open* are more receptive to new ideas and they have the tendency to appreciate novelty. In a similar vein, entrepreneurs are more likely to venture into uncharted waters and exploit novel opportunities if they have a *conscientious* personality because conscientious individuals are diligent, persistent, and achievement oriented. By the same token, individuals with *low neuroticism* are able to withstand the stressful conditions of starting a business and are more likely to overcome the riskiness of founding a business based on new knowledge.

Hypothesis 1a: A higher score on the extroversion trait will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 1b: A higher score on the agreeableness trait will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 1c: A higher score on the openness trait will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 1d: A higher score on the conscientiousness trait will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 1e: Among entrepreneurs with strong critical thinking ability, a lower score on the neuroticism trait will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Personality, environment and novelty of opportunity exploited

The individual-opportunity nexus framework of entrepreneurship has established that opportunity exploitations are not made in a vacuum, but instead are influenced by the environment (Shane 2003, p. 145). Indeed, there is an emerging consensus in the literature that views the nature of entrepreneurial exploitation activities as jointly determined by the nexus of environmental factors that shape the emergence of opportunities and the supply of opportunity-seekers with the right entrepreneurial personalities to exploit such opportunities (Shane 2000; 2003). In line with this stream of thought, our study aims to empirically examine the interactions between personality and environmental unpredictability. Environmental unpredictability has been historically defined as the volatile changes in technologies, customer tastes, and competitive behavior (Galbraith 1973). Environmental uncertainty may involve uncertainty about what actions key organizational constituents such as suppliers, competitors, consumers, and the government might take (Milliken 1987). A more recent definition by Zahra and Covin (1995) characterized an unpredictable environment as having, “high levels of competitiveness,

market uncertainties, and a general vulnerability to influences from forces external to the firm's internal environment".

There are copious amounts of evidence in the literature that highlight the importance of generating original ideas in unstable environments (Lumpkin and Dess 1996; Miller and Friesen 1984; Zahra, 1993). Grant (1996) found that updated knowledge of markets and technologies is critical for firms operating in unpredictable environments while Teece (1998) reported that entrepreneurs would gain competitive advantage in unstable environments if they could constantly reconfigure their resources to exploit new opportunities. Unstable environments often necessitate an innovative orientation (Miller 1983; Miller et al. 1988) and Miller advocated the need for entrepreneurs in unpredictable environments to "engage in product market innovation and be the first to come up with proactive innovations" (Miller 1983, p. 771). Essentially, environmental unpredictability present an opening for entrepreneurs to identify new opportunities through elaborate information scanning and search.

Unpredictable environmental conditions pressure entrepreneurs to spend a greater amount of their time and resources scanning the environment for information and cues (Covin and Slevin 1990). These boundary spanning and information acquisition activities are directed toward understanding existing market demands and technological changes. Environmental unpredictability provide the impetus for *extraverted* individuals who thrive on social interactions, are energized by active involvement in activities and are seen as go-getters to work harder in searching for novel opportunities for exploitation. Similarly, capricious conditions in the environment would encourage *agreeable* individuals who are helpful and more likely to cooperate with others, to scan the environment for novel market and technology knowledge. Furthermore, *open* individuals, who are receptive to new ideas and experiences, fearless to try

out untested ideas, are more likely to draw on their prior knowledge to exploit novel opportunities under unpredictable environmental conditions. In a similar vein, the volatilities in the environment are more likely to push *conscientious* individuals into uncharted waters and exploit novel opportunities because of their diligent, persistent, and achievement oriented characters. On the same note, environmental uncertainties would strengthen the tendency of *non-neurotic* individuals, who are able to overcome the stress and riskiness of founding a business to scan the environment, gather relevant information, and identify novel opportunities for exploitation based on new knowledge.

Thus we hypothesis the following:

Hypothesis 2a: Among entrepreneurs with a higher score on the extroversion trait, environmental unpredictability will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 2b: Among entrepreneurs with a higher score on the agreeableness trait, environmental unpredictability will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 2c: Among entrepreneurs with a higher score on the openness trait, environmental unpredictability will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 2d: Among entrepreneurs with a higher score on the conscientious trait, environmental unpredictability will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 2e: Among entrepreneurs with a lower score on the neuroticism trait, environmental unpredictability will be associated with greater likelihood of opportunity exploitation based on new knowledge.

The main thrust of our study is that the influence of personality on the entrepreneur's propensity to exploit novel opportunities for new venture creation is driven by the environment he/she operates in. In particular, environmental unpredictability increases the likelihood of entrepreneurs with personality attributes such as extroversion, agreeableness, openness to experience, conscientiousness, and non-neuroticism to exploit opportunities based on new knowledge.

Personality, environment, culture and novelty of opportunity exploited

The aggregate psychological trait theory views that, if there are more people with entrepreneurial values in a country, there will be more people displaying entrepreneurial behavior (Uhlaner and Thurik, 2007). Scholars have affirmed that irrespective of the environmental conditions, a society's cultural orientation towards entrepreneurship plays an important role in the entrepreneurial process (McGrath and Macmillan, 1992; Wennerkers et al., 2005). In the context of this paper, it is interesting to point the role of a low uncertainty avoidance culture in encouraging entrepreneurs to exploit novel opportunities for start-ups. While other national cultural dimensions including power distance, individualism, and masculinity may have a moderating impact on the entrepreneur's novel opportunity exploitation, we believe that uncertainty avoidance orientation is the most important cultural value dimension related to entrepreneurship, and thus we focus on this dimension in the current study. Reasons for the importance of uncertainty avoidance in entrepreneurial decisions can be found in earlier

works by economists such as Knight (1921). In his perspective, the entrepreneur's main function is bearing the real uncertainty by making judgmental decisions in the face of incalculable and business hazards.

It has been found that societies differ in their orientation towards entrepreneurial activity (Wennerkers et al., 2005). More specifically, the degree to which uncertainty is acceptable within a given culture varies greatly among countries (Hofstede, 2001). Cultures with low uncertainty avoidance have low levels of stress and anxiety, greater tolerance and acceptance of uncertain situations, and a strong belief in rewarding people for innovative approaches. Low uncertainty-avoidance cultures are more accepting of ambiguity (Hofstede 1980, 2001); that is, they accept unclear situations, and any deviation from the normal variation is accepted. They see uncertainty as an inherent part of life and more easily accept each situation as it comes.

Uncertainty avoidance is likely to influence entrepreneur's decision to exploit novel opportunities for new venture creation. Two individuals with similar personalities operating in an unpredictable environment may respond differently to the knowledge they possess under different uncertainty avoidance cultures. A low uncertainty avoidance culture may encourage extraverted, agreeable, open, conscientious, and non-neurotic entrepreneurs operating in an unpredictable environment to exploit novel knowledge for business start-ups. These individuals who function in volatile environments may be more motivated to take the risk in testing out new ideas in their entrepreneurial start-ups. We base this argument on the fact that a low uncertainty avoidance culture are more receptive to risk and uncertainty, and thus provide the added incentive for entrepreneurs with the right personality (extraversion, agreeableness, openness, conscientiousness, and non-neuroticism) in unpredictable environments to exploit novel opportunities.

Hypothesis 3a: Among entrepreneurs with a higher score on the extroversion trait, environmental unpredictability in a low uncertainty avoidance culture will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 3b: Among entrepreneurs with a higher score on the agreeableness trait, environmental unpredictability in a low uncertainty avoidance culture will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 3c: Among entrepreneurs with a higher score on the openness trait, environmental unpredictability in a low uncertainty avoidance culture will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 3d: Among entrepreneurs with a higher score on the conscientious trait, environmental unpredictability in a low uncertainty avoidance culture will be associated with greater likelihood of opportunity exploitation based on new knowledge.

Hypothesis 3e: Among entrepreneurs with a lower score on the neuroticism trait, environmental unpredictability in a low uncertainty avoidance culture will be associated with greater likelihood of opportunity exploitation based on new knowledge

RESEARCH METHOD

Sample

The sample consists of 570 founders and co-founders of new-technology based firms (NTBF) in United Kingdom, Thailand, and South Korea. NTBF are defined as independent (Little 1977), relatively young firms (Ferguson and Olofsson 2004), operating in a high technology sector (Autio and Lumme, 1998). These countries were selected because they represent the full range of scores on Hofstede's (1980) low avoidance uncertainty-high avoidance uncertainty index. On a 100-point scale, with higher scores representing a higher

avoidance uncertainty culture, Hofstede reported scores or the UK, Thailand, and South Korea of 35, 64, and 85, respectively. Questionnaires were administered in English for the UK, in Thai for the Thailand sample, and in Korean for the South Korean sample. The Thai and Korean questionnaires were translated, then back-translated by an independent expert in the field to ensure consistency in the meaning to the original questionnaire. Pretests indicated no significant interpretative problems with any of the samples.

The data for this study were collected over a 4-year period from 2004-2007. Similar data collection procedures were employed with the UK, Thailand, and South Korea surveys. For the UK survey, 1,358 invitations were mailed during the four years to NTBFs in the West Midlands, North West and London, and out of these 1,358 invitations, a total of 203 CEOs agreed to participate, yielding an 15% response rate. Possible non-response bias was examined by comparing the representation of high-tech manufacturing sectors of respondents (n = 203) with those of non-respondents (n = 1,358). One-way between group analysis of variance (ANOVA) of high-tech sectors resulted in a statistically non-significant F of 0.85 (p = 0.64). For the Thailand survey, 1,200 companies were randomly selected from the population of high-tech start-ups registered with the national government. A total of 172 responses were received, yielding a response rate of 14%. ANOVA analysis of high-tech sectors resulted in a statistically non-significant F of 0.92 (p = 0.70). In the case of South Korea, 702 high-tech companies located within the Incheon and Daedok districts were selected. A total of 195 usable questionnaires were returned, for a 27% response rate. ANOVA analysis of high-tech sectors resulted in a statistically non-significant F of 0.55 (p = 0.88).

To minimize common method variance, questions for one of the independent variables, that is environmental unpredictability, and the dependent variable, that is novelty of opportunity

exploitation were also administered with the deputy CEO/co-founder of the firm. The personality, culture, and control questions were administered only to the CEOs.

Data analysis method

Prior to testing the hypotheses, ANOVAs were performed to determine if differences existed in the personality traits and environmental unpredictability measures within the UK, Thailand, and South Korea samples. To test the hypotheses, we used a hierarchical regression analysis.

Dependent variable

Based on the concepts of market novelty and technical knowledge, we developed seven original items for the dependent variable, novelty of opportunity exploitation based on new knowledge. This variable was measured by asking the respondent CEO and deputy CEO to state their level of agreement on seven statements, which were anchored on a 5-point Likert scale of 1 (Strongly disagree) to 5 (Strongly Agree). Examples of items are: “Most of my customers and/or potential customers consider my product/service new and unfamiliar,” and “I have taken measures or will be taking measures to protect the intellectual property (IP) associated with the products/services that my company is offering”. The alpha reliability of these items was 0.78. For full details of the study’s questionnaire items and its operationalizations, see Appendix 1.

In order to ensure the reliability of the data used in the analyses, we compared the responses of the CEOs with those of the deputy CEOs. We found that there was a high level of convergence between the responses of the CEOs and deputy CEOs on the measurement items of the dependent variable. One-way ANOVA analyses revealed that there were no statistically significant differences between the responses of the CEOs and deputy CEOs on the dependent construct ($F = 0.72$; $p = 0.69$). The weighted Kappa coefficient, which assesses the inter-rater

agreement for ordinal data was 0.78, which according to Landis and Koch (1977) represents a substantial strength of inter-rater agreement. Furthermore, the responses of these two groups were positively correlated (r = 0.76) at the 1% level. To minimize the potential effects of common method variance, the responses of the deputy CEOs were used to represent the dependent variables.

Independent variables

The three independent variables in this study were personality, environmental unpredictability, and uncertainty avoidance culture.

Personality was measured using the NEO-FFO (Costa and McCrae, 1992), a 60-item instrument to measure the Big Five personality dimension. Each personality dimension is assessed by 12 items, and items responses are coded on a five-point Likert scales ranging from Strongly Disagree (1) to Strongly Agree (5). This instrument was selected due to the high internal consistency reliability reported in previous research; 0.89 for Neuroticism, 0.79 for Extraversion, 0.76 for Openness, 0.74 for Agreeableness, and 0.84 for Conscientiousness (Schmit and Ryan, 1993). The current study found reliability coefficients of 0.80 for extraversion, 0.76 for agreeableness, 0.71 for openness, 0.73 for conscientiousness, and 0.83 for neuroticism.

The environmental unpredictability variable was measured using Miller and Dröge's (1986) five-item descriptive phrases anchored by 7-point semantic differential-type scales. Although Miller and Dröge did not report the reliability of their environment uncertainty scale, we found that the alpha reliability of the uncertainty scale was 0.75. To ensure that the responses represent a true reflection of the firm's environmental conditions, and not the individual differences between the CEOs and deputy CEOs, we compared the responses of these two groups. We found that there was a notable positive agreement among CEOs and deputy CEOs of

similar firms ($F = 0.62$; $p = 0.49$) than CEOs and deputy CEOs of different firms ($F = 3.04$, $p < 0.001$). This indicates that the responses were a true representation of the firm's environmental uncertainties. Given that the deputy CEOs' responses were used to represent the dependent variables, the CEOs' responses were thus used to represent the environment uncertainty variable.

Following the recommendation by Konig et al. (2007), we measured the uncertainty avoidance culture at the individual level. Konig and colleagues emphasized that whenever individuals are studied, researchers should measure cultural orientations at the individual level instead of culture at the aggregate level. They hold that the use of aggregate-level scales at the individual level often involves losses of reliability and validity. Moreover, the authors highlight that cultural dimensions should be measured using scales based on scenarios rather than using scales based on Likert items. Thus we measured the uncertainty avoidance index using the three scenario-based situations from Konig et al.'s (2007). Two behavioral options follow each scenario. The first option represents a low score on the uncertainty avoidance dimension, whereas the second option represents a high score. Between the two behavioral options, there are two mirror-inverted three-point scales that are directed towards the first and the second option, respectively. The two scales range from somewhat true of me (3/4) over very true of me (2/5) to extremely true of me (1/6)**.**

Control variables

We included variables which have been shown to relate to the individual's propensity to exploit entrepreneurial opportunities: age (Long 1982), education attainment (Casson 1995), experience within the industry of the new venture (Aldrich 1999), and the firm's industrial sector (Taylor 1996). Only the CEOs were asked to answer the questions on the control variables.

RESULTS

Table 1 presents the descriptive statistics and Pearson correlations among variables in the study for all the 570 responses As shown in the table, novelty of knowledge was negatively correlated with uncertainty avoidance ($r = - 0.35$; $p < 0.01$), primary education ($r = - 0.13$; $p < 0.01$) and neuroticism ($r = -0.19$; $p < 0.05$). In addition, we found that age, environment unpredictability, pre-university/vocational, undergraduate, postgraduate education, and the personality traits of extroversion, agreeableness, openness, and conscientiousness were positively correlated with the dependent variable ($p < 0.05$). Experience in the relevant industry was significantly correlated with novel opportunity exploitation at the 1% level ($r = 0.20$). Overall, the correlation coefficients among the variables were all below 0.60 (Kennedy 1992) and none of the variance inflation factors (VIFs) for the models was greater than 2, which is lower than the guideline of ten suggested by Chatterjee and Price (1991). Thus it was unlikely that multicollinearity among the independent variables affected the findings.

INSERT TABLE 1 ABOUT HERE

The average age of respondents in the UK and South Korean samples was 35 years with the Thai sample being slightly lower at 29 years. The average experience of individuals in both the Thai and UK samples is 7 years, while the experience for the South Koran group is 10 years. In terms of education levels, comparable proportions were noted in the three samples. Majority of respondents have undergraduate or postgraduate degrees. All the three samples had equal spread of respondents from the four industries including software, ICT hardware, engineering, and life sciences.

Table 2 shows the results of the ANOVA analyses to determine if differences existed in the personality traits, perceptions of environmental unpredictability and uncertainty avoidance within the UK, Thailand, and South Korean samples. As observed, there were statistically non-significant differences in the responses to the personality traits and environmental unpredictability measures across the three samples. However, the South Korean sample displayed a statistically higher ($p < 0.05$) uncertainty avoidance index than the UK and Thailand samples. Overall, the results indicate that the three samples differ only on the uncertainty avoidance culture index, with the South Korean group scoring the highest on uncertainty avoidance, followed by the Thailand and UK groups.

INSERT TABLE 2 ABOUT HERE

Hierarchical multiple regression was used to examine the amount of variance explained by the base model (control variables only), the main-effects model (controls and independent variables), and the full model (controls, independent variables, and hypothesized interactions). Table 3 presents the results of the multiple regressions predicting the novelty of opportunity exploitation based on new knowledge. As observed in Model 1, age, experience, pre-university/vocational, undergraduate, and postgraduate education were significantly related to the novelty of opportunity exploitation based on new knowledge ($p < 0.05$). The findings in Model 1 also highlighted that secondary education was negatively related to the novelty of opportunity exploitation ($p < 0.05$). The effects of the control variables remained mostly unchanged in the main effects model. The results in the main effects model found that the personality traits of extroversion ($b = 1.50$, $p < 0.05$), agreeableness ($b = 1.49$, $p < 0.05$), openness($b = 1.56$, $p < 0.05$), conscientiousness ($b = 1.53$, $p < 0.05$), and neuroticism ($b = -1.62$,

$p < 0.05$), were significantly related to the dependent variable, providing support for Hypothesis 1a, 1b, 1c. 1d, and 1e, which predicts that a higher score on the extroversion, agreeableness, openness, and conscientiousness traits, and a lower score on the neuroticism trait will be associated with greater likelihood of opportunity exploitation based on new knowledge. The main-effects models explained a significant amount of variance over and above the base model ($\Delta R^2 = 0.09$, $p < 0.01$).

INSERT TABLE 3 ABOUT HERE

Hypotheses 2 and 3 were tested in Model 3, where the two-way and three-way interactions were incorporated in the regression analyses. Hypotheses 2a-2e, which predict the moderating effects of environmental unpredictability on the relationship between the Big-Five personality traits and the likelihood of exploiting opportunity based on new knowledge were supported by the regression results. All the interaction terms between the personality traits of extroversion, agreeableness, openness, conscientiousness, and neuroticism were statistically significant at the 5% level. Hypotheses 3a to 3e predict the three-way interactions among personality traits such as extroversion, agreeableness, openness, conscientiousness, and neuroticism, environmental unpredictability, and uncertainty avoidance culture. The results show that high extroversion, agreeableness, openness, conscientiousness, and low neuroticism, have the strongest positive relationship with exploitation of novel opportunities based on new knowledge in an unpredictable environment and low uncertainty avoidance culture.

The results in the full model indicated that there were significant positive three-way interactions among the extroversion, agreeableness, openness, conscientiousness, and neuroticism traits, environmental unpredictability, and uncertainty avoidance ($p < 0.01$). The

findings provided evidence that three-way interactions among personality traits, environmental unpredictability, and uncertainty avoidance had higher predictive power than two-way interactions between personality traits and environmental unpredictability. The beta coefficients for all the three-way interactions were larger than the coefficients for the two-way interactions. In addition, the three-way interactions were statistically significant at the 1% level as compared to 5% for the two-way interactions.

When the environment is unpredictable and the culture is low on uncertainty avoidance, extroversion had the strongest positive relation to the exploitation of novel opportunities based on new knowledge. Exploitation of novel knowledge was highest when extroversion and environment unpredictability were high in a low uncertainty avoidance culture. These results support Hypothesis 3a. Likewise, when the environment is unpredictable and the culture is low on uncertainty avoidance, agreeableness had the strongest positive relation to exploitation of novel knowledge, and exploitation of novel knowledge was highest when agreeableness, environmental unpredictability were high in a low uncertainty avoidance culture, thus supporting Hypothesis 3b. Moreover, when the environment is unpredictable and the culture is low on uncertainty avoidance, openness had the strongest positive relation to the exploitation of novel opportunities based on new knowledge, thereby supporting Hypothesis 3c. In addition, exploitation of novel knowledge was lowest when the environment was stable and the culture is high on uncertainty avoidance. Hypothesis 3d predicts a three-way interaction between openness to new experience, environmental unpredictability, and uncertainty avoidance: when the environment is unpredictable and the culture is low on certainty avoidance, openness to new experience had the strongest positive relation to exploitation of novel knowledge. Novelty of knowledge is highest when all three variables are high, supporting Hypothesis 3d. Similarly,

exploitation of novel knowledge is greatest when neuroticism is low, environmental unpredictability is high, and uncertainty avoidance is low. Novelty of knowledge is lowest when neuroticism is high, the environment is predictable, and the culture is high on uncertainty avoidance, providing support for Hypothesis 3e.

The model variables explain about 39% of the variance in the dependent variable in the full model. Essentially, the full model explains a significant amount of variance over and above the main effects model ($\Delta R^2 = 0.14$, $p < 0.01$)

DISCUSSION AND CONCLUSION

Studies that aim to differentiate entrepreneurs from non-entrepreneurs using the personality trait theory have long been criticized for their inconsistent findings (Gartner 1988). Rather than focusing on the differences between entrepreneurs and non-entrepreneurs, our paper aims to examine the personal variations among different categories of entrepreneurs. This paper focused on distinguishing characteristics of entrepreneurs who start new ventures based on novel opportunities, versus those who start new ventures based on less novel opportunities. We found that entrepreneurs who exploit novel opportunities do indeed distinguish themselves from those who exploit less novel opportunities. Entrepreneurs who exploit novel opportunities score higher on the extroversion, agreeableness, openness and conscientiousness traits, and lower on the neuroticism trait. Furthermore, the positive effects of these personality traits on the novelty of opportunity exploitation are strengthened among entrepreneurs who operate in unpredictable environments and low uncertainty avoidance cultures.

Our findings contribute to the understanding of entrepreneurs' opportunity exploitation and highlight that personality, environmental, and cultural factors are significant in

distinguishing between entrepreneurs who start new businesses based on novel opportunities and those who start based on less novel opportunities. Among all the two-way interactions examined, environmental uncertainty was found to have the strongest moderating influence on the conscientiousness-novel opportunities relationship. This suggests that the combination of a conscientious personality with environmental unpredictability is the strongest predictor of novel opportunity exploitation. Interestingly, while environmental unpredictability does not have a direct effect on opportunity exploitation, it moderates the effects of personality traits on opportunity exploitation. These findings provide a more nuanced view of the relationship between personality and opportunity exploitation. Moreover, the three way interactions of personality, environmental unpredictability, and uncertainty avoidance culture highlight the need to use a contingency perspective when studying the effects of individual characteristics on entrepreneurial behavior. Specifically, the three-way interactions revealed that entrepreneurs who are extraverts, agreeable, open, conscientious, and non-neurotic and who operate in an unpredictable environment and low uncertainty avoidance culture have the greatest propensity to exploit novel opportunities. Taken together, our study is dissimilar from other studies on entrepreneurial personality in that it tests the effects of personality in conjunction with the environment and culture on the propensity to exploit novel opportunities. This study not only contributes to the entrepreneurship literature on the personal characteristics that differentiate various types of entrepreneurs, but also advances our understanding of the impact of the joint personal, environmental, and cultural factors on entrepreneurs' propensities to exploit novel opportunities. The findings reinforce the individual-opportunity nexus perspective, in that exploitation of business opportunities should take into account the environment and the opportunity-seeking individual.

The implications of our study are manifold. From a policy perspective, the importance of a low uncertainty avoidance culture for the exploitation of novel opportunities provides an opportunity for policy intervention through changes in the education curriculum. Educators should investigate to what extent their education system and relevant labor market, social, fiscal legislations foster a lower or higher degree of uncertainty avoidance within the population. This is important because while personality traits are genetic and unalterable (Jang et al., 1996), cultural orientations are acquired and can be altered, thus providing an opportunity for policy intervention.

Second, in a highly competitive environment, the ability to create new markets and new technologies is vital for both survival and profitability. Governments regularly intervene in the entrepreneurial process to identify and exploit new ideas and processes in the market (Bridge et al. 1998). In many instances, support agencies are tasked to select individuals who are worthy of support, hence it would be more effective to select and offer full support to those individuals with the greatest potential for innovation. Amidst the many factors that government agencies should consider when selecting individuals for support, including their track records, capital investments, and strategic directions, the personality of these individuals should also be weighed. While some authors view the reliance on personality profiling as futile (Gartner 1988), authors like Fagenson (1993 p. 424) cite many others who recognize the influence of personality on entrepreneurial behavior. Indeed, many companies have used personality tests as one of the selection tools in the hiring process (see Hough and Oswald 2000, for a review).

By the same token, the findings of our study elucidate that knowledge of the entrepreneurs' personalities would be of much interest to investors and lending organizations such as banks when evaluating entrepreneurs' potential for exploiting new market and

technological ideas, particularly in a dynamic entrepreneurial eco-system. Identifying entrepreneurs who have the right personality to capitalize on novel opportunities in an uncertain environment would increase the probability of producing entrepreneurs with new market and technological innovations (Covin and Slevin 1989; Zahra and Covin 1995).

The individual-opportunity nexus perspective adopted in our research adds meaningful information to the literature on opportunity exploitation. More specifically, the interaction relationship among the three conceptual constructs of personality, environmental unpredictability, and uncertainty avoidance culture may help future investigations in the realm of opportunity exploitation. Researchers could further examine the role of the individual in various entrepreneurial exploitation activities. For example, how do individuals' cognitive properties and personality traits affect their opportunity exploitation behavior in terms of their product/service offerings, resource acquisitions (e.g., financial and human capital resources), and market selections? Or how do these individual factors help to explain the translation of novel opportunity exploitation into new venture creation? And under the above circumstances, do the environmental conditions influence the impact of individual factors?

Future research reflecting the importance of ecological influences could explore the potential moderating influences of the economic, political, and socio-cultural environments as well as industry differences such as knowledge conditions, demand conditions, industry life cycles, appropriability conditions, and industry structures (Shane 2003, p. 121) to better understand why some entrepreneurs are more successful than others at recognizing novel opportunities. Furthermore, as the data for our study is obtained from entrepreneurs in high-technology industries, the results may not be applicable to other non-high-tech businesses where there is less emphasis on technological novelty. Thus it would be useful for future studies to

include responses from the non-high-tech sectors to ascertain if the findings from this study are indeed generalizable beyond the exploitation of technological opportunities. In view of cultural influences on an individual's perception of the entrepreneurial climate (Hayton et al. 2002; Huisman, 1985), we would also like to encourage future studies to delve further into the complementary effects between national culture, including the individual cultural dimensions of individualism, power-distance index, and masculinity as well as environmental contexts on an individual's opportunity exploitation behavior.

In conclusion, while prior research has examined the influence of entrepreneurs' personalities and the dynamism of the environment on entrepreneurial behavior separately, our study confirms their joint effects, as well as their interaction effects with uncertainty avoidance culture, on entrepreneurs' opportunity exploitation behavior. Consistent with the individual-opportunity nexus framework of Shane and Venkataraman, we posit that the nature of entrepreneurial exploitation activities are jointly determined by the nexus of environmental factors that shape the emergence of opportunities and the supply of opportunity-seekers with the right entrepreneurial personalities to exploit such opportunities.

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TABLE 1

Correlation of Variables (N = 570)[a]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Dependent variables																				
1. Novelty of knowledge	1																			
Control variables																				
2. Software	0.04	1																		
3. ICT Hardware	0.05	0.02	1																	
4. Engineering	0.06	0.01	0.05	1																
5. Health & Life Sciences	0.05	0.05	0.01	0.02	1															
6. Others[b]	0.01	0.06	0.02	0.04	0.02	1														
7. Age	0.13*	0.07	0.04	0.01	0.03	0.05	1													
8. Experience in relevant industry	0.20**	0.05	0.04	0.02	0.05	0.02	0.12*	1												
9. Primary	-0.13*	0.02	0.06	0.03	0.02	0.03	0.06	0.04	1											
10. Secondary	-0.08†	0.05	0.03	0.04	0.04	0.06	0.03	0.05	0.02	1										
11. Pre-university/vocational	0.11*	0.06	0.02	0.04	0.06	0.04	0.02	0.02	0.03	0.04	1									
12. Undergraduate	0.12*	0.07	0.02	0.05	0.04	0.03	0.02	0.04	0.04	0.06	0.03	1								
13. Postgraduate	0.14*	0.03	0.50	0.01	0.04	0.06	0.03	0.04	0.05	0.01	0.02	0.01	1							
Independent variables																				
14. Uncertainty Avoidance	-0.35**	0.03	0.05	0.01	0.07	0.02	0.05	0.05	0.04	0.05	0.04	0.06	0.04	1						
15. Extraversion	0.16*	0.05	0.03	0.07	0.04	0.03	0.05	0.04	0.05	0.05	0.06	0.05	0.06	0.06	1					
16. Neuroticism	-0.19*	0.06	0.01	0.04	0.05	0.07	0.04	0.03	0.03	0.06	0.02	0.01	0.03	0.03	0.06	1				
17. Agreeableness	0.11*	0.02	0.02	0.03	0.07	0.02	0.03	0.02	0.02	0.04	0.01	0.02	0.04	0.02	0.01	0.04	1			
18. Openness	0.14*	0.05	0.06	0.06	0.01	0.02	0.02	0.06	0.01	0.02	0.03	0.03	0.05	0.04	0.02	0.01	0.03	1		
19. Conscientiousness	0.18*	0.02	0.04	0.02	0.05	0.04	0.06	0.05	0.02	0.03	0.05	0.05	0.04	0.04	0.01	0.03	0.02	0.04	1	
20. Environment unpredictability	0.18*	0.03	0.03	0.01	0.02	0.05	0.05	0.03	0.01	0.02	0.06	0.04	0.03	0.05	0.05	0.02	0.01	0.03	0.02	1
Mean	3.60	0.23	0.25	0.22	0.20	0.10	33.00	8.00	0.09	0.12	0.24	0.38	0.17	3.85	3.42	3.57	3.63	2.81	2.99	4.68
Std. Deviation	0.61	0.47	0.46	0.42	0.37	0.45	1.47	2.78	0.35	0.42	0.41	0.39	0.33	1.69	0.32	0.46	0.36	0.48	0.55	1.43
Minimum	1	0	0	0	0	0	23	4	0	0	0	0	0	1	1	1	1	1	1	1
Maximum	5	1	1	1	1	1	51	32	1	1	1	1	1	6	5	5	5	5	5	7

N = 570

a The correlation coefficients were based on the responses of the CEOs

b Others include Plastics & Synthetic Rubber, Aircraft Manufacturing, and Electricity Distribution Apparatus

** p < .01; * p < .05; † p < .10

TABLE 2

ANOVA analysis of Responses to Personality Traits, Environmental Unpredictability, and Uncertainty Avoidance items

		n = 203	n = 172	n = 195	Significance of F
		UK	Thailand	South Korea	
1. Extraversion	Mean	3.38	3.41	3.47	0.771
	Std. Dev	0.30	0.33	0.33	
2. Agreeableness	Mean	3.64	3.60	3.65	0.622
	Std. Dev	0.41	0.36	0.31	
3. Openness	Mean	2.79	2.79	2.85	0.649
	Std. Dev	0.46	0.51	0.47	
4. Conscientiousness	Mean	3.05	2.93	2.99	0.517
	Std. Dev	0.58	0.53	0.58	
5. Neoroticism	Mean	3.56	3.55	3.60	0.564
	Std. Dev	0.47	0.45	0.46	
6. Environmental unpredictability	Mean	4.70	4.71	4.63	0.582
	Std. Dev	1.40	1.45	1.44	
7. Uncertainty avoidance	Mean	3.23	3.91	4.41	0.039
	Std. Dev	1.40	1.76	1.91	

TABLE 3

Hierarchical Multiple Regression Predicting the Novelty of Opportunity Exploitation Based on Novel Knowledge (N=570)

	Model 1: Controls	Model 2: Controls + Main effects	Model 3: Controls + Main effects + Interaction Terms
R-squared	0.16	0.25	0.39
Change in R^2	0.16**	0.09**	0.14**
F-value	411.93	574.47	630.57
Probability	0.000	0.000	0.000
	B	**B**	**B**
Controls			
Constant	2.20**	2.25**	2.21**
Software	0.63+	0.68+	0.64+
ICT Hardware	0.34	0.29	0.29
Engineering	0.48+	0.47+	0.67+
Others	0.53	0.49	0.49
Age	1.34*	1.39*	1.54+
Actual experience	1.49*	1.54*	1.53*
Secondary	-1.51*	-1.40*	-1.40*
Pre-University/Vocational	1.23*	1.12*	1.11+
Undergraduate	1.27*	1.33*	1.32*
Postgraduate	1.38*	1.39*	1.44*
Main effects			
Extroversion		1.50*	1.67*
Agreeableness		1.49*	1.60*
Openness		1.56*	1.65*
Conscientiousness		1.53*	1.79*
Neuroticism		-1.62*	-1.74*
Environmental Unpredictability (EU)		0.61+	0.39+
Uncertainty Avoidance (UA)		-0.72+	-0.69+
Interaction Terms [a]			
Extroversion x EU			1.43*
Agreeableness x EU			1.51*
Openness x EU			1.37*
Conscientiousness x EU			1.56*
Neuroticism x EU			-1.49*
Extroversion x EU x UA			-2.29**
Agreeableness x EU x UA			-2.15**
Openness x EU x UA			-2.02**
Conscientiousness x EU x UA			-2.33**
Neuroticism x EU x UA			2.41**

** $p < 0.01$; * $p < 0.05$; + $p < 0.10$

a All 2-way interactions between the personality traits – extroversion, agreeableness, openness, conscientiousness, neuroticism, and uncertainty avoidance culture were statistically non-significant. Similarly, all 2-way interactions between environmental unpredictability and uncertainty avoidance culture were statistically non-significant. Only the statistically significant 2-way interactions were reported.

APPENDIX I

Measure Items and Response Format

Variables	Measurements
Dependent variable	
a) Exploitation of business opportunity based on novel knowledge (α = 0.78)	
Please rate the extent to which you agree with the following statements	
i) Most people in the industry including my competitors feel that the product	1 - Strongly Disagree
or service that my company is offering is new to the market/s we currently serve	5 - Strongly Agree
ii) My product/service is developed for a niche or specialized market	
iii) Most of my customers and/or potential customers consider my product/service	
new and unfamiliar	
iv) At the point of start-up, there were few competitors offering similar product/servive	
to my potential customers	
v) The technologies or procedures required by this product/service were not available	
more than a year ago	
vi) I have taken measures or will be taking measures to protect the intellectual property (IP)	
associated with the products/services that my company is offering	
vii) At the point of start-up, there were no competitors using similar technology associated with	
the product/service that my company is offering	
Independent variables	
a) Personality (measures of Extraversion, Agreeableness,	
Conscientousness, Neuroticism, and Openness to Experience)	
60-item scale using Costa and McCrae (1992) NEO-FFI	1 - Strongly Disagree
	5 - Strongly Agree
b) Uncertainty Avoidance Culture	
3 scenario-based questions (Konig et al., 2007)	1 - Extremely True
	2 - True of me
	3 - Somewhat
	4 - Somewhat
	5 - True of me
	6 - Extremely True
c) Environment uncertainty	
5-item bipolar adjective scale (Miller and Droge, 1986)	7- point bipolar adjective
	scale
Control variables	
a) Industry sectors	Software, ICT-Hardware, Engineering
	Health, Others
b)Age at start-up	Actual age
c) Experience in the industry	Number of years
d) Education attainment levels	Primary, secondary,
	pre-university/vocational qualification,
	undergraduate, postgraduate