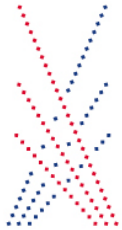

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Opportunity recognition in new product development: The roles of regulatory focus and entrepreneurial learning

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Opportunity recognition in new product development: The roles of regulatory focus and entrepreneurial learning

Abstract

Why are some entrepreneurs more able to recognize opportunities, especially in the process of developing new product? Based on the regulatory focus theory and entrepreneurial learning perspective, we used a sample of 237 new product development project leaders from high-tech firms and explored the relationship between regulatory focus and opportunity recognition, as well as the potential mediators of exploitative learning and exploratory learning. The results illustrate that regulatory focus, namely promotion focus and prevention focus, have opposing effects on opportunity focus, respectively. Besides, both exploitative learning and exploratory learning not only positively affect opportunity recognition, but also mediate the relationship between regulatory focus and opportunity recognition in new product development.

Key words

Opportunity recognition, exploitative and exploratory learning, regulatory focus, entrepreneurial learning, new product development project.

Track: Entrepreneurship

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Introduction

Recognizing opportunities for new ventures is the core ability of a successful entrepreneur (Ardichvili, Cardozo and Ray, 2003). However, "key questions remain not only about what factors facilitate the recognition of opportunities, but also about why these factors play such a role" (Grégoire, Shepherd and Schurer Lambert, 2010, p. 413). Entrepreneurship scholars (e.g., Grégoire, Shepherd and Schurer Lambert, 2010; Lorenz, Ramsey and Richey Jr, 2018; Tumasjan and Braun, 2012) generally argue that there is heterogeneity such as individual difference existing in entrepreneurs' ability to recognize opportunities and primarily adopt cognitive perspective to explain the central question, why are some entrepreneurs more able to recognize opportunities than others (Dyer, Gregersen and Christensen, 2008)? Regulatory focus theory (RFT) is at the core of this research (Tumasjan and Braun, 2012) and has been established as a constructive theoretical lens which discusses individuals' motivation and preference for certain goals and strategic actions (Fischer, Mauer, and Brettel, 2018) such as recognizing opportunities.

Although the burgeoning attempts have sharpened our understanding of opportunity recognition, they fail to provide a comprehensive explanation. Specifically, most of the entrepreneurship research on opportunity recognition primarily concentrate on the individual differences of entrepreneurs themselves (e.g. Grégoire, Shepherd and Schurer Lambert, 2010; Lorenz, Ramsey and Richey Jr, 2018; Tumasjan and Braun, 2012) or the nature of opportunities (e.g. Ardichvili, Cardozo and Ray, 2003; Grégoire and Shepherd, 2012; Smith, Matthews and Schenkel, 2009) but rarely consider the entrepreneurial process articulated by Shane and Venkataraman (2000). Since opportunity recognition emerges as a process (Ozgen and Baron, 2007), it's essential to consider the contextual role playing in the entrepreneurial process. For example, although the developmental process of opportunity recognition is similar to new

product development (NPD), most entrepreneurs recognize opportunities for building entire business rather than new products (Ardichvili, Cardozo and Ray, 2003).

"Entrepreneurship is a process of learning, and a theory of entrepreneurship requires a theory of learning" (Minniti and Bygrave, 2001, p.7). However, the current research has significantly ignored the vital role of the learning process acting in opportunity recognition and "must be augmented by a more fine-grained examination of learning" (Corbett, 2005, p.474). As an entrepreneurial process of learning to recognize new knowledge and market opportunities (Shane, 2000), NPDs are usually influenced by the two types of learning processes, namely exploitative and exploratory learning (Atuahene-Gima and Murray, 2007). By its very nature, NPD involves a combination of exploitation and exploration in problem solving, implementation of solutions and opportunity recognition (Atuahene-Gima, 2003). However, to date, very few studies (see Politis, 2005) have explored the specific role of exploitative and exploratory learning playing in opportunity recognition, especially during the entrepreneurial process.

As the NPD projects require potential opportunities for survival and development (Jin, Shu, and Zhou, 2019), especially in an environment where the likelihood of failure is high (Hu, McNamara, and Piaskowska, 2017), the high-tech firms operating within it present an ideal context in which to explore how project leaders' cognitive traits affect their ability in recognizing opportunities. Thus, our study focuses upon the relationship between the regulatory focus and opportunity recognition and further explores the potential mediating role of exploitative and exploratory learning in the NPD projects of high-tech firms.

Our study uses a new data set of 237 NPD project leaders in China and has two potential contributions. First, our study contributes to the entrepreneurial learning perspective by moving away from previous static approaches and develops a more dynamic perspective on the transformation process of entrepreneurial learning (Corbett, 2005; Minniti and Bygrave, 2001).

Specifically, our study finds there is an intermediate process of exploitative and exploratory learning existing in the relationship between regulatory focus and opportunity recognition. Also, our study helps to better understand opportunity recognition during the entrepreneurial process by adopting a regulatory focus perspective. It allows us to understand a great deal about how individuals recognize opportunities based on the process of learning. Our paper empirically justifies that entrepreneurs' cognitive mechanism will affect their adoption of learning types and subsequently affect their ability in opportunity recognition.

Theory and Hypotheses

Opportunity recognition in new product development

NPD activities are critical for new ventures (Jin, Shu, and Zhou, 2019). It appears that recognizing the right opportunities from NPD projects for sustainable development are particularly important for high-tech ventures regarding the high rates of NPD failure. In fact, the process of learning from failure and recognizing new potential opportunities from such failure also benefits the whole venture, through the application of that knowledge learned to subsequent projects or business (e.g., McGrath, 1999). Thus, it's crucial to find what factors and how they facilitate opportunity recognition in new product development.

Emerging empirical studies have been done to analyse the relationship between regulatory focus and opportunity recognition (e.g., McMullen and Shepherd, 2002; Tumasjan, and Braun, 2012). For example, McMullen and Shepherd (2002) argue that when facing the same stimuli, promotion-focused individuals usually set lower thresholds for whether an opportunity actually exists and are more willing to act on this opportunity. Contrarily, the prevention-focused individuals will set higher criteria for a potential opportunity and be more cautious with acting on such opportunity. However, how regulatory focus affects opportunity recognition during the entrepreneurial process remain unsolved (George et al., 2016). Our

extant knowledge on regulatory focus in opportunity recognition has "remained fragmented and inconclusive" (Tumasjan and Braun, 2012, p.623), and such an effect in the new product development remains to be explored.

Besides, individuals learn in different ways and these differences affect their ability to recognize opportunities. Thus, "it needs to be fortified by investigations of the process of learning" (Corbett, 2005, p.474). Opportunity recognition, is defined here as the ability to identify good ideas and transform them into profitable new products. We thus apply regulatory focus theory and entrepreneurial learning perspective as the overarching theoretical angle, as it provides a helpful lens to explore why entrepreneurs (in distinct cognitive traits) adopt different learning types and how specific behaviour leads to various opportunity recognition ability in new product development. Entrepreneurial learning here is defined as an experiential process of learning to recognize and act on opportunity during the entrepreneurial process of NPD (Cope, 2005; Rae, 2017). It stresses that exploitative learning and exploratory learning are the key types for understanding what and how entrepreneurs learn in the opportunity recognition process (Wang and Chugh, 2014). In the context of NPD, exploitative learning process involves "the refinement and extension of existing competencies, technologies, and paradigms" (March, 1991, p. 85), which stresses efficiency and implementation of NPD. On the contrast, explorative learning process relates to greater experimentation and innovation with new alternatives in developing new products (Atuahene-Gima and Murray, 2007).

Overall, our study proposes that the effects of regulatory focus on their abilities in opportunity recognition is based on the existence of learning asymmetries, namely exploitative and explorative learning, which act as mediators in the relationship between regulatory focus and opportunity recognition, and thus provides fundamental arguments for developing the main hypotheses in our study as follows.

Regulatory focus and opportunity recognition

Regulatory focus theory posits two distinct modes of how individuals regulate their own behaviours to reach certain goals (Higgins, 1998). Promotion-focused individuals are primarily concerned with advancement, growth, and accomplishment and therefore motivated to seek gains and new achievements. Contrarily, prevention-focused individuals are primarily concerned with protection, safety and responsibility and thus tend to be motivated to avoid losses or setbacks. In line with prior studies, we propose that, under the NPD project context, the entrepreneurs' promotion focus will affect opportunity recognition positively and prevention focus affect opportunity recognition negatively. The reasons are as follows:

Entrepreneurs with a high level of promotion focus are prone to be more creative, remaining more open to new ideas and information, active to find problem solutions and generating a higher number of alternatives during the entrepreneurial process of NPD (Crowe and Higgins, 1997; Friedman and Förster, 2001). Thus, they get an advantage in generating new possibilities, considering novel alternatives and conceive of creative ideas and information which in turn facilitate opportunity recognition (Crowe and Higgins, 1997; Brockner, Higgins and Low, 2004), whereas the opposite should be true for prevention-focused entrepreneurs.

Besides, promotion-focused entrepreneurs going for attaining gains makes them stick to novel information (Tumasjan and Braun, 2012) which in turn increases the likelihood of engaging in more thorough information processing facing the high rate of failure in NPD (Hu, McNamara, and Piaskowska, 2017). They are more likely to regard the NPD failures as other opportunities for searching for new solutions or new development direction. They hold the idea that success comes after a large amount of failure (Sitkin, 1992) and follow the law of "trial and error", which provides facilities for recognizing opportunities during the process of NPD. Contrarily, entrepreneurs with a high level of prevention focus are more hesitant to spend time on processing novel information and regard NPD failure as just a failure. Thus, they are more likely to discount signals of a potential opportunity.

Thus, promising business ideas and opportunities result from forward-looking visions (Brockner, Higgins, and Low, 2004) which are typically derived from the underlying motives of high level of promotion-focused rather than prevention-focused entrepreneurs' ideals and aspirations. We propose:

H1: *The level of promotion focus is positively associated with opportunity recognition.*

H2: *The level of prevention focus is negatively associated with opportunity recognition.*

Entrepreneurial learning and opportunity recognition

Exploitation and exploration are fundamental aspects of the entrepreneurial process and play central roles in opportunity recognition (Shane and Venkataraman, 2000). In the face of the high rate of NPD project failure, high-tech firms cannot merely eschew exploratory projects. Rather, they must find a way to cope with failures and understand these experiences to enhance the potential for success in subsequent efforts. In fact, the process of learning from failure and recognizing new potential opportunities from such failure also benefits the whole firm, through the application of that knowledge learned to subsequent projects (e.g., McGrath, 1999).

Exploitation arises out of a necessity for entrepreneurial firms to fully use their limited resources in existing technology and product-market domains (Hughes, Hughes, and Morgan, 2007). This enables the entrepreneurs to recognize more new opportunities by building on and replicating both the firm's and the founders' prior technological and market knowledge and experience (Shane, 2000). It provides greater opportunities for new combinations and recombinations of existing knowledge from which new insights may emerge, thus benefiting the NPD process (Cyert and March, 1963).

Besides, exploration enhances opportunity recognition because it increases the entrepreneurs' abilities to add new variants of knowledge to their knowledge repertoire (March, 1991). By providing new insights into the design of new features and benefits into a product,

exploration ensures that entrepreneurs to recognize more new opportunities that may differentiate it from competitors (Katila and Ahuja, 2002). We propose:

> ***H3a and H3b****: Both exploitative learning (a) and exploratory learning (b) have positive effects on opportunity recognition.*

The mediating role of entrepreneurial learning

The first four hypotheses explore the direct effects of regulatory focus and entrepreneurial learning on opportunity recognition. Herein, we further explore how entrepreneurial learning mediates the relationship between regulatory focus and opportunity recognition. As promotion-focused individuals prefer to take risky actions and prevention-focused individuals tend to have a conservative bias to risk (Silbiger, et al., 2017), we argue that different cognitive traits will adopt various types of learning processes facing the high risk in developing new products.

As promotion focus is associated with reaching for "maximal goals" (Idson, Liberman, and Higgins, 2000), these entrepreneurs are expected to pursue goals such as improving their NPD project's competitive position to the best possible level. Hence, typical achievements that entrepreneurs with high levels of promotion focus perceive as "hits," which help them to achieve their overall professional goals by engaging in exploratory learning, include but are not limited to: attracting new customers, launching new products, and improving financial indicators relative to previous years and/or competitors. Engagement in exploratory learning, the active search for new business opportunities (Raisch and Birkinshaw, 2008), might lead to perceived rewards in the form of new product launches or an expansion of customer base (Shepherd, Covin and Kuratko, 2009).

Research has long emphasized the uncertain nature of exploratory activities given the lack of knowledge about their effective future payoffs (Kline and Rosenberg, 2010). In fact, many exploratory projects fail over time. Given those entrepreneurs' desire to avoid the negative emotions associated with such a situation, the high levels of promotion focus also

induce entrepreneurs to continuously focus on exploitative leaning. For instance, refinement activities that improve product or service quality, and those that enhance process reliability enable NPD project leaders to achieve rather predictable short-term "hits" in the form of increased customer satisfaction or decreased production costs and, subsequently, higher profit margins (e.g., Gibson and Birkinshaw, 2004; He and Wong, 2004). We propose:

> ***H4a and H4b****: The level of promotion focus has a positive effect on: (a) exploitative learning and (b) exploratory learning.*

Entrepreneurs with high levels of prevention focus are typically associated with striving for "minimal goals" (Idson, Liberman, and Higgins, 2000), which are defined as the "lowest goal whose end state will produce satisfaction" (Brendl and Higgins, 1996, p.104). Hence, a high level of prevention focus encourages NPD project leaders to improve their NPD's market position to a minimum threshold level that satisfies the demands of stakeholders as well as their own needs for security and responsibility. Besides, entrepreneurs with high levels of prevention focus strive to fulfil their minimal goals and thereby meet stakeholders' demands. Those minimal goals typically relate to improving product or service quality according to customer requests or increasing the NPD's profit as requested by the board. Due to their basic need for responsibility, individuals with high levels of prevention focus have been shown to be intrinsically motivated to continuously reduce error rates (Pennington and Roese, 2003).

As such, entrepreneurs with high (as compared to low) levels of prevention focus are more likely to steadily engage in exploitative quality-improvement measures in order to meet not only customer demands but also their own quality standards. This argumentation is in line with previous research that theorizes that entrepreneurs with high levels of prevention focus often have experience in throughput functions, such as production, which are closely tied to exploitative improvements (Chiaburu, 2010).

The exploration of non-paradigmatic business opportunities bears a high probability of failure (Anderson and Tushman, 1990) due to the unknown outcomes and frequent failure of such search processes (Kline and Rosenberg, 2010). Entrepreneurs with high levels of prevention focus are generally sensitive to the possibility of failure and aim to avoid it. Hence, regulatory focus theory implies that these entrepreneurs' basic need for safety likely motivates them to avoid any potential failure associated with engaging in uncertain exploration, even if that implies missing potentially promising opportunities (Hmieleski and Baron, 2008). Thus, facing the substantial failure of exploration initiatives in NPD, entrepreneurs with a high level of prevention focus will be more engaged in exploitative learning and impede exploratory learning. We propose:

> ***H5a and H5b****: The level of prevention focus has: (a) a positive effect on exploitative learning and (b) a negative effect on exploratory learning.*

Taken together, the above considerations describe a model in which regulatory focus (i.e. promotion focus and prevention focus) is associated with opportunity recognition (i.e. H1 and H2), exploitative learning (i.e. H3a and H4a) and exploratory learning (i.e. H3b and H4b). Furthermore, exploitative and exploratory learning are associated with opportunity recognition (i.e. H5a and H5b). In sum, the above hypotheses specify a mediating model, in which exploitative and exploratory learning mediate the relationship between regulatory focus and opportunity recognition (see Figure 1). We propose:

> ***H6a and H6b****: Exploitative learning mediates: the relationship between (a) the level of promotion focus and opportunity recognition and (b) prevention focus and opportunity recognition.*

H6c and H6d*: Exploratory learning mediates: the relationship between (c) the level of promotion focus and opportunity recognition and (d) prevention focus and opportunity recognition.*

[Insert Figure 1 about here]

Methodology

Sample

This study focused on high-tech firms in Shanghai city, China since the high-tech sector in China has received theoretical and practical attention. What's more, Shanghai, as the most high-tech city in Mainland China (Business Insider, 2019), has an extensively high concentration of high-tech industry and issues NPD projects information within high-tech firms yearly. Thus, this study used an initial online survey based on a list of 1812 high-tech firms with technology-innovation projects information issued by *Shanghai Science and Technology Committee* (STCSM) on 6th June 2017. NPD project leaders were our respondents who are the project's key resource providers (Shepherd and Cardon, 2009) and have comprehensive knowledge of NPD projects (Jenkins and McKelvie, 2016). As they are usually nominated by the executives of the firms, we obtained the contact information of the executives from the firms' registration records on China's *National Enterprise Credit Information Publicity System (NECIPS)*.

A rigorous and iterative back-translation process was applied to design the questionnaire, following a pre-test with two British academics with expert knowledge in cross-cultural questionnaire surveys, and a pilot study with 10 NPD project leaders from different Chinese high-tech ventures. Feedback from the pre-test and the pilot study was fully incorporated in the final questionnaire. Finally, we received 237 usable responses in our study with an effective response rate of 13.08%, corresponding with the response rate in similar studies in China, e.g.

14.5% in Wang et al. (2018). Table 1 summarizes the profile of respondents. Noteworthily, in term of the responding ventures, all of them, with fewer than 517 employees, are categorized as small and medium-sized enterprises (Tang and Tang, 2012).

[Insert Table 1 about here]

To address the potential risk of non-response bias, we compared responding and nonresponding firms, and also compared early and late respondents. First, T-test comparisons of the 237 participating firms and 1550 non-participating firms provided in the NECIPS on the average age did not reveal significant differences between the two groups. Thus, we concluded that participating firms did not differ significantly from non-participating firms. Besides, the result of comparison between the variables of the late respondents and those of the early respondents, resulted in no significant differences. Thus, non-response bias is not an issue in our study.

Measures

In order to maximize construct validity we have used existing scales and items wherever possible (see Table 2). The key constructs were measured using seven-point Likert scales.

***Opportunity recognition*.** Referring to Ozgen and Baron (2007), we measured opportunity recognition by three items focusing on the entrepreneurs' ability to recognize opportunities in the entrepreneurial process of developing new products (e.g., "Seeing potential new opportunities comes very naturally to me"). The self-reported measure is appropriate to measure opportunity recognition ability and is consistent with prior studies (e.g., Asante and Affum-Osei, 2019; Lorenz, Ramsey, and Richey Jr, 2018).

***Promotion focus and prevention focus*.** According to Lockwood, Jordan and Kunda (2002), we assessed promotion focus and prevention focus by means of nine items, respectively.

Besides, we reworded those items from an academic context to fit the context of our sample (e.g., "I often think about how I will achieve project success").

Exploitative learning and exploratory learning. Focusing on the NPD project (e.g., Atuahene-Gima and Murray, 2007), we measured exploitative learning with five items focusing on the learning activities for the purpose of improving productivity and efficiency. For example, "Our goal was to search for information to refine common methods and ideas in solving problems in the project". To tap exploratory learning, we developed five items that focus on the learning activities that are based for the purpose of experimentation. For example, "Our aims were to collect new information that forced us to learn new things in the product development project."

Control variables. Following prior research, we controlled for age (Lévesque and Minniti, 2006), gender (DeTienne and Chandler, 2007), education (Gruber, MacMillan, and Thompson, 2012), tenure (Kammerlander et al., 2015) and entrepreneurial self-efficacy (Tumasjan and Braun, 2012), as they could affect individuals' opportunity recognition. For example, Ozgen and Baron (2007) argues that entrepreneurs with a high entrepreneurial efficacy are more likely to adopt proactive search for opportunities.

As the prior experience such as work experience (Tumasjan and Braun, 2012), entrepreneurial experience and managing experience (Gruber, MacMillan, and Thompson, 2012) could influence opportunity recognition as prior knowledge (e.g., Shane, 2000), we also controlled another four variables relating to NPD projects: managing experience ("the total number of NPD projects you have managed?"), failure experience ("the total number of failed NPD projects you managed?"), the number of operational projects ("the number of NPD projects currently in operation in firm"), and the number of managing projects ("the number of NPD projects are currently managed by you").

[Insert Table 2 about here]

Reliability and validity

As advocated by Hair et al. (2006), we conducted a rigorous process to purify and validate the measurement scale items. Table 2 displays the exploratory factor analysis results of our main variables. All the item factor loadings are greater than 0.6, which are in the accept range. The results show that all the items load cleanly on the expected factors, showing no significant cross-loadings. Using a series of fit indices, the confirmatory factor analysis results in DELTA2=CFI=0.973, TLI=0.971, and RMSEA=0.035 ($\chi 2$ (579) =743.254, p=0.000), which also indicates adequate model fit (Hu and Bentler, 1998).

To assess the measures' reliability, we calculated coefficient alpha reliability and composite reliability indices. The results (see Table 2) show that all coefficient alpha reliabilities exceeded the accepted 0.7 threshold (Cronbach, 1951), and the composite reliabilities for the all scales were higher than the minimum threshold of 0.7 (Hair et al., 2006).

For assessing convergent validity, we used two methods. First, within the CFA setting, we calculated average variances extracted (AVE). The Table 2 shows that the AVE of all the five constructs, are greater than the minimum threshold of 0.5 (Fornell and Larcker, 1981), except for exploitative learning (AVE=0.479). However, the composite reliability of exploitative learning is higher than 0.6, thus the convergent validity is still adequate (e.g., He, Kukar-Kinney, and Ridgway, 2018). Second, we observed that convergent validity is evident as the path coefficients from latent constructs to their corresponding manifest indicators are statistically significant (i.e., $t > 2.0$). All items load significantly on their corresponding latent construct, with the lowest t-value at 9.502 (see Table 2), providing evidence of convergent validity (Anderson and Gerbing, 1988).

Discriminant validity was assessed by comparing the correlation between pairs of constructs and the square root AVEs of the constructs. Table 3 presented the descriptive statistics, correlations and the square root of AVEs and illustrated that all the square root of

AVEs are higher than the correlations, indicating sufficient discriminant validity (Fornell and Larcker, 1981).

[Insert Table 3 about here]

Common method bias

We integrated both procedural methods and statistical techniques to reduce the potential of common method bias. Respondents were assured that their answers were confidential and that there was no right or wrong answers to the questions in the survey; thus, to reduce the respondents' evaluation apprehension. With statistical techniques, Harman's one factor test is performed. The EFA for all of the multiple-item constructs result in the expected factor solution, which accounted for 66.029% of the total variance, with the first factor only accounting for 21.101%. Common method bias is not a serious concern in our study, as a single-factor solution does not emerge and the first factor does not explain most of the variance, common method bias was not a serious concern in our study (Podsakoff and Organ, 1986).We also conducted a confirmatory factor analysis (CFA) to scrutinize this finding. The result showed that, the model fit of this measuring model with only one dominant factor (χ^2 (545) = 869.316, CFI =0.945, TLI=0.939, RMSEA=0.070, p=0.000) was worse than our research model (χ^2 (579) = 743.254, CFI =0.973, TLI=0.971, RMSEA=0.035, p=0.000). Hence, common method bias was not a serious concern in our study.

Results

To test our hypotheses, we used structural equation modelling (SEM) in Mplus 7.0. (Muthén and Muthén, 2012). Further, we applied a bootstrapping method, as it does not require a normal sampling distribution (Preacher and Hayes, 2008), and can eliminate the potential risk of a Type I error and low statistical power caused by the Baron and Kenny (1986) method for testing

the magnitude and statistical difference of mediation effects (Shrout and Bolger, 2002). We therefore replaced the original sample (N=237) with 3000 bootstrap samples to repeatedly calculate the mean unstandardized indirect effect as well as the 90% bias-corrected and accelerated confidence intervals (CIs) for the mediation analyses. As this approach produced an asymmetrical confidence interval, an exact *p*-value is unable to be calculated. The significance was demonstrated as the bias-corrected bootstrap CIs for the mediating effects based on 3000 bootstrap samples did not include zero (Lorenz, Ramsey, and Richey Jr, 2018).

Table 4 illustrates the results of the hypotheses testing. Promotion focus [0.060, 0.380], prevention focus [-0.178, -0.019], exploitative learning [0.040, 0.391] and exploratory learning [0.170, 0.465] where the figures in parentheses are the lower 5% and the upper 5% are significantly associated with opportunity recognition. This is because their bias-corrected bootstrap CIs of the direct effects did not include zero. Thus, our results show that H1, H2, H3a and H3b are supported. Likewise, promotion focus [0.426, 0.658] and prevention focus [-0.169, -0.005], are related with exploratory learning; and, promotion focus [0.424, 0.695] is related with exploitative learning, and thus H4b, H5b and H4a are supported. However, H5a is not supported as the bias-corrected bootstrap CIs of the direct effect of prevention focus on exploitative included zero [-0.067, 0.063].

[Insert Table 4 about here]

Furthermore, Table 4 also represents the results of the confidence intervals of mediating effects, which illustrate that only the bias-corrected bootstrap CIs of the mediating of exploitative learning between prevention focus and opportunity recognition included zero [-0.035, 0.058] at the level of 0.1 level, and thus H6b is not supported. On the contrary, H4a, H4c and H4d are supported. Based on the SEM analysis, our study presents the final influencing paths with estimating values in this model, shown in Figure 2. Besides, the

additional paths analysis in the Figure 2 also shows that only education and managing experience among the control variables have effects on opportunity recognition.

[Insert Figure 2 about here]

Post-hoc analysis

As March (1991) argues that the ventures should balance exploitative learning and exploratory learning to achieve the best learning strategy, our study further explores their potential ambidextrous effects on opportunity recognition. Referring to Kammerlander et al (2015), our study calculated ambidextrous learning by the sum of, the product of, and the difference between exploitative learning and exploratory learning, resulting in additive ambidexterity, multiplicative ambidexterity, and subtractive ambidexterity, respectively. In the Model 2, Model 4 and Model 6, the results show that prevention focus has no effect on additive ambidexterity (β=-0.028, $p>0.1$), multiplicative ambidexterity (β=-0.138, $p>0.1$), and subtractive ambidexterity (β =-0.090, $p>0.1$). On the contrary, promotion focus has positive effect on additive ambidexterity (β=0.543, $p<0.001$), multiplicative ambidexterity (β=0.533, $p<0.001$), and subtractive ambidexterity (β =0.118, $p<0.05$).

As the Models 8 to 11 show, promotion focus has a positive affect opportunity recognition, and prevention focus negatively affects opportunity recognition, in line with our results supporting H1 and H2. What's more, the positive effect of promotion focus on opportunity recognition decreases from 0.369 ($p<0.001$) in Model 8 to 0.197 ($p<0.05$) in Model 9, 0.199 ($p<0.05$) in Model 10, and 0.333 ($p<0.001$) in Model 11 after introducing additive ambidexterity, multiplicative ambidexterity, and subtractive ambidexterity, respectively. According to Baron and Kenny (1986), additive ambidexterity, multiplicative ambidexterity, and subtractive ambidexterity, respectively partially mediates the promotion focus - opportunity recognition relationship.

Discussion

In this study, we explored the effects of regulatory focus and entrepreneurial learning on opportunity recognition in new product development. This study has three main contributions. Firstly, our study timely offers a comprehensive explanation for the "numerous unanswered questions remain surrounding what factors facilitate opportunity identification as well as how and why these factors are so crucial" (Shepherd and Patzelt, 2018, p. 25). Our study explores the factors that have direct effects on opportunity recognition in NPD. The hypotheses testing results show that promotion focus (i.e. H1), exploitative learning (i.e. H3a) and exploratory learning (i.e. H3b) all positively affect opportunity recognition, and prevention focus negatively affect opportunity recognition (i.e. H2). These findings support McMullen and Shepherd's (2002) study that promotion focus leads not only to higher entrepreneurial intentions but also to more successful opportunity recognition. Besides, it also adds values to Tumasjan and Braun's (2012) research by showing that promotion focus positively affect not only opportunity recognition but also exploitative learning and exploratory learning.

Furthermore, we contribute to the entrepreneurial learning perspective by applying a more fine-grained examination of two types of entrepreneurial learning during the entrepreneurial process of NPD. As it is essential and fundamental to explore when and how learning happens during the entrepreneurial process (Wang and Chugh, 2014), we move away from previous static approaches and develop a more dynamic perspective on the process of entrepreneurial learning (Gemmell, 2017; Minniti and Bygrave, 2001; Politis and Gabrielsson, 2005). The empirical results show that exploitative learning mediates the relationship between promotion focus and opportunity cognition (i.e. H6a). Besides, the exploratory learning mediates the relationship between promotion focus and opportunity cognition (i.e. H6c) and also the relationship between prevention focus and opportunity cognition (i.e. H6d). However, contrary to what we proposed, prevention focus has no effect on exploitative learning (i.e. H5a)

and thus exploitative learning does not mediate the relationship between prevention focus and opportunity recognition (i.e. H6b). Nevertheless, these findings are in line with previous studies (e.g. Wu et al., 2008; Tumasjan and Braun, 2012), which broaden the theoretical boundary of entrepreneurial learning and "provides us the opportunity to uncover why some individuals acquire and transform information in different manners…, and why these behaviours result in different opportunity recognition and exploitation abilities" (Corbett, 2005, p.474).

Our study also expands the boundary of cognitive perspective applying in entrepreneurship research by verifying the notion that entrepreneurs' cognitive traits will influence their entrepreneurial behaviors during the entrepreneurial process. In contrast to existing entrepreneurship studies which have concentrated on the effect of CEO's regulatory focus on their firms, such as environmental innovation (Liao and Long, 2018), SME internationalization (Adomako, Opoku and Frimpong, 2017), and firm acquisitions (Gamache et al., 2015), our study focused on the role of NPD project leaders' regulatory focus in specific entrepreneurial behaviour, namely exploitative and exploratory learning. In line with the emerging studies, such as Kammerlander et al (2015), Tuncdogan, Van Den Bosch, and Volberda (2015), our study highlighted regulatory focus as a key driver of project leaders' ambidextrous behaviour. The former study stressed the effect of CEO's regulatory focus on established firms' engagement in both exploratory and exploitative activities, and the latter emphasized general notions of leaders and ambidextrous activities. Furthermore, unlike previously studies concerning entrepreneurial opportunity, for example Hmieleski and Baron (2008) focusing on opportunity exploitation in a pre-firm stage, and Tumasjan and Braun (2012) using an ambiguous entrepreneurial opportunity task, our study focuses on the NPD project leaders' ability to recognize opportunities in the process of NPD, which complement the empirical evidence on the role of regulatory focus in the entrepreneurial process.

Management implications

Our study also has management implications. Our results illustrate that a high level of promotion focus among projects leaders will be particularly meaningful for recognizing opportunities in developing NPD projects in high-tech ventures. The top management team (TMT) is suggested to hire the project leaders who score high on promotion focus. Adapted questions from the Lockwood et al., (2002) scale on regulatory focus (see Table 1) might help the TMT investigate the level of a candidate's promotion focus in a pre-offer assessment. For the exiting NPD project leaders, special entrepreneurship education and training are recommended to improve their self-regulatory skills. For example, Bryant (2007) suggested several promotion focused enhancing efforts to increase potential entrepreneurs' probability of successful opportunity recognition.

Limitations and future directions

Our study has several limitations that can be addressed in future research. First, our study primarily relies on self-reports. Self-reporting and introspection may contain many biases and errors (DeTienne, Shepherd and Castro, 2008) such as retrospective bias, and attribution bias. There is also a risk that relying upon participants' self-reporting may yield a distorted picture through self-selection bias (Beaver and Jennings, 2005), where the participant may have their own motivations for wanting to share or not share their experiences. Although we asked the interviewees about specific results or changed behaviour and respective examples, our study theorizing does not necessarily extend to learning that results in increased accuracy or improved performance but certainly future research could do so.

Additionally, while the traditional view of experiential learning posits that each of us tends toward one preferred style, recent speculation suggests a more complex approach (Mainemelis, Boyatzis and Kolb, 2002). Individuals will tap each of the learning styles depending upon the context and content of what is being experienced (Corbett, 2005). Thus,

the future studies can explore the interaction of various learning modes, for example the interaction of exploitative and exploratory learning (Atuahene-Gima and Murray, 2007), which could help to open the 'black box' of the underlying process of entrepreneurial learning.

Finally, as Corbett (2005, p487) argued "it is that we need all "types" of learners on our team to identify and successfully exploit opportunities", it is beneficial for future entrepreneurship scholars to further explore the process of such a social process (Klotz et al., 2014). For example, Carmeli and Dothan (2017) found generative work relationship facilitates both direct and indirect learning from experience of failure. Besides, Tuncdogan et al., (2017) illustrated that the promotion focus of a unit's management team relates positively to the unit's exploratory innovation. In contrast, prevention focus has a marginal negative effect. Hence, a detailed investigation of the interplay both at the individual and team level, will create additional insight into entrepreneurial learning (Wang and Chugh, 2014).

Conclusion

Why are some entrepreneurs more able to recognize opportunities than others? Our study empirically explores the roles of regulatory focus and entrepreneurial learning playing in opportunity recognition in new product development. Our results show that regulatory focus (i.e. promotion focus and prevention focus) and entrepreneurial learning (i.e. exploitative learning and exploratory learning) directly affect opportunity recognition, and exploitative learning and exploratory learning act as mediators between regulatory focus and opportunity recognition.

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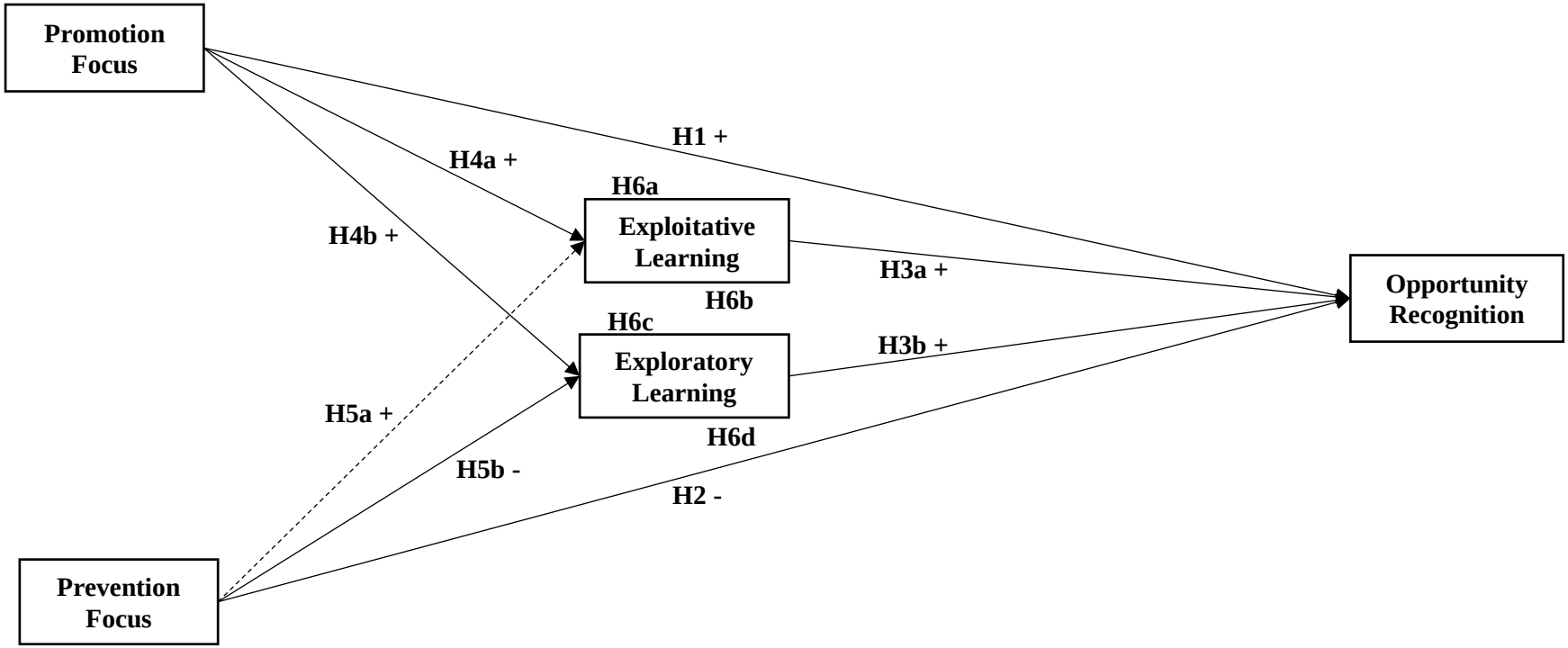


Note: H6a: Promotion focus – exploitative learning – opportunity recognition
H6b: Prevention focus – exploitative learning – opportunity recognition
H6c: Promotion focus – exploratory learning – opportunity recognition
H6d: Prevention focus – exploratory learning – opportunity recognition

Figure 1 Conceptual model

Table 1. The sample profile

Characteristic	Frequency	Percentage
Gender		
Male	128	54.0
Female	109	46.0
Age		
29 or less	35	14.8
30 to 40	87	36.7
41 to 50	97	40.9
51 and above	18	7.6
Education		
Below bachelor	3	1.3
Bachelor	166	70.0
Master	65	27.4
PhD	3	1.3
Venture size		
50 or less	47	19.8
51 to 100	108	45.6
100 to 150	32	13.5
151 to 200	18	7.7
201 to 250	16	6.7
251 to 516	16	6.7
Venture age		
1 to 5	126	53.2
6 to 10	75	31.6
11 to 15	26	11.0
15 to 20	7	2.9
21 to 25	3	1.3
Ownership type		
Privately held	196	82.7
Joint share	20	8.4
Foreign-invested	17	7.2
State-owned	4	1.7
Industry type		
Electronic information	103	43.5
New energy and materials	41	17.3
Integrated optical	35	14.8
New biotechnology	32	13.5
Others	26	11.0
Sum-up	237	100

Table 2. Measurements

Items description summary	Standardized loading	t-value
Prevention Focus (α=**.974; CR=.974; AVE= .807**)		
1. I am anxious that I will fall short of my responsibilities and obligations.	1.000 [a]	
2. In general, I am focused on preventing negative events in my life.	.894	21.182
3. I often think about the person I am afraid I might become in the future.	.987	22.556
4. I often worry that I will fail to accomplish my career goals.	.944	23.147
5. I often imagine myself experiencing bad things that I fear might happen to me.	.938	25.478
6. I frequently think about how I can prevent failures in my life.	.917	22.348
7. I am more oriented toward preventing losses than I am toward achieving gains.	.943	24.529
8. My major goal in venture right now is to avoid becoming a career failure.	.955	23.774
9. I see myself as someone who is primarily striving to become the self I "ought" to be- to fulfil my duties, responsibilities, and obligations.	.885	21.503
Promotion Focus **(α=.944; CR=.945; AVE=.655)**		
1. I typically focus on the success I hope to achieve in the future.	1.000 [a]	
2. In general, I am focused on achieving positive outcomes in my life.	.973	15.361
3. I often think about the person I would ideally like to be in the future.	.934	14.708
4. I often think about how I will achieve career success.	.892	15.713
5. I often imagine myself experiencing god things that I hope will happen to me.	.918	15.580
6. I frequently imagine how I will achieve my hopes and aspirations.	.867	15.959
7. Overall, I am more oriented toward achieving success than preventing failure.	.935	16.397
8. My major goal in venture right now is to achieve my career ambitions.	.896	14.496
9. I see myself as someone who is primarily striving to reach my "ideal self" - to fulfil my hopes, wishes, and aspirations.	.947	15.197
Exploitative Learning **(α=.818; CR=.820; AVE=.479)**		
1. Our goal was to search for information to refine common methods and ideas in solving problems in the project.	1.000 [a]	
2. Our aim was to search for ideas and information that we can implement well to ensure productivity rather than those ideas that could lead to implementation mistakes in the project and in the marketplace.	.887	10.313
3. We search for the usual and generally proven methods and solutions to product development problems.	.814	9.502
4. We used information acquisition methods that helped us understand and update the firm's current project and market experiences.	.921	11.436
5. We emphasized the use of knowledge related to our existing project experience.	.906	9.661
Exploratory Learning (α=**.843; CR=.844; AVE=.520**)		
1. We preferred to collect information with no identifiable strategic market needs to ensure experimentation in the project.	1.000 [a]	
2. In information search, we focused on acquiring knowledge of project strategies that involved experimentation and high market risks.	.904	9.969
3. Our aim was to acquire knowledge to develop a project that lead us into new areas of learning such as new markets and technological areas.	.965	10.210
4. We collected novel information and ideas that went beyond our current market and technological experiences.	.983	10.104
5. Our aims were to collect new information that forced us to learn new things in the product development project	.960	9.655

Opportunity Recognition (α**=.787; CR=.787; AVE=.552**)		
1. I have a special alertness or sensitivity toward new opportunities (e.g., about new products and new markets).	1.000 [a]	
2. While going about day-to-day activities, I see potential new ideas (e.g., on new products and new markets).	.903	10.314
3. Seeing potential new opportunities comes very naturally to me.	.943	10.034
Model fit: χ^2 (579) = 743.254, d.f. =424; DELTA2 = CFI =0.973; TLI = 0.971; RMSEA=0.035; p=0.000.		

[a] Fixed factor loading. α = Cronbach's alpha, CR = Composite Reliability, AVE = Average Variance Extracted

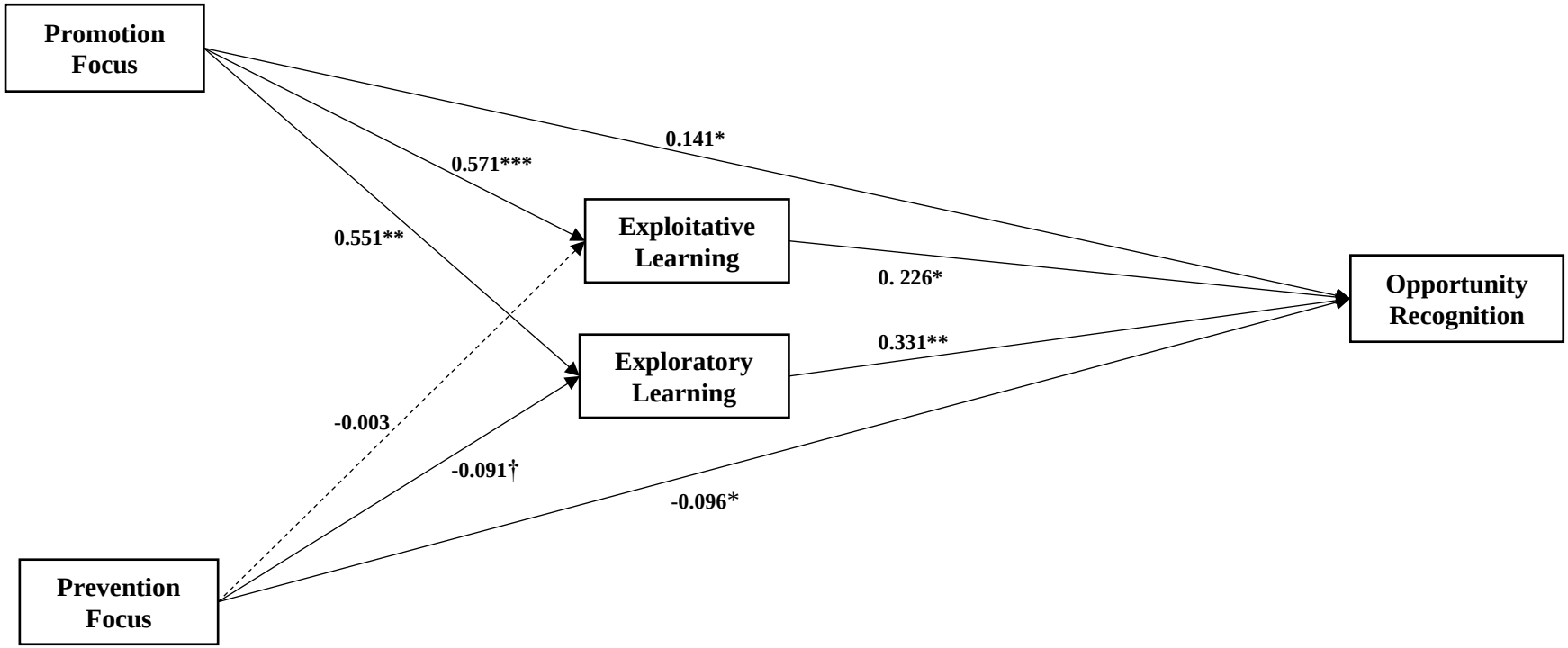
Table 3. Descriptive statistics and correlations

Variables	1	2	3	4	5	6	7	8	9	10	11
1.Tenure											
2. Efficacy	.077										
3. Managing experience	-.083	.142*									
4. Failure experience	-.064	-.077	.633***								
5. Number of operational projects	-.066	.050	.295***	.370***							
6. Number of managing projects	-.012	-.013	.436***	.502***	.603***						
7. Prevention focus	.001	-.142*	-.118	-.021	.001	-.055	*0.898*				
8. Promotion focus	.144*	.569***	.006	-.113	-.095	-.111	-.104	*0.809*			
9. Exploitative learning	.115	.630***	.044	-.028	-.075	-.076	-.061	.547***	*0.692*		
10. Exploratory learning	.052	.523***	.119	-.033	.033	.031	-.171**	.506***	.603***	*0.721*	
11. Opportunity recognition	.078	.469***	.089	-.040	-.023	.103	-.213**	.474***	.515***	.566***	*0.743*
Mean	6.304	5.469	5.810	1.793	6.004	2.443	4.118	5.302	5.555	5.354	5.295
Standard deviation	4.331	0.732	4.415	1.784	7.709	2.527	1.041	0.709	0.741	0.793	0.866

N = 237; †p < 0.1; *p < 0.05; **p < 0.01; ***p < 0.001(two-tailed p-value); Italic figures on the diagonal are the square root of the average variance extracted for the constructs.

Table 4. Results of hypotheses testing

Hypotheses	Specific indirect	Estimate	Standardized error	Two-tailed p-value	Lower 5%	Upper 5%	Results
H1	Promotion focus - > Opportunity Recognition	0.141	0.096	0.043	0.060	0.380	Significant
H2	Prevention focus - > Opportunity Recognition	-0.096	0.048	0.047	-0.178	-0.019	Significant
H3a	Exploitative learning - > Opportunity recognition	0.226	0.108	0.036	0.040	0.391	Significant
H3b	Exploratory learning - > Opportunity recognition	0.313	0.090	0.001	0.170	0.465	Significant
H4a	Promotion focus - > Exploitative Learning	0.571	0.081	0.000	0.424	0.695	Significant
H4b	Promotion focus - > Exploratory Learning	0.551	0.070	0.000	0.426	0.658	Significant
H5a	Prevention Focus - > Exploitative Learning	-0.003	0.039	0.935	-0.067	0.063	Non-significant
H5b	Prevention Focus - > Exploratory Learning	-0.091	0.050	0.067	-0.169	-0.005	Significant
H6a	Promotion focus - > Exploitative learning - > Opportunity recognition	0.129	0.065	0.046	0.024	0.239	Significant
H6b	Prevention focus - > Exploitative learning - > Opportunity recognition	-0.001	0.010	0.941	-0.018	0.014	Non-significant
H6c	Promotion focus - > Exploratory learning - > Opportunity recognition	0.173	0.055	0.002	0.094	0.275	Significant
H6d	Prevention focus - > Exploratory learning - > Opportunity recognition	-0.029	0.019	0.130	-0.066	-0.003	Slightly significant



Note: †p < 0.1; *p < 0.05; **p < 0.01; ***p < 0.001(two-tailed p-value).

Additional paths in the model (estimate)

Gender-> Opportunity recognition:-0.001
Age-> Opportunity recognition:-0.042
Tenure-> Opportunity recognition: 0.115
Education-> Opportunity recognition: 0.083**
Entrepreneurial self-efficacy-> Opportunity recognition: 0.090
Managing experience -> Opportunity recognition: 0.014†
Failure experience-> Opportunity recognition: -0.003
The number of operational projects: 0.134
The number of managing projects: 0.034

Figure 2. Structural model

Table 5 Results of post-hoc analysis

	Additive ambidexterity		**Multiplicative ambidexterity**		**Subtractive ambidexterity**		**Opportunity recognition**				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Gender	0.192	0.120	0.097	0.713	-0.211	-0.199*	0.222*	0.179†	0.146	0.143	0.153
	(0.134)	(0.129)	(0.729)	(0.701)	(0.088)	(0.088)	(0.100)	(0.096)	(0.089)	(0.089)	(0.096)
Age	-0.024	-0.020	-0.036	-0.012	-0.061	-0.061	0.028	0.030	0.036	0.031	0.022
	(0.080)	(0.076)	(0.434)	(0.415)	(0.052)	(0.052)	(0.059)	(0.057)	(0.053)	(0.052)	(0.056)
Tenure	0.009	0.002	0.057	0.019	0.009	0.010	0.003	-0.001	-0.002	-0.002	-0.002
	(0.015)	(0.015)	(0.084)	(0.080)	(0.010)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)
Education	-0.267*	-0.234†	-0.567*	-0.391*	0.114	0.097	-0.128	-0.097	-0.031	-0.025	-0.084
	(0.131)	(0.126)	(0.715)	(0.685)	(0.086)	(0.086)	(0.098)	(0.093)	(0.087)	(0.088)	(0.093)
Managing experience	0.004	0.004	0.021	0.020	-0.024†	-0.021	0.004	0.001	0.000	0.000	-0.001
	(0.020)	(0.019)	(0.110)	(0.106)	(0.013)	(0.013)	(0.015)	(0.014)	(0.013)	(0.013)	(0.014)
Failure experience	-0.026	-0.011	-0.190	-0.109	0.075*	0.067*	-0.061	-0.047	-0.044	-0.041	-0.038
	(0.051)	(0.049)	(0.276)	(0.265)	(0.033)	(0.033)	(0.038)	(0.036)	(0.034)	(0.034)	(0.036)
Entrepreneurial efficacy	0.306***	0.996***	0.882***	0.222***	0.143*	0.226**	0.586***	0.370***	0.092	0.102	0.400***
	(0.093)	(0.109)	(0.507)	(0.593)	(0.061)	(0.074)	(0.069)	(0.081)	(0.088)	(0.087)	(0.082)
Number of managing projects	0.012	0.015	0.105	0.123	-0.022	-0.020	0.086**	0.086**	0.081**	0.079**	0.083**
	(0.036)	(0.034)	(0.195)	(0.187)	(0.024)	(0.023)	(0.027)	(0.026)	(0.024)	(0.024)	(0.025)
Number of operational projects	-0.010	-0.006	-0.056	-0.034	-0.009	-0.010	-0.018*	-0.015†	-0.013†	-0.013†	-0.016*
	(0.011)	(0.010)	(0.059)	(0.056)	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)
Independent variables											
Prevention focus		-0.028		-0.138		-0.090		-0.104*	-0.097*	-0.097*	-0.093*
		(0.061)		(0.334)		(0.042)		(0.043)	(0.042)	(0.042)	(0.046)
Promotion focus		0.543***		0.533***		0.118*		0.369***	0.197*	0.199*	0.333***
		(0.111)		(0.602)		(0.075)		(0.082)	(0.080)	(0.080)	(0.082)

Mediating variables											
Additive ambidexterity									0.279*** (0.046)		
Multiplicative ambidexterity										0.051*** (0.008)	
Subtractive ambidexterity											0.132† (0.072)
R-squared	0.482	0.533	0.467	0.518	0.103	0.131	0.283	0.352	0.444	0.444	0.445
Adjusted R-squared	0.462	0.510	0.446	0.494	0.067	0.089	0.255	0.320	0.414	0.412	0.410
Highest VIF	1.917	1.923	1.917	1.923	1.917	1.923	1.917	1.923	2.227	2.074	
F change	23.487***	12.256***	22.111***	11.849***	2.893**	3.690*	9.963***	11.968***	36.844***	37.182***	3.320†

N = 237; Unstandardized coefficients are reported; Robust standard errors are in parentheses. †p < 0.1; *p < 0.05; **p < 0.01; ***p < 0.001