Management students' entrepreneurial mindset: What kind of factors affect their opportunity recognition capabilities?

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Executive Summary

The current complex and dynamic markets need business professionals with an entrepreneurial mindset to recognize opportunities. I decided to explore the cognitive factors associated with the management students' opportunity recognition capability. First, I use the managerial cognition capabilities, pattern recognition, structural alignment, and mental model theories, to make a non-linear model of the opportunity recognition process. Second, I sampled professionals and technicians who are currently studying engineering as a second profession and engineering post-degree students. Through a self-applied survey, I measured the level of the relationship between self-reported alertness activities (AL) and self-perception of opportunities capabilities (OR). Also, I measured other variables such as age, work experiences, tenure, educational levels, and functional specialization. Third, I used mental model proxies such as entrepreneurial knowledge (EK), entrepreneurial education (EE), and entrepreneurship experience to measure their effect on OR. In general work conclusion, time may be enough to build mental models with a positive effect on individuals' alertness and entrepreneurial knowledge, but opportunity recognition entails that the content of management students' mental models should be specific prototypes or exemplars to match with market failures that they can exploit. So, Higher Education Institutions must innovate because the traditional curriculum does not expose management students to entrepreneurial education.

Keywords: Opportunity Recognition; Managerial Cognitive Capabilities; Mental Model Theory; Entrepreneurial Education; Alertness; Entrepreneurial Knowledge

Chapter 1: Introduction

In today's complex and dynamic markets, rapid advancements in science and technology present numerous opportunities for innovation. To maintain a competitive advantage, companies must capitalize on these opportunities as they arise. (Audretsch & Fiedler, 2023; Eggers & Kaplan. 2009; George et al, 2016; Grégoire et al, 2010; Lin & Chen, 2023; Teece, 2007; Tynan, 2023). Innovation is vital to economic growth and international competitiveness, and entrepreneurship is an important pathway to achieve it (Rodriguez et al., 2015; Schuelke-Leech, 2021). In growing market competitiveness, there is a need for business professionals with an entrepreneurial way of thinking to identify opportunities to innovate, with curiosity to make new connections and create value for stakeholders (Markovetz et al., 2017; Rodriguez et al., 2015; Schuelke-Leech, 2021; Täks et al, 2014).

Firm success depends on the discovery and development of opportunities that can be produced, in part, from individuals' cognitive and creative capabilities (Teece, 2007). To do the above, individuals rely on their knowledge and experience to sense opportunities (Åberg & Shen, 2020; Martin & Bachrach. 2018). Individuals' experiences and observations may trigger the formation of beliefs about the opportunities that might be pursued (Felin & Zenger. 2009). So, theorizing and imagination play an important role in generating beliefs about new opportunities (Felin & Zenger. 2009). The mental models that individuals employ (e.g., their representation of the business network) impact their capability to sense opportunities increasing or decreasing interpretive flexibility (Dong, 2023; Ghosh et al., 2023; Martin & Bachrach. 2018). Business professionals trapped in a

mindset may become prisoners of their assumptions, information filters, and problem-solving strategies for instance preventing a successful opportunity recognition (Eggers & Kaplan, 2009; Teece, 2007).

Despite the opportunity recognition research in both strategic management and entrepreneurship literature (e.g., Baron, 2006; Grégoire et al, 2010; Helfat & Peteraf, 2015), two questions remain: Why some people, but not others, can identify opportunities? Can persons be trained for that task? (Baron, 2006; George et al, 2016). Management students must develop an entrepreneurial mindset because of the positive correlation between entrepreneurship and economic growth (João & Silva, 2020). Students' entrepreneurial mindset, knowledge, skills, and attitudes are strongly associated with innovation and creativity to sense and seize business opportunities. (Niemand et al, 2022; Täks et al, 2014). Opportunity value can only be determined post hoc, so opportunity recognition implies subjective efforts to comprehend the environment and imagine what may be (Grégoire et al, 2010; Lim et al, 2023). So, is vital to explore the cognitive factors such as entrepreneurial alertness and opportunities recognition that may influence management students' engagement in entrepreneurial activities (João & Silva, 2020; Rodriguez et al., 2015; an exception sees Al-Ghazali et al, 2022). So, my research question is, what cognitive factors may influence the management students' entrepreneurial skill of recognizing business opportunities?

Research Objectives

General

To explore the cognitive factors associated with the management students' opportunity recognition capabilities.

Specifics

1. To make an integrated review of the opportunity recognition phenomenon.

2. To explore the effect of management students' cognitive processes as alertness on their opportunity recognition capabilities.

3. To explore the effect of management students' cognitive structures as entrepreneurial mental models on their opportunity recognition capabilities.

Research Design

This dissertation is structured in the following sections. First, I make a theoretical paper to describe an integrated review of the managerial cognition capabilities (Helfat & Peteraf, 2015), pattern recognition (Baron, 2006), structural alignment (Grégoire et al, 2010), and mental model (Craik, 1943; Evans, 2006; Johnson-Laird, 2001) theories. In summary, management students who pay attention to changes in the environment and can perceive the patterns correctly could recognize the opportunities behind market failures. The management students' mental models define what specific changes will be selected to attend, what structural alignment will be made to build the patterns necessary to identify opportunities, and finally what specific courses of action will be taken to introduce new or

improved supply-demand combinations. Finally, I infer some practical implications associated with entrepreneurial education.

Second, I will conduct two empirical studies with actual management students to evaluate some of the theoretical relationships described and proposed in my literature review. In the first empirical paper, I explore the relationship between management students' self-reported alertness activities and their opportunity recognition capabilities. I sampled professionals and technicians who are currently studying industrial engineering as a second profession and engineering post-degree students. Through a self-applied survey, I measured the level of alertness (AL) and opportunity recognition (OR), and its relationship. Also, I measure context variables such as age, work experiences, tenure, educational level, and functional specialization. Exploratory factor analysis shows that both constructs (i.e., AL and OR) are unidimensional and between them, there is a significant positive relationship. Also, results show that there is a significant positive relationship between AL and respondents' age, tenure, work experience, and post-degree. Also, I found a significant difference in the level of OR only between respondents with functional specialization in operation, logistics, and IT. Interestingly, factors that affect AL do not influence OR.

In the second empirical paper, I explore the effect of the management students' mental model -formed by entrepreneurship experiences and entrepreneurial education or knowledge- on their opportunity recognition capabilities. I collected a new sample of professionals and technicians who are currently management students. Through a self-applied survey, I measured the level of opportunity recognition (OR), and its relationship with mental model proxies such as entrepreneurial knowledge (EK), entrepreneurial education (EE), and entrepreneurship experience. Also, I measure context variables such as age, work experiences, tenure, educational level, and functional

specialization. Exploratory factor analysis shows that EK, EE, and OR constructs are unidimensional, and they have convergent and discriminant validities and show that between them, there are significant positive relationships. Theoretically, I suggest there may be a partial mediation of EK on the relationship between EE and OR. Moreover, the results show a positive relationship between EK and age. Results show no significant relationship between age, tenure, educational level, functional specialization, and work experience with OR. Finally, there is no significant relationship between tenure, work experience, and functional specialization with EK.

Finally, I make a general conclusion with limitations and future research lines.

Thesis Contribution

There are many factors associated with the opportunity recognition phenomenon, for instance, a review finds three categories of them: personal (prior knowledge, experience, cognitive processes, personality traits, and genetics), organizational (potential financial reward, entrepreneurial culture, decision-making processes, organizational learning, and information sourcing), and environmental (networks, technology, demographic change, market conditions, and social entrepreneurship) (Filser et al, 2020). In this work, I focused on personal categories such as cognitive processes and structures. This work contributes firstly to the Strategic Management literature with a non-linear Opportunity Recognition model as an alternative to the managerial cognitive capability model (Helfat & Peteraf, 2015) at least on the dynamic managerial capability of sensing (Helfat & Peteraf, 2003), I build the model by an integrated review of different theoretical perspectives from strategic management, entrepreneurship (Baron, 2006; Grégoire et al,

2010), and mental model (Craik, 1943; Evans, 2006; Johnson-Laird, 2001) literature. Secondly, this work contributes to Entrepreneurial Education literature highlighting that management students must be trained in opportunity recognition before other technical competencies (Costa et al., 2018).

To illustrate my theoretical model, firstly I explore the relationships between self-reported alertness activities and self-perception of opportunities capabilities, the results show that time is a critical factor in building mental models that have positive effects on individuals' alertness but recognizing business opportunities requires more specific mental model contents. Entrepreneurial education should provide the "what" and "how" to students may build those mental models. To illustrate the prior results, a second empirical work, explores the effect of entrepreneurial mental model proxies (entrepreneurial education, entrepreneurial knowledge, and entrepreneurship experiences) on opportunity recognition, the results show a positive relationship between them. So, an entrepreneurial mindset may not be necessarily a result of age, work experience, tenure, education, or functional specialization, but it may require more specific entrepreneurship experiences and knowledge. Higher education institutions with entrepreneurial education programs should provide those experiences and knowledge. Subsequent research will be necessary to sort out whether the theoretical statements hold up.

Chapter 2: The Management Students' Opportunity Recognition: Integrating Theories.

Abstract

Opportunity recognition is critical to business professionals such as managers, executives, and entrepreneurs alike. I make an integrated review of the managerial cognitive capabilities, mental model, pattern recognition, and structural alignment theories generating a theoretical non-linear model of the individuals' opportunity recognition capability. In summary, professionals who pay attention to changes in the environment and can perceive the patterns correctly could recognize the opportunities behind market failures. The business professionals' mental models define what specific changes will be selected to attend, what structural alignment will be made to build the patterns, and finally what specific course of action will be taken to introduce new or improved supply-demand combinations. Improving the management students' opportunities recognition capabilities may imply changes in their entrepreneurial education, training, and experiences.

Keywords: opportunity recognition; sensing opportunities; managerial cognitive capabilities; mental model theory; entrepreneurial education.

Introduction

Rapid changes in science and technology characterize almost any complex and dynamic market environment creating opportunities for innovation, so, to sustain a competitive advantage firms must exploit the opportunities that arise from those changes (Eggers & Kaplan. 2009; George et al, 2016; Grégoire et al, 2010; Lin & Chen, 2023; Teece, 2007; Tynan, 2023). Top managers' cognition is a key issue in explaining managerial behaviors and their influence on firm performance (Niittymies & Pajunen, 2020). Cognitions have a central role as business professionals recognize and enact novel opportunities (Ma & Yang, 2022; Mostafiz et al., 2022; Niittymies & Pajunen, 2020).

Managerial cognition encompasses the managers' mental models and beliefs, mental processes (or capabilities), and emotions (Cao *et* al., 2020; Helfat & Martin, 2015). Business professionals' experiences and observations may trigger the formation of beliefs about the opportunities that might be pursued (Felin & Zenger, 2009). So, theorizing and imagination play an important role in generating beliefs about new opportunities (Felin & Zenger, 2009). The mental models that managers or executives employ (e.g., their representation of the business network) impact their capability to sense opportunities increasing or decreasing interpretive flexibility (Martin & Bachrach. 2018).

Board directors' skills, experiences, and knowledge of business, technology, and industry impact their alertness and what directors pay attention to, thus influencing their responses to strategic change (Åberg & Torchia, 2020). Managers' cognitive capabilities of perception and attention are critical components of their dynamic capabilities of sensing opportunities (Cao et al., 2020; Helfat & Peteraf, 2015). Business professionals differ in

their cognitive capability of attention so, they can differ in how correctly and quickly sense new opportunities, their differences in attention can be path-dependent (Helfat & Peteraf, 2015). Business professionals use their market mental models to simplify complex competitive environments and make decisions through decision rules to filter information ("selective perception") (Day & Nedungandi, 1994; Karakaya & Yannopoulos, 2010).

Opportunity recognition has been defined as the cognitive process through which individuals conclude that they get an opportunity (Baron, 2006). The cognitive processes more relevant to explain the opportunity recognition phenomenon have been categorization (to place a new experience into clusters of similar experiences) and structural alignment (to identify meaningful relations between technology and markets based on mental models and analogy theories) (Santos et al, 2015).

Despite the opportunity recognition research in both strategic management and entrepreneurship literature, two questions remain: Why some people, but not others, can identify opportunities? Can persons be trained for that task? (Baron, 2006; George et al, 2016). Both, the managerial cognitive capabilities (Helfat & Peteraf, 2015) and opportunity recognition as pattern recognition (Baron, 2006) theories focus on the cognitive processes (e.g., attention, perception, alertness, and search) overlooking the role of the cognitive structures and the cognitive structures and processes relationship in recognizing business opportunities. The purpose of this study is to respond to those basic questions through an integrated review of managerial cognitive capabilities (Helfat & Peteraf, 2015), pattern recognition (Baron, 2006), structural alignment (Grégoire et al, 2010), and mental model (Craik, 1943; Evans, 2006; Johnson-Laird, 2001) theories.

This work makes a theoretical contribution to strategic management literature through a new approach to the factors that influence opportunity recognition allowing

answers to the questions: why some people can identify opportunities? and can persons be trained for that task? This work makes a practical contribution to entrepreneurship education highlighting some important factors to design new training programs to enhance management students' opportunity recognition capabilities.

Background

Opportunity Recognition

Business opportunities arise from changes in the business environment which create a market failure that an individual can exploit (George et al, 2016). A market failure is defined as the inefficient allocation of resources in markets produced by the presence of few markets, consumers, and producers with non-competitive behavior, or non-existence of equilibrium problems (Ledyard, 1989). However, the market failure concept has been criticized because describes a situation that could exist everywhere (Zerbe & McCurdy, 1999).

Firm success depends on the discovery and development of those opportunities that can be produced, in part, from individuals' cognitive and creative capabilities (Teece, 2007). Opportunity value can only be determined post hoc, so opportunity recognition implies subjective efforts to comprehend the environment and imagine what may be (Grégoire et al, 2010; Lim et al, 2023). There are at least, three factors associated with opportunities recognition: engagement in an active search, alertness (i.e., the capacity to recognize general opportunities), and prior knowledge of a market, industry, or customer (Baron, 2006).

The knowledge gained from prior experiences shapes new perceptions and affects the sensing opportunities (Adna & Sukoco, 2020; Åberg & Torchia, 2020; Helfat & Peteraf, 2015). Sensing new opportunities is a scanning, creation, learning, and interpretative activity (Teece, 2007). Sensing opportunities and threats can be facilitated if business professionals use an analytical framework to highlight important issues and use their evaluative and inferential skills (Teece, 2007). Business professionals often use analogical transfer from past experiences to deal with current strategic choice, their ability to apply correct analogies depend in part on the quality of their perceptions of structural relations of the new problems (Gary *et al*, 2012). Individuals' cognitive structures acting as templates enable them to perceive a connection between apparently unrelated changes forming patterns of new business opportunities (Baron, 2006).

Business professionals generally focus on superficial features when selecting analogies perhaps for more automatic information processing (Gary *et al*, 2012; Grégoire et al, 2010b). The cognitive process of structural alignment (i.e., comparing the new information with a model and considering the alignment between the superficial features and the structural relationships of target and source) may play an important role in opportunity recognition (Grégoire et al, 2010b).

When business professionals face new business environment information build a mental model via categorization using their experience, and that mental model underpins opportunities beliefs, and judgment (Wood et al, 2014). People's mental models direct their attention to important causal relationships to forecast alternative solutions (Bagdasarov *et al*, 2016). Attention is an act of focused awareness of specific information that eases the business environmental scanning to sense opportunities and threats (Helfat & Peteraf,

2015). Managers' representations about competitors, suppliers, and customers focus their attentional resources on some agents and exclude others (Porac *et al*, 1989).
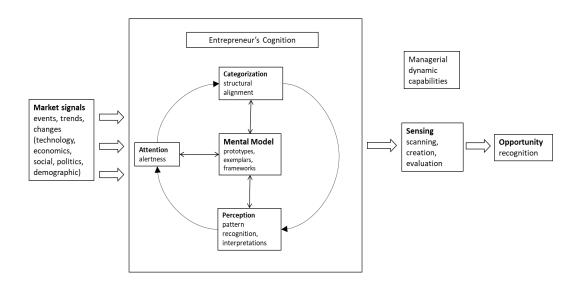
Business professionals' selective perceptions and interpretations are combined to produce their situation perceptions through the pattern recognition and interpretation of data (Adner & Helfat, 2003; Helfat & Peteraf, 2015; Gholampour Rad, 2017). Individuals can recognize patterns by their cognitive structures such as prototypes (idealized representations of the most typical combination of attributes associated with an event) and exemplars (specific examples of relevant concepts) (Baron, 2006). So, business professionals' capacity to sense emerging opportunities is affected by their mental models (Martin & Bachrach, 2018).

Business professionals have different mental models of industry, market, and firms (Porac et al, 1989). Differences depend on their experiences and knowledge (Day & Nedungandi, 1994; Zheng et al, 2016). Different business professionals' mental models have different decision rules to filter the information about changes (Karakaya & Yannopoulos, 2010) so, their patterns of dynamic attention are probably different. Focus on different changes implies different dots to link, therefore, a different change pattern to perceive (Helfat & Peteraf, 2015; Gholampour Rad, 2017). Different perception means different interpretations. Different interpretations lead to different analogies to make (Gary *et al*, 2012), if the problem is different, then the answer will be probably different. So, business professional opportunity recognition capabilities will be different because their different mental models influence differently their cognitive processes. Those differences explain why some individuals, but not others, can identify opportunities.

Using the Input-Process-Outcome model (McGrath, 1964) I summarize the integrated model (figure 1). First, I propose to Input the market signals such as trends, or

technological, economic, or demographic changes. Second, I propose that an entrepreneurial professional's cognition is an ongoing Recursive Process of interaction between cognitive processes (attention, categorization, and perception) and cognitive structures (mental models). Finally, I propose as Output the managerial dynamic capabilities (behaviors) of sensing business opportunities which underpin the opportunity recognition capability.

Figure 1: Opportunity recognition non-linear model.

Entrepreneur's Cognition

Market signals
events, trends, changes (technology, economics, social, politics, demographic)

Attention
alertness

Categorization
structural alignment

Mental Model
prototypes, exemplars, frameworks

Perception
pattern recognition, interpretations

Managerial dynamic capabilities

Sensing
scanning, creation, evaluation

Opportunity recognition

Note: based on Adner and Helfat (2003), Baron (2006), Bagdasarov *et al*, (2016), Grégoire et al., (2010b), Helfat and Peteraf (2015), Jones et al., (2011), Karakaya & Yannopoulos, (2010), and Santos et al, (2015).

In summary, the opportunity recognition non-linear model entails that the entrepreneurial professional's mental model (cognitive structures) define what specific

changes will be selected to attend, what structural alignment will be made to build the patterns, and finally what specific course of action will be taken to introduce new or improved supply-demand combinations. However, the cognitive processes (attention, categorization, and perception) can trigger changes in a manager's mental model by assimilation (i.e., an extension or refinement of a mental model) or accommodation (revision of a mental model) adding new knowledge and correcting misconceptions and inaccuracies in existing knowledge (Palmunen et al, 2021; van Ments & Treur, 2021). Business professionals who pay attention to changes in the environment and can perceive the patterns correctly could recognize the opportunities behind market failures and through their experience and learning can change their mental models enhancing their patterns perception (Jones et al, 2011). The above explains why some management students can identify opportunities but, can management students be trained for that task?

Management students' entrepreneurial education

Entrepreneurial education refers to the procedures for imparting, developing, and shaping enterprising skills (Wiramihardja et al., 2022). Entrepreneurial education can be broadly defined as holding entrepreneurial thinking that will allow one to think creatively and innovatively about many problems (Schuelke-Leech, 2021). Literature supports the idea that entrepreneurship can be taught, however, the question that remains is how i.e., what teaching and learning approaches are more effective (Abd Rahim et al., 2021; Kuratko, 2005; Lindberg et al., 2017). However, there is no comprehensive research on how students respond to entrepreneurship education (Täks et al, 2014).

Research shows mixed results on the effect of entrepreneurial education on students' entrepreneurial intentions and attitudes i.e., some studies have found positive, and others

have found negative effects (Hassan et al., 2020; Lyu et al., 2023; Oftedal et al., 2018). Compulsory entrepreneurship courses could lower students' interest in entrepreneurship but improve their entrepreneurial competencies perceptions (Stenholm et al., 2021). Lyu et al. (2023) argue that different types of entrepreneurial education pedagogy may show different effectiveness in different stages of the entrepreneurial process. Also, there is no consensus among scholars on whether education as an external context could improve opportunity recognition competence (Abd Rahim et al., 2022; Oftedal et al., 2018).

Entrepreneurial knowledge is a type of human capital about the person's capacity to manage entrepreneurial aspects including planning, financing, management, and regulations for start-ups (Vafaei-Zadeh et al, 2023). Entrepreneurship education may allow to students develop skills such as communication, teamwork, and the ability to defend business decisions (Schuelke-Leech, 2020). Transfer is the application of knowledge acquired in one situation to another to increase success (Unger et al, 2011). Entrepreneurial knowledge and opportunity recognition could be positively related to entrepreneurial intentions (Vafaei-Zadeh et al, 2023). Research on entrepreneurship education highlights the importance of active, experiential, learning by doing, and real-world pedagogies (Lindberg et al., 2017).

Rodriguez et al, (2015) argue that is critical that university students receive entrepreneurship training to supply firms with innovative team members and managers. Non-entrepreneurship teaching in business schools could not support the competencies of opportunity recognition, perseverance, and mobilizing resources (Stenholm et al., 2021). The above is explained because the entrepreneurial domain is more opportunity-driven while the managerial is more resource-driven (Kuratko, 2005). Educational institutions should focus on an entrepreneurial mindset rather than merely teaching students to create

ventures (Park et al., 2020). Entrepreneurial mindset is a way to increase the students' capabilities not just to start a business, but to think about future career directions (Secundo et al, 2023). So, the promotion of an entrepreneurial mindset and competencies at different educational levels is important for both innovative and non-innovative entrepreneurship (Guerrero et al., 2021).

Some researchers argue that entrepreneurial education may show a positive influence on opportunity recognition (Filser et al., 2020; Wiramihardja et al., 2022). Entrepreneurial education may help students to identify themselves as entrepreneurs enhancing the opportunity recognition process (Filser et al., 2020). Management students can develop through experience or educational background the perceptual capabilities and alertness to recognize opportunities (Felin & Zenger, 2009).

Some activities may improve opportunity recognition, for instance, being alert, searching, gathering information, communicating, solving problems, and evaluating (Okolie et al., 2021). Teaching entrepreneurship through case studies may be effective in developing the student's cognitive ability to recognize opportunities (Abd Rahim et al., 2021). Also, the normative dimension (values and norms) of the university context may have a positive and significant relationship with opportunity recognition (Oftedal et al., 2018).

Costa et al. (2018) argue that students interested in becoming entrepreneur must be trained in opportunity recognition before other technical competencies (e.g., writing a business plan) because opportunity recognition competence is a pre-requisite to an entrepreneurship process which begin with an opportunity recognition (Lim et al, 2023; Okolie et al, 2021; Othman et al, 2020) which may influence the behavioral or entrepreneurial intention (Anwar et al, 2021).

According to the Opportunity Recognition Process non-linear model (Figure 1), the students' opportunity recognition capability will be enhanced by students' mental model that allows them the best-focusing alertness to market signals, the best structural alignment between market signals with prototypes or exemplars of mental model to build patterns that allow them to develop their sensing behaviors. At the same time management students may learn through education programs the prototypes and exemplars that allow them to build mental models to develop their perceptual capabilities and alertness to recognize patterns between seemingly unrelated events and identify business opportunities (Baron, 2006; Costa et al., 2018; Felin & Zenger, 2009).

Discussion

Sensing opportunities is an interpretative activity made by individuals' evaluative and inferential skills (Teece, 2007). Business professionals require subjective efforts to comprehend the environment and imagine what may be a business opportunity (Grégoire et al, 2010). So, individuals can produce beliefs about new opportunities by theorizing and imagination (Felin & Zenger. 2009). Mental models support those inferences (Andonovski, 2022). So, the mental model of competitive advantage can affect the sensing capability (Karakaya & Yannopoulos, 2010).

The structural alignment between business professionals' interpretation and the mental model used as an analogy will lead to sense-making through the iterative processes of scanning, evaluation, and creation of the market scenario (Gary *et al*, 2012; Teece, 2007). Different scenarios allow for identifying different market failures so, different

business professionals may define different courses of action to exploit - or not -, a business opportunity (George et al., 2016; Grégoire et al., 2010; Grégoire et al., 2010b).

Regarding the theoretical implications, the opportunity recognition non-linear model describes a recursive interaction between business professionals' mental models as cognitive structures and their cognitive processes such as attention, categorization, and perception. So, different individuals' mental models influence differently to their cognitive processes and vice versa allowing some persons, but not others, to recognize a business opportunity.

So, to explore the opportunity recognition phenomenon is not enough to consider just the business professionals' cognitive processes like traditional models (see, Baron, 2006; Helfat & Peteraf, 2015) also researchers are required to obtain their mental models. There are three general methods of obtaining an individual's mental models: verbal (open or semi-structured interview), graphic (maps with variables and their relationships), and hybridized (a combination of verbal and graphic) (Grenier & Dudzinska-Przesmitzki, 2015). In the opportunity domain, Endres and Wood (2007) recommended structured interview techniques.

Regarding the practical implications, education and training may influence individuals' entrepreneurial development and performances (Alim et al., 2022), so in opportunity recognition training design is necessary to consider the trainee's antecedents such as education, work experience, tenure, and functional specialization. On the other hand, graduates do not venture into entrepreneurship due to some factors such as failure to assess the environment, fear of failure, scarce financial resources, and problems in identifying business opportunities (Othman et al., 2020). So, students interested in

becoming entrepreneurs must be trained in opportunity recognition before other technical competencies (Costa et al., 2018).

Finally, is necessary to consider that the work experience and skill diversity in managerial teams could have a mixed effect on team performance obstructing the team members' capacity to change (Magpili & Pazos, 2017). However, similar educational backgrounds and novel environments may have a positive role in team mental model convergence (Mohammed *et al.,* 2010).

Conclusion

This work describes a non-linear model for business professionals' opportunity recognition phenomenon through an integrated review. In summary, business professionals who pay attention to changes in the environment and can perceive the patterns correctly could recognize the opportunities behind market failures. The business professionals' mental models define what specific changes will be selected to attend, what structural alignment will be made to build the patterns, and finally what specific course of action will be taken to introduce new or improved supply-demand combinations. At the same time, the cognitive processes (attention, categorization, and perception) can trigger changes in the manager's mental model adding new knowledge and correcting misconceptions and inaccuracies in existing knowledge enhancing their opportunity recognition capabilities.

Improving the management students' recognition opportunities implies developing an entrepreneurial mindset formed by mental models about the market environment and possible responses to market failures. A training program should be based on highlighting the inconsistencies in the individuals' mental models increasing the mental models' change

process. That training program will require a prior normative standard such as management simulation software.

This work has limitations, first is just a theoretical exercise so, an empirical evaluation is required. Second, the theoretical scope for review is limited so, other theories can be potentially added.

Chapter 3: The Relationship between Management Students' Opportunity Recognition and Alertness.

Abstract

This work explores the relationship between management students' alertness process and business opportunities recognition capability. Through a self-applied survey, I measured both alertness (AL) and opportunity recognition capability (OR). Also, I used age, work experiences, tenure, educational level, and functional specialization as context variables. Exploratory factor analysis shows that both constructs are unidimensional and between them, there is a significant positive relationship. Also, there is a significant positive relationship between AL and age, tenure, work experience, and post-degree. There is a significant difference in OR level only between respondents with functional specialization in operation, logistics, and IT. Factors that affect AL do not influence OR. Also, functional specialization does not affect the AL level. The development of the management students'

alertness activities may depend on time; however, their opportunity recognition capabilities may depend on the content of their mental models.

Introduction

Rapid changes in science and technology characterize almost any complex and dynamic market environment creating opportunities for innovation, so, to sustain a competitive advantage business professionals must exploit the opportunities that arise from those changes (Eggers & Kaplan. 2009; George et al, 2016; Grégoire et al, 2010; Lin & Chen, 2023; Teece, 2007; Tynan, 2023). In business professionals "the alertness component of attention can facilitate the detection and creation of new opportunities" (Helfat & Peteraf, 2015 p.839). Entrepreneurial alertness makes individuals more prone to recognize and discover opportunities (Felin & Zenger. 2009; Franczak et al, 2023).

Business professionals who more accurately perceive emerging changes in technology and clients' demands are more likely to sense new opportunities (Helfat & Peteraf, 2015). Opportunities arise from changes in the business environment which create a market disequilibrium that an individual can exploit (George et al, 2016). Understanding the factors that influence opportunity recognition may increase the likelihood that business

professionals find profitable opportunities (Filser et al., 2020). There are at least, three factors associated with opportunities recognition: engagement in an active search, alertness (i.e., the capacity to recognize general opportunities), and prior knowledge of a market, industry, or customer (Baron, 2006).

Attention is an act of focused awareness of specific information that eases the managerial environmental scanning to sense opportunities and threats (Helfat & Peteraf, 2015). Business professionals differ in their cognitive capability of attention so, they can differ in how correctly and quickly sense new opportunities, their differences in attention can be path-dependent (Helfat & Peteraf, 2015). Board directors' skills, experiences, and knowledge of business, technology, and industry impact their attention, thus influencing their responses to strategic change (Åberg & Torchia, 2019). So, the specific research questions in this chapter are: What is the relationship between business professionals' alertness and their opportunity recognition capabilities? Could show business professionals a different level of reported alertness to a market signal depending on their characteristics such as age, tenure, and functional specialization?

The purpose of this study is to explore the factors associated with management students' alertness process and opportunity recognition capability. I use different individuals' characteristics as variables and evaluate their effect on reported management students' alertness and opportunity recognition capabilities. I sampled professionals and technicians who are currently studying engineering as a second profession in Chile. This is a reasonable sample considering the long tradition of Chilean Industrial Engineering degrees focused on general management skills. I measured the management students' level of alertness and opportunity recognition through a scale (Alim et al., 2022; Tang et al.,

2012) and its relationship with the different students' tenure, work experiences, and functional specialization, among other attributes such as demographics and education.

This work makes a theoretical contribution to strategic management research by exploring factors associated with management students' alertness and opportunity recognition. Regarding the Opportunity Recognition Model developed in prior theoretical work (see chapter 2) the empirical data are obtained from a reasonable sample of management students, so the results can sustain it. The practical contribution is to explore how some factors may influence management students' alertness on business opportunities recognition in the market and describe some possible ways to train them to enhance it.

Background and Hypotheses

Alertness has been treated as a process (Casson, 2005; Felin & Zenger, 2009; Tang et al, 20102). Entrepreneurial alertness can be understood as an innate capacity to recognize opportunities (Endres & Wood, 2007). However, business professionals with greater experience may have greater alertness to opportunities (Åberg & Shen, 2019). Also, there is a difference between the subjective belief that an opportunity exists for someone and the cognitive process of recognizing that an opportunity exists for oneself (Gregoire et al, 2010b). Board directors' skills, experiences, and knowledge of business, technology, and industry impact their alertness and what directors pay attention to, thus influencing their responses to strategic change (Åberg & Torchia, 2019). Throughout their lives management students and business professionals may change their mental models through the addition of new knowledge and correcting misconceptions (Palmunen et al., 2021). Business

professionals' experiences and observations may trigger the formation of beliefs about the opportunities that might be pursued (Felin & Zenger. 2009).

H1a. Older management students show more alertness than younger ones.

H1b. Older management students show more opportunity recognition than younger ones.

Business professionals with more work experience may have more complex business mental models (Jones et al, 2011). Using their mental model business professionals can direct their attention to more diverse causal relationships to forecast alternative solutions (Bagdasarov *et al*, 2016). Business professionals trapped in a mindset may become prisoners of their assumptions, information filters, and problem-solving strategies, for instance preventing their firms from entering a new product market (Eggers & Kaplan, 2009; Teece, 2007). Business professionals with more work experience and knowledge may have higher alertness to business opportunities (Åberg & Shen, 2019). The attention provides direction to learn from work experience increasing the business professionals' human capital (Adner & Helfat, 2003).

H2a. Management students with more work experience show more alertness than management students with less work experience.

H2b. Management students with more work experience show more opportunity recognition than management students with lesser work experience.

Business professionals with more tenure in their firm may develop more complex mental models about their competitors, suppliers, and customer focusing their attention on them excluding other agents (Porac *et al*, 1989). The recognition of opportunities entails the resemblance between outside world events and mental models of situations and contexts (Grégoire et al, 2010). More exact business professionals' mental models of the key principles of the business environment will lead to better strategic decisions (Gary & Wood,

2011). Different mental models may explain, at least in part, the differences in the cognitive capability of attention between different managers (Helfat & Peteraf, 2015). So, business professionals with more knowledge and experience in their firm may have higher alertness (Åberg & Shen, 2019).

H3a. Management students with more tenure in their current firm show more alertness than management students with lesser tenure.

H3b. Management students with more tenure in their current firm show more opportunity recognition than management students with lesser tenure.

Managerial cognition provides direction to learn from experience increasing the business professionals' human capital (Adner & Helfat, 2003; Badrinarayanan et al., 2019; Martin & Bachrach, 2018). Managerial sensing capabilities are rooted in human capital i.e., the knowledge and skills obtained from education and training influence their attention to business (Adner & Helfat, 2003; Badrinarayanan et al., 2019; Helfat & Martin, 2015; Martin & Bachrach, 2018). Business professionals with more knowledge may have higher alertness to opportunities (Åberg & Shen, 2019). Management students may learn through formal education the prototypes and exemplars that allow them to recognize patterns between seemingly unrelated events and identify business opportunities (Baron, 2006).

H4a. Management students with higher educational levels show more alertness than management students with lesser educational levels.

H4b. Management students with higher educational levels show more opportunity recognition than management students with lesser educational levels.

Business professionals' constructs as markets, segments, and competitive forces are abstractions given meaning through selective search, perception, and attention to environmental variables that according to their experiences they cannot overlook (Day &

Nedungandi, 1994). Differences in managerial career paths produce differences in business professionals' human capital obtained from education, training, and prior work experience (Adner & Helfat, 2003; Badrinarayanan et al., 2018; Helfat & Martin, 2015; Martin & Bachrach, 2018). For instance, a business professional with a financial career possibly has a mental model of market competition quite different than a business professional with a marketing or operation career, so, they focus on different changes and possibly with different levels of alertness (Åberg & Torchia, 2019; Helfat & Peteraf, 2015). So, business professionals differ in their cognitive capability of attention and that difference can be path-dependent (Helfat & Peteraf, 2015). Management students' experiences and observations may trigger the formation of beliefs about the opportunities that might be pursued (Felin & Zenger. 2009).

H5a. Management students with different functional specializations show different levels of alertness.

H5b. Management students with different functional specializations show different levels of opportunity recognition.

Business professionals rely on simplified representations of the world (mental model and strategic beliefs) that direct their attention and imprint the development of capabilities, so, higher-quality representations lead to better capabilities than a misperception of the competitive situation (Ambrosini & Bowman, 2009; Tripsas & Gavetti, 2000). Different management students' mental models have different decision rules to filter the information about changes (Karakaya & Yannopoulos, 2010) so, their patterns of dynamic attention are probably different. Focus on different changes implies different dots to link so, a different change pattern to perceive (Helfat & Peteraf, 2015;

Gholampour Rad, 2017). "The alertness component of attention can facilitate the detection and creation of new opportunities" (Helfat & Peteraf, 2015 p.839).

H6. Management students with higher levels of alertness have more level of opportunity recognition than management students with lesser levels of alertness.

Method

The present study adopted a quantitative and cross-sectional design to gather data from management students with some work experience via a self-applied questionnaire on the Qualtrics™ platform. The collected data were analyzed using SPSS.

Compliance with Ethical Standards

The author declares that no funding was received.

The author declares to have no conflict of interest.

The participants received and accepted informed consent.

Sample

The sample encompasses professionals and technicians who are currently studying engineering as a second profession and post-degree students in a Chilean university. They were invited to answer the survey through university formal authorities in 2023. There is not any incentive.

I obtained 555 total responses. All incomplete surveys were erased. After that clean process, 467 responses remained. Respondents were 345 (73.9%) male and 122 (26.1%) female, with an average age of 35.5 years. Their education level included 126 (27%)

technical, 280 (60%) university, and 61 (13.1%) post-degree. They have an average tenure of 5.85 years and 12.73 years of work experience. 41.1% have a functional specialization in operations, 16.7% in IT, 15% in administration, 8.6% in logistics, 7.9% in R&D, 4.9% in human resources, 2.6% in finances, and less than 2% in both accounting and marketing.

Survey

The survey contained demographic (age, gender), educational level (technical, university, post-degree), tenure (years), work experience (years), and functional specialization (marketing, finance, operations, human resources, logistics, research and development, accounting, IT, and administration) questions.

I used a Likert scale with five points (strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree). Questions of alertness (AL) are obtained from Tang et al (2012). Tang et al (2012) use an alertness operational definition with three dimensions: scanning and searching for new information (constantly scanning the environment for changes) with six items, connecting previously disconnected information (pulling together pieces of information and building coherent alternatives) with three items, and evaluating whether information represents an opportunity (making evaluations and judgment) with four items. Given that the dimension of association and connection is similar to Helfat and Peteraf's (2015) definition of perception (i.e., the construction of meaningful information from events in the environment through pattern recognition), and the dimension of evaluation and judgment is similar to the Helfat and Peteraf's (2015) definition of reasoning and problem-solving capabilities related to seize opportunities, I decided to use only the questions relative to the scanning and searching dimension. So, alertness (AL) is operationally defined as self-reported alertness activities.

Questions of opportunity recognition (OR) are obtained from Ozgen and Baron (2007), also in Wiramihardja et al., (2022), and Alim et al., (2022). Those scales were selected because they are aligned to the definition of opportunity recognition competency as the ability to find new ideas i.e., a cognitive process different from cognitive structure or mental model. I decided to delete one of the Ozgen and Baron (2007) items because it was built in negative form, and it may confuse respondents. So, in this work opportunity recognition is operationally defined as self-perceived capabilities to recognize opportunities.

The questions are translated into Spanish using Brislin's (1979) method. All scales are shown in Table 1, the selected items to AL and OR have numbers.

Table 1

Items selected for AL and OR
Alertness. (Tang, et al 2012)
Scanning and search (AL)
AL_1 - I have frequent interactions with others to acquire new information.
AL_2 - I always keep an eye out for new business ideas when looking for information.
AL_3 - I read news, magazines, or trade publications regularly to acquire new information.
AL_4 - I browse the Internet every day.
AL_5 - I am an avid information seeker.
AL_6 - I am always actively looking for new information.
Association and connection
I see links between seemingly unrelated pieces of information

I am good at "connecting dots."
I often see connections between previously unconnected domains of information

Evaluation and judgment
I have a gut feeling for potential opportunities
I can distinguish between profitable opportunities and not-so-profitable opportunities
I have a knack for telling high-value opportunities apart from low-value opportunities
When facing multiple opportunities, I am able to select the good ones.

Opportunity Recognition (OR) (Ozgen & Baron, 2007)
"Seeing" potential new venture opportunities does not come very naturally to me
OR_1 - While going about routine day-to-day activities, I see potential new venture ideas all around me.
OR_2 - Recognizing a good opportunity usually requires experience in a specific industry or marketplace.
OR_3 - Discussions with my family or friends can help me to recognize business opportunities.
OR_4 - I am alert or sensitive toward new venture opportunities. (Alim et al., 2022)

Variables

The dependent variable was OR. The independent variable was AL. Other variables were gender, age (years), tenure (years), work experience (years), educational level (technician, university, post-degree), and functional specialization.

Analyses

First, I conducted an exploratory factor analysis to validate both the AL and OR measures. Principal component analysis was utilized for factor extraction, and the Varimax rotation method was used to transform the final factor solution into a simple solution for interpretation. Second, I made regressions between AL and OR constructs and each

continuing variable i.e., age, tenure, and work experience. Finally, I made an ANOVA analysis to determine the significance level of the differences in the mean of the AL and OR construct for educational level and functional specialization variables.

Results

In the next lines, I describe the results and more relevant tables. The complete analyses can be found in Appendix A.

Regarding AL, the initial solution shows items with low factor loading so, I decided to erase them. I obtained a unidimensional construct (Table 2) that includes the AL_3 item with .452 factor loading but the construct shows a Cronbach's alfa of 0.725 so I decided to keep it.

Table 2

Factorial Matrix [a]

	Factor 1
AL_6 -I am always actively looking for new information	,874
AL_5 - I am an avid information seeker	,848
AL_3 - I read news, magazines, or trade publications regularly to acquire new information	,452

Extraction Method: Maximum verisimilitude

a. 1 factor extracted. Required 4 iterations.

I validated the AL construct using the Netemeyer et al (2003) recommendations. So, in this case, the convergent validity is accepted when inter-item correlations are significant (Table 3) despite the low correlations between AL_3 and AL_5, and AL_3 and AL_6. Also, the discriminant validity is accepted when the inter-item partial correlations controlled by the mean of the construct are not significant (Table 4).

Table 3

Correlations

		AL_3	AL_5	AL_6
AL_3	Pearson Correlation	1	,383**	,395**
	Sig. (bilateral)		,000	,000
	N	467	467	467
	Bootstrap Bias	0	,002	,000
	Typ. Error	0	,042	,045

		Interval of confidenc e at 95%	Inferior	1	,302	,306
			Superior	1	,464	,477
AL_5	Pearson Correlation			,383**	1	,742**
	Sig. (bilateral)			,000		,000
	N			467	467	467
	Bootstrap	Bias		,002	0	,001
		Typ. Error		,042	0	,034
		Interval of confidenc e at 95%	Inferior	,302	1	,670
			Superior	,464	1	,802
AL_6	Pearson Correlation			,395**	,742**	1
	Sig. (bilateral)			,000	,000	
	N			467	467	467
	Bootstrap	Bias		,000	,001	0
		Typ. Error		,045	,034	0
		Interval of confidenc e at 95%	Inferior	,306	,670	1
			Superior	,477	,802	1

**. Correlation is significant at 0,01 level (bilateral).

b. Autodocimants results are based on 1000 samples of bootstrap sampled

Table 4

Correlations

Variables de control				AL_3	AL_5	AL_6
AL_mean	AL_3	Correlation		1,000	-,749	-,773
		Sig. (bilateral)			,000	,000
		gl		0	464	464
		Bootstrapª	Bias	0,000	,002	,000
			Typ. Error	0,000	,034	,023

		Interval of confidence at 95%	Inferior		1,000	-,806	-,817
			Superior		1,000	-,677	-,729
AL_5	Correlation				-,749	1,000	,158
	Sig. (bilateral)				,000		,001
	gl				464	0	464
	Bootstrapª	Bias			,002	0,000	-,002
		Typ. Error			,034	0,000	,075
		Interval of confidence at 95%	Inferior		-,806	1,000	,009
			Superior		-,677	1,000	,294
AL_6	Correlation				-,773	,158	1,000
	Sig. (bilateral)				,000	,001	
	gl				464	464	0
	Bootstrapª	Bias			,000	-,002	0,000
		Typ. Error			,023	,075	0,000
		Interval of confidence at 95%	Inferior		-,817	,009	1,000
			Superior		-,729	,294	1,000

a. Autodocimants results are based on 1000 samples of bootstrap sampled

Regarding OR, the initial solution shows items with low factor loading so, I decided to erase them. I obtained a unidimensional construct (Table 5) with a Cronbach's alfa of 0.725.

Table 5

Factorial Matrix ª

	Factor 1
OR_4- I am alert or sensitive toward new venture opportunities	,820
OR_1- While going about routine day-to-day activities, I see potential new venture ideas all around me	,758
OR_3- Discussions with my family or friends can help me to recognize business opportunities	,554

Extraction Method: Maximum verisimilitude
a. 1 factor extracted. Required 4 iterations.

I validated the measures with the recommendations of Netemeyer et al, (2003) So, in this case, the convergent validity is accepted when inter-item correlations are significant (Table 6) despite the low correlations between OR_3, and OR_1, and OR_3 and OR_4. Also, the discriminant validity is accepted when the inter-item partial correlations controlled by the mean of the construct are not significant (Table 7).

Table 6

Correlations

		OR_1	OR_3	OR_4
OR_1	Pearson Correlation	1	,420[**]	,622[**]
	Sig. (bilateral)		,000	,000
	N	467	467	467

				OR_1	OR_3	OR_4
	Bootstrap	Bias		0	-,001	,000
		Typ. Error		0	,046	,038
		Interval of confidence at 95%	Inferior	1	,327	,539
			Superior	1	,506	,691
OR_3	Pearson Correlation			,420**	1	,454**
	Sig. (bilateral)			,000		,000
	N			467	467	467
	Bootstrap	Bias		-,001	0	,001
		Typ. Error		,046	0	,047
		Interval of confidence at 95%	Inferior	,327	1	,358
			Superior	,506	1	,542
OR_4	Pearson Correlation			,622**	,454**	1
	Sig. (bilateral)			,000	,000	
	N			467	467	467
	Bootstrap	Bias		,000	,001	0
		Typ. Error		,038	,047	0
		Interval of confidence at 95%	Inferior	,539	,358	1
			Superior	,691	,542	1

**. Correlation is significant at 0,01 level (bilateral).
b. Autodocimants results are based on 1000 samples of bootstrap sampled

Table 7

Correlations

Variables de control			OR_1	OR_3	OR_4
OR_mean	OR_1	Correlation	1,000	-,601	-,360
		Sig. (bilateral)		,000	,000
		gl	0	464	464

	Bootstrapª	Bias			0,000	,000	-,001
		Typ. Error			0,000	,036	,050
		Interval of confidence at 95%	Inferior	1,000	-,668	-,460
			Superior	1,000	-,525	-,259
OR_3	Correlation			-,601	1,000	-,529
	Sig. (bilateral)			,000		,000
	gl			464	0	464
	Bootstrapª	Bias			,000	0,000	,002
		Typ. Error			,036	0,000	,041
		Interval of confidence at 95%	Inferior	-,668	1,000	-,603
			Superior	-,525	1,000	-,436
OR_4	Correlation			-,360	-,529	1,000
	Sig. (bilateral)			,000	,000	
	gl			464	464	0
	Bootstrapª	Bias			-,001	,002	0,000
		Typ. Error			,050	,041	0,000
		Interval of confidence at 95%	Inferior	-,460	-,603	1,000
			Superior	-,259	-,436	1,000

a. Autodocimants results are based on 1000 samples of bootstrap sampled

A correlation between AL and OR shows a value of .486 (p < .01) with a 95% confidence interval moving between .386 to .544, so according to Anderson & Gerbing (1988) given the interval does not cover the value 1 both constructs are different.

A regression shows a significant positive relation between AL and OR acting as a predictive validation of the AL construct confirming hypothesis 6 (Table 8).

Table 8

Coefficients ª

Model	Coeff. no standard		Coeff. typification	t	Sig.	Confidence Interval 95,0% for B	
	B	Error típ.	Beta			Lim. inferior	Lim. superior

	(Constant)	1,794	,174		10,293	,000	1,451	2,136
1	AL_mean	,495	,043	,468	11,434	,000	,410	,580

a. Dependent Variable: OR_mean

Regarding the hypotheses. Hypothesis 1a is about the relationship between age and AL, a regression shows a significant positive relation (Table 9). Hypothesis 1b is about the relation between age and OR, a regression shows no significant relation ($p = 0.322$). So, hypothesis 1a is accepted and 1b is rejected.

Table 9

Coefficients [a]

		Coeff. no standard		Coeff. typificatio n	t	Sig.	Confidence Interval 95,0% for B	
Model		B	Error typ.	Beta			Lim. inferior	Lim. superior
1	(Constant)	3,455	,142		24,262	,000	3,176	3,735
	age	,014	,004	,167	3,644	,000	,007	,022

a. Dependent Variable: AL_mean

Hypothesis 2a is about the relationship between work experience and AL, a regression shows a significant positive relation (Table 10). Hypothesis 2b is related to the relationship between work experience and OR, a regression shows no significant relation (p = 0.224). So, hypothesis 2a is accepted and 2b is rejected.

Table 10

Coefficients [a]

Model		Coeff. no standard B	Error typ.	Coeff. typificatio n Beta	t	Sig.	Confidence Interval 95,0% for B Lim. inferior	Lim. superior
1	(Constant)	3,810	,059		64,858	,000	3,695	3,926
	Work experience	,012	,004	,141	3,068	,002	,004	,019

a. Dependent Variable: AL_mean

Hypothesis 3a refers to the relationship between tenure and AL, and a regression shows a significant positive relationship between them (Table 11). Hypothesis 3b is referred to the relationship between tenure and OR, a regression shows a slight no significant relation (p = 0.056). So, hypotheses 3a is accepted and 3b is rejected.

Table 11

Coefficients [a]

Model		Coeff. no standard B	Error typ.	Coeff. typification Beta	t	Sig.	Confidence Interval 95,0% for B Lim. inferior	Lim. superior
1	(Constant)	3,868	,045		86,12 1	,000	3,779	3,956
	tenure	,016	,005	,137	2,973	,003	,005	,027

a. Dependent Variable: AL_mean

I decided to make a multiple regression between the dependent variable AL_mean and the age, work experience, and tenure variables. The results (table 12) show that the age variable in the presence of the work experience variable increases its beta value and reduces its significance to .052. The work experience variable in the presence of the age variable shows no significant negative beta value. The tenure variable shows no effect on the age variable, but work experience shows no significantly more negative beta value. The tenure

variable itself shows a not significant beta value lesser than in Table 11. Considering that the three variables reflect the flow of time, so, the results may be the effect of collinearity.

Table 12

Multiple regression

Model		Coeff. No standard		Coeff. typification	t	Sig.	Confidence Interval 95,0% for B	
		B	Error type	Beta			Lim. inferior	Lim. superior
1	(Constant)	3,455	,142		24,262	,000	3,176	3,735
	Age	,014	,004	,167	3,644	,000	,007	,022
2	(Constant)	3,438	,200		17,233	,000	3,046	3,830
	Age	,015	,008	,176	1,949	,052	,000	,030
	Work experience	-,001	,008	-,011	-,123	,902	-,016	,014
3	(Constante)	3,427	,199		17,191	,000	3,035	3,818
	Age	,015	,008	,177	1,963	,050	,000	,030
	Work experience	-,005	,008	-,058	-,613	,540	-,021	,011
	Tenure	,010	,006	,087	1,600	,110	-,002	,023

a. Dependent Variable: AL_mean

Hypothesis 4a is about the relationship between educational level and AL. I made an ANOVA analysis, the Levene test was not significant, and the ANOVA intergroup was significant (p = 0.04). Tukey post hoc test shows the post-degree group with significantly

higher mean alertness than the other (Table 12). So, hypothesis 4a is accepted. Hypothesis 4b refers to the relationship between educational level and OR. I made an ANOVA, and both the Levene and ANOVA tests were not significant. So, hypothesis 4b is rejected.

Table 13

Multiple Comparations

Dependent
Variable: AL_mean

(I) educat			Mean Differences (I-J)	Error typ.	Sig.	Confidence Interval 95,0%	
						Lim. inferior	Lim. superior
HSD de Tukey	technical	university	-,02923	,07427	,918	-,2039	,1454
		post degree	-,25935*	,10799	,044	-,5133	-,0054
	university	technical	,02923	,07427	,918	-,1454	,2039
		post degree	-,23011*	,09783	,050	-,4601	-,0001
	post degree	technical	,25935*	,10799	,044	,0054	,5133
		university	,23011*	,09783	,050	,0001	,4601

*. Mean differences are significant at 0.05 level.

Hypothesis 5a is referred to the relationship between functional specialization and AL, an ANOVA shows both Levene and ANOVA tests were not significant. Hypothesis 5b is about the relationship between functional specialization and OR, an ANOVA shows a Levene test with no significance and ANOVA significant test ($p = 0.001$). The Tukey post hoc test shows significant differences between IT, operations, and logistic groups, the logistic group show a higher OR mean than IT (Table 13), and the mean differences between operation and logistic was not significant. So, hypothesis 5a is rejected and 5b is partially accepted.

Table 14

Multiple Comparations

Dependent Variable:		OR_mean				Confidence Interval 95,0%	
(I) specialization			Mean Differences (I-J)	Error typ.	Sig.	Lim. inferior	Límite superior
HSD de Tukey	Informatic	Marketing	-,73321	,28478	,200	-1,6208	,1544
		Finances	-,34829	,22381	,828	-1,0458	,3493
		Operations	-,34135*	,09691	,014	-,6434	-,0393
		Human Resources	-,41230	,17126	,282	-,9461	,1215
		Logistic	-,60940*	,14037	,001	-1,0469	-,1719
		Research and Development	-,26346	,14408	,663	-,7125	,1856
		Account	-,00107	,26795	1,000	-,8362	,8341
		Administration	-,29988	,11883	,223	-,6702	,0705

*. Mean differences are significant at 0.05 level.

In summary, in this work, AL and OR are two unidimensional constructs with a significant positive relationship. The variables age, work experience, and tenure positively affect AL but not OR. The individuals with a post-degree education show a higher level of AL than those with technician and university education. The functional specialization in operations, IT, and logistics shows different levels of OR between them. The other specialization shows no differences.

Discussion

Regarding the results, first I must highlight that as predicted by Helfat and Peteraf (2015) the AL influence positively the OR. However, the other results show that it is a necessary but insufficient condition. In the next lines, I try to explain this affirmation.

The tenure, age, and work experiences are measured in years, so they represent the flow of time in management students' lives, work markets, and current firms.

Regarding age, we know that mental models are constructed by individuals' experiences (Jones et al., 2011) changing along their lives through the addition of new knowledge and correcting misconceptions (Palmunen et al., 2021) so, the flow of time implies more opportunities to improve management students' mental model about market, segments and competitive forces (Day & Nedungandi, 1994) enhancing their AL (Åberg & Shen, 2020).

The work experience implies that management students build more diverse business mental models (Jones et al., 2011) allowing them to direct their attention to the more diverse causal relationship (Bagdasarov *et al*., 2016) and improving their AL (Åberg & Shen, 2019). Tenure implies that management students may build more complex mental models about their competitors, suppliers, and customers (Porac *et al*, 1989) which are used to filter and store information (Jones *et al*, 2011) focusing their attention on the market, segments, and competitive forces (Day & Nedungandi, 1994) enhancing their AL (Åberg & Shen, 2020).

So, time is enough to build mental models and explain the positive effect on individuals' AL because throughout our lives we learn from experiences or instructions. Management students learn every time they choose. Decision-making and the consequences of choice produce experiences. The experiences are integrated into a mental model by accommodation or assimilation. New or adjusted mental models enlarge the management students ' AL allowing perceive more specific and relevant market information. The above explains the results obtained for AL for age, work experience, tenure, and education.

Despite the significant and positive relationship between AL and OR, the factors that significantly influence AL do not influence OR. The individuals' OR depends on the structural alignment of perception with prototypes and exemplars stored in their memory (Baron, 2006; Santos et al, 2015). So, the flow of time is not enough to build and store the specific mental models capable of matching with market events. Also, management students require learning and training to change their mental models (Jones et al., 2011; van Ments & Treur, 2021).

Management students need time to learn through observation or instruction changing their mental model (van Ments & Treur, 2021) and increasing their human capital (Adner & Helfat, 2003; Badrinarayanan et al., 2018; Martin & Bachrach, 2018) therefore, more knowledge may allow more AL to opportunities (Åberg & Shen, 2019), especially post-degree studies allow adding new knowledge and correct misconceptions and inaccuracies in their current business mental model (Palmunen et al, 2021).

We know that differences in career paths may trigger the formation of beliefs about the opportunities that might be pursued using theorizing and imagination (Felin & Zenger. 2009) to build cognitive structures such as prototypes or exemplars that management students can use to match with market events (Baron, 2006) to make sense of new information and to identify a course of action to introduce new or improved supply-demand combination (Grégoire et al, 2010). The above may explain the significant differences in OR between management students with IT, operations, and logistics specialization, however, that explanation is only partial because the other functional specialization does not show the same differences.

To recognize opportunities the management students' mental models must be special, their content must be prototypes or exemplars that match with market failures they

can exploit. The above may explain why business professionals in old and successful firms are not able to exploit opportunities despite having them at their fingertips (see Polaroid's failure in Tripsas & Gavetti, 2000). Future research may show if some functional trajectories systematically promote more entrepreneurial capabilities than others.

Conclusion

I sampled professionals and technicians who are currently studying engineering as a second profession and engineering post-degree students. Through a self-applied survey, I measured the level of AL and OR, and its relationship. Also, I evaluated the effects of age, tenure, work experiences, educational level, and functional specialization on AL and OR. Exploratory factor analysis shows that both constructs AL and OR are unidimensional and between them, there is a significant positive relationship. Also, shows that there is a significant positive relationship between AL and respondents' age, tenure, work experience, and post-degree. There is a significant difference in the level of OR only between respondents with functional specialization in operation, logistics, and IT. Factors that affect AL do not influence OR. Also, functional specialization does not affect the level of AL.

In summary, time may be enough to build mental models that explain the positive effect on individuals' alertness but to recognize opportunities the content of management students' mental models should be prototypes or exemplars that match with market failures they can exploit.

This work has limitations. First, the sample is formed only for management students with work experience. Future research should enlarge its focus to managers, executives, and entrepreneurs particularly to measure their level of OR versus their effective sensing

opportunities. Second the survey, of the items, allows only a superficial exploration, future research requires new items more specifically associated with an entrepreneurial mindset.

This work makes a theoretical contribution by expanding the strategic management literature by exploring factors associated with management students' alertness and opportunity recognition. The empirical data illustrated the theoretical model of the relationship between cognitive processes and structures developed in prior theoretical papers and explored some factors that may influence that relationship.

The managerial implications point to understanding the difference between the development of management students' capability of alertness by the simple flow of time and the management students' capability to recognize a business opportunity which may be more dependent on their entrepreneurial mindset. So, to develop an entrepreneurial way of thinking to identify opportunities, the management student's formation should include entrepreneurial education for the formation and adaptation of their mental models.

Chapter 4: The Effect of the Management Students' Entrepreneurial Mental Models on their Opportunity Recognition Capability.

Abstract

I measured the effects of management students' mental models on their opportunity recognition capability (OR). Through a self-applied survey, I used mental model proxies such as entrepreneurial experience, entrepreneurial knowledge (EK), and education (EE). Other context variables are age, work experiences, tenure, educational level, and functional specialization. I found that EK, EE, and OR are unidimensional constructs and both EE and EK show a significant positive effect on OR. There is a significant positive effect of age on EK. Both the OR and EK show a significant difference in mean between individuals with or without entrepreneurial experience. There is a significant positive effect of EE on EK. Age, tenure, work experience, education, and functional specialization do not have a significant effect on OR. Tenure, work experience, and functional specialization do not have a significant effect on EK.

Introduction

Any complex and dynamic market environment creates opportunities that firms must exploit (Eggers & Kaplan. 2009; George et al., 2016; Grégoire et al., 2010; Lin & Chen, 2023; Teece, 2007; Tynan, 2023). The ability to recognize opportunities depends on

business professional members' knowledge and learning capacity (Mostafiz et al., 2022; Silva de Araújo et al., 2018). Firm success depends on the discovery and development of opportunities that can be produced, in part, from business professionals' cognitive and creative capabilities (Teece, 2007).

The business professionals' primary role is to identify new opportunities for the firm (Eggers & Kaplan. 2009). Individuals may create new opportunities through their sense-making activities (Helfat & Peteraf, 2015). To do the above business professionals relied on their knowledge and experience to sense opportunities (Åberg & Shen, 2020; Martin & Bachrach. 2018). Management students' experiences and observations may trigger the formation of beliefs about the opportunities that might be pursued (Felin & Zenger. 2009). So, theorizing and imagination play an important role in generating beliefs about new opportunities (Felin & Zenger. 2009). Business professionals trapped in a mindset may become prisoners of their assumptions, information filters, and problem-solving strategies, for instance preventing their firms from entering a new product market (Eggers & Kaplan, 2009; Teece, 2007).

In prior work I suggest that the flow of time is not enough to management students to develop opportunities recognition capability, also they require mental models as prototypes and exemplars. In this work, I use three proxies to evaluate those arguments. The purpose of this study is to expand the opportunity recognition research by mental model theory to understand the effect of management students' entrepreneurial education and knowledge, and entrepreneurship experience on their opportunity recognition capabilities. I sampled professionals and technicians who are currently studying engineering as a second profession. I measured the management students' level of opportunity recognition (Ozgen and Baron, 2007; Wiramihardja et al., 2022), and mental

models proxies such as respondents' entrepreneurial education (De la Cruz del Rio-Rama et al., 2016; Wiramihardja et al., 2022), entrepreneurial knowledge (Roxas, 2014; Wiramihardja et al, 2022), and entrepreneurship experience. Also, I measured other variables such as age, work experience, educational level, tenure, and functional specialization.

This work contributes to strategic management literature exploring the effect of management students' mental models on their opportunity recognition capabilities. The empirical data are obtained from a reasonable sample of management students, so the results can be sustained it. The practical contribution tries to understand some factors that could influence management students' opportunity recognition capabilities and underpin entrepreneurial education training programs to enhance them.

In what follows, first, I explain the pertinent literature. In the second section, I describe the hypothesis. In the third section, I describe the method. In the fourth section, I describe the results. In the fifth section, I make a discussion. Finally, I make conclusions with limitations and future research lines.

Background and Hypotheses

Individuals build and rebuild their mental model through their experiences and learning (Jones et al, 2011). Business professionals acquire knowledge about future events, alternatives, and the consequences of those alternatives through prior work experiences involving learning by doing (Adner & Helfat, 2003). Throughout their lives management students may change their mental models through the addition of new knowledge and correcting misconceptions (Palmunen et al., 2021). Entrepreneurial knowledge is a type of

human capital about the person's capacity to manage entrepreneurial aspects including planning, financing, management, and regulations for start-ups (Vafaei-Zadeh et al., 2022). Management students with greater experience may have greater alertness to opportunities (Åberg & Shen, 2019). Business professionals may have knowledge structures such as prototypes or exemplars that they can use to match with market events (Baron, 2006).

H1a. Management students with more age will show more opportunity recognition.

H1b. Management students with more age will show more entrepreneurial knowledge.

Business professionals with more tenure in the firm may have a more complex mental model of the business environment (Day & Nedungandi, 1994). Opportunity recognition is important to managers, entrepreneurs, and executives alike (Grégoire et al., 2010b; Roelandt et al., 2022). There are at least, three factors associated with opportunity recognition: engagement in an active search, alertness, and prior knowledge of a market, industry, or customer (Baron, 2006). Business professionals' knowledge can be firm-specific (technologies, products, and processes) and industry-specific (competition, regulation, technology, and supply chain) (Åberg & Shen, 2020). Researchers have found similarities and differences in individuals' mental models due to differences in managerial experiences (Karakaya & Yannopoulos, 2010). Management students with more tenure have a higher probability of experiencing the firm's internal entrepreneurship.

H1c. Management students with more tenure will show more opportunity recognition.

H1d. Management students with more tenure will show more entrepreneurial knowledge.

When management students face new business environment information build a mental model via categorization using their experience, and that mental model underpins opportunities beliefs, and judgment (Wood et al, 2014). The knowledge gained from prior experiences shapes new perceptions and affects their sensing of opportunities (Adna &

Sukoco, 2020; Åberg & Torchia, 2019; Helfat & Peteraf, 2015). Management students build and rebuild their mental model through their experiences and learning (Jones et al, 2011). Business professionals often use analogical transfer from past experiences to deal with current strategic choices (Gary *et al*, 2012). Opportunity recognition considers the resemblance between market events and individuals' mental models (Grégoire et al, 2010). Management students can develop through experience or educational background the perceptual capabilities and alertness to recognize opportunities (Felin & Zenger, 2009). Business professionals acquire knowledge about future events, alternatives, and consequences of those alternatives through prior work experiences involving learning by doing (Adner & Helfat, 2003). Some individuals and no others can recognize the connections or patterns between seemingly unrelated events because they may possess cognitive structures such as prototypes (idealized representations of a class of objects or events) or exemplars (specific examples of concepts stored in memory) that they can use to match with events (Baron, 2006).

H2a. Management students with entrepreneurship experiences will show higher opportunity recognition than students without that experience.

H2b. Management students with entrepreneurship experiences will show higher entrepreneurial knowledge than students without that experience.

Human capital is the set of knowledge and skills obtained from education, training, and learning from prior work experience, so differences in managerial career paths produce differences in business professionals' human capital (Adner & Helfat, 2003; Badrinarayanan et al., 2019; Helfat & Martin, 2015; Martin & Bachrach, 2018). Professional sensing capabilities are rooted in managerial human capital i.e., the knowledge and skills obtained from education and training influence their attention to business (Adner

& Helfat, 2003; Badrinarayanan et al., 2018; Helfat & Martin, 2015; Martin & Bachrach, 2018). Management students' entrepreneurial education may increase opportunity recognition (Wiramihardja et al., 2022). Management students may learn through formal education the prototypes and exemplars that allow them to recognize patterns between seemingly unrelated events and identify business opportunities (Baron, 2006). Formation and adaptation of a mental model can occur in two forms assimilation (i.e., an extension or refinement of a mental model) or accommodation (revision of a mental model) (van Ments & Treur, 2021). The knowledge structures or mental models may play a role in the management students' cognitive representation of the external reality influencing their biases and heuristics to anticipate market changes and make decisions (Helfat & Martin, 2015; Helfat & Peteraf, 2015).

H2c. Management students with more entrepreneurial education will show higher opportunity recognition than students with lesser entrepreneurial education.

H2d. Management students with more entrepreneurial education will show higher entrepreneurial knowledge than students with lesser entrepreneurial education.

H2e. Management students with higher educational levels will show higher opportunity recognition than students with lesser education.

Human capital is the set of knowledge and skills obtained from education, training, and learning from prior work experience (Adner & Helfat, 2003; Badrinarayanan et al., 2019; Helfat & Martin, 2015; Martin & Bachrach, 2018). Business professionals with more work experience may show a more exact mental model of the key principles of various business environments (Gary & Wood, 2011). Management students' experience and learning may change their mental models (Jones et al, 2011). Differences in managerial career paths may produce differences in business professionals' human capital (Adner &

Helfat, 2003). More work experience may allow to management students develop various prototypes or exemplars to match market events (Baron, 2006). Through those various work experiences management students may increase their opportunity recognition (Felin & Zenger, 2009) and possibly their entrepreneurial knowledge. Business professionals' knowledge can be firm-specific (technologies, products, and processes) and industry-specific (competition, regulation, technology, and supply chain) (Åberg & Shen, 2020). There are at least, three factors associated with opportunity recognition: engagement in an active search, alertness, and prior knowledge of a market, industry, or customer (Baron, 2006). Management students acquire knowledge about future events, alternatives, and consequences of those alternatives through prior work experiences involving learning by doing (Adner & Helfat, 2003).

H3a. Management students with more work experience may show more opportunity recognition.

H3b. Management students with more work experience may show more entrepreneurial knowledge.

Business professionals' attention to different business issues may depend on their human capital (knowledge, skills, education, and experience) (Helfat & Martin, 2015). Human capital is obtained from education, training, and learning from prior work experience, so differences in managerial career paths may produce differences in individuals' human capital including entrepreneurial education (Adner & Helfat, 2003; Badrinarayanan et al., 2019; Helfat & Martin, 2015; Martin & Bachrach, 2018; Wiramihardja et al, 2022). Prior market knowledge influences opportunity recognition (Baron, 2006). Mental models are used not only to reason but to filter and store new information (Jones *et al*, 2011). Some management students and no others can recognize

the connections or patterns between seemingly unrelated events because they may possess cognitive structures such as prototypes or exemplars that they can use to match with events (Baron, 2006). Knowledge structures or mental models may play a role in the management students' cognitive representation of the external reality influencing their biases and heuristics to anticipate market changes and make decisions (Helfat & Martin, 2015; Helfat & Peteraf, 2015).

H4a. Management students with different functional specializations show different levels of opportunity recognition.

H4b. Management students with different functional specializations show different levels of entrepreneurial knowledge.

Method

The present study adopted a quantitative and cross-sectional design to gather data from management students with some work experience via a self-applied questionnaire on the Qualtrics™ platform. The collected data were analyzed using SPSS.

Compliance with Ethical Standards

The author declares that no funding was received.

The author declares to have no conflict of interest.

The participants receive and accept informed consent.

Sample

The sample encompasses professionals and technicians who are currently studying engineering as a second profession and post-degree students in a Chilean university. They

were invited to answer the survey through university formal authorities in 2023. There is not any incentive.

I obtained 425 total responses. All incomplete surveys were erased. After a clean process, 352 responses remained. Respondents were 273 (77.6%) male and 79 (22.4%) female, with an average age of 35.9 years. Their education level included 77 (21.9%) technicians, 228 (64.8%) at university, and 47 (13.4%) post-degree. They have an average tenure of 5.67 years and 13.54 years of work experience. 47.4% have a functional specialization in operations, 13.4% in administration, 11.4 % in IT, 9.7% in logistics, and almost 3% each in account, marketing, human resources, R&D, and finances.

Survey

The survey encompasses demographic (age, gender), educational level (technician, university, post-degree), tenure (years), work experience (years), functional specialization (marketing, finance, operations, human resources, logistics, R&D, accountability, and IT), and entrepreneurship experience (Yes/No) questions.

A five-point Likert scale (strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree) was developed. Questions of opportunity recognition (OR) are obtained from Ozgen & Baron (2007), and Alim et al. (2022). Those scales were selected because they allow the measure of opportunity recognition competency as the ability to find new ideas i.e., a cognitive process different from cognitive structure or mental model. To facilitate the analysis one of the Ozgen and Baron (2007) scale was deleted because it is built in negative form. So, in this work opportunity recognition is operationally defined as self-perceived capabilities to recognize opportunities.

Questions about Entrepreneurial Education (EE) are obtained from De la Cruz del Rio-Rama et al., (2016) also in Wiramihardja et al., (2022). Those scales were selected because their questions are redacted to be responded to by students like this work's sample. So, in this work, entrepreneurial education is operationally defined as the opinion about the role of educational institutions in promoting entrepreneurship.

Questions of Entrepreneurial Knowledge (EK) are obtained from Roxas (2014) also in Wiramihardja et al, (2022). Those scales were selected because their questions are built to be responded to by students like the sample in this work. So, in this work, entrepreneurial knowledge is operationally defined as self-reported entrepreneurial knowledge stored.

The questions are translated into Spanish using Brislin's (1970) method. EE, EK, and OR questions used are numbered in Table 14.

Table 15

Items selected for EE, EK, and OR

Entrepreneurial Education. (Del Rio-Rama et al, 2016)

EE 1– My actual studies give me essential knowledge and tools to create my own company.

EE 2 – Institutes would have to support company creation by students.

EE 3 – I would like to have more subjects in my institute about entrepreneurship.

EE 4 – The function to encourage entrepreneurship belongs to the institutes through education

Entrepreneurial Knowledge (Roxas, 2014)

EK 1 – I have the knowledge required to start a business.

EK 2 – The institute has helped me with getting the knowledge required to start a business

EK 3 – I have sufficient knowledge about specific training for young entrepreneurs

Opportunity Recognition (OR) (Ozgen and Baron, 2007)

"Seeing" potential new venture opportunities does not come very naturally to me

OR_1 - While going about routine day-to-day activities, I see potential new venture ideas all around me.

OR_2 - Recognizing good opportunity usually requires experience in a specific industry or marketplace.

OR_3 - Discussions with my family or friends can help me to recognize business opportunities.

OR_4 - I am alert or sensitive toward new venture opportunities. (Alim et al., 2022)

Variables

The dependent variable was OR. The independent variables were entrepreneurship experience, EE, and EK. Other variables were gender, age (years), tenure (years), work experience (years), educational level (technician, university, post-degree), and functional specialization.

Data analysis

I evaluate the hypothesis by making first an exploratory factor analysis to validate the EE, EK, and OR measures. Principal component analysis was utilized for factor extraction, and the Varimax rotation method was used to transform the final factor solution into a simple solution for interpretation. Second, I made regressions between OR, EE, and EK, and each continuous variable i.e., age, tenure, and work experience. Finally, I made an ANOVA analysis to determine the significance level of the differences in the mean of the OR and EK constructs for educational level and functional specialization variables and T-students for the dichotomic entrepreneurship experience variable.

Results

In the next lines, I describe the results and more relevant tables. The complete analysis is in Appendix B.

Regarding Entrepreneurial Education (EE), the initial solution showed items with low factor loading so, I decided to erase them. I obtained a unidimensional construct (Table 15) with a Cronbach's alfa of .709.

Table 16

Factorial Matrix [a]

	Factor 1
EE_2 – Institutes would have to support company creation by students.	,602
EE_3 – I would like to have more subjects in my institute about entrepreneurship	,692
EE_4 – The function to encourage entrepreneurship belongs to the institutes through education	,719

Extraction Method: Maximum verisimilitude.
a. 1 factor extracted. Required 4 iterations.

I validated the EE construct using the Netemeyer et al (2003) recommendations. So, in this case, the convergent validity is accepted when inter-item correlations are significant (Table 16) despite the low correlations between EE_2, EE_3, and EE_2 and EE_4. Also, the discriminant validity is accepted when the inter-item partial correlations controlled by the mean of the construct are not significant (Table 17).

Table 17

Correlations EE

		EE_2	EE_3	EE_4
EE_2	Pearson Correlation	1	,417**	,433**
	Sig. (bilateral)		,000	,000
	N	352	352	352
EE_3	Pearson Correlation	,417**	1	,498**
	Sig. (bilateral)	,000		,000
	N	352	352	352
EE_4	Pearson Correlation	,433**	,498**	1
	Sig. (bilateral)	,000	,000	
	N	352	352	352

**. Significant correlation at level 0,01 (bilateral).

Table 18

Partial Correlations EE

			EE_2	EE_3	EE_4
EE_mean	EE_2	Pearson Correlation	1,000	-,531	-,557
		Sig. (bilateral)		,000	,000
		N	0	349	349
	EE_3	Pearson Correlation	-,531	1,000	-,408
		Sig. (bilateral)	,000		,000
		N	349	0	349
	EE_4	Pearson Correlation	-,557	-,408	1,000
		Sig. (bilateral)	,000	,000	
		N	349	349	0

Regarding Entrepreneurial Knowledge (EK), the initial solution shows items with low factor loading so, I decided to erase them. I obtained a unidimensional construct (Table 18) with a Cronbach's alfa of .708.

Table 19

Factorial Matrix

	Factor 1
EK_1 – I have the knowledge required to start a business	,622
EK_2 – The institute has helped me with getting the knowledge required to start a business	,728
EK_3 – I have sufficient knowledge about specific training for young entrepreneurs	,658

Extraction Method: Maximum verisimilitude.
a. 1 factor extracted. Required 3 iterations.

I validated the measures with the recommendations of Netemeyer et al, (2003) So, in this case, the convergent validity is accepted when inter-item correlations are significant (Table 19) despite the low correlations between EK_1, EK_2, and EK_1 and EK_3. Also, the discriminant validity is accepted when the inter-item partial correlations controlled by the mean of the construct are not significant (Table 20).

Table 20

Correlations EK

		EK_1	EK_2	EK_3
EK_1	Pearson Correlation	1	,453**	,409**
	Sig. (bilateral)		,000	,000
	N	352	352	352
EK_2	Pearson Correlation	,453**	1	,479**
	Sig. (bilateral)	,000		,000
	N	352	352	352
EK_3	Pearson Correlation	,409**	,479**	1
	Sig. (bilateral)	,000	,000	
	N	352	352	352

**. Significant correlation at level 0,01 (bilateral).

Table 21

Partial Correlations EK

Control Variables			EK_1	EK_2	EK_3
EK_mean	EK_1	Pearson Correlation	1,000	-,463	-,541
		Sig. (bilateral)		,000	,000
		gl	0	349	349
	EK_2	Pearson Correlation	-,463	1,000	-,494
		Sig. (bilateral)	,000		,000
		Gl	349	0	349
	EK_3	Pearson Correlation	-,541	-,494	1,000
		Sig. (bilateral)	,000	,000	
		gl	349	349	0

Regarding Opportunity Recognition (OR), the initial solution shows items with low factor loading so, I decided to erase them. I obtained a unidimensional construct (Table 21) with a Cronbach's alfa of .677.

Table 22

Factorial Matrix

	Factor 1
OR_1 - While going about routine day-to-day activities, I see potential new venture ideas all around me	,615
OR_3 - Discussions with my family or friends can help me to recognize business opportunities	,510
OR_4 - I am alert or sensitive toward new venture opportunities	,816

Extraction Method: Maximum verisimilitude.

a. 1 factor extracted. Required 4 iterations.

I validated the measures with the recommendations of Netemeyer et al, (2003) So, in this case, the convergent validity is accepted when inter-item correlations are significant (Table 22) despite the low correlations between OR_1 and OR_3, and OR_3 and OR_4. Also, the discriminant validity is accepted when the inter-item partial correlations controlled by the mean of the construct are not significant (Table 23).

Table 23

Correlations OR

		OR_1	OR_3	OR_4
OR_1	Pearson Correlation	1	,314**	,502**
	Sig. (bilateral)		,000	,000
	N	352	352	352
OR_3	Pearson Correlation	,314**	1	,416**
	Sig. (bilateral)	,000		,000
	N	352	352	352
OR_4	Pearson Correlation	,502**	,416**	1
	Sig. (bilateral)	,000	,000	
	N	352	352	352

**. Significant correlation at level 0,01 (bilateral).

Table 24

Partial Correlations OR

Control Variables			OR_1	OR_3	OR_4
OR_mean	OR_1	Pearson Correlation	1,000	-,578	-,481
		Sig. (bilateral)		,000	,000
		gl	0	349	349
	OR_3	Pearson Correlation	-,578	1,000	-,437
		Sig. (bilateral)	,000		,000
		gl	349	0	349
	OR_4	Pearson Correlation	-,481	-,437	1,000
		Sig. (bilateral)	,000	,000	
		gl	349	349	0

A correlation between EE and EK does not show significance. Both correlations between EE and OR and EK and OR results are significant. The correlation between EE and OR shows a 95% confidence interval from .215 to .441. The correlation between EK and OR shows a 95% confidence interval moving from .311 to .497. So, in both cases according to Anderson & Gerbing (1988) given the interval does not cover the value 1 the constructs are different.

Regressions show a significant positive relation between EE or EK, and OR acts as an EE and EK predictive validation (Tables 24 and 25).

Table 25

Predictive Validity EE

Model	Coef. no standard		Coefficients typification	t	Sig.	Confidence Interval 95,0% for B	
	B	Error típ.	Beta			Limit inferior	Limit superior
1 (Constant)	2,492	,195		12,768	,000	2,108	2,876
EE_mean	,308	,047	,333	6,596	,000	,216	,400

a. Variable dependent: OR_mean

Table 26

Predictive Validity EK

Model	Coef. no standard		Coefficients typification	t	Sig.	Confidence Interval 95,0% for B	
	B	Error típ.	Beta			Limit inferior	Limit superior
1 (Constant)	2,680	,133		20,158	,000	2,419	2,942
EK_mean	,339	,040	,409	8,378	,000	,260	,419

a. Variable dependent: OR_mean

Regarding the hypotheses. Hypotheses 1a and 1b are about the relationship between age and OR and EK. Regressions show no significant relationship between age and OR but

show a significant relationship between age and EK (Table 26). Hypotheses 1c and 1d are about the relationship between tenure and OR and EK. Both are rejected.

Table 27

EK y age

Model		Coef. standard		no Coefficients typification	t	Sig.	Confidence Interval 95,0% for B	
		B	Error típ.	Beta			Limit inferior	Limit superior
1	(Constant)	2,579	,198		13,024	,000	2,189	2,968
	age	,017	,005	,165	3,124	,002	,006	,027

a. Variable dependent: EK_mean

Hypothesis 2a is about the relationship between entrepreneurship experience and OR. I made a T-student test for the dichotomic item (Table 27). The result is significant for mean differences (table 28).

Table 28

Descriptives Entrepreneurial experience and OR

entrep_exp		N	Mean	Deviation type	Mean error type.
OR_mean	Yes	166	3,9859	,61118	,04744
	No	186	3,5591	,65971	,04837

Table 29

T-student entrepreneurial experience for OR

		Levene test		T-test						Confidence interval of 95% for the difference	
		F	Sig.	t	gl	Sig. (bilateral)	Means Difference	Difference Error típ.		Inferior	Superior
OR_mean	Assuming equal variance	4,745	,030	6,272	350	,000	,42680	,06805		,29297	,56063
	No Assuming equal variance			6,300	349,504	,000	,42680	,06775		,29355	,56005

Hypothesis 2b is about the relationship between entrepreneurship experience and EK. I made a T-student test for the dichotomic item (Table 29). The result is significant for differences in mean (Table 30).

Table 30

Descriptives Entrepreneurship experience and EK

entrep_exp		N	Media	Deviation type.	Mean Error type.
EK_mean	Yes	166	3,3494	,77051	,05980
	No	186	3,0341	,81468	,05974

Table 31

T-student entrepreneurship experience for EK

		Levene test		T-test					Confidence interval of 95% for the difference	
		F	Sig.	t	gl	Sig. (bilateral)	Means Difference	Difference Error típ.	Inferior	Superior
EK_mean	Assuming equal variance	1,872	,172	3,719	350	,000	,31535	,08479	,14858	,48212
	No Assuming equal variance			3,731	348,811	,000	,31535	,08453	,14910	,48159

Hypothesis 2c is about the relationship between EE and OR. Table 24 shows the significant relationship between them.

Hypothesis 2d is about the relationship between EE and EK, table 32 shows a positive and significant relationship (p < .05). Given there is a positive relationship between EK and OR (table 26) a regression by stages was made and the result may suggest a partial mediation from EE on EK and OR relationship (table 33). Hypothesis 2e is about the relationship between educational level and OR, an ANOVA shows that both Levene and ANOVA tests were not significant.

Table 32

EE y EK

Model	Coef. no standard		Coefficients typification	t	Sig.	Confidence Interval 95,0% for B

	B	Error típ.	Beta			Limit inferior	Limit superior
1 (Constante)	2,703	,248		10,901	,000	2,215	3,191
EE_mean	,116	,059	,104	1,964	,050	,000	,233

a. Variable dependent: EK_mean

Table 33

Partial Mediation EK

Model	Coef. no standard		Coefficients typification	t	Sig.	Confidence Interval 95,0% for B	
	B	Error típ.	Beta			Límite inferior	Límite superior
1 (Constante)	2,680	,133		20,158	,000	2,419	2,942
EK_mean	,339	,040	,409	8,378	,000	,260	,419
2 (Constante)	1,644	,207		7,923	,000	1,236	2,052
EK_mean	,314	,039	,378	8,123	,000	,238	,390
EE_mean	,271	,043	,293	6,295	,000	,187	,356

a. Variable dependent: OR_mean

Hypotheses 3a and 3b are about the relationship between work experiences and OR and EK. Both regressions are not significant. Hypotheses 4a and 4b are about the relationship between different functional specializations and EK and OR, in both, the ANOVA shows that both Levene and ANOVA tests were not significant.

In summary, I found a unidimensional construct for each of the OR, EE, and EK constructs. Both the EE and EK have a positive significant relationship with OR. There is a significant positive relationship between age and EK. Also, for both the OR and EK there is a significant difference of mean between those with an entrepreneurship experience and

those without it. There is a positive and significant relationship between the EE and EK and may have a partial mediation between them.

On the other hand, age, tenure, and work experience do not have a significant relationship with OR. Also, educational level and functional specialization do not have a relationship with OR. Tenure, work experience, and functional specialization do not have a significant relationship with EK.

Discussion

Regarding the results, firstly I found three unidimensional constructs OR, EE, and EK. The OR is influenced positively by EE and EK. Questions about EE are focused on the respondent's opinion about the role of educational institutions in promoting entrepreneurship. Questions about EK are focused on respondents' self-reports about the entrepreneurial knowledge that they have stored. Finally, questions about OR are focused on self-perceived capabilities to recognize opportunities.

We know that entrepreneurial education encompasses the procedures for imparting, developing, and shaping enterprising skills, and may show a positive influence on opportunity recognition (Wiramihardja et al., 2022). Also, entrepreneurial knowledge is human capital about planning, financing, management, and regulations for start-ups that may be positively related to entrepreneurial intentions (Vafaei-Zadeh et al., 2022). So, a positive relationship between EE and EK with OR constructs could be expected.

Management students build and rebuild their mental model through their experiences and learning (Jones et al, 2011). The knowledge structures or mental models may play a role in the management students' cognitive representation of an external reality

influencing their biases and heuristics (Helfat & Martin, 2015; Helfat & Peteraf, 2015). EK is a type of human capital for planning, financing, management, and regulations for start-ups (Vafaei-Zadeh et al., 2022). So, the positive relationship between age and EK can be explained by the management students' experiences. However, no significant relationship between work experience and EK could point out that the entrepreneurial mindset depends on more diverse experiences than just working.

The entrepreneurial mindset is characterized by a heuristic-based decision logic that allows a quick decision (Naumann, 2017). So, is likely that the entrepreneurship experience allows to management students develop an entrepreneurial mindset that may explain its positive influence on OR and EK. The management students' entrepreneurship experiences allow them to develop a type of human capital as EK about planning, financing, management, and regulations (Vafaei-Zadeh et al., 2022). The knowledge stored may increase the management students' self-perception of their opportunity recognition capabilities (OR).

The positive relation between EE and EK may respond to entrepreneurial knowledge stored by respondents from an institutional entrepreneurial education received by them which reinforced their opinion about the role of educational institutions in promoting entrepreneurship. However, the possible partial mediation effect from EE on the EK and OR relationship deserves second sight. If my entrepreneurial knowledge comes from an entrepreneurship experience then that knowledge may enhance my self-perception about my opportunity recognition capabilities, but if I consider especially important the formal entrepreneurial education and I do not receive it, then that may reduce my self-confidence in my entrepreneurial knowledge stored reducing my opportunity recognition capability self-perception.

There is no significant relationship between age, tenure, educational level, functional specialization, and work experience with OR. We know that individuals' opportunity recognition depends on the structural alignment of outside world events and mental models of situations as prototypes and exemplars stored in their memory (Baron, 2006; Grégoire et al, 2010; Santos et al, 2015). So, the flow of time, formal education, or specialization is not enough for management students can build and store the specific mental models capable of matching with market events. Also, management students require learning (Jones et al., 2011; van Ments & Treur, 2021). Management students need time to learn through observation or instruction to change their mental model (van Ments & Treur, 2021), and increase their human capital (Adner & Helfat, 2003; Badrinarayanan et al., 2018; Martin & Bachrach, 2018).

Finally, there is no significant relationship between EK and tenure, work experience, and functional specialization. EK is a specific type of human capital about the person's capacity to handle entrepreneurial aspects such as planning, financing, management, and regulations for start-ups (Vafaei-Zadeh et al., 2022). So, the flow of time like tenure, work experience, or experiences from the managerial specialization, is not enough to develop EK, specific management students' experiences are required to build the mental models useful to structural alignment with market events (Baron, 2006). Literature supports the idea that entrepreneurship can be taught, however, the question that remains is how i.e., what teaching and learning approaches are more effective (Abd Rahim et al, 2021; Kuratko, 2005; Lindberg et al, 2017).

Conclusion

I try to expand the opportunity recognition literature through the mental model theory. I sampled professionals and technicians who are currently studying engineering as a second profession and engineering post-degree students. Through a self-applied survey, I measured entrepreneurship experience and the level of entrepreneurial knowledge (EK), entrepreneurial education (EE), and opportunity recognition (OR) operationalized variables. Also, I related them with management students' age, work experiences, tenure, educational level, and functional specialization.

Exploratory factor analysis shows that EK, EE, and OR constructs are unidimensional and between them, there are significant positive relationships and a possible partial mediation from EE on the EK and OR relationship. Also, show a positive relationship between EK and age and a significant relationship with work experience. There is a significant positive relationship between entrepreneurship experience and OR and EK. Results show no significant relationship between age, tenure, educational level, functional specialization, and work experience with OR. Finally, there is no significant relationship between tenure, work experience, and functional specialization with EK.

In summary, time may be enough to build mental models explaining the positive effect on management students' entrepreneurial knowledge, but opportunity recognition entails that the content of the management students' mental models should be more specific such as prototypes or exemplars obtained from entrepreneurial experiences or learning to match with market failures that they can exploit.

This work has limitations. First, the sample is formed only by management students with work experience. Future research should focus on managers and entrepreneurs

particularly to measure their level of OR versus their effective sensing opportunities. Second the survey, the items allows only a superficial exploration, future research requires new items more specifically associated with entrepreneurial management. Finally, the result may suggest a partial mediation from EE on the EK and OR relationship, but future research is required to explore it.

This work makes a theoretical contribution to strategic management literature using the mental model theory to highlight the important relationship between cognitive structures such as EK and EE, and OR capability. Also, exploring some factors that may influence that relationship. The empirical data illustrated the theoretical model of the relationship between cognitive processes and structures developed in prior theoretical papers and explored some factors that may influence that relationship.

The managerial implications point to understanding the differences between the development of management students' mental models by the flow of time and the management students' capability to recognize a business opportunity which may depend more on their mental models such as exemplars and prototypes.

Chapter 5: Conclusion

Summarizing Chapter 2

Through an integrated review based on managerial cognition capabilities, pattern recognition, structural alignment, and mental model theories, I propose a non-linear opportunity recognition model. In summary, management students who pay attention to changes in the environment and can perceive the patterns correctly could recognize the opportunities behind market failures. The management students' mental models define what specific changes will be selected to attend, what structural alignment will be made to build the patterns, and finally what specific course of action will be taken to introduce new or improved supply-demand combinations. At the same time cognitive processes (attention, categorization, and perception) can trigger changes in student's mental models by assimilation and accommodation. I make some inferences in the entrepreneurial education domain.

Summarizing Chapter 3

I made an empirical paper to understand the relationship between management students' alertness and opportunity recognition capability. I sampled professionals and technicians who are currently studying engineering as a second profession and engineering post-degree students. Through a self-applied survey, I measured the level of alertness (AL) and opportunities recognition (OR), and its relationship with the different management students' variables such as age, work experiences, tenure, educational level, and functional specialization. Exploratory factor analysis shows that both constructs AL and OR are unidimensional, and different, and between them, there is a significant positive relationship. Also, shows that there is a significant positive relationship between AL and respondents' age, tenure, work experience, and post-degree. There is a significant difference in the level of OR only between respondents with functional specialization in operation, logistics, and IT. Factors that affect AL do not influence OR. This work contributes to strategic management literature exploring the effect of management students' mental models on their opportunity recognition capabilities. The empirical data are obtained from a reasonable sample of management students, so the results can be sustained it. The practical contribution tries to understand some factors that could influence management students' opportunity recognition capabilities and underpin entrepreneurial education training programs to enhance them.

Summarizing Chapter 4

I made another empirical paper to understand the effect of management students' mental model proxies such as entrepreneurship experiences, entrepreneurial knowledge (EK), and entrepreneurial education (EE) on opportunity recognition capability (OR). I sampled professionals and technicians who are currently studying engineering as a second profession and engineering post-degree students. Through a self-applied survey, I measured the OR, the mental model proxies, and other variables such as age, work experiences, tenure, educational level, and functional specialization. Exploratory factor analysis shows that EK, EE, and OR constructs are unidimensional and between them, there are significant positive relationships and a possible partial mediation from EE on the EK and OR relationship. Also, show a positive relationship between EK and age and a significant relationship with work experience. There is a significant positive relationship between entrepreneurship experience and OR and EK. Results show no significant relationship between age, tenure, educational level, functional specialization, and work experience with OR. Finally, there is no significant relationship between tenure, work experience, and functional specialization with EK. This work makes a theoretical contribution to strategic management literature using the mental model theory to highlight the important relationship between cognitive structures such as EK and EE, and OR capability. Also, exploring some factors that may influence that relationship. The empirical data illustrated the theoretical model of the relationship between cognitive processes and structures developed in prior theoretical papers and explored some factors that may influence that relationship.

Research objectives

Regarding the research objectives. The first specific objective was to make an integrated review of the opportunity recognition literature. Using concepts of managerial cognitive capabilities, pattern recognition, structural alignment, and mental model theories I made a non-linear model of the opportunity recognition process highlighting the critical and recursive relationship between cognitive processes (Attention, Categorization, and Perception) and cognitive structures (Mental Models).

The second specific objective was to make an empirical exploration of management students' cognitive processes as alertness (AL) on their opportunity recognition capabilities (OR). Also, I measured the role of other context variables such as age, tenure, work experience, educational level, and functional specialization. Results show that AL and OR are unidimensional and different and that AL has a significant positive effect on OR. Also, show that the factors that affect AL (age, tenure, work experience, and post-degree) do not influence OR.

The third specific objective was to explore the effect of management students' cognitive structures as entrepreneurial mental models on their opportunity recognition capabilities. I used three mental model proxies: entrepreneurship experiences, entrepreneurial education (EE), and entrepreneurial knowledge (EK). Also, I measured age, tenure, work experience, educational level, and functional specialization and its effects on the management students' opportunity recognition capability (OR). The results show that EK, EE, and OR constructs are unidimensional and both EK and EE show a significant positive effect on OR. Also, shows a significant positive effect of entrepreneurship experience on OR and EK. Finally, results show again, that there is no significant

relationship between age, tenure, educational level, functional specialization, and work experience with OR.

Empirical works show that there are significant relationships between self-perception of alertness (i.e., cognitive process) and self-perception of opportunities capabilities (i.e., cognitive process) an idea already predicted by Helfat and Peteraf (2015). Also, shows that there are significant relationships between self-perception of opportunities capabilities (i.e., cognitive process) and mental model proxies (i.e., cognitive structures) which is related to my proposed theoretical model.

Improving the management students' opportunities recognition capabilities may imply developing an entrepreneurial mindset formed by mental models about the market environment and possible responses to changes. Time may be enough to build mental models explaining the positive effect on individuals' alertness, but recognizing opportunities requires specific mental model contents. So, higher education institutions are required to develop broad entrepreneurial education programs so the students can build and change entrepreneurial mental models as prototypes and exemplars.

Those mental model contents about the market, customers, competitors, trends, and changes may explain why some individuals, but not others, can identify opportunities. An entrepreneurial mindset is not a necessary result of age, work experience, tenure, education, or functional specialization.

Theoretical Implications

Regarding the theoretical implications, the Opportunity Recognition non-linear model highlights the recursive interactions between cognitive structures and cognitive processes in an entrepreneurial mindset. Specifically, management students' mental models

influence their attention, categorization, and perception processes, and these cognitive processes can retrieve, form, or change those mental models. To my knowledge, those relationships have been not explored neither in strategic management or entrepreneurship literature. So, in the model, every contact point between constructs is a research guide.

The above was exemplified through both the positive relationship between alertness and opportunity recognition, and the positive relationship between entrepreneurial mental model proxies (entrepreneurial knowledge, entrepreneurial education, and entrepreneurship experience) and opportunity recognition. So, the theoretical model contains factors or constructs that explain the opportunity recognition phenomenon and describe the relationship between them. Also, I described the theoretical assumption underlying the theoretical model (i.e., managerial cognitive capabilities, pattern recognition, structural alignment, and mental model theories). The model allows us to evaluate some relationship between those factors. In Whetten's (1989) words I described the What, How, and Why, but the questions about Who, When, and Where (i.e., the range of the theory) remain unanswered, still.

In this work opportunity recognition as a phenomenon is referred specifically to individuals facing changes in their business environment. If the changes create a market disequilibrium, then managers or entrepreneurs should exploit it. So, the theoretical model cannot be applied to stable markets or changes that do not create market disequilibrium. Logically this theoretical model can be more useful to research in emergent than developed economies.

Managerial Implications

Regarding the managerial implications, firstly this work shows that the managerial recruitment criteria must be adapted in emergent economies. Age, educational level, work experience, functional specialization, and tenure could be insufficient. More relevant are entrepreneurship experiences and entrepreneurial knowledge or education as antecedents to candidates' capability to recognize business opportunities.

Second, especially in emergent economies, management students must be educated in entrepreneurship to form or change their mental models enhancing their human capital. So, entrepreneurial education and training should be conducted according to the different students' mental models and profiles (Zhang et al, 2021). The formation must encompass both decision-making and feedback from the consequences of choice because they produce experiences possible to integrate into management students' mental models. So, case analysis and managerial games are better methods than classical instruction. Entrepreneurial education cannot be focused on starting a business it can be broadly defined to improve the management students' ability to think creatively and innovatively (i.e., entrepreneurial thinking) including emotional management skills (Foo, 2009; Schuelke-Leech, 2020).

Growing market and business pressure raise the need for business professionals with entrepreneurial knowledge and skills; however, the traditional curriculum does not expose management students to entrepreneurial education (Rodriguez et al, 2015). Curriculum shapes the person's understanding of problems, and the information and procedures to solve those problems (Gruber et al, 2012). In literature entrepreneurial education has been related to entrepreneurial mindset (Naumann, 2017).

The formation of an entrepreneurial mindset is like the construction of a social identity because both constructs comprise knowledge, values, beliefs, and attitudes that refer to oneself as an entrepreneur so, fostering an entrepreneurial mindset in management students is more a change task whom they think they are i.e., their entrepreneur mental model or entrepreneur mental portrait (Korte, 2018; Zhang et al, 2021).

The mental model of entrepreneurs has been the focus of entrepreneurial education and training (Zhang et al, 2021). Entrepreneurship education has implicitly followed the constructivist educational model which supposes that human build knowledge structures that evolve constantly and that the new knowledge force a change in how we organize the information content, so is important to understand the students' deep cognitive change that is underway (Krueger, 2007).

Limitations and future research

This work has limitations. First, I measured the relationship between OR and cognitive structures (MM) and one cognitive process (AL). Future research could measure the relationship between the remaining processes (categorization and perception) and OR, and the relationship between cognitive structures and processes.

Second, the theoretical model uses as Output the managerial dynamic capability of sensing but there are two additional managerial capabilities (i.e., seizing and reconfiguring) more important than sensing. Future research must enlarge the model to include all dynamic managerial capabilities.

Third, the investigation is developed only around management students. So, future research should focus on managers or entrepreneurs in emergent economies, especially small and medium firms which probably may face a more dynamic business environment.

Fourth, the surveys used mental model proxies and self-perception of opportunities recognition capabilities. Future research should include items reflecting real managers' mental models obtained by interview techniques, and real opportunities recognition capabilities.

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