3-2023

Exploring diversity and depth of knowledge, metacognition, and individual ambidexterity

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2023

Exploring Diversity and Depth of Knowledge, Metacognition, and Individual Ambidexterity

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Submitted to Lee Kong Chian School of Business
in partial fulfillment of the requirements for the
Degree of Doctor of Philosophy in Business
(General Management)

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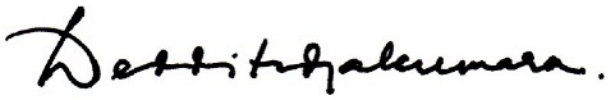
I hereby declare that this PhD dissertation is my original work and it has been written by me in its entirety.
I have duly acknowledged all the sources of information which have been used in this dissertation.

This PhD dissertation has also not been submitted for any degree in any university previously.



Deddi Tedjakumara
30 March 2023

ABSTRACT

EXPLORING DIVERSITY AND DEPTH OF KNOWLEDGE, METACOGNITION, AND INDIVIDUAL AMBIDEXTERITY

Deddi Tedjakumara

Recent data show that the average lifespan of a company listed in the Standard and Poor's 500 (S&P 500) Index has declined from 32 years in 1965 to 21 years in 2020 (Clark, 2021), and it is estimated that 75% of the companies listed in the S&P 500 today will disappear from the list by 2027 (Hillenbrand, 2019). Organizational theory holds that for a company to be sustainable, it must strike a balance between exploring new possibilities and exploiting old certainties (March, 1991). The ability to manage the tension between exploration and exploitation is important at both organizational and individual levels (Gibson & Birkinshaw, 2004; Birkinshaw & Gupta, 2013)

Complementing previous studies on the antecedents of individual exploration and exploitation behavior, this study examines diversity of knowledge and depth of knowledge as antecedents to employee exploration and exploitation behaviors. It was also theorized that metacognition interacts with depth of knowledge and diversity of knowledge to predict individual exploration and exploitation behaviors.

Data (N = 414) were collected from participants randomly sampled from two large companies in Indonesia. Results indicated that exploration and exploitation behaviors were positively correlated with diversity of knowledge, depth of knowledge and metacognition. When metacognition, knowledge diversity, and knowledge depth were considered simultaneously, results indicated that only knowledge diversity and metacognition predicted exploration behavior. Also when simultaneously considering the predictors, only metacognition uniquely predicted exploitation behavior, whereas diversity and depth of knowledge did not.

Results did not support the hypothesized interactions between knowledge diversity, knowledge depth, and metacognition in predicting exploration and exploitation behaviors. However, exploratory analyses revealed that job complexity positively predicted exploration and exploitation behavior. These results provide insight into factors affecting exploration and exploitation. Results can be used to inform practitioners to develop or facilitate exploration and exploitation behaviors.

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ACKNOWLEDGEMENT

Writing this dissertation has been a significant intellectual journey for me. I am especially grateful to Professor **Gary J. Greguras**, who, as chair of the dissertation committee and supervisor, provided challenges, questions, and advice that fueled my thinking as a scholar and researcher, from the initial process of identifying the topic to the final defence. I would also like to thank **Michael R. Bashshur** (SMU) and **Michael A. Daniels** (UBC) on my dissertation committee, whose questions and suggestions during the proposal and final meeting opened up new and interesting avenues for further study. The process of forming this mindset was also underway in every class and seminar at the beginning of this program, and for that I would like to thank each professor who led these sessions.

There is no end to a journey without a beginning. As I recall the beginning of this journey, I thank **Dr. Phillip C. Zerrillo** for encouraging me to start this doctoral program that I had been putting off for 15 years. In the midst of a study, the Covid 19 pandemic presented me with many unexpected professional challenges that required my full attention. In this situation, I thank Professor **Shantanu Bhattacharya** who gave me the opportunity to complete this study. Considering this

journey, I also thank **Louise Hui** who provided me with excellent administrative support and guidance.

Outside of academics, I thank my wife, **Nia Lin**, who continues to support me, and my daughter, **Clara Emmanuella**, who always cheers me on. I owe a lot of time to them. I would also like to thank my mother **Noviani** and my younger sister **Nina** who have always encouraged me to complete this study.

I could not have completed this study without the support of my colleagues, especially the presence and availability of **Dr. Ida Juda Widjojo** and **M.A.E. Tatiana**, who represented me in my many tasks. For this, I thank them.

My study is about ambidexterity, and I will also deal with ambidexterity afterwards. How do I reconcile the scientific thinking I have acquired so far with the practical thinking I need for my work, that will be my next challenge and my next journey. With the same blessing and grace of God, I will walk through it.

DEDICATION

I dedicate this dissertation to my wife, **Nia Lin**,

and my only daughter, **Clara Emmanuella**.

Also to my mother, **Noviani**,

and my late father, **Tjandramulia**,

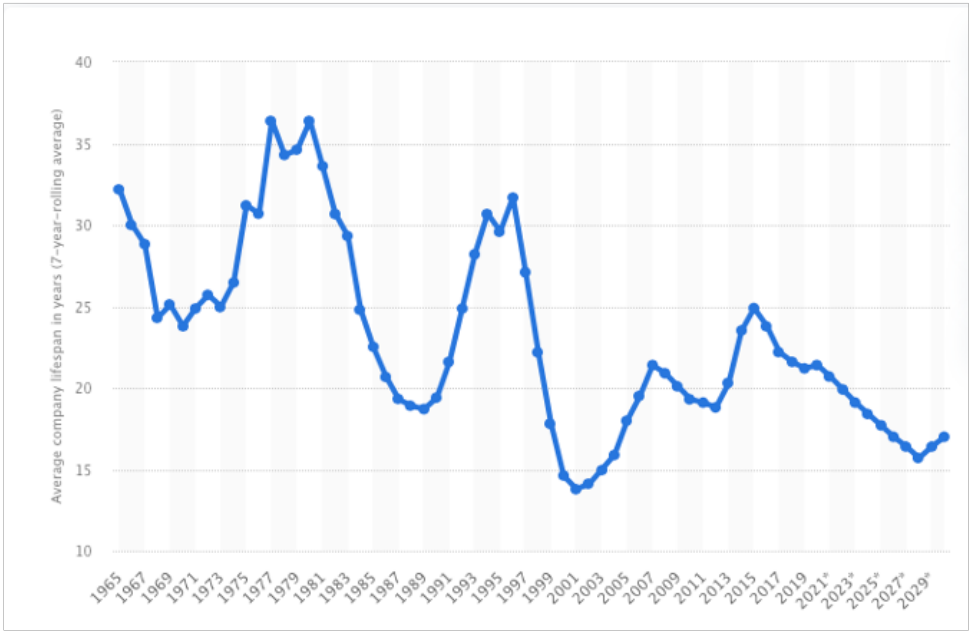
who was very happy when I started this program, but sadly passed away

when I had just finished a course (“Dad, I did it!”).

INTRODUCTION

Recent data show that the average lifespan of a company in the Standard and Poor's 500 (S&P 500) Index has fallen from 32 years in 1965 to 21 years in 2020 (Clark, 2021, see Figure 1). In fact, it is estimated that 75% of the companies listed in the S&P 500 today will disappear from the list by 2027 due to acquisitions, mergers, or bankruptcies (Hillenbrand, 2019). However, among the companies that disappear and are replaced, are those that have lasted a long time, some even more than 100 years (DeGeus, 2002), such as some automotive companies (Carrol Bigelow, Seidel, & Tsai., 1996).

Figure 1
Average company lifespan on Standard and Poor's 500 Index from 1965 to 2030, in years *(rolling-7-year average)*



Source: Statista (https://www.statista.com/statistics/1259275/average-company-lifespan/)

The question of how companies maintain their performance and competitive advantage is a question that has long been raised. This question has been addressed by various disciplines such as strategic management, history, organizational sociology, psychology, and economics (O'Reilly & Tushman, 2008). The concept of organizational dynamic capability, which is defined as the organization's ability to adapt, integrate, and reconfigure resources, has emerged from the strategic management perspective as a key element in organizational sustainability (Helfat & Peteraf., 2009; Teece, Pisano & Shuen, 1997). One specific capability affecting an organization's dynamic capabilities is organizational ambidexterity (O'Reilly & Tushman, 2008).

Organizational ambidexterity is an organizational capacity to have exploitation behavior (e.g. finding ideas for incremental innovation) and exploration behavior (e.g. finding possibility for discontinuous innovation) in a balanced manner (Tushman & O'Reilly, 1996; O'Reilly, & Tushman, 2011). Several studies indicate that organizational ambidexterity is an effective strategy for organizations to remain viable and successful in a changing business environment (Birkinshaw, Zimmermann & Raisch, 2016). For this reason, organizational ambidexterity (i.e., exploration and exploitation) can be viewed as a concrete form of an organizational dynamic capability (O'Reilly & Tushman, 2008)

THEORETICAL REVIEW AND HYPOTHESES

Exploration and Exploitation at Organizational Level

The concept of ambidexterity arose from the theory that to be sustainable, an organization must perform two important behaviors in a balanced manner, namely, exploration of new possibilities and exploitation of old certainties (March, 1991). Exploration is an activity characterized by search and experimentation of new courses of action, while exploitation is characterized by refinement of the existing course of action (March, 1991, Cheng & Van de Ven, 1996). With these different characteristics, exploration is an activity that (possibly) increases variation in performance, whereas exploitation is an activity that (possibly) decreases variation in performance (Burgelman, 2002).

Exploration and exploitation differ fundamentally not only in what they do, but also in the nature and logic underlying them, so that exploration and exploitation create a tension (e.g., experimentation in exploration may reduce the speed of refinement of existing skills) (He & Wong, 2004). Organizational ambidexterity, then, is basically the ability of an organization to manage the tension between exploration and exploitation. Managing this tension depends on the perspective of exploration and exploitation. If exploration and exploitation are viewed as mutually exclusive because one of the two factors is the limited resources in the particular organization (e.g., limitation of personnel, funds, capacity, etc.), then exploration and exploitation activities cannot occur simultaneously. At this point, a

compromise emerges as a strategy to manage this tension. With this tradeoff, ambidexterity can be seen as an attempt to reach an optimal equilibrium point between exploration and exploitation-a punctuated equilibrium (Gupta & Shalley, 2006). The sequential strategy, i.e., alternating between exploration and exploitation activities, is one of the derivations from this perspective (Chen & Katila, 2008)

Another perspective is to view exploration and exploitation as two independent activities that can occur simultaneously rather than alternating (e.g., Baum, Li, & Usher (2000); Beckman, Haunschild, & Phillips, 2004; Katila & Ahuja, 2002). This view is based on the understanding that these two activities may have different resources and are not shared (e.g., research to develop new products (exploration activities) is funded from investors' fresh funds, while improvements to existing processes to make them more efficient (exploitation activities) are funded from operating income). From this point of view, exploration and exploitation can occur simultaneously at the same time. The strategy of building autonomous units within the organization to conduct exploration and exploitation separately (Chen & Katila, 2008) is a derivative of this perspective. Whether exploration and exploitation are considered mutually exclusive or orthogonal depends on the level of analysis (i.e., individual versus group), how limited the available resources are, and how close the relationship between these resources is (Gupta & Shalley, 2006).

Exploration and Exploitation at Individual Level

As many constructs previously discussed at the organizational level have their counterparts at the individual level, the direction of studies and research on organizational ambidexterity is also shifting from the organizational level to the individual level (Pertusa-Ortega, Molina-Azorin, Tari, Pereira-Moliner, & Lopez-Gamero, 2021; Schilke, Hu & Helfat, 2018). Many studies suggest that organizational ambidexterity depends on the individuals involved in exploitation and exploration activities (Gibson & Birkinshaw, 2004; Birkinshaw & Gupta, 2013; Keller & Weibler, 2015; Raisch, Birkinshaw, Probst, & Tushman, 2009; Schnellbacher, Heidenreich, & Wald, 2019). Even in organizations with limited resources, individual ambidexterity may be directly reflected in organizational ambidexterity as the same employees are used for exploration and exploitation activities. Therefore, this study focuses on factors and conditions that may impact exploration and exploitation at the individual level.

At the organizational level, exploration and exploitation activities may be carried out by different individuals or teams (O'Reilly & Tushman, 2008), so in these loosely coupled domains exploration and exploitation become orthogonal (Gupta & Shalley, 2006) and may occur in parallel and simultaneously (Baum, et al., 2000; Beckman et al., 2004). At the individual level, resources are limited, so exploration and exploitation are mutually exclusive and therefore cannot be conducted simultaneously (Gupta & Shalley, 2006). Individual ability to engage in both exploitation and exploration activities in a single work role (Kauppila & Tempelaar, 2016, Mom, Bosch, & Volberda, 2009) does not imply that

exploration and exploitation occur simultaneously. The ability to balance exploration and exploitation behavior at the individual level is considered more of a punctuated equilibrium (Burgelman, 2002; Gupta & Shalley, 2006). Individual ambidexterity, then, is the behavioral orientation of individuals to engage in exploration and exploitation activities within a given time period (Mom et al, 2009) and to switch from one behavior to another, including the mindset underlying each behavior (Bledow, Frese, Anderson, Erez, & Farr, 2009).

If we use the analogy of ambidexterity in humans, the first requirement for an ambidextrous person is that they have a right hand and a left hand. The second requirement is that both hands function relatively equally well, and the last is that they can easily and smoothly switch between the right and left hands. Studies of individual ambidexterity have been consider the behavior, skills, or outcomes of exploration and exploitation behaviors (Awojide, Hodgkinson, & Ravishankar, 2018). Examination of the antecedents of the emergence of exploration and exploitation behavior is one of the studies that have been conducted in the context of individual ambidexterity (e.g., Mom, Bosch, & Volberda, 2007; Mom, Fourne, & Jansen, 2015). Studies have also been conducted on the ability to switch between these two behaviors (e.g., Bidmon & Lillegraven, 2020; Tempelaar & Rosenkranz, 2019) and on how individual ambidexterity affects performance (e.g., Mom et al., 2015; Schnellbacher & Heidenreich, 2020; Torres, Drago, & Aqueveque, 2015).

Studies on the relationship between individual ambidexterity and performance emphasize the importance of high exploration and high exploitation behavior

for individual innovative performance (Rosing & Zacher, 2016). For this reason, it is important to know more about how these two behaviors emerge and develop. This study focuses on the factors that influence the occurrence of exploration and exploitation behaviors.

Studies on investigating antecedents for exploratory and exploitative behaviors, primarily focus on the role of organizational systems, leadership practices, and psychological factors that support, motivate, and lead individuals to behave explorative and exploitative. (Tarba, Jansen, Mom, Raisch, & Lawton, 2020). For example, from a leadership perspective, delegation of authority and responsibility (Mathieu, Gilson, & Ruddy, 2006) and supportive leadership styles (Jansen, Kostopoulos, & Mihalache, 2016) influence the emergence of exploratory and exploitative behaviors at the individual and team level. Challenging goals positively affect motivation to innovate both incrementally (e.g., exploitation) and radically (e.g., exploration) innovation (Sitkin, See, Miller, Lawless, & Carton, 2011, Schnellbacher et.al., 2019). Other studies have found that openness to experience and conscientiousness also influence the occurrence of these two behaviors (Keller & Weibler, 2015).

Exploration and exploitation behaviors are essentially one learning process where the difference is only in the trajectory; exploitation is learning on an existing trajectory, while exploration is learning on a completely different trajectory than the existing one (Gupta & Shalley, 2006). But exploration and exploitation are not just about learning. Both exploration and exploitation refer

to the search for new ideas based on new (in exploration) or existing information (in exploitation). Therefore, the interplay between exploration and exploitation is learning and innovation (Benner & Tushman, 2002; He & Wong, 2004).

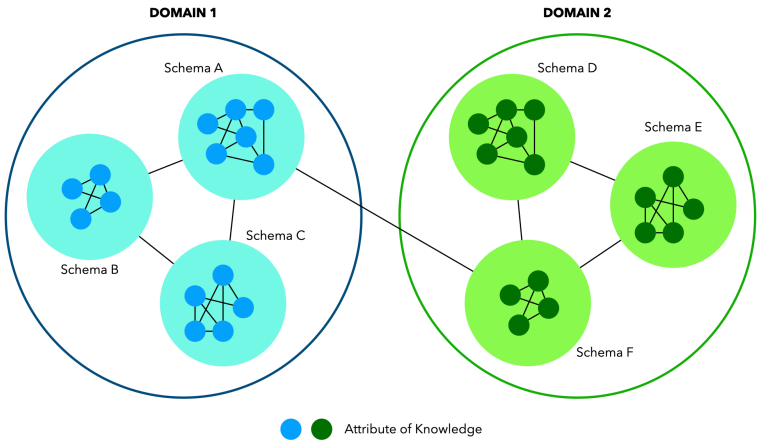
Some studies have shown that exploration and exploitation behaviors are influenced by cognitions (Bink & Marsh, 2000) and that exploratory and exploitative behaviors are elicited by different cognitive processes (Laureiro-Martinez, Brusoni, Canessa, & Zollo, 2015). Several studies show that knowledge (March, 1991; Raisch et al., 2009) and the source and domain of knowledge play a role in influencing exploitation and exploration behaviors. For example, research suggests that the horizontal and bottom-up flow of knowledge in the internal organization contributes significantly to exploration and exploitation behavior (Mom et al., 2007). Knowledge derived from relationships with external parties such as customers can also strengthen exploration and exploitation capabilities (Hoang & Rothaermel, 2010). Combining existing knowledge about customers with existing knowledge about technology improves exploitation (Danneels, 2002). Combining existing knowledge about technology with the search for new external market opportunities improves exploration (Gruber, MacMillan, & Thompson., 2012).

Combining or recombining knowledge is an important process in both exploration and exploitation; new combinations of dispersed knowledge for exploration and combinations of knowledge that already exists in a known way for exploitation (Taylor & Greve, 2006; Wadhwa & Kotha, 2006; Kiss, Libaers, Barr, Wang, & Zachary, 2020). Consequently, diversity of knowledge and depth of knowledge likely play a role in the emergence of these two behaviors.

Diversity and Depth of Knowledge

The knowledge structure consists of attributes, schemas, and domains (Dane, 2010 - see Figure 2). The determination of knowledge depth and diversity then depends on the knowledge domain and is related to the 'intensity' of relationships between schemas. In business practice, there is an opportunity to look at the knowledge domain from a practical approach, where the domain is viewed from a profession or occupation rather than from the epistemology of knowledge. Each profession has a body of knowledge, defined as the knowledge a person needs to effectively perform a job or profession.

Figure 2
Attribute, Scheme and Domain of Knowledge



Note. Adapted from "Reconsidering the trade-off between expertise and flexibility: A cognitive entrenchment perspective" by Dane, E., 2010, *Academy of Management Review*, *35*(4), p.581 (http://dx.doi.org/10.5465/AMR.2010.53502832). Copyright 2010.

Diversity of knowledge indicates the extent to which an individual has multiple knowledge domains (Mannucci & Yong, 2018) that are dispersed

(Frey, Luthje, & Haag., 2011). Assuming that employees have a limited and equal amount of time, it is likely that the number of schemas they have for each knowledge domain is less than that of employees who focus on only one domain (Teodoridis, Bikard, & Vakili, 2019). Also, the relationships between the schemas they possess may be fewer and weaker than for an expert. However, the weak relationship between these attributes and schemas provides people with the flexibility to accept new domains and schemas (Amabile, 1983; Dane, 2010), thus increasing their ability to explore new combinations (Perry-Smith & Shalley, 2003; Taylor & Greve, 2006) that deviate from the existing domain paradigm (De Dreu, Baas, & Nijstad, 2008). Studies on innovation show a positive relationship between diversity of knowledge and creative solutions (Gilson & Shalley, 2004) and amount of innovation (Frey et.al., 2011). Most novel innovations result from the combination of diverse knowledge (Leiponen & Helfat, 2010).

The more diverse an individual's knowledge, the greater the propensity to combine new knowledge than individuals who are less diverse (Nagle & Teodoridis, 2020). This is because diversity of knowledge contributes to learning something new more easily. New knowledge that is related to previous knowledge is easier to learn and understand (Carlile, 2004) because the new knowledge is assimilated with concepts that are already present in the previous cognitive structure (Cohen & Levinthal, 1990). Someone will understand something new more easily if it is his or her adjacent knowledge. Diversity of knowledge makes a person versatile and opens opportunities for more and more new knowledge that is easier to learn because these new

things are adjacent knowledge. The amount of this new knowledge also increases the chances for new combinations. Therefore, it is believed that diversity of knowledge positively influences exploration behavior.

H1a: Diversity of knowledge positively correlates with exploration behavior.

In addition, diversity of knowledge helps a person recognize existing conditions in a domain by adopting perspectives from other domains that the person already has, and it increases the possibility for the person to recognize new relationships within his or her existing schema (Perry-Smith, 2006; Taylor & Greve, 2006). This means that a person who has diverse knowledge can also use the attributes of existing knowledge to create a new schema in the existing knowledge domain, and this influences exploitation behavior. Research found that diverse knowledge is related to the number of incremental innovations (Frey et.al., 2011). The term incremental innovation is often used to refer to exploitation outcomes.

H1b: Diversity of knowledge positively correlates with exploitation behavior.

Depth of knowledge indicates the extent to which an individual has knowledge in a domain characterized by an increased understanding of the complexity of knowledge (Mannucci & Yong, 2018). An expert who has a great depth of knowledge not only has a large number of knowledge attributes (Fiske & Taylor, 1991) that are detailed and accurate (Dane, 2010),

but also has a rich ability to recognize the linkage between attributes (Fiske & Taylor, 1991). As a result, the number of schemas an expert possesses in a domain is often very large (Chi et.al., 1981; Dane, 2010). A deep understanding of the relationships among these attributes leads to new ideas (Gavetti & Levinthal, 2000). Deep knowledge of an industry, for example, is often required for radical innovations (Zahra & George, 2002), especially for innovations that occur as complex solutions to problems (Katz & Du Preez, 2008).

H2a: Depth of knowledge positively correlates with exploration behavior.

Depth of knowledge also helps a person use knowledge more efficiently (Levinthal & March, 1993; Mom et al., 2007) by recognizing and selecting which attribute relations or schemas are more promising to achieve good results (Haas & Ham , 2015; Taylor & Greve, 2006), which is one of the characteristics of exploitation behavior. The depth of knowledge increases the possibility of recombination between attributes and between schemas (Amabile, 1983; Dane, 2010, Mannucci & Yong, 2018), so they can produce something new.

Studies show that local recombination from existing schemas and attributes can also produce innovations (Kaplan & Vakili, 2015), which are often judged to be the result of exploitation behavior. Moreover, deep knowledge tends to promote involvement in existing and specialized activities

(Christensen, 2006), which can then lead to cognitive inertia in exploring other domains (Tripsas & Gavetti, 2000).

H2b: Depth of knowledge positively correlates with exploitation behavior.

Metacognition

Exploration and exploitation are processes of learning and innovation (Benner & Tushman, 2002; He & Wong, 2004). Learning and innovation involve cognitive processes; a mental process that is multifaceted and different for each situation and context. How one actively manages this cognitive process is what we know as the metacognitive process. Metacognition is "knowledge of one's cognitive processes or anything related to them" (Flavell, 1976, p.232). Metacognition plays a role in various cognitive processes such as learning, decision making, and other high-level cognitive processes (Son & Metcalfe, 2000), including the development of new ideas to solve problems in specific contexts (e.g., Erbas & Bas, 2015; Hargrove & Nietfeld, 2015).

Many researchers agree that metacognition is higher-order thinking that consists of two components: Knowledge about cognition and regulation of cognition (Brown, 1987; Harrison & Valin, 2018). Knowledge about cognition (often referred to as metacognitive knowledge) is a person's awareness of their cognitive abilities and cognitive processes (Flavell, 1979; Schraw & Moshman, 1995) or can also be defined as cognitive understanding of people, tasks, and strategies (Haynie, Shepherd, & Patzelt, 2012). Regulation of cognition (often

referred to as metacognitive skills) refers to how we direct and control our cognitive processes (Schraw & Moshman, 1995).

Metacognitive skills are not the same as intelligence (Sternberg, 1990), and the relationship between the two is very complex. Some studies suggest a positive correlation between fluid intelligence and metacognition (Sarac, Onder, & Karakelle, 2014; Van der Stel & Veenman, 2014), but even though metacognition is related to intelligence to some extent, it adds value over intelligence (Berger & Reid , 1989, Minnaert, 1996). Intelligence explains on average 10 percent of the unique variance in learning, while metacognition explains 17 percent of the unique variance and both explain 20 percent of the variance in learning across ages, types, and domains (Veenman, Wilhelm, & Beishuizen, 2004; Veenman & Spaans, 2005). In another study, intelligence was found to play a role in the initiation of metacognition but had no effect on the subsequent developmental process (Veenman & Beishuizen, 2004), such that an appropriate level of metacognition in their development can compensate for an individual's cognitive limitations (Veenman, Van Hout-Wolters, & Afflerbach, 2006).

Metacognition has been found to play an important role in the learning process in many studies. For example, metacognition has been found to be a predictor of academic success (Pintrich & De Groot, 1990) and accuracy of self appraisal of the capability (Dunning, Johnson, Ehrlinger, & Kruger., 2003, Kruger & Dunning, 1999) Metacognition also helps a person learn new information (Everson & Tobias, 1998).

Metacognition plays a role in innovation. Innovation is a problem-solving process that involves finding a new idea that is useful in a particular context (Stenberg & Lubart, 1999). This process is a cognitive process (Amabile, 1983) in which metacognition comes into play to select knowledge and adapt the work plan for implementation. (Jia, Li, & Cao., 2019).

The process of combining and recombining knowledge, which is an important activity in exploration and exploitation behaviors, is also a cognitive process. In this context, prior knowledge, be it the diversity or depth of knowledge, can be considered as input to the cognitive process of combining or recombining knowledge. The cognitive processes involved may vary depending on the context and situation. Metacognition is believed to play a very important role in cognitive processes to understand comprehensive and dynamic tasks and situations (Baron & Henry, 2010).

Exploration and exploitation are context dependent, so the cognitive processes required to exploit the diversity or depth of knowledge may vary. The extent to which individuals can direct and control cognitive processes affects the cognitive processes used for exploration and exploitation. Someone who has a higher level of metacognition likely will better recognize and use his or her own diversity or depth of knowledge. For example, someone who has a higher level of metacognition will be more skillful and flexible in choosing the cognitive process that leads to better results (. Metacognition influences the relationships between the diversity and depth of knowledge and exploration and exploitation

behavior, so higher metacognition strengthens the relationship between the diversity and depth of knowledge and exploration and exploitation behavior.

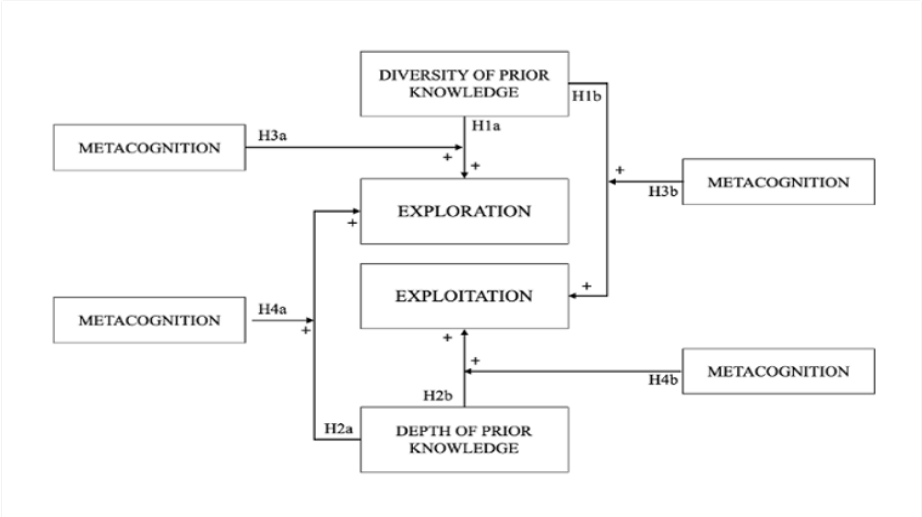
H3a: Metacognition interacts with diversity of knowledge, such that the relationship between diversity and exploration is strengthened when metacognition is higher.

H3b: Metacognition interacts with diversity of knowledge, such that the relationship between diversity and exploitation is strengthened when metacognition is higher.

H4a: Metacognition interacts with depth of knowledge such that the relationship between depth and exploration is strengthened when metacognition is higher.

H4b: Metacognition interacts with depth of knowledge, such that the relationship between depth and exploitation is strengthened when metacognition is higher.

Figure 3
Hypotheses Model



METHODS

RESPONDENT PROFILE

The sample for this survey was drawn from employees of two large holding companies in Indonesia. The first company is a multi-business company with 11 business units, including automotive, heavy machinery, mining, real estate, information technology, and financial services. The second company also has multiple business units, including pharmaceuticals, nutrition, distribution, and medical devices. Due to technological change, customer demand, intense competition in the economy, and regulation, these industries likely require exploration and exploitation activities within the company. These two business groups also employ a system of employee rotation between functions and between business units, so that employees of these two companies have the opportunity to acquire different functional and business skills.

Invitations for the online survey were distributed to employees of 35 subsidiaries, including the 2 holding companies themselves. The HR manager of each business unit selected 50 potential respondents by computer-generated random numbers from a list of full-time employees at the 'staff' level and above. The 'staff' level here is the level at which their work involves analysis in the problem-solving process. Therefore, their work likely has more to do with exploration and exploitation behavior. Next, HR managers distributed the survey invitations and survey via email. This survey was conducted anonymously. Responses were collected directly on the online survey platform.

Management was unable to view the responses of individual respondents. The total number of invitations was 1750. Responses to complete the survey: 629 employees, a response rate of 35.95%. After deleting participants who failed the attention check item, 414 valid responses were received (65.82% of the responses received and 23.65 % of those invited to participate).

The average age of respondents was 36.14 years (SD = 7.83), 61.3% of respondents were male and 35.8% were female, while 2.9% preferred not to provide information regarding gender. The average organizational tenure was 10.5 years (SD = 6.98). The average length of career was 13.6 years (SD = 7.64) and the average length of service in the current position was 4.57 years (SD = 3.72). The profiles of the respondents can be seen in Table 1.

Table 1
Respondent Profile

	Number of Respondent	Valid %
GENDER		
Male	252	61.3
Female	147	35.8
Not Mention	12	2.9
EDUCATION		
Lower than Bachelor Degree	15	3.6
Bachelor Degree	297	72.1
Higher than Bachelor Degree	100	24.3
JOB LEVEL		
Non managerial	124	30.2
First line manager	140	34.1
Middle manager	123	29.9
Upper manager	24	5.8
LINE OF BUSINESS		
Automotives	56	13.7
Financial services	71	17.4
Heavy equipment	1	0.2
Mining/construction	17	4.2
Property	9	2.2
Information technology	57	13.9
Pharmaceutical	112	27.4
Nutrition	22	5.4
Distribution & logistics	2	0.5
Animal health	15	3.7
Holding/Corporate	23	5.6
Others	24	5.9

(Years)	AGE	COMPANY TENURE	CAREER TENURE	POSITION TENURE
Mean	36.14	10.50	13.60	4.57
Std. Deviation	7.83	6.98	7.64	3.72

MEASURES

All items were responded to on a 5-point scale ranging from very small or not descriptive to very large or very descriptive. In this survey, all items were translated into Indonesian by a professional translator. A back translation into English was done for rechecking and no significant differences were found.

Exploration and exploitation

Exploration is the extent to which an employee looks for new things to do beyond what he or she is already doing. Exploitation is the extent to which an individual uses what he or she already has, such as knowledge, experience, and other resources, to perform. Exploitation and exploration were measured by adapting the 7-item scale developed by Mom, Van Den Bosch, and Volberda (2007). These scales were developed based on the exploration and exploitation characteristics proposed by March (1991). These individual-level scales have also been used in other studies, such as Rosing and Zacher (2016).

Adaptations were made to make the exploration and exploitation behaviors so that they were more general and applicable to a variety of contexts, tasks, and jobs, rather than focusing on specific types of work. The response scale and anchors were also adjusted from 7-point response scales to 5-point response scales items, ranging from 1 = to a very small extent to 5 = to a very large extent.

The original and adapted items can be found in Appendix 1. Cronbach's alpha for Exploration and Exploitation is 0.781 and 0.723, respectively, indicating acceptable internal consistency in the current study.

Metacognition

Metacognition is a person's knowledge of his or her cognitive processes and the ability to control or organize them (Brown, 1987; Flavell, 1979). As in several previous studies of metacognition (Kleitman & Stankov, 2007, Magno, 2008; Young & Fry, 2008), in this study, these two components are measured and combined to indicate an overall metacognition factor.

To measure metacognition, the Metacognition Awareness Inventory (MAI) scale was adapted. The MAI is a 52-item measure of metacognition based on two components of metacognition, knowledge about cognition and regulation of cognition (Schraw & Dennison, 1994). The MAI is one of the most used self-reported instruments in metacognition studies (Harrison & Valin, 2017).

Previous studies have used the MAI to measure overall metacognition (Kleitman & Stankov, 2007, Magno, 2008; Young & Fry, 2008). Harrison and Valin (2017) by using item response theory to MAI, found 19 items that provide good fit indices in the CFA (TLI =0.954; CFI = 0.959 and RMSEA = 0.046) and fit better than Schraw and Dennison's (1994) model and the 8-factor model of the MAI, so they were considered an optimal model for measuring general metacognition. In this study, these 19 items were used to measure overall metacognition. Items were adapted from the educational context to the more

general work environment. The original and adapted items can be found in Appendix 2. The Cronbach's alpha of these 19 items is 0.919.

Diversity and Depth of Knowledge

Previous studies have measured depth and diversity of knowledge indirectly at the individual level, e.g., by genre of creative output (Mannucci & Yong, 2018) or topic of scientific publications (Teodoridis et.al., 2019). Direct measures of knowledge depth and diversity through self-report have already been developed by others, but in the context of organizational knowledge management (Yang & Sheng., 2017). Unfortunately, the items created are domain-specific to the R&D department, making it difficult to adapt them to general work environments.

For this reason, items were created independently in this study. Depth of knowledge is defined as the extent to which an individual has a deep understanding of the knowledge required to perform the current job (e.g., if you are an accountant, you have the knowledge to prepare financial reports). Diversity of knowledge is defined as the extent to which a person has knowledge that is not required to perform the current job but can help them perform the current job better (e.g., if you are an accountant, you may also have knowledge about consumer behavior of the company's products).

To assess the content validity of the depth and variety of knowledge items, a Q-sort was conducted using the 15 items of diversity of knowledge and 15 items of depth of knowledge which were independently created (see Appendix 3).

This Q-sort was conducted online by emailing a file with instructions and 30 randomly ordered statements to six individuals in Indonesia who have a good command of English. These six people have different professions, namely assessor in assessment center, management consultant, employee of HR, sales manager, senior marketing manager and chief operating officer. They all work in one institution. They had 2 days to sort the statements into categories. They were free to determine the number of categories they thought appropriate to classify the thirty statements. The participants generally placed the items of diversity and depth of knowledge in different classifications. If an item was assigned to a category that was not as expected, the item was eliminated. For example, if a participant assigned 12 of the 15 items of diversity of knowledge and 4 of 15 of depth items to a group, those 4 knowledge depth items were not used in this study, nor were the 3 knowledge diversity items that this participant assigned to another classification. This was done for each participant and the items that were remaining of these deletions for the 6 participants were selected. In this way, 8 items for diversity of knowledge and 8 items for depth of knowledge were retained. The analysis and result of the Q-sort are presented in Appendix 4

To further assess these items, a Confirmatory Factor Analyses were conducted. Results indicate that one item in the diversity of knowledge (DVRS), namely DVRS 5, and two items for depth of knowledge (DPTH), namely DPTH 3 and DPTH 4, had factor loadings of less than 0.3, As such 3 items were excluded when creating scales and calculating the reliabilities for the DVRS and DPTH variables. By excluding these 3 items, $\chi 2$ (degrees of freedom) changes from

3.647 (1924) to 3.289 (1741). The different test for $\chi 2$ is significant at $p< 0.000$, meanwhile, the $\chi 2(df)/df$ also improved from 1.90 to 1.88.

Discriminant analysis of the 8 variables of the hypothesis model; diversity of knowledge (DVRS), depth of knowledge (DPTH), metacognition (MTCG), exploration (EXPR), exploitation (EXPT), ambidexterity (AMDX), job complexity (CPLX), and negative affect (NEGA)-was performed using confirmatory factor analysis. In this analysis, the 8-factor model had a chi-square and degrees of freedom ratio below 2 (see Table 3), an RMSEA = 0.05 and an SRMR = 0.06 indicating that this 8-factor model has a good fit between the hypothesized model and the observed data (Hu & Bentler, 1999). The 8-factor model as hypothesized model then was compared to alternative models. For all of these alternatives models, no indicator of goodness of fit was found to be better than the 8-factor model. The chi-square difference test between the 8-factor model and each of the alternative models revealed a significant difference in $p < 0.001$ with results indicating that the 8-factor model is the best fitting model (see Table 2).

In particular, I compared 8-factor model to the 7-, 6-, 5-, 4-, and 1-factor models which the combination of variables offers the possibility of a reasonable theoretical explanation. The first was the 7-factor model. These alternative models combined DVRS and DPTH, DPTH with MTCG, and DVRS with MTCG, while the other six variables were fixed in 6 factors. In addition, the 7-factor of this model also combined EXPL and EXPT, EXPL and AMDX, and EXPT with AMDX, while the other 6 factors remain the same. The goodness-

of-fit indicators such as RMSEA, SRMR, CFI, and TLI of the 8-factor model were better than the six alternatives of the 7-factor models. The chi-square difference test between the 8-factor model and each of the 7-factor models also revealed a significant difference in $p < 0.001$ indicating that 8-factor model has a better fit.

The 6-factor model combined DPTH, DVRS, and MTCG as one factor. Then EXPR, EXPT, and AMDX were combined while the other 5 factors remained. These 2 6-factor models had goodness-of-fit indicators that were no better than those of the 8-factor model. The chi-square difference test between the 8-factor model and the 6-factor models also showed significant differences in $p < 0.001$, thus the 8-factor model still has a better fit.

The 5-factor model combined EXPR, EXPT, DVRS, and DPTH. This nested 5-factor model was also formed by combining EXPR, EXPT, DVRS, and MTCG as one factor, with the other 4 factors fixed. Finally, there was also a combination of EXPR, EXPT, DPTH, and MTCG. The three combinations for the 5-factor model also showed that RMSEA, RMR, CFI, and TLI were not better than those for the 8-factor model. The chi-square difference test between the 8-factor models and each of the 5-factor models was also significantly different at $p < 0.001$.

In addition, the 4-factor model was performed by combining EXPR, EXPT, AMDX, DPTH, and DVRS, whereas the other 3 factors were retained. The combinations were also performed for EXPR, EXPT, AMDX, DPTH, MTCG

and for EXPR, EXPT,AMDX,DVRS, MTCG. After that, the 1-factor model was also created. Neither the 4-factor model nor the 1-factor model showed indicators of goodness of fit, including $\chi 2(df)/df$, that were better than those of the 8-factor model. The chi-square difference test between 8 factors, 4 factors, and 1 factor showed a significant difference in $p< 0.001$, such that the 8-factor model was a better-fitting model than the 4-factor model and the 1-factor model.

The chi-square difference test (see Table 2), which shows a statistically significant difference between the 8-factor model and the other alternative models (p-value < 0.00001), supports discriminant validity of 8 variables in the hypothesis model (Bagozzi & Phillips, 1982). In sum, these analyses indicate that the 8-factor hypothesized measurement model fit the data best and is retained for subsequent analyses.

Table 2
Goodness of Fit Analysis

Model	χ^2(df)	df	χ^2(df)/df	df DIFF*	χ^2(df) DIFF*		TLI	CFI	SRMR	RMSEA
8-Factor Model	3674.37	1924	**1.9098**				0.8300	0.8300	0.0600	0.0500
7-Factor model (DPTH+ DVRS)	4031.85	1932	2.0869	8	357.48	***	0.7900	0.8000	0.0700	0.0500
7-Factor Model (DPTH +MTCG)	4279.39	1931	2.2162	7	605.02	***	0.7700	0.7800	0.0700	0.0600
7 Factor Model (DVRS + MTCG)	3994.81	1931	2.0688	7	320.44	***	0.8000	0.8000	0.0600	0.0500
7-Factor model (EXPR + EXPT)	3907.31	1933	2.0214	9	232.94	***	0.8100	0.8100	0.0800	0.0500
7-Factor model (EXPR+ AMDX)	3928.50	1931	2.0344	7	254.13	***	0.8100	0.8100	0.0600	0.0500
7-Factor model (EXPT+ AMDX)	4102.23	1933	2.1222	9	427.86	***	0.7900	0.7900	0.0800	0.0500
6 Factor Model (EXPR+EXPT+AMDX)	4227.22	1937	2.1824	13	552.85	***	0.7700	0.7800	0.0700	0.0600
6 Factor Model (DPTH+DVRS+MTCG)	4503.48	1937	2.3250	13	829.11	***	0.7500	0.7600	0.0700	0.0600
5 Factor Model (EXPR+EXPT+DPTH+DVRS)	4792.59	1942	2.4679	18	1118.22	***	0.7200	0.7300	0.0700	0.0600
5 Factor Model (EXPR+EXPT+DPTH+MTCG)	5028.84	1942	2.5895	18	1354.47	***	0.7000	0.7100	0.0800	0.0600
5 Factor Model (EXPR+EXPT+DVRS+MTCG)	4717.50	1942	2.4292	18	1043.13	***	0.7300	0.7400	0.0700	0.0600
4 Factor Model (EXPR+EXPT+AMDX+DPTH+DVRS)	5122.28	1946	2.6322	22	1447.91	***	0.6900	0.7000	0.0800	0.0700
4 Factor Model (EXPR+EXPT+AMDX+DPTH+MTCG)	5341.47	1946	2.7448	22	1667.10	***	0.6700	0.6800	0.0800	0.0700
4 Factor Model (EXPR+EXPT+AMDX+DVRS+MTCG)	5016.74	1946	2.5780	22	1342.37	***	0.7000	0.7100	0.0800	0.0600
One Factor Model	7648.27	1952	3.9182	28	3973.90	***	0.4600	0.4800	0.1000	0.0900

***** *Difference between 8-factor model and this model*

*+ : p<=0.1 * : p<=0.05 ** : p<=0.01 *** : p<=0.001*

Additional Variables for Exploratory Analyses

Job Complexity

To measure job complexity, four sub-scales (i.e., autonomy, variety, feedback, and wholeness) of the core dimensions of the Job Characteristic Inventory (Sims, Szilagyi, & Keller., 1976) were used. This scale can be used as an indicator of a unidimensional construct of job complexity (Aldag, Barr. & Brief, 1981; Stone & Gueutal, 1985). Cronbach's alpha 0.797 shows acceptable internal consistency. The items on job complexity can be found in Appendix 6, Section 4.

Individual Ambidexterity

Individual ambidexterity is defined as the behavior of a person who is able to switch between exploration and exploitation. In this study, ambidexterity was measured using 4 self-constructed questions for this study with 5 scales ranging from not at all typical of me to very typical of me. The Cronbach's alpha for these 4 items was 0.783. The items on individual ambidexterity can be found in Appendix 6, Section 5

Control Variables

A previous study has found that age and functional tenure of managers were negatively related to exploration and exploitation behavior, while organizational tenure was positively correlated to exploration and exploitation behavior (Mom, et.al., 2015). For this reason, age, organizational tenure, and

functional tenure were used as control variables in this study. The length of time in the organization and the length of time in the position indicated organizational and functional tenure.

Information processing as a cognitive process is also influenced by trait negative affectivity (Noguchi, Gohm & Dalsky, 2006). For this reason, trait negative affectity was also a control variable in this study and was measured using negative affectivity items from the PANAS (Watson, Clark & Tellegen, 1988). The Cronbach's alpha for negative affect is 0.899, indicating good internal consistency.

There is debate about the use of control variables (Spector & Brannick, 2011). As such, analyses within the main body of the manuscript do not include control variables. However, analyses with control variables are included Appendix 5.

Table 3
Correlation Matrix and Cronbach's Alpha

VARIABLE	DPTH	DVRS	MTCG	EXPR	EXPT	AMDX	CPLX	NEGA	AGE	TCOY	TPOS
DPTH	***0.821***										
DVRS	.584**	***0.859***									
MTCG	.462**	.658**	***0.919***								
EXPR	.226**	.446**	.442**	***0.781***							
EXPT	.193**	.245**	.299**	.407**	***0.723***						
AMDX	.183**	.392**	.418**	.357**	.247**	***0.783***					
CPLX	.278**	.320**	.339**	.393**	.279**	.237**	***0.797***				
NEGA	-.261**	-.177**	-.186**	-.099*	-0.085	0.043	-.272**	***0.899***			
AGE	.168**	.150**	-0.033	0.028	-0.058	-0.013	0.026	-.133*			
TCOY	.162**	.129**	-0.006	0.064	-0.011	0.075	0.004	-0.064	.755**		
TPOS	.167**	.173**	0.036	0.004	-0.014	0.054	-0.030	-0.041	.518**	.449**	
N	414	414	414	414	414	414	414	414	357	413	412
MEAN	3.909	3.816	3.941	3.636	3.778	3.504	3.793	2.363	36.140	10.500	4.570
STDEV	0.574	0.522	0.429	0.569	0.525	0.666	0.594	0.808	7.827	6.976	3.722

DVRS (Diversity of Knowledge), DPTH (Depth of Knowledge), MTCG (Metacognition), EXPR (Exploration), EXPT (Exploitation), AMDX (Ambidexterity), CPLX (Job Complexity), NEGA (Negative Affect), AGE (Age), TCOY (Tenure in the Company), TPOS (Tenure in the Position)

5 point scales were used for all variables except for AGE, TCAR, TCOY and TPOS.

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Cronbach's Alpha is given in the diagonal

ANALYSIS AND RESULTS

Table 3 presents the correlations among the variables in this study. The statistically significant correlations among the predictor variables, moderating variable, and criterion variables are consistent with the original hypotheses. To reduce the multicollinearity that occurs in moderation analysis, the predictors variables used in this regression were standardized variables. Standardized variables were chosen instead of centered variables because with standardized variables the interpretation of predictor and moderator effects on criteria may be easier (Cohen, Cohen, West & Aiken, 2013; Frazier, Tix & Barron, 2004). Across analyses, the highest variance inflation factor (VIF) from all standardized variables is 3.874 which is below 10, thereby indicating that multicollinearity may not be a problem in the current study (Hair, Anderson, Tatham, & Black, 1995; Neter, Kutner, & Wasserman, 1996).

EXPLORATION

The bivariate analysis in Table 3 shows that knowledge diversity has a positive correlation with exploratory behavior ($r = 0.446$, $p < 0.01$). This significant correlation supports Hypothesis 1A - "Diversity of knowledge positively correlates with exploration behavior". The bivariate analysis in Table 3 shows that depth of knowledge also correlated positively with exploration behavior ($r=0.226$, $p< 0.01$), supporting Hypothesis 2A-"Depth of knowledge positively correlates with exploration behavior."

I provided a more stringent test by conducting multivariate analysis in which the three predictors (i.e., diversity of knowledge, depth of knowledge, and metacognition) were simultaneously considered in a linear regression. Table 4 shows the results of the hierarchical regression analyzing the main effect of depth and diversity of knowledge on exploration behavior (Model 1) and the interactions between diversity, depth, and metacognition on exploration behavior (Model 2).

The main effects model explained significant variance in exploration behavior (R^2 = 0.242, p< 0.001). Model 1 indicates a positive correlation between knowledge diversity and exploration behavior (B= 0.203, β = 0.403, p <.001). In contrast, depth of knowledge did not uniquely predict exploration behavior.In bivariate analyses, metacognition was positively correlated with exploration behavior (r = 0.442, p < 0.01 - see Table 3) and also had a main effect on exploration behavior in multivariate analysis (see Table 4 Model 1).

Model 2 results included the 2-way interactions between metacognition with diversity and metacognition with depth of knowledge. Model 2 showed that the interaction of metacognition with diversity of knowledge and the interaction of metacognition with depth of knowledge were not significant predictors of exploration behavior. Thus, Hypothesis 3A-"Metacognition interacts with diversity of knowledge such that the relationship between diversity and exploration is strengthened when metacognition is higher"-was not supported, nor was Hypothesis 4A-"Metacognition interacts with depth of knowledge such that the relationship between depth and exploration is strengthened when

metacognition is higher." Thus, metacognition does not act as a moderating variable in the current study.

Table 4
Hierarchical Regression - Exploration

EXPLORATION	Model 1 (Main)				Model 2 (2 Ways Interaction)			
	Unstandardized		Standardized		Unstandardized		Standardize	
	B	Std. Error	Beta		B	Std. Error	Beta	
(Constant)	3.636	0.024		**	3.637	0.027		**
Diversity of Knowledge	0.179	0.036	0.315	***	0.178	0.036	0.312	***
Depth of Knowledge	-0.048	0.030	-0.084		-0.049	0.031	-0.087	
Metacognition	0.156	0.033	0.274	***	0.158	0.034	0.277	***
Diversity X Metacognition					0.005	0.027	0.012	
Depth X Metacognition					0.001	0.036	0.002	
Diversity X Depth					-0.008	0.028	-0.021	
Max VIF	2.139				3.874			
R Square	0.242				0.243			
Adjusted R Square	0.237				0.231			
R Square Changes	0.242				0.000			
F Changes	43.740***				0.036			

* : p<=0.05 ** : p<=0.01 *** : p<=0.001 n=414

EXPLOITATION

Table 3 shows a positive bivariate correlation between knowledge diversity and exploitation behavior ($r = 0.245$, $p < 0.01$). A positive bivariate correlation was also found between depth of knowledge and exploitation behavior ($r = 0.193$, $p < 0.01$). Thus, the hypotheses H1b - “Diversity of knowledge positively correlates with exploitation behavior” and H2b - “Depth of knowledge positively correlates with exploitation behavior”- were supported.

Table 5 shows the results for exploitation behavior. Model 1 was the main effects model for exploitation behavior. The multivariate analysis in Table 5, Model 1 shows that both knowledge diversity and knowledge depth were not significant predictors of exploitation behavior when considered simultaneously

with metacognition. As with exploration behavior, metacognition had a significant effect on exploitation behavior (see Table 5 Model 1, B= 0.124, β = 0.236, p< 0.001).

Model 2 includes 2-way interactions between metacognition and the diversity of knowledge and metacognition depth of knowledge for exploitation behavior. Model 2 shows that the interaction of metacognition with diversity and the interaction of metacognition with depth of knowledge do not significantly explain additional variance in exploitation behavior. Hypothesis 3B - "Metacognition interacts with diversity of knowledge, such that the relationship between diversity and exploitation is strengthened when metacognition is higher" and Hypothesis 4B - "Metacognition interacts with depth of knowledge, such that the relationship between depth and exploitation is strengthened when metacognition is higher" were not supported.

Table 5
Hierarchical Regression – Exploitation

EXPLOITATION	**Model 1 (Main)**				**Model 2 (2 Ways Interaction)**			
	Unstandardized		Standardized		Unstandardized		Standardized	
	B	Std. Error	Beta		B	Std. Error	Beta	
(Constant)	3.778	0.025		**	3.773	0.027		**
Diversity of Knowledge	0.032	0.036	0.061		**0.038**	0.037	0.073	
Depth of Knowledge	0.025	0.031	0.048		**0.035**	0.031	0.066	
Metacognition	0.124	0.033	0.236	***	**0.113**	0.034	0.215	**
Diversity X Metacognition					**0.009**	0.028	0.024	
Depth X Metacognition					**-0.051**	0.036	-0.131	
Diversity X Depth					**0.039**	0.028	0.108	
Max VIF	2,139				3.874			
R Square	0.095				0.101			
Adjusted R Square	0.088				0.087			
R Square Changes	0.095				0.006			
F Changes	14.359***				0.845			

* : p<=0.05 ** : p<=0.01 *** : p<=0.001 n=414

ADDITIONAL ANALYSIS

Job Complexity

Job complexity can be used as an indicator of information complexity because as the complexity of the work increases, the complexity of the information needed also increases as the domain and sources of the information needed increase (Bystrom & Jarvelin, 1995). In general, the more complex a job is, the more complex the information that must be processed. Therefore, in the additional analysis, I analyze job complexity as an alternative moderating variable.

In this study, job complexity explained significant variance in exploration behavior ($\beta = 0.288$, $p < .001$ - see Table 6 Model 1) and in exploitation behavior ($\beta = 0.219$, $p < .001$ - see Table 7 Model 1) when simultaneously considering diversity and depth of knowledge However, there were no interactions of knowledge diversity with job complexity and also no interaction of knowledge depth with job complexity in explaining variance in exploration or exploitation behavior (see Model 2 in Table 6 and Table 7).

Table 6
Job Complexity and Exploration

EXPLORATION	Model 1 (Main)				Model 2 (2 Ways Interaction)			
	Unstandardized		Standardized		Unstandardized		Standardized	
	B	Std.	Beta		B	Std.	Beta	
(Constant)	3.636	0.024		**	3.635	0.026		**
Diversity of Knowledge	0.232	0.030	0.407	***	0.233	0.031	0.409	***
Depth of Knowledge	-0.052	0.030	-0.092		-0.055	0.031	-0.096	
Job Complexity	0.164	0.025	0.288	***	0.165	0.026	0.290	***
Diversity X Job Complexity					-0.004	0.031	-0.007	
Depth X Job Complexity					0.013	0.033	0.023	
Diversity X Depth					-0.004	0.018	-0.009	
Max VIF	1.581				2.003			
R Square	0.274				0.274			
Adjusted R Square	0.269				0.264			
R Square Changes	0.274				0.000			
F Changes	51.587***				0.060			
* : p<=0.05 ** : p<=0.01 *** : p<=0.001								

Table 7
Job Complexity and Exploitation

EXPLOITATION	Model 1 (Main)				Model 2 (2 Ways Interaction)			
	Unstandardized		Standardized		Unstandardized		Standardized	
	B	Std.	Beta		B	Std.	Beta	
(Constant)	3.778	0.024		**	3.779	0.027		**
Diversity of Knowledge	0.078	0.031	0.148	*	0.081	0.031	0.154	**
Depth of Knowledge	0.024	0.030	0.046		0.024	0.031	0.046	
Job Complexity	0.115	0.026	0.219	***	0.115	0.026	0.220	***
Diversity X Job Complexity					-0.038	0.032	-0.078	
Depth X Job Complexity					0.001	0.034	0.001	
Diversity X Depth					0.019	0.019	0.052	
Max VIF	1.581				2.003			
R Square	0.106				0.112			
Adjusted R Square	0.100				0.099			
R Square Changes	0.106				0.006			
F Changes	16.248***				0.909			
* : p<=0.05 ** : p<=0.01 *** : p<=0.001								

Individual Ambidexterity

Additional exploratory analyses investigated the relationships between exploration and exploitation behavior and ambidexterity. Model 1 in Table 8 is a regression of exploration and exploitation on ambidexterity. The regression results support that exploration and exploitation predict ambidexterity (R^2 =

0.180, p < 0.001). Model 2 in Table 8 shows that there is no interaction between exploration and exploitation on ambidexterity.

Table 8
Exploration and Exploitation Regression on Ambidexterity

AMBIDEXTERITY	Model 1 (Main)				Model 2 (2 Ways Interaction)			
	Unstandardized Coefficients		Standardized Coefficients		Unstandardized Coefficients		Standardized Coefficients	
	B	Std. Error	Beta		B	Std. Error	Beta	
(Constant)	3.504	0.030			3.494	0.032		
Exploration	0.205	0.033	0.308	***	0.204	0.033	0.307	***
Exploitation	0.081	0.033	0.122	*	0.082	0.033	0.122	*
Exploration X Exploitation					0.027	0.025	0.050	
Max VIF	1.198				1.999			
R Square	0.140				0.142			
Adjusted R Square	0.136				0.136			
R Square Changes	0.140				0.002			
F Changes	33.453***				1.180			
* : p<=0.05 ** : p<=0.01 *** : p<=0.001 n=414								

Multivariate analyses were also performed for knowledge diversity, knowledge depth, and metacognition, as well as a 2-way interactions between these variables as predictors with individual ambidexterity as a criterion. Knowledge diversity (β = 0.258, p <.001 - see Table 9 Model 1) and metacognition (β = 0.297, p <.001 - see Table 9 Model 1) were significant predictors of individual ambidexterity, but knowledge depth was not. The interactions between knowledge diversity and metacognition and knowledge depth and metacognition did not account for significant variance in the prediction of individual ambidexterity (see Table 9 Model 2).

Table 9
Diversity and Depth of Knowledge and Metacognition
Regression on Ambidexterity

AMBIDEXTERITY	Model 1 (Main)				Model 2 (2 Ways Interaction)			
	Unstandardized		Standardized		Unstandardized		Standardized	
	B	Std.	Beta		B	Std.	Beta	
(Constant)	3.504	0.029		**	3.512	0.033		***
Diversity of Knowledge	0.172	0.043	0.258	***	0.172	0.043	0.258	***
Depth of Knowledge	-0.069	0.036	-0.104		-0.068	0.037	-0.102	
Metacognition	0.198	0.039	0.297	***	0.191	0.040	0.286	***
Diversity X Metacognition					0.006	0.033	0.013	
Depth X Metacognition					-0.035	0.043	-0.072	
Diversity X Depth					0.008	0.034	0.017	
Max VIF	2.139				3.874			
R Square	0.206				0.209			
Adjusted R Square	0.200				0.197			
R Square Changes	0.206				0.002			
F Changes	35.495***				0.427			
* : p<=0.05 ** : p<=0.01 *** : p<=0.001								

CONTROL VARIABLES

In this study, the above regressions were repeated with the inclusion of control variables (age, organizational tenure, functional tenure, and negative affect). The baseline model, which was a multiple regression on the control variables, did not significantly explain the variance in exploration, exploitation, or individual ambidexterity behavior (see Appendix 5- Model 0). In the main effects model (see Appendix 5- Model 1), which statistically could significantly explain the variance in exploration, exploitation, or individual ambidexterity behavior, the presence of control variables did not change the conclusions of the hypothesis test above. The two-way interaction model that includes control variables did not significantly explain the variance in the three criteria above (see Appendix 5 - Model 2).

DISCUSSION

This study tested the potential main and interactive effects of knowledge diversity, knowledge depth and metacognition on exploration and exploitation behaviors. Given bivariate results differed from multivariate results, this Discussion section focuses on the results of the multivariate analyses.

Exploration

In this study, I explored the relation between diversity of knowledge and exploration behavior. In multivariate analysis, results indicated that diversity of knowledge positively correlated to exploration behavior. This result supports the findings of other studies that exploration is the result of a process that combines knowledge, for example, knowledge about technology and markets (Gruber et al, 2012). Because of the diversity of knowledge, employees have more opportunities to combine knowledge, so exploration is higher.

Depth of knowledge, originally expected to increase the richness of knowledge combinations (Amabile, 1983; Mannucci & Yong, 2018) did not positively relate with exploration in this study. Although the bivariate correlation was as expected, when considering diversity of knowledge simultaneously, the relation was not significant. This suggests that depth of knowledge does not uniquely account for variance in exploration behavior.

If lack of knowledge weakens the relationship between attributes and schemas and increases the flexibility to integrate new knowledge schemas (Amabile, 1983), then depth of knowledge might actually hinder . Deep knowledge leads to cognitive entrenchment (Dane, 2010), i.e., a more rigid and less flexible relationship between attributes and knowledge schemas (Chi, 2006, Lewandowsky et al., 2007), reducing the ability to accept new principles (Frensch & Stenberg, 2014). This is an alternative explanation for why depth of knowledge did not predict exploration. Further analysis revealed that there was no interaction between diversity and depth of knowledge, suggesting that the effect of diversity of knowledge on exploration behavior was not influenced by depth of knowledge, and the effect of depth of knowledge on exploration behavior was also not influenced by diversity of knowledge. However, null findings are difficult to interpret as there are a myriad of potential reasons for null findings.

In this study, a significant positive relationship was found between metacognition and exploration, but no interaction was found between metacognition and diversity of knowledge or between metacognition and depth of knowledge in shaping exploration behavior. In essence, exploration is learning and innovation (Benner & Tushman, 2002; He & Wong, 2004). Thus, the results of this study showing that metacognition is a predictor of exploration behavior are consistent with previous studies suggesting that metacognition plays a role in learning and creativity processes (Jia, Li & Cao, 2019). No interaction was found between diversity of knowledge .or depth of knowledge and metacognition in shaping exploration behavior.

Exploitation

Results did not observe that depth of knowledge relates to exploitation. Exploitation, which occurs in search of depth (Katila and Ahuja, 2002), was not significantly impacted by depth of knowledge. Depth of knowledge, which is thought to promote the ability to efficiently identify and select relationships between attributes and knowledge schemas (Levinthal & March, 1993; Mom et al., 2007), had no effect on exploitation behavior in this study. A person's tendency to draw on preexisting ideas in a new situation (Cohen & Levinthal, 1990; Lovett & Anderson, 1996; Jeppesen & Lakhani, 2010) could be an alternative explanation for this result. Deep knowledge that reflects expertise could lead someone to possess occupational self-efficacy and feel that drawing on existing ideas is sufficient. The desire to tap into new possibilities from existing knowledge then may not arise.

Similar to depth of knowledge, diversity of knowledge was not a significant predictor of exploitation behavior. Knowledge diversity, which was expected to facilitate exploitation by borrowing perspectives from other fields (Perry-Smith, 2006; Taylor & Greve, 2006), was not found in this study. However, metacognition did relate to exploitation behavior These results suggest that metacognition explained the variance in exploitation behavior.

The interplay between exploration and exploitation is learning and innovation (Benner & Tushman, 2002; He & Wong, 2004). The difference is whether this process takes the same path as existing knowledge (exploitation) or a different

path (exploration) (Gupta & Shalley, 2006). For this reason, both exploration and exploitation are essentially learning processes, so metacognition plays an important role here. This is one possible explanation why metacognition was the only unique predictor of exploitation behavior when considering all predictors simultaneously in this study.

ADDITIONAL ANALYSES

Job Complexity

As additional analysis, this study found that job complexity was a significant and consistent predictor of both exploration and exploitation behaviors. This result is consistent with the findings of studies that job complexity promotes the emergence of ideas (Amabile, 1988; Oldham & Cummings, 1996). The discovery of job complexity as a predictor of both exploration and exploitation suggests that, in addition to knowledge and metacognition playing a role in cognitive and motivational processes, external drives are also required for exploration and exploitation behaviors to develop. Disruptions to the status quo are necessary to alter the path of learning and innovation and avoid inertia in human cognition (Liao, Fei & Liu, 2008), and they likely are enabled by the complexity of work.

Individual Ambidexterity

Although this study focuses on exploration and exploitation behavior, an additional analysis of the correlates of exploration and exploitation as predictors of ambidexterity was conducted. This study supports previous theories that

exploration and exploitation are predictors of ambidexterity. It will be interesting to see if this is related to ambidexterity in our daily lives. It is more difficult for a right-handed person to use their left hand, while it is challenging for a left-handed person to use their right hand. The better a person becomes at using a hand that is not their dominant hand, the more likely they are to become ambidextrous. Exploration is a process that puts a person in an unfamiliar situation and therefore is not a person's natural tendency (Frey, Luthje, and Haag, 2011). Exploration is therefore something that is more difficult for the person. Exploration is not a 'dominant hand' in the sense of the right-handed/left-handed analogy, so those who are more skilled at it have a higher tendency to become ambidextrous.

At the individual level, exploration and exploitation are mutually exclusive (Gupta & Shalley, 2006). In this study, exploration and exploitation appear to be orthogonal because the unit of time in which they are measured is one year. This means that an individual can switch between exploration and exploitation within a given time period. This supports the theory that ambidexterity at the individual level is a switch between exploration and exploitation, while at the organizational level ambidexterity means simultaneous exploration and exploitation.

LIMITATIONS , FURTHER RESEARCH, AND CONCLUSION

Several limitations of the current study are worth noting. These limitations also highlight avenues for future research. First, this study did not consider potential cognitive processes that may influence exploration and exploitation behavior. For example, this study does not examine how diversity or depth of knowledge relates to or interacts with the process of creative thinking in the realization of exploration or exploitation.

Second, in examining the extent to which metacognition influences exploration and exploitation behavior, this study considered metacognition as overall factor rather than specific cognitive processes because metacognition is a person's ability to understand, be aware of, and control their cognitive processes (Nelson, 1996). Therefore, in this study, metacognition was considered in the general domain, regardless of which cognitive processes were present (Veenman et.al., 2006). Further studies looking at the relationships or interactions between the diversity and depth of knowledge and metacognition in more specific cognitive processes such as combining new knowledge, recombining existing knowledge, the creative process, or problem solving could provide further interesting results and insights.

Third, motivational factors were not considered in this study when investigating exploration and exploitation behavior. In a previous study, individual intrinsic motivational orientation was found to have a significant positive correlation with exploration and exploitation behavior (Mom, Chang, Cholakova, &

Jansen, 2019). Further studies incorporating motivational factors will explain the broader contribution of diversity or depth of knowledge, as it is possible that diversity and depth of knowledge also contribute to motivational processes.

Fourth, the data collection in this study was conducted at the same time, with the same instrument, and were self-reported, so it is susceptible to common method bias (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). The factor analysis did not reveal a single factor; nonetheless, common method bias is a potential limitation. In further studies, it would be desirable if an objective scale of measuring diversity and depth of knowledge or other rating method were also used to replace or supplement the self-perception scales used in this study.

In this study, job complexity was found to be a predictor of the occurrence of exploration and exploitation behaviors. This opens the possibility of further studies on the factors of job complexity that may serve as drivers of exploratory or exploitative behavior. This study may also provide an overview of individual responses to the types of job complexity they face. The diversity or depth of knowledge may also influence this response.

MANAGERIAL IMPLICATIONS

Developing employee knowledge diversity is an important action organizations should take to improve employee exploration and exploitation behaviors. Employee development strategies through job rotation and cross-functional projects to improve access to diverse knowledge are options that can be taken.

Given the importance of metacognition in predicting exploration and exploitation behaviors, .the development of employees' exploration and exploitation behaviors can also occur through the development of metacognition. Metacognition develops at a young age, but its components continue to develop throughout life (Alexander, Carr & Schwanenflugel, 1995) and the development of metacognition from a specific domain to a general domain (Veenman et al, 2006), so the development of metacognition is still possible in adult workers. Several studies show that metacognition training can be performed and has increasing effects on some cognitive processes, for example, for creative thinking (Jia et.al., 2019).

Job design can be used to shape work motivation, learning, and development (Parker, 2014), including behavior to achieve paradoxical outcomes (e.g., safety and productivity) (Johns, 2010). Then, job design can also be used to shape the complexity of work in ways that encourage the emergence of exploratory and exploitative behaviors. This job complexity can result from the design of the job, but it can also result from the work situation. Assigning employees to solve complex work situations or challenges or into cross functional team (Tempelaar & Rozenkranz, 2019) can be a way to encourage exploratory or exploitative behavior. It is important to create an understanding that exploration and exploitation are not characteristics of a particular position or job, but behaviors that can occur in any position, job, or situation.

CONCLUSION

Diverse knowledge is an important predictor of exploratory behavior. Moreover, metacognition plays an important role and is also a significant predictor of the occurrence of exploration and exploitation behaviors. Further analysis revealed that job complexity is a factor that can predict the occurrence of exploration and exploitation behaviors. Factors that foster exploratory behavior appears to require further attention.

APPPENDIX 1

Exploration and Exploitation Behavior Measurement (Mom et al., 2007) - Adapted.

Scale: 1= to a very small extent , 5= to a very large extent
Adapted from 1 = to a very small extent, 7 = to a very large extent.

Exploration

Item Stem:

Original: *To what extent did you, last year, engage in work related activities that can be characterized as follows:*
Adapted: In doing your work last year, to what extent did you:

Original: *Searching for new possibilities with respect to products/services, processes or markets*
Adapted: Search for new possibilities (e.g., products/services, processes, markets)?

Original: *Evaluating diverse options with respect to products/services, processes or market*
Adapted: Evaluate diverse options (e.g., products/services, processes, markets)?

Original: *Focusing on strong renewal of products/services or processes*
Adapted: Prioritize radical changes (e.g., in product/services or processes)?

Original: *Activities requiring quite some adaptability of you*
Adapted: Engage in activities that required you to adapt?

Original: *Activities requiring you to learn new skills or knowledge*
Adapted: Learn new skills or knowledge?

Exploitation:

Original: Activities of which a lot of experience has been accumulated by yourself

Adapted: Use past experiences that have been accumulated by yourself to perform your job?

Original: Activities which serve existing (internal) customers with existing services/products

Adapted: Perform activities with existing people/services/products/process?

Original: Activities of which it is clear to you how to conduct them

Adapted: Perform activities where it was clear to you how to conduct them?

Original: Activities primarily focused on achieving short-term goals

Adapted: Focus primarily on achieving short-term goals?

Original: Activities which you can properly conduct by using your present knowledge

Adapted: Conduct your activities by using your existing knowledge?

Original: Activities which clearly fit into existing company policy

Adapted: Engage in activities which clearly fit into existing company policy?

APPENDIX 2

19 items of MAI (Harrison & Valin, 2017) – Adapted

Scale 1-5:

1 = Not at all typical of me, 2 = Not very typical of me, 3 = Somewhat typical of me, 4 = Fairly typical of me, and 5 = Very typical of me.

Instructions: Please respond to the following items indicating how typical each statement is of you.

Knowledge of Cognition

Original: I know what kind of information is most important to learn.

Adapted: I know what kind of information is most important when doing this job.

Original: I know what the teacher expects me to learn.

Adapted: I know what is expected from me on this job.

Original: I have control over how well I learn.

Adapted: I have control over how well I think

Original: I can motivate myself to learn when I need to.

Adapted: I can motivate myself to think when I need to.

Original: I am aware of what strategies I use when I study.

Adapted: I am aware of what strategies I use to think on this job.

Original: I am a good judge of how well I understand something.

Adapted: no change

Original: I find myself using helpful learning strategies automatically.

Adapted: I find myself using helpful thinking strategies automatically.

Original: I know when each strategy I use will be most effective.

Adapted: no change

Regulation of Cognition

Original: I think about what I really need to learn before I begin a task.
Adapted: I think about what I really need to know before I begin a task.

Original: I set specific goals before I begin a task.
Adapted: no change

Original: I periodically review to help me understand important relationships.
Adapted: I periodically review to help me understand the important connections among the information I possess.

Original: I summarize what I've learned after I finish.
Adapted: I summarize what I've learned after I finish my job.

Original: I try to translate new information into my own words.
Adapted no change

Original: I change strategies when I fail to understand.
Adapted: I change my strategies when I fail to understand.

Original: I use the organizational structure of the text to help me learn.
Adapted: I use systematic information to help me know something.

Original: I ask myself if what I'm reading is related to what I already know.
Adapted: I ask myself if the new information is related to what I already know

Original: I re-evaluate my assumptions when I get confused.
Adapted: no change

Original: I ask myself if I learned as much as I could have once I finish a task.
Adapted: no change

Original: I stop and go back over new information that is not clear.
Adapted: no change

APPENDIX 3

30 Developed Items for Diversity and Depth of Knowledge

DIVERSITY OF KNOWLEDGE
My professional knowledge is diverse.
I have a range of knowledge that helps me see my job from different points of view.
My professional knowledge goes beyond my particular job.
My professional knowledge focuses primarily on my particular job (R)
My knowledge is not limited to the fundamental elements of my job.
I have a diverse knowledge that enables me to recognize different effects on my job performance.
I have a broader professional knowledge for my job.
I know numerous points of view to perform my job.
I am a generalist with respect to my job.
I have a broad professional knowledge that helps me recognize how my work relates to other work.
My professional knowledge is not limited to my specific job.
My broad professional knowledge helps me identify what factors affect my job performance.
I have a narrow set of professional knowledge (R).
I have diverse work-related knowledge.
I possess a range of knowledge that enables me to consider different perspectives in my job.

DEPTH OF KNOWLEDGE
I have in-depth knowledge to perform my job
My job-related knowledge is profound.
My knowledge required for my job is superficial (R).
In relation to my job, I consider myself to be a specialist.
Regarding my job, I am an expert.
In terms of work-related knowledge, I am proficient for my job.
To be proficient at my job, I need a deeper understanding (R)
I lack an understanding of how to do my job. (R)
I have detailed knowledge required to perform my job.
I have expertise to perform my job.
I have a good understanding of the knowledge required for my job.
I have thorough knowledge required to perform my current job.
In terms of my job-related knowledge, I consider myself a novice (R).
I have mastered the knowledge required to do my job.
I have mastered the details of my job-related knowledge.

APPENDIX 4
Q Sort Analysis and Result

To increase the reliability of the items depth and diversity of knowledge, a Q-sort was performed on the 30 items that had been previously created. This Q-sort is performed online by emailing a file containing instructions and 30 randomly assembled statement items. This Q-sort is conducted with 6 individuals in Indonesia who have a good understanding of English. These six people have different jobs, namely assessor in assessment center, management consultant, HR staff, sales officer, senior marketing manager and chief operating officer. These six people work in one institution. They had 2 days to sort the statements into categories, with one category representing statements that they felt had similarities.

Analysis

Response 1

The responses are divided into 3 categories labeled as Expert Specialist (In Depth Knowledge), Broad Generalist (Wide Knowledge), and Novice (Shallow & Narrow Knowledge). For the In-depth Knowledge category, 14 questions of knowledge depth were selected and there is a reverse question for diversity of knowledge that falls into this category. For the Broad Knowledge category, 13 items of diversity of knowledge were selected and none of the items of depth of knowledge. For the third category, namely Novice, 3 reverse

items of Depth of Knowledge were selected. In this category, there is only one reversed item on knowledge diversity.

Response 2

The responses are divided into two categories: Breadth/Diversity of Knowledge and Depth/Expertise. In the Breadth of Knowledge category, all questions on diversity of knowledge and one question on depth of knowledge were selected. For the Depth category, all 14 depth of knowledge questions were selected. Of all the responses, this second response is the closest to the original questions in terms of number of categories, labels, and selected items.

Response 3

Response 3 is the response with the most unique category. The responses are divided into 4 categories, namely directorship, team leader, subject matter expert/specialist/ and entry-level/fresh graduate. It appears that the response is given with the idea that these statements are used to examine the characteristics or competencies of the different positions in the company. In the Directorship category, there are 4 items on diversity and 3 items on depth of knowledge. This is the category with the most diverse mix of item depth and diversity. In the Team Leader category, 9 items of diversity were selected. In the Subject Matter Expert category, 8 items of knowledge depth were selected and one reversed item on diversity was selected. In the entry level category, there are also 4 items of depth of knowledge and 1 reversed item of diversity of knowledge.

Response 4

Responses were given in 6 categories without labeling. In category 1, 7 items of knowledge diversity were selected, while in category 3, 6 items of diversity were selected. The clear difference between categories 1 and 3 is that in category 1, statements were selected that refer only to knowledge diversity, while in category 3, statements were selected that include the impact of knowledge diversity. In category 2, there are 10 items related to depth of knowledge, while 3 reverse items related to depth of knowledge are included in category 4. In category 5, 2 reverse items on knowledge diversity were selected and 1 item on knowledge depth. The three items in category 5 have similarities, that is, the three statements contain words related to the concept of focus. Category 6 consists of only 1 reversed item depth of knowledge.

Response 5

The responses are divided into 3 categories without labeling. In category 1, there are 13 items diversity of knowledge. In category 2, there are 11 items depth of knowledge and 2 items diversity of knowledge. Category 3 consists of 4 items on depth of knowledge, all of which are reversed items. Response 5 is very similar to Response 1.

Response 6.

Responses are divided into 5 categories without labeling. Category 1 consists of 5 items on knowledge diversity, while 8 items on knowledge diversity fall into Category 2. Similar to response 4, the difference between categories 1 and 2 is whether the statement refers only to diversity (category 2) or also includes

the impact of knowledge diversity (category 1). In Category 3, there are 9 items related to depth of knowledge. In category 4, there is 1 reverse item on diversity of knowledge and 2 items on depth of knowledge. It appears that this category was created to account for similarities in focus on specific knowledge, as also occurred in response 4. Category 5 contains 4 reversed items from the depth of knowledge and one reversed item from the diversity of knowledge.

Overall, the responses were given considering the nature of diversity and depth of knowledge as the basis for the categories, with the exception of response 3, which has a different category concept. Further analysis was based on consistency. To make it easier to see the consistency, the visual method is used. In the compilation, each statement is represented by a colored box. The green box represents the diversity of knowledge and the blue box represents the depth of knowledge . Consistency is considered to exist if the item was the same color as the dominant color in that category. A dominant color may be present if all boxes in that category were the same color (e.g., categories 1, 2, 3, and 4 in response 4) or if there are other colors but it is visually obvious that one color was very dominant (e.g., expert and broad categories in response 1) or breadth and depth of category in response 2).

The color of the box that does not match the dominant color in a category (e.g., the statement "My professional knowledge focuses primarily on my particular job" (green box) in the Expert category (which is blue dominant in Response 1) is considered an inconsistent item. If there is no dominant color in a category (e.g., directorship category in response 3, category 5 in response 4, category 4

in response 6), then all items in that category are considered inconsistent. If there is only one statement in a category (category 6 in response 4), the item is also considered inconsistent.

The results of this analysis are presented in a matrix with gray boxes for consistent items and red boxes for inconsistent items (see Table A). Based on the results of this analysis, 8 items for diversity of knowledge and 8 items for depth of knowledge were proposed for use in this study (see Table B).

‘

Table A

Analysis Matrix

	REVIEWER					
	1	2	3	4	5	6
DEPTH OF KNOWLEDGE						
I have in-depth knowledge to perform my job						
My job-related knowledge is profound.						
My knowledge required for my job is superficial (R).						
In relation to my job, I consider myself to be a specialist.						
Regarding my job, I am an expert.						
In terms of work-related knowledge, I am proficient for my job.						
To be proficient at my job, I need a deeper understanding (R)						
I lack an understanding of how to do my job. (R)						
I have detailed knowledge required to perform my job.						
I have expertise to perform my job.						
I have a good understanding of the knowledge required for my job.						
I have thorough knowledge required to perform my current job.						
In terms of my job-related knowledge, I consider myself a novice (R).						
I have mastered the knowledge required to do my job.						
I have mastered the details of my job-related knowledge.						

	RESPONSE					
	1	2	3	4	5	6
DIVERSITY OF KNOWLEDGE						
My professional knowledge is diverse.						
I have a range of knowledge that helps me see my job from different points of view.						
My professional knowledge goes beyond my particular job.						
My professional knowledge focuses primarily on my particular job (R)						
My knowledge is not limited to the fundamental elements of my job.						
I have a diverse knowledge that enables me to recognize different effects on my job performance.						
I have a broader professional knowledge for my job.						
I know numerous points of view to perform my job.						
I am a generalist with respect to my job.						
I have a broad professional knowledge that helps me recognize how my work relates to other work.						
My professional knowledge is not limited to my specific job.						
My broad professional knowledge helps me identify what factors affect my job performance.						
I have a narrow set of professional knowledge (R).						
I have diverse work-related knowledge.						
I possess a range of knowledge that enables me to consider different perspectives in my job.						

Selected Items for Diversity and Depth of Knowledge

Depth of Knowledge

1. I have in-depth knowledge to perform my job
2. Regarding my job, I am an expert.
3. To be proficient at my job, I need a deeper understanding (R)
4. I lack an understanding of how to do my job. (R)
5. I have detailed knowledge required to perform my job.
6. I have expertise to perform my job.
7. In terms of my job-related knowledge, I consider myself a novice (R).
8. I have mastered the details of my job-related knowledge.

Diversity of Knowledge

1. My professional knowledge is diverse.
2. I have a range of knowledge that helps me see my job from different points of view.
3. I have a diverse knowledge that enables me to recognize different effects on my job performance.
4. I have a broader professional knowledge for my job.
5. I am a generalist with respect to my job.
6. I have a broad professional knowledge that helps me recognize how my work relates to other work.
7. My professional knowledge is not limited to my specific job.
8. I have diverse work-related knowledge

APPENDIX 5

Multiple Regression - Exploration and Exploitation
Diversity of Knowledge, Depth of Knowledge, Metacognition,
and Control Variable

EXPLORATION WITH CONTROL VARIABLES	Model 0 (Base)				Model 1 (Main)				Model 2 (2 Ways Interaction)			
	Unstandardized		Standardized		Unstandardized		Standardized		Unstandardized		Standardized	
	B	Std.	Beta		B	Std.	Beta		B	Std.	Beta	
(Constant)	3.628	0.030		***	3.632	0.026		***	3.625	0.029		***
Age	-0.020	0.049	-0.036		0.016	0.043	0.028		0.015	0.044	0.026	
Tenure in Company	0.066	0.048	0.112		0.035	0.042	0.060		0.034	0.042	0.058	
Tenure in Position	-0.034	0.037	-0.058		-0.063	0.032	-0.106		-0.062	0.032	-0.105	
Negative Affect	-0.076	0.030	-0.135	*	-0.019	0.028	-0.033		-0.022	0.028	-0.039	
Diversity of Knowledge					0.168	0.039	0.294	***	0.166	0.039	0.290	***
Depth of Knowledge					-0.062	0.033	-0.110		-0.064	0.034	-0.113	
Metacognition					0.180	0.035	0.321	***	0.186	0.036	0.331	***
Diversity X Metacognition									0.030	0.030	0.079	
Depth X Metacognition									-0.011	0.038	-0.026	
Diversity X Depth									-0.014	0.030	-0.037	
Max VIF	2.666				2.719				4.056			
R Square	0.025				0.267				0.270			
Adjusted R Square	0.014				0.252				0.248			
R Square Changes	0.025				0.242				0.002			
F Changes	2.230				38.366***				0.386			
* : p<=0.05 ** : p<=0.01 *** : p<=0.001												

EXPLOITATION WITH CONTROL VARIABLES	Model 0 (Base)				Model 1 (Main)				Model 2 (2 Ways Interaction)			
	Unstandardized		Standardized		Unstandardized		Standardized		Unstandardized		Standardized	
	B	Std.	Beta		B	Std.	Beta		B	Std.	Beta	
(Constant)	3.784	0.028		***	3.784	0.027		**	3.770	0.030		***
Age	-0.077	0.045	-0.147		-0.052	0.044	-0.099		-0.054	0.044	-0.103	
Tenure in Company	0.042	0.044	0.077		0.021	0.042	0.039		0.029	0.042	0.053	
Tenure in Position	0.020	0.034	0.036		0.004	0.033	0.007		0.004	0.033	0.007	
Negative Affect	-0.054	0.028	-0.102		-0.014	0.028	-0.026		-0.020	0.028	-0.039	
Diversity of Knowledge					0.036	0.039	0.068		0.039	0.040	0.075	
Depth of Knowledge					0.013	0.033	0.025		0.023	0.034	0.044	
Metacognition					0.128	0.036	0.248	***	0.121	0.036	0.233	**
Diversity X Metacognition									0.047	0.030	0.136	
Depth X Metacognition									-0.084	0.038	-0.224	*
Diversity X Depth									0.037	0.030	0.105	
Max VIF	2.666				2.719				4.056			
R Square	0.016				0.106				0.119			
Adjusted R Square	0.005				0.088				0.094			
R Square Changes	0.116				0.090				0.013			
F Changes	1.463				11.628***				1.725			
* : p<=0.05 ** : p<=0.01 *** : p<=0.001												

Multiple Regression - Individual Ambidexterity
Exploration, Exploitation and Control Variable

AMBIDEXTERITY WITH CONTROL VARIABLES	Model 0 (Base)				Model 1 (Main Effect)				Model 2 (2 Ways Interaction)			
	Unstandardized Coefficients		Standardized Coefficients		Unstandardized Coefficients		Standardized Coefficients		Unstandardized Coefficients		Standardized Coefficients	
	B	Std. Error	Beta		B	Std. Error	Beta		B	Std. Error	Beta	
(Constant)	3.502	0.035		***	3.504	0.033		***	3.493	0.034		***
Age	-0.108	0.057	-0.164		-0.089	0.053	-0.135		-0.088	0.053	-0.132	
Tenure in Company	0.126	0.055	0.183	*	0.094	0.052	0.138		0.094	0.052	0.137	
Tenure in Position	0.021	0.043	0.031		0.031	0.040	0.045		0.030	0.040	0.044	
Negative Affect	0.000	0.035	0.000		0.037	0.033	0.056		0.036	0.033	0.054	
Exploration					0.213	0.036	0.323	***	0.212	0.036	0.320	***
Exploitation					0.078	0.036	0.117	*	0.079	0.036	0.120	*
Exploration X Exploitation									0.029	0.027	0.053	
Max VIF	2.666				2.689				2.692			
R Square	0.016				0.160				0.163			
Adjusted R Square	0.004				0.146				0.146			
R Square Changes	0.016				0.144				0.003			
F Changes	1.394				30.008***				1.145			

* : p<=0.05 ** : p<=0.01 *** : p<=0.001 n=414

Multiple Regression - Individual Ambidexterity
Diversity of Knowledge, Depth of Knowledge, Metacognition, and Control Variable

AMBIDEXTERITY WITH CONTROL VARIABLES	Model 0 (Base)				Model 1 (Main Effect)				Model 2 (2 Ways Interaction)			
	Unstandardized Coefficients		Standardized Coefficients		Unstandardized Coefficients		Standardized Coefficients		Unstandardized Coefficients		Standardized Coefficients	
	B	Std. Error	Beta		B	Std. Error	Beta		B	Std. Error	Beta	
(Constant)	3.502	0.035		***	3.505	0.032		***	3.515	0.035		***
Age	-0.108	0.057	-0.164		-0.067	0.052	-0.101		-0.063	0.053	-0.095	
Tenure in Company	0.126	0.055	0.183	*	0.092	0.050	0.135		0.095	0.051	0.138	
Tenure in Position	0.021	0.043	0.031		-0.008	0.039	-0.011		-0.011	0.039	-0.016	
Negative Affect	0.000	0.035	0.000		0.063	0.033	0.096		0.064	0.034	0.098	
Diversity of Knowledge					0.140	0.047	0.212	**	0.142	0.047	0.215	**
Depth of Knowledge					-0.047	0.040	-0.072		-0.045	0.041	-0.069	
Metacognition					0.212	0.042	0.325	***	0.202	0.043	0.310	***
Diversity X Metacognition									-0.025	0.036	-0.057	
Depth X Metacognition									-0.011	0.045	-0.024	
Diversity X Depth									0.020	0.036	0.045	
Max VIF	2.666				2.719				4.056			
R Square	0.016				0.210				0.213			
Adjusted R Square	0.004				0.195				0.190			
R Square Changes	0.016				0.195				0.003			
F Changes	1.394				28.630***				0.397			

* : p<=0.05 ** : p<=0.01 *** : p<=0.001 n=414

APPENDIX 6

Questionnaire

Electronically Distributed and Collected by Qualtrix

Thank you for participating in this survey. As mentioned in the introductory email, the purpose of this survey is to explore some of the factors that influence employee behavior in exploring new things and exploiting the existing resources.

Your participation in this study is voluntary and you are free to withdraw your participation at any time. The survey will take no more than 15 minutes to complete.

This survey has been reviewed and approved by the Singapore Management University Institutional Review Board. There are no risks associated with participating in this survey. All responses in the survey will be recorded anonymously. Your anonymity is protected by not being asked to sign and return a consent form. Completion of the survey is considered your consent. No identifying information of respondents is collected in the survey and no one can link the responses to you.

I appreciate your participation in completing this survey. Thank you.

Deddi Tedjakumara
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Dissertation Chair:
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Professor of OBHR - Singapore Management University

Section 1

Instructions:
Please respond to the following items indicating how typical each statement is of you.

No	Statement	*Not at all typical of me*	*Not very typical of me*	*Somewh at typical of me*	*Fairly typical of me*	*Very typical of me*
1	I have in-depth knowledge to perform my job	1	2	3	4	5
2	Regarding my job, I am an expert.	1	2	3	4	5
3	To be proficient at my job, I need a deeper understanding (R)	1	2	3	4	5
4	I lack an understanding of how to do my job. (R)	1	2	3	4	5
5	I have detailed knowledge required to perform my job.	1	2	3	4	5
6	I have expertise to perform my job.	1	2	3	4	5
7	In terms of my job-related knowledge, I consider myself a novice (R).	1	2	3	4	5
8	I have mastered the details of my job-related knowledge.	1	2	3	4	5
9	My professional knowledge is diverse.	1	2	3	4	5
10	I have a range of knowledge that helps me see my job from different points of view.	1	2	3	4	5

11	I have a diverse knowledge that enables me to recognize different effects on my job performance.	1	2	3	4	5
12	I have a broader professional knowledge for my job.	1	2	3	4	5
13	I am a generalist with respect to my job.	1	2	3	4	5
14	I have a broad professional knowledge that helps me recognize how my work relates to other work.	1	2	3	4	5
15	My professional knowledge is not limited to my specific job.	1	2	3	4	5
16	I have diverse work-related knowledge	1	2	3	4	5

Section 2

Instructions:
Please respond to the following items indicating how typical each statement is of you.

No	Statement	*Not at all typical of me*	*Not very typical of me*	*Somewhat typical of me*	*Fairly typical of me*	*Very typical of me*
1	I know what kind of information is most important when doing this job.	1	2	3	4	5
2	I know what is expected from me on this job.	1	2	3	4	5

3	I have control over how well I think	1	2	3	4	5
4	I can motivate myself to think when I need to.	1	2	3	4	5
5	I am aware of what strategies I use to think on this job.	1	2	3	4	5
6	I am a good judge of how well I understand something.	1	2	3	4	5
7	I find myself using helpful thinking strategies automatically.	1	2	3	4	5
8	I know when each strategy I use will be most effective.	1	2	3	4	5
9	I think about what I really need to know before I begin a task.	1	2	3	4	5
10	I set specific goals before I begin a task.	1	2	3	4	5
11	***To demonstrate your attention, please select number 4 for this question.***	1	2	3	4	5
12	I periodically review to help me understand the important connections among the information I possess.	1	2	3	4	5
13	I summarize what I've learned after I finish my job.	1	2	3	4	5
14	I try to translate new information into my own words.	1	2	3	4	5

15	I change my strategies when I fail to understand.	1	2	3	4	5
16	I use systematic information to help me know something.	1	2	3	4	5
17	I ask myself if the new information is related to what I already know	1	2	3	4	5
18	I re-evaluate my assumptions when I get confused.	1	2	3	4	5
19	I ask myself if I learned as much as I could have once I finish a task.	1	2	3	4	5
20	I stop and go back over new information that is not clear.	1	2	3	4	5

Section 3:

Instructions:
Please respond to the following items indicating to what extent did you doing this in your work last year.

No	Questions	*To a very small extent*	*To a small extent*	*To a moderate extent*	*To a large extent*	*To a very large extent*
	In doing your work last year, to what extent did you:					
1	Search for new possibilities (e.g., products/services, processes, markets)?	1	2	3	4	5
2	Evaluate diverse options (e.g., products/services, processes, markets)?	1	2	3	4	5

3	Prioritize radical changes (e.g., in product/services or processes)?	1	2	3	4	5
4	Engage in activities that required you to adapt?	1	2	3	4	5
5	Learn new skills or knowledge?	1	2	3	4	5
6	***For this question, please select the scale "To a very large extent", to demonstrate your attention.***	1	2	3	4	5
7	Use past experiences that have been accumulated by yourself to perform your job?	1	2	3	4	5
8	Perform activities with existing people/services/products/ process?	1	2	3	4	5
9	Perform activities where it was clear to you how to conduct them?	1	2	3	4	5
10	Focus primarily on achieving short-term goals?	1	2	3	4	5
11	Conduct your activities by using your existing knowledge?	1	2	3	4	5
12	Engage in activities which clearly fit into existing company policy?	1	2	3	4	5

Section 4:

Instructions:
Please respond to the following items indicating how much did you have it in your work last year.

No	Questions	*Very little amount*	*Little amount*	*Moderate Amount*	*Large Amount*	*Maximum Amount*
1	The amount of variety in my job	1	2	3	4	5
2	The opportunity for independent thought and action	1	2	3	4	5
3	The opportunity to find out how well I am doing on my job.	1	2	3	4	5
4	The opportunity to do a job from the beginning to end (i.e., the chance to do a whole job)	1	2	3	4	5

Section 5

Instructions:
Please respond to the following items indicating how typical each statement is of you.

No	Statement	*Not at all typical of me*	*Not very typical of me*	*Somewhat typical of me*	*Fairly typical of me*	*Very typical of me*
In my job, I am a person who:						
1	… easily alternate between looking for ideas with new knowledge and with existing knowledge.	1	2	3	4	5
2	… switch between searching new possibilities and using my past experiences easily.	1	2	3	4	5

3	….switch easily between activities that beyond what I am already used to perform and with something I'm already very good at.	1	2	3	4	5
4	… alternate between generating diverse option and focusing on the most viable option.	1	2	3	4	5

Section 6

Instructions:
This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you generally feel this way; that is, how you fell on average. Use the following scale to record your answers.

1	2	3	4	5
Very slightly or not at all	A little	Moderately	Quite a bit	Extremely

___ Interested	___ Hostile	___ Nervous
___ Distressed	___ Enthusiastic	___ Determined
___ Excited	___ Proud	___ Attentive
___ Upset	___ Irritable	___ Jittery
___ Strong	___ Alert	___ Active
___ Guilty	___ Ashamed	___ Afraid
___ Scared	___ Inspired	

Section 7

Instructions: Please fill or choose some demographic datas.

Age: years old

Gender:
- Male
- Female
- Prefer not to mention

Line of Business:
- automotive
- financial services
- heavy equipment
- mining/construction
- property
- energy
- infrastructure
- logistics
- agribusiness
- information technology

Educational Background:
- Below bachelor's degree
- Bachelor Degree
- Above Bachelor Degree

Current position:
- Non managerial
- First line manager
- Middle manager
- Upper manager

Length of service in this career: years
Length of service in this company: years
Length of service in current position: years

REFERENCES

Aldag, R. J., Barr, S. H., & Brief, A. P. (1981). Measurement of perceived task characteristics. *Psychological Bulletin*, *90*(3), 415.

Alexander, J. M., Carr, M. & Schwanenflugel, P. J. (1995). Development of metacognition in gifted children: Directions for future research. *Developmental Review*, 15, 1–37.

Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of personality and social psychology*, *45*(2), 357.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. *Research in organizational behavior*, *10*(1), 123-167.

Awojide, O., Hodgkinson, I. R., & Ravishankar, M. N. (2018). Managerial ambidexterity and the cultural toolkit in project delivery. *International journal of project management*, *36*(8), 1019-1033. http://dx.doi.org/10.1016/j.ijproman.2018.07.007

Baron, R. A., & Henry, R. A. (2010). How entrepreneurs acquire the capacity to excel: Insights from research on expert performance. *Strategic Entrepreneurship Journal*, *4*(1), 49-65.

Baum, J. A., Li, S. X., & Usher, J. M. (2000). Making the next move: How experiential and vicarious learning shape the locations of chains' acquisitions. *Administrative Science Quarterly*, *45*(4), 766-801.

Beckman, C. M., Haunschild, P. R., & Phillips, D. J. (2004). Friends or strangers? Firm-specific uncertainty, market uncertainty, and network partner selection. *Organization science*, *15*(3), 259-275.

Benner, M. J., & Tushman, M. (2002). Process management and technological innovation: A longitudinal study of the photography and paint industries. *Administrative science quarterly*, *47*(4), 676-707.

Berger, R. S., & Reid, D. K. (1989). Differences that make a difference: Comparisons of metacomponential functioning and knowledge base among groups of high and low IQ learning disabled, mildly mentally retarded, and normally achieving adults. *Journal of Learning Disabilities*, *22*(7), 422-429.

Bidmon, C. M., & Boe-Lillegraven, S. (2020). Now, switch! Individuals' responses to imposed switches between exploration and exploitation. *Long Range Planning*, *53*(6), 101928.

Birkinshaw, J., & Gupta, K. (2013). Clarifying the distinctive contribution of ambidexterity to the field of organization studies. *Academy of Management Perspectives*, *27*(4), 287-298. http://dx.doi.org/10.5465/amp.2012.0167

Birkinshaw, J., Zimmermann, A., & Raisch, S. (2016). How do firms adapt to discontinuous change? Bridging the dynamic capabilities and ambidexterity perspectives. *California Management Review*, *58*(4), 36-58. http://dx.doi.org/10.1525/cmr.2016.58.4.36

Bink, M. L., & Marsh, R. L. (2000). Cognitive regularities in creative activity. *Review of General Psychology*, *4*(1), 59-78.

Bledow, R., Frese, M., Anderson, N., Erez, M., & Farr, J. (2009). A dialectic perspective on innovation: Conflicting demands, multiple pathways, and ambidexterity. *Industrial and Organizational Psychology*, *2*(3), 305-337. http://dx.doi.org/10.1111/j.1754-9434.2009.01154.x

Brown, A. L. (1987). Metacognition, executive control, self-regulation, and other more mysterious mechanisms. *Metacognition, motivation, and understanding*, 65-116.

Burgelman, R. A. (2002). Strategy as vector and the inertia of coevolutionary lock-in. *Administrative science quarterly*, *47*(2), 325-357. http://dx.doi.org/10.2307/3094808

Byström, K., & Järvelin, K. (1995). Task complexity affects information seeking and use. *Information processing & management*, *31*(2), 191-213. http://dx.doi.org/10.1016/0306-4573(95)80035-R

Carlile, P. R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization science*, *15*(5), 555-568.

Carroll, G. R., Bigelow, L. S., Seidel, M. D. L., & Tsai, L. B. (1996). The fates of de novo and de alio producers in the American automobile industry 1885–1981. *Strategic Management Journal*, *17*(S1), 117-137.

Clark,D. (2021, August 27). *Average company lifespan of S&P 500 companies 1965-2030.* Statista. https://www.statista.com/statistics/1259275/average-company-lifespan/

Chen, E. L., & Katila, R. (2008). Rival interpretations of balancing exploration and exploitation: Simultaneous or sequential. *Handbook of technology and innovation management*, *1*.

Cheng, Y. T., & Van de Ven, A. H. (1996). Learning the innovation journey: order out of chaos?. *Organization science*, *7*(6), 593-614.

Chi, M. T. (2006). Laboratory methods for assessing experts' and novices' knowledge. *The Cambridge handbook of expertise and expert performance*, 167-184.

Christensen, C. M. (2006). The ongoing process of building a theory of disruption. *Journal of Product innovation management*, *23*(1), 39-55. http://dx.doi.org/10.1111/j.1540-5885.2005.00180.x

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). Applied multiple regression/correlation analysis for the behavioral sciences. Routledge.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative science quarterly*, *35*(1), 128-152.

Dane, E. (2010). Reconsidering the trade-off between expertise and flexibility: A cognitive entrenchment perspective. *Academy of Management Review*, *35*(4), 579-603. http://dx.doi.org/10.5465/AMR.2010.53502832

Danneels, E. (2002). The dynamics of product innovation and firm competences. *Strategic management journal*, *23*(12), 1095-1121. http://dx.doi.org/10.1002/smj.275

De Dreu, C. K., Baas, M., & Nijstad, B. A. (2008). Hedonic tone and activation level in the mood-creativity link: toward a dual pathway to creativity model. *Journal of personality and social psychology*, *94*(5), 739.

De Geus, A. (2002). *The living company*. Harvard Business Press.

Dunning, D., Johnson, K., Ehrlinger, J., & Kruger, J. (2003). Why people fail to recognize their own incompetence. *Current directions in psychological science*, *12*(3), 83-87. http://dx.doi.org/10.1111/1467-8721.01235

Erbas, A. K., & Bas, S. (2015). The contribution of personality traits, motivation, academic risk-taking and metacognition to the creative ability in mathematics. *Creativity Research Journal*, *27*(4), 299-307.

Everson, H. T., & Tobias, S. (1998). The ability to estimate knowledge and performance in college: A metacognitive analysis. *Instructional science*, *26*(1-2), 65-79. http://dx.doi.org/10.1007/978-94-017-2243-8_4

Fiske, S. T., & Taylor, S. E. (1991). *Social cognition*. Mcgraw-Hill Book Company.

Flavell, J. H. (1976). Metacognitive aspects of problem solving. *The nature of intelligence*

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American psychologist*, *34*(10), 906. http://dx.doi.org/10.1037/0003-066X.34.10.906

Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of counseling psychology*, *51*(1), 115.

Frensch, P. A., & Sternberg, R. J. (2014). Expertise and intelligent thinking: When is it worse to know better?. In *Advances in the psychology of human intelligence* (pp. 157-188). Psychology Press.

Frey, K., Lüthje, C., & Haag, S. (2011). Whom should firms attract to open innovation platforms? The role of knowledge diversity and motivation. *Long range planning*, *44*(5-6), 397-420.

Gavetti, G., & Levinthal, D. (2000). Looking forward and looking backward: Cognitive and experiential search. *Administrative science quarterly*, *45*(1), 113-137. http://dx.doi.org/10.2307/2666981

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of management Journal*, *47*(2), 209-226.

Gilson, L. L., & Shalley, C. E. (2004). A little creativity goes a long way: An examination of teams' engagement in creative processes. *Journal of management*, *30*(4), 453-470.

Gruber, M., MacMillan, I. C., & Thompson, J. D. (2012). From minds to markets: How human capital endowments shape market opportunity identification of technology start-ups. *Journal of management*, *38*(5), 1421-1449. http://dx.doi.org/10.1177/0149206310386228

Gupta, A. K., Smith, K. G., & Shalley, C. E. (2006). The interplay between exploration and exploitation. Academy of management journal, 49(4), 693-706.

Haas, M. R., & Ham, W. (2015). Microfoundations of knowledge recombination: Peripheral knowledge and breakthrough innovation in teams. In *Cognition and Strategy*. Emerald Group Publishing Limited

Hair, J. F. Jr., Anderson, R. E., Tatham, R. L. & Black, W. C. (1995). Multivariate Data Analysis (3rd ed). New York: Macmillan.

Hargrove, R. A., & Nietfeld, J. L. (2015). The impact of metacognitive instruction on creative problem solving. *The Journal of Experimental Education*, *83*(3), 291-318. http://dx.doi.org/10.1080/00220973.2013.876604

Harrison, G. M., & Vallin, L. M. (2018). Evaluating the metacognitive awareness inventory using empirical factor-structure evidence. *Metacognition and Learning*, *13*(1), 15-38. http://dx.doi.org/10.1007/s11409-017-9176-z

Haynie, J. M., Shepherd, D. A., & Patzelt, H. (2012). Cognitive adaptability and an entrepreneurial task: The role of metacognitive ability and feedback. *Entrepreneurship Theory and Practice*, *36*(2), 237-265.

He, Z. L., & Wong, P. K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization science*, *15*(4), 481-494.

Helfat, C. E., & Peteraf, M. A. (2009). Understanding dynamic capabilities: progress along a developmental path. *Strategic organization,* 7(1), 91-102.

Hillenbrand, P., Kiewell D., Miller-Cheevers, R., Ostojic, I., Springer,G. (2019, June 28). *Traditional company, new businesses: The pairing that can ensure an incumbent's survival.* McKinsey & Company. https://www.mckinsey.com/industries/oil-and-gas/our-insights/traditional-company-new-businesses-the-pairing-that-can-ensure-an-incumbents-survival?cid=eml-web

Hoang, H. A., & Rothaermel, F. T. (2010). Leveraging internal and external experience: exploration, exploitation, and R&D project performance. *Strategic management journal*, *31*(7), 734-758.

Jansen, J. J., Kostopoulos, K. C., Mihalache, O. R., & Papalexandris, A. (2016). A socio-psychological perspective on team ambidexterity: The contingency role of supportive leadership behaviours. *Journal of Management Studies*, *53*(6), 939-965. http://dx.doi.org/10.1111/joms.12183

Jeppesen, L. B., & Lakhani, K. R. (2010). Marginality and problem-solving effectiveness in broadcast search. *Organization science*, *21*(5), 1016-1033. http://dx.doi.org/10.1287/orsc.1090.0491

Jia, X., Li, W., & Cao, L. (2019). The role of metacognitive components in creative thinking. *Frontiers in psychology*, *10*, 2404.

Johns, G. (2010). Some unintended consequences of job design. *Journal of Organizational Behavior*, *31*(2/3), 361-369. http://dx.doi.org/10.1002/job.669

Kaplan, S., & Vakili, K. (2015). The double-edged sword of recombination in breakthrough innovation. *Strategic Management Journal*, *36*(10), 1435-1457. http://dx.doi.org/10.1002/smj.2294

Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of management journal*, *45*(6), 1183-1194. http://dx.doi.org/10.2307/3069433

Katz, B., & Du Preez, N. (2008). The role of knowledge management in supporting a radical innovation project. *Methods and tools for effective knowledge life-cycle-management*, 331-345.

Kauppila, O. P., & Tempelaar, M. P. (2016). The social-cognitive underpinnings of employees' ambidextrous behaviour and the supportive role of group managers' leadership. *Journal of Management Studies*, *53*(6), 1019-1044. http://dx.doi.org/10.1111/joms.12192

Keller, T., & Weibler, J. (2015). What it takes and costs to be an ambidextrous manager: Linking leadership and cognitive strain to balancing exploration and exploitation. *Journal of Leadership & Organizational Studies*, *22*(1), 54-71. http://dx.doi.org/10.1177/1548051814524598

Kleitman, S., & Stankov, L. (2007). Self-confidence and metacognitive processes. *Learning and individual differences*, *17*(2), 161-173. http://dx.doi.org/10.1016/j.lindif.2007.03.004

Kiss, A. N., Libaers, D., Barr, P. S., Wang, T., & Zachary, M. A. (2020). CEO cognitive flexibility, information search, and organizational ambidexterity. *Strategic Management Journal*, *41*(12), 2200-2233.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: how difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of personality and social psychology*, *77*(6), 1121. http://dx.doi.org/10.1037/0022-3514.77.6.1121

Laureiro-Martínez, D., Brusoni, S., Canessa, N., & Zollo, M. (2015). Understanding the exploration–exploitation dilemma: An fMRI study of attention control and decision-making performance. *Strategic management journal*, *36*(3), 319-338. http://dx.doi.org/10.1002/smj.2221

Leiponen, A., & Helfat, C. E. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic management journal*, *31*(2), 224-236. http://dx.doi.org/10.1002/smj.807

Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic management journal*, *14*(S2), 95-112.

Lewandowsky, S., Little, D., & Kalish, M. L. (2007). Knowledge and expertise. In F.T. Durso (Eds), *Handbook of applied cognition*. (83-109) John Wiley & Sons.

Liao, S. H., Fei, W. C., & Liu, C. T. (2008). Relationships between knowledge inertia, organizational learning and organization innovation. *Technovation*, *28*(4), 183-195.

Lovett, M. C., & Anderson, J. R. (1996). History of success and current context in problem solving: Combined influences on operator selection. *Cognitive psychology*, *31*(2), 168-217

Magno, C. (2010). The role of metacognitive skills in developing critical thinking. *Metacognition and learning*, *5*, 137-156. http://dx.doi.org/10.1007/s11409-010-9054-4

Mannucci, P. V., & Yong, K. (2018). The differential impact of knowledge depth and knowledge breadth on creativity over individual careers. *Academy of Management Journal*, *61*(5), 1741-1763.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization science*, *2*(1), 71-87.

Mathieu, J. E., Gilson, L. L., & Ruddy, T. M. (2006). Empowerment and team effectiveness: An empirical test of an integrated model. *Journal of applied psychology*, *91*(1), 97.

Minnaert, A. (1996). Can metacognition compensate for intelligence in the first year of Belgian higher education?. *Psychologica Belgica*, *36*(4). http://dx.doi.org/10.5334/pb.903

Mom, T. J., Chang, Y. Y., Cholakova, M., & Jansen, J. J. (2019). A multilevel integrated framework of firm HR practices, individual ambidexterity, and organizational ambidexterity. *Journal of Management*, 45(7), 3009-3034.

Mom, T. J., Fourné, S. P., & Jansen, J. J. (2015). Managers' work experience, ambidexterity, and performance: The contingency role of the work context. *Human Resource Management*, *54*(S1), s133-s153.

Mom, T. J., Van Den Bosch, F. A., & Volberda, H. W. (2007). Investigating managers' exploration and exploitation activities: The influence of top-down, bottom-up, and horizontal knowledge inflows. *Journal of management studies*, *44*(6), 910-931.

Mom, T. J., Van Den Bosch, F. A., & Volberda, H. W. (2009). Understanding variation in managers' ambidexterity: Investigating direct and interaction effects of formal structural and personal coordination mechanisms. *Organization Science*, *20*(4), 812-828.

Nagle, F., & Teodoridis, F. (2020). Jack of all trades and master of knowledge: The role of diversification in new distant knowledge integration. *Strategic management journal*, *41*(1), 55-85. http://dx.doi.org/10.1002/smj.3091

Nelson, T. O. (1996). Consciousness and metacognition. American Psychologist, 51, 102–116.

Neter, J., Kutner, M. H., Nachtsheim, C. J., & Wasserman, W. (1996). Applied linear regression. *Chicago, IL: Irwin*, *720*.

Noguchi, K., Gohm, C. L., & Dalsky, D. J. (2006). Cognitive tendencies of focusing on positive and negative information. *Journal of Research in Personality*, *40*(6), 891-910. http://dx.doi.org/10.1016/j.jrp.2005.09.008

Oldham, G. R., & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *Academy of management journal*, *39*(3), 607-634.

O'Reilly III, C. A., & Tushman, M. L. (2008). Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Research in organizational behavior*, *28*, 185-206. http://dx.doi.org/10.1016/j.riob.2008.06.002

O'Reilly III, C. A., & Tushman, M. L. (2011). Organizational ambidexterity in action: How managers explore and exploit. *California management review*, *53*(4), 5-22.

Parker, S. K. (2014). Beyond motivation: Job and work design for development, health, ambidexterity, and more. *Annual review of psychology*, *65*, 661-691.

Perry-Smith, J. E. (2006). Social yet creative: The role of social relationships in facilitating individual creativity. *Academy of Management journal*, *49*(1), 85-101.

Pertusa-Ortega, E. M., Molina-Azorín, J. F., Tarí, J. J., Pereira-Moliner, J., & López-Gamero, M. D. (2021). The microfoundations of organizational ambidexterity: A systematic review of individual ambidexterity through a multilevel framework. BRQ Business Research Quarterly, 24(4), 355-371. http://dx.doi.org/10.1177/2340944420929711

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of educational psychology*, *82*(1), 33. http://dx.doi.org/10.1037/0022-0663.82.1.33

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of applied psychology*, 88(5), 879. http://dx.doi.org/10.1037/0021-9010.88.5.879

Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of management*, *12*(4), 531-544. http://dx.doi.org/10.1177/014920638601200408

Raisch, S., Birkinshaw, J., Probst, G., & Tushman, M. L. (2009). Organizational ambidexterity: Balancing exploitation and exploration for sustained performance. *Organization science*, *20*(4), 685-695.

Rosing, K., & Zacher, H. (2016). A new perspective on individual ambidexterity and its relationship with innovative performance. In *Academy of Management Proceedings* (Vol. 2016, No. 1, p. 14293). Briarcliff Manor, NY 10510: Academy of Management. http://dx.doi.org/10.5465/ambpp.2016.14293abstract

Sarac, S., Önder, A., & Karakelle, S. (2014). The relations among general intelligence, metacognition and text learning performance. *Egitim ve Bilim*, *39*(173).

Schilke, O., Hu, S., & Helfat, C. E. (2018). Quo vadis, dynamic capabilities? A content-analytic review of the current state of knowledge and recommendations for future research. *Academy of management annals*, *12*(1), 390-439. http://dx.doi.org/10.5465/annals.2016.0014

Schnellbächer, B., & Heidenreich, S. (2020). The role of individual ambidexterity for organizational performance: examining effects of ambidextrous knowledge seeking and offering. *The Journal of Technology Transfer*, *45*(5), 1535-1561. http://dx.doi.org/10.1007/s10961-020-09781-x

Schnellbächer, B., Heidenreich, S., & Wald, A. (2019). Antecedents and effects of individual ambidexterity–A cross-level investigation of exploration and exploitation activities at the employee level. *European Management Journal*, *37*(4), 442-454. http://dx.doi.org/10.1016/j.emj.2019.02.002

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary educational psychology*, *19*(4), 460-475. http://dx.doi.org/10.1006/ceps.1994.1033

Schraw, G., & Moshman, D. (1995). Metacognitive theories. *Educational psychology review*, *7*(4), 351-371. http://dx.doi.org/10.1007/BF02212307

Sims Jr, H. P., Szilagyi, A. D., & Keller, R. T. (1976). The measurement of job characteristics. *Academy of Management journal*, *19*(2), 195-212.

Sitkin, S. B., See, K. E., Miller, C. C., Lawless, M. W., & Carton, A. M. (2011). The paradox of stretch goals: Organizations in pursuit of the seemingly impossible. *Academy of management review*, *36*(3), 544-566. http://dx.doi.org/10.5465/AMR.2011.61031811

Son, L. K., & Metcalfe, J. (2000). Metacognitive and control strategies in study-time allocation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*(1), 204.

Spector, P. E., & Brannick, M. T. (2011). Methodological urban legends: The misuse of statistical control variables. *Organizational research methods*, 14(2), 287-305. http://dx.doi.org/10.1177/1094428110369842

Sternberg, R. J. (1990). *Metaphors of mind: Conceptions of the nature of intelligence*. Cambridge University Press.

Sternberg, R. J., & Lubart, T. I. (1999). The concept of creativity: Prospects and paradigms. *Handbook of creativity*, *1*(3-15). http://dx.doi.org/10.1017/CBO9780511807916.003

Stone, E. F., & Gueutal, H. G. (1985). An empirical derivation of the dimensions along which characteristics of jobs are perceived. *Academy of Management Journal*, *28*(2), 376-396.

Tarba, S. Y., Jansen, J. J., Mom, T. J., Raisch, S., & Lawton, T. C. (2020). A microfoundational perspective of organizational ambidexterity: Critical review and research directions. *Long Range Planning*, *53*(6), 102048.

Taylor, A., & Greve, H. R. (2006). Superman or the fantastic four? Knowledge combination and experience in innovative teams. *Academy of management Journal*, *49*(4), 723-740. http://dx.doi.org/10.5465/amj.2006.22083029

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, *18*(7), 509-533.

Tempelaar, M. P., & Rosenkranz, N. A. (2019). Switching hats: The effect of role transition on individual ambidexterity. *Journal of Management*, *45*(4), 1517-1539. http://dx.doi.org/10.1177/0149206317714312

Teodoridis, F., Bikard, M., & Vakili, K. (2019). Creativity at the knowledge frontier: The impact of specialization in fast-and slow-paced domains. *Administrative Science Quarterly*, *64*(4), 894-927. http://dx.doi.org/10.1177/0001839218793384

Torres, J. P., Drago, C., & Aqueveque, C. (2015). Knowledge inflows effects on middle managers' ambidexterity and performance. *Management Decision*, *53*(10), 2303-2320.

Tripsas, M., & Gavetti, G. (2020). Capabilities, cognition, and inertia: Evidence from digital imaging. *Strategic management journal*, *21*(10/11), 1147-116. http://dx.doi.org/10.1002/9781405164054.ch23

Tushman, M. L., & O'Reilly III, C. A. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California management review*, *38*(4), 8-29.

Van der Stel, M., & Veenman, M. V. (2014). Metacognitive skills and intellectual ability of young adolescents: A longitudinal study from a developmental perspective. *European journal of psychology of education*, *29*, 117-137

Veenman, M. V. J., & Beishuizen, J. J. (2004). Intellectual and metacognitive skills of novices while studying texts under conditions of text difficulty and time constraint. *Learning and Instruction,* 14, 619–638.

Veenman, M. V., & Spaans, M. A. (2005). Relation between intellectual and metacognitive skills: Age and task differences. *Learning and individual differences*, *15*(2), 159-176.

Veenman, M. V., Van Hout-Wolters, B. H., & Afflerbach, P. (2006). Metacognition and learning: Conceptual and methodological considerations. *Metacognition and learning*, *1*, 3-14.

Veenman, M. V., Wilhelm, P., & Beishuizen, J. J. (2004). The relation between intellectual and metacognitive skills from a developmental perspective. *Learning and instruction*, *14*(1), 89-109.

Wadhwa, A., & Kotha, S. (2006). Knowledge creation through external venturing: Evidence from the telecommunications equipment manufacturing industry. *Academy of Management journal*, *49*(4), 819-835. http://dx.doi.org/10.5465/amj.2006.22083132

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology*, *54*(6), 1063. http://dx.doi.org/10.1037/0022-3514.54.6.1063

Yang, D., Jin, L., & Sheng, S. (2017). The effect of knowledge breadth and depth on new product performance. *International Journal of Market Research*, *59*(4), 517-536

Young, A., & Fry, J. D. (2008). Metacognitive awareness and academic achievement in college students. *Journal of the Scholarship of Teaching and Learning*, *8*(2), 1-10.

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of management review*, *27*(2), 185-203.