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**CEO's Managerial Cognition and Dynamic Capabilities:
A Meta-analytical Study from Micro-founded Approach**

Abstract

Micro-founded approach allows unpacking the processes by which dynamic capabilities are created. In this line, managerial cognition has been proposed as variable related to dynamic capabilities, but the high number of cognitive variables reported and some contradictory results hinder its theoretical contribution. This study classifies managerial cognitive variables of the Chief Executive Officer (CEOs) in three types of dynamic managerial capabilities: managerial sensing, managerial seizing and managerial reconfiguration. We estimate the correlation of these managerial capabilities with dynamic capabilities of the firm. We focused on CEOs' managerial cognitive variables. We use a three-level random effects model to synthesize 101 correlations reported from 2007 to 2021, representing 6,153 CEOs around the world. This meta-analysis reveals a positive relationship between CEOs' managerial cognition and dynamic capabilities, especially with respect to those cognitive variables that support managerial sensing as the perception of opportunities and entrepreneurial alert.

Keywords: dynamic capabilities, dynamic managerial capabilities, managerial cognition, meta-analysis, microfoundations

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Introduction

Microfoundations revolution has opened doors to understand how individuals and teams contribute to firm heterogeneity (Ployhart & Donald Hale, 2014). Classically, scholars have proposed organizational and environmental variables to explore differences among firms. They have pointed out that heterogeneity is associated with different capabilities to understand the environment, move and update their resources, and are constantly transformed (Galvin et al., 2014). These capabilities, named as dynamic capabilities, are “the abilities of an organization to create, extend or modify their resource base intentionally” (Helfat et al. 2009, p.1). Nonetheless, despite reports of positive effects on organizational performance (Bitencourt et al., 2019; Fainshmidt et al. 2016; Zhou et al., 2019), competitive advantages (Di Stefano et al. 2014; Peteraf et al., 2013), external fitness (Helfat & Peteraf, 2009), survival (Dixon et al., 2014), and innovation outcomes (Mitchell & Skrzypacz, 2015), the generation of such dynamic capabilities is unclear (Kurtmollaiev, 2017; Salvato & Vassolo, 2014).

At the organizational level, scholars have explored variables such as access to tangible and intangible resources, firm strategies focused on knowledge management, and the creation of institutional partnerships (Bitencourt et al., 2019). In that approach, environmental changes are the source of dynamic capabilities, and organizations respond to them. Hence, in stable environments there would be no need for dynamic capabilities. However, that organizational approach is unable to explain the complexity of dynamic capabilities (Felin et al., 2012). The stimulus-response model invoked by organizational level explanations does not account for the innovative process, it supposes that threats and opportunities are intrinsically in the business environment, and it cannot offer an explanation of the causal mechanism underlying the firm’s response (Bendig et al., 2018).

Nevertheless, firms face unstructured business environment daily. In those environments there are not threats or opportunities, only changes that can be interpreted through perceptual processes. Then, the exploration of the sources of dynamic capabilities requires a micro-founded approach that uses the conceptual tools of the behavioral perspective to breaks the stimulus-response model opening the black box (Felin et al., 2012; Felin et al., 2015; Gavetti, 2005; Helfat & Peteraf, 2015; Ployhart & Donald Hale, 2014).

According to microfoundations approach, dynamic capabilities arise from actions and interactions among individuals. Those capabilities are emergent phenomena articulated through psychological and social processes (Felin et al., 2012; Hodgkinson & Healey, 2011). In the articulation process, CEOs are a source of variability because they are the agents responsible for building, integrating, and reconfiguring firm's resources. In firms, they "orchestrate" the resources and capabilities of their organizations to adapt to environmental changes (Kor & Mesko, 2013; Sirmon & Hitt, 2009).

Nonetheless, CEOs cannot arise dynamic capabilities, they activate a micro-founded mechanism that influences the conditions of employee actions allowing the social interaction and the learning in the firm (Bendig et al., 2018). In sum, CEOs do not create dynamic capabilities, they have a pivotal role in the development of these capabilities, stimulating the conditions to emerge them. To stimulate the generation of dynamic capabilities, CEOs use managerial dynamic capabilities (Adner and Helfat, 2003) that are supported by their individual resources as their cognition, human capital, and social capital. In this study we emphasize the role of one of those resources: managerial cognition.

The contribution of managerial cognition has hitherto been hidden due to two issues. Firstly, the high number of cognitive variables reported in the literature, including perceptual,

attentional, attitudinal, and cognitive styles. And secondly, there are conflicting results in the literature. Whereas many studies have revealed negative or non-significant relationships (Eggers & Kaplan, 2009; Garrett et al., 2009; Kiss & Barr, 2015; Zhao & Parry, 2012), other studies have reported positive relationships (Patel, 2019; Roundy et al., 2018; Song et al., 2013; Yu & Lindsay, 2016).

We assert that managerial cognition is not a variable; it is a family of several variables that could be articulated by their function in the support of dynamic managerial capabilities. Therefore, it is relevant to assess the current state of the research identifying the cognitive variables reported in the literature and the evidence of association with dynamic capabilities. We have decided to use a meta-analytic approach because it helps to achieve the assessment of the current research, search all the cognitive variables reported, and estimating the association by each variable with dynamic capabilities. In contrast to qualitative reviews, meta-analysis is a strategy for quantitative literature review that allows the integration of results in the literature and to explore new hypotheses not included in the primary research (Sartal, et al., 2021). Additionally, it is useful for exploring the heterogeneity in the results of primary studies (Carlson & Ji, 2011; Sartal, et al., 2021). Therefore, this study pursues to analyze the association between CEOs' managerial cognition variables and the dynamic capabilities.

To conceptualize the association between CEOs' managerial cognition and dynamic capabilities we have adopted the model proposed by Bendig et al. (2018) that explain collective social phenomena through the individual action and the social interaction. According to this model, CEO's traits trigger complex micro-founded mechanism that allow the emergency of collective phenomena as the dynamic capabilities. We have focus the analysis in the trigger role of the CEOs excluding cognitive phenomena of the top management teams because they are not

considered in the model, they are incomparable to the individual cognition, and need to be subjected to separate analysis.

Overall, this study makes several contributions. First, it offers a theoretical model to integrate the micro-founded approach building bridges between managerial cognition, dynamic managerial capabilities and dynamic capabilities. It is achieved through the model of Bendig et al. (2018). Second, offers a classification of cognitive variables reported in the literature. Third, it quantifies the relationship between CEOs' managerial cognition variables and dynamic capabilities as an overall construct and the three types of them. Fourth, it tests moderator variables that explain the conflicting results. And fifth, it shows the active role of CEOs in the emergence of dynamic capabilities, highlighting that their comprehension of the environment is related to their development. These contributions locate managerial cognition of the CEOs as a trigger of the causal mechanism underlying to dynamic capabilities, offering a new line for multidisciplinary studies using psychological and business variables in strategic management.

In what follows, we describe the theoretical framework of dynamic capabilities, the micro-founded approach, and the concept of managerial cognition. We then move on to detailing our methodology and results before discussing our findings.

Theoretical Framework

Dynamics Capabilities

The dynamic capabilities' framework extends theoretical arguments of the resource-based view (Nelson & Winter, 1982), pointing out that rare, valuable, inimitable, and irreplaceable resources can be created by the same organization (Ambrosini & Bowman, 2009). Dynamic capabilities are “the ability of an organization to create, extend or modify their resource base intentionally” (Helfat et al. 2009, p. 1). They are a mechanism for enhancing consistency between organizational resources and changes in the environment, allowing adaptation (Teece, 2014).

Teece (2007) classified dynamic capabilities into three types: sensing, seizing, and reconfiguration. The sensing capability captures changes in the environment that may be interpreted as opportunities or threats; seizing focuses on the mobilization of resources to exploit opportunities; and finally, the reconfiguration capability enables a continuous renewal of resources to maintain benefits sustainably. It includes enhancing, combining, protecting, and reconfiguring the business assets.

A prominent feature of dynamic capabilities is that they are developed through the history of the organization, therefore they are hard to imitate (Teece, 2007; Teece, 2014). Although competitors can generate similar capabilities, it is not possible to replicate them, because they are developed and articulated by tacit knowledge components that cannot be easily transferred (Nonaka et al., 2016).

Although effects of dynamic capabilities on organizational performance and adaptation have been reported (Bitencourt et al., 2019; Fainshmidt et al. 2016), the current discussion centers around the generation of these valuable capabilities (Kurtmollaiev, 2017). Scholars have

repeatedly reported positive effects on performance, adaptation, and creation of competitive advantages. Several moderators have also been identified such as the size of the organization (Fernandes et al., 2017; Fernandez-Ortiz & Lombardo, 2009) and environmental dynamism (Frank et al., 2017; Wilhelm et al., 2015). Nonetheless, the sources of the dynamic capabilities have not been defined. In this paper we use a micro-founded approach to study the sources of these capabilities.

Microfoundations of dynamic capabilities

Scholars have proposed two explanations for the sources of dynamic capabilities: those that use organizational-level variables, and microfoundations explanations based on individual variables and the social interactions (Salvato & Vassolo, 2014). In the organizational-level, dynamic capabilities are firm's responses to environmental changes. Bitencourt et al. (2019) used a meta-analytic study to synthesize the major organizational-level variables that predict the development of dynamic capabilities. They noted that access to tangible and intangible resources, firm strategies focused on knowledge management, and the creation of institutional partnerships promote dynamic capabilities, with moderate correlations between .34 and .41.

On the other hand, the microfoundations framework states that the sources of dynamic capabilities are in the individual variables and the social interaction among individuals. Specifically, in managerial cognition, research has shown that CEOs' interpretations of business environments (Roundy et al., 2018), and the managerial attention (Eggers & Kaplan, 2013) are related to the development of dynamic capabilities. However, there are contradictory results left unexplained. For instance, Garrett et al. (2009) stated that perception of the environment and the perception of being pioneering in the market exhibit a negative relationship with dynamic capabilities, but Simon and Shrader (2012) pointed out a positive relationship. Further, Dibrell et

al. (2011) reported a non-significant relationship between managerial attitudes about the business environment and innovation, but Yang et al. (2018) stated a positive relationship.

Nonetheless, when these two types of explanations are compared, a micro-founded approach offers some advantages. First, all social systems, including organizations, consist of people and exist because of people (Felin & Foss, 2005). Organizational-level explanations overlook the fact that behind each organizational variable, there is a micro-founded phenomenon. Even though knowledge management and the creation of institutional partnerships have been acknowledged by Bitencourt et al. (2019) as predictors of dynamic capabilities, these variables are outcomes of the managerial decision-making process and the social relationships between organizational agents such as CEOs, employees, and teams. Hence, we must explore the sources of dynamic capabilities in individuals and their interactions, and not only in organizational variables (Kurtmollaiev, 2017).

Second, organizational-level explanations do not solve the problem of agency: where to look for dynamic capabilities (Kurtmollaiev, 2017). Organizational-level explanations suppose that sensing, seizing, and reconfiguration are actions carried out by an agent called “organization,” a theoretical view which is both ambiguous and inexact. It is a reification of organizations. On the other hand, the micro-founded approach recognizes the role of individuals within organizations, their resources, and social interactions, which are the building blocks of dynamic capabilities (Felin et al., 2015; Miron-Spektor et al., 2018; Ployhart & Donald Hale, 2014; Teece 2007; Winter, 2013). The answer to the problem of agency is to find the agents responsible for organizational changes and their social dynamics; consequently, the role of CEOs is predominant because of their senior level of influence given by the institutional hierarchy (Kurtmollaiev, 2017).

The conceptualization of the mechanism by which individual variables microfoundation organizational variables is described by Coleman's model (1990). It states that the causal mechanism that associate two organizational variables must be grounded in individual action and social interaction (Coleman, 1990). Hence, microfoundation tries to unpack the underlying constituents of collective phenomena opening the black box (Abell et al., 2008; Fellin et al., 2015).

Later, Bendig et al. (2018) makes an extension to Coleman's model to understand the role of the CEOs in the development of dynamic capabilities. According to them, CEOs foster the conditions to allow the emergency of collective phenomena. In the case of dynamic capabilities, CEOs cannot create those organizational capabilities, CEOs mobilize firm's resources enabling the development of complementarities and the emergency of aggregated organizational phenomena as dynamic capabilities.

In the Figure 1 we depicted the model proposed by Bending et al. (2018). CEO's managerial cognition, a type of CEOs' traits composed by perceptions, beliefs, and attitudes, influences the CEOs' managerial actions. In this paper, actions of the CEOs will be defined as the dynamic managerial capabilities (Adner & Helfat, 2003) deployed to mobilize resources. Due to the hierarchical position of the CEOs they can mobilize firm's resources that influence the conditions under employees work fostering the learning and the coordination among individuals. Dynamic capabilities emerge from the coordination among those individuals. Therefore, to understand the association of the firm resources and dynamic capabilities must be explained by the path of the micro-founded causal mechanism activated by the CEOs. Bendig et al. (2018) tested this model showing that the CEO personality influence the firm knowledge capital, and in turn it influences the dynamic capabilities.

<<FIGURE_1>>

Dynamic Managerial Capabilities

Therefore, CEOs in the dynamic capabilities' framework are crucial because they are responsible for identifying opportunities and threats, making decisions about the mobilization of resources and productive capabilities, and continuously updating organizational resources and capabilities (Adner & Helfat, 2003; Kor & Mesko, 2013). Their managerial actions foster conditions to the rise of collective phenomena. Their institutional role calls on them to “orchestrate” the resources and capabilities of their organizations to adapt to environmental changes (Kor & Mesko, 2013; Sirmon & Hitt, 2009).

Following this assertion, dynamic capabilities involve the actions of CEOs and require them to display specific managerial actions, named by Adner and Helfat (2003) as dynamic managerial capabilities. These are “the capabilities with which managers build, integrate and reconfigure organizational resources and capabilities” (Adner & Helfat, 2003 p. 1012). CEOs use their managerial capabilities to stimulate the building of dynamic capabilities. According to Helfat and Peteraf (2015) they can be divided into three types: managerial sensing, managerial seizing, and managerial reconfiguration.

To display dynamic managerial capabilities, CEOs apply their individual psychological and social resources to support those (Helfat & Martin, 2015). Adner and Helfat (2003) divided these managerial resources into three groups: managerial cognition, social capital management, and human capital of the manager. Therefore, dynamic managerial capability is a formative construct where resources cause the construct (Coltman et al., 2008). Such individual resources would account for the diverse skill levels of CEOs in sensing opportunities and threats, seizing,

and reconfiguration (Mostafiz et al., 2019; Corrêa et al., 2019). We focus on managerial cognition, however for an explanation of managerial social capital and managerial human capital see Adner & Helfat (2003) and (Helfat & Martin, 2015).

Managerial Cognition

The concept of cognition has been used in two ways in the management literature: as mental processes and mental structures (Helfat & Peteraf, 2015). These concepts are disparate but complementary. Mental processes refer to any mental function involved in the acquisition, storage, performance, handling, processing, and use of knowledge. These processes can be mental activities such as attention, perception, learning, and problem-solving (VandenBos, 2010). On the other hand, mental structures have been associated with several terms such as mental frames, mental models, or schemes; however, all denote ways of structuring the knowledge stored in the mind (Helfat & Peteraf, 2015). For this study, Bartlett's classical definition was adopted. Mental structures are representations of knowledge about an entity or situation, their qualities, and their relationships. This concept seeks to capture the abstractions that individuals have developed about the world and stored in their memory (Bartlett, 1932).

In managerial cognition, it is impossible to separate structures and mental processes. For this reason, Kaplan (2011) defined it as the way in which CEOs notice and interpret changes in the organizational context, which gives shape to their decisions and strategic actions. Observing a change and interpreting it require both mental processes such as perception and attention, and mental structures that the managers have previously built. Hence, managerial cognition is used by CEOs in their managerial activities.

Managerial activities suppose the building of interpretation of the business environment and the transmission of this to other individuals in the organization. This process is described by

Gioia and Chittipeddi (1991), who claimed that CEOs' managerial activities extend from the creation of meaning, called sense-making, to transferring this sense to others, called sense-giving. In sense-making, perception and attention to the environment are the essential cognitive processes, whereas social cognition, language, and communication are relevant in sense-giving (Helfat & Peteraf, 2015). In other words, when CEOs are coping with uncertainty and environmental ambiguity, they develop mental structures that represent the internal and external environment of the organization. These structures allow them to design strategies and subsequent actions. In addition, social interactions are used to influence the creation of meaning for their peers and employees (influencing the sense-making of others) in a process of transferring meaning (sense-giving).

In sense-making, CEOs face unstructured and ambiguous environmental changes that require interpretation (Plambeck, 2012; Plambeck & Weber, 2010). There are no opportunities or threats in the environment *per se*; their designation as such requires the interpretation of the CEO (Roundy et al., 2018). After this, CEOs transmit their interpretations to workers and principal stakeholders for mobilizing organizational resources.

Therefore, we propose a conceptual intersection between the process described by Gioia and Chittipeddi (1991) and the three dynamic managerial capabilities of Helfat and Peteraf (2015). Managerial sensing proposed by Helfat and Peteraf (2015) is related to the sense-making process described by Gioia and Chittipeddi (1991), whereas managerial seizing and reconfiguring matches with sense-giving, which involves influencing the interpretations of others to mobilize them. This conceptual intersection explains that dynamic capabilities have a micro-founded mechanism that is triggered by the managerial cognition. In deploying managerial dynamic capabilities, CEOs read the environment, shape or modify their mental structures from

attentional and perceptual processes, mobilize firm's resources and transmit their interpretations to others, influencing the mental structures and the activities of employees stimulating them for a particular purpose. Kor and Mesko (2013) summarized this idea by stating that the CEO is a master "orchestrating" a great symphony and that the music sheet is the mindset. Figure 1 summarizes this mechanism.

<<FIGURE_2>>

However, CEOs have distinct ways of creating and transmitting meaning, therefore this is a source of variability to the dynamic capabilities. They have unique interpretations of the environment, and different abilities to transmit information to others (Adner & Helfat, 2003; Helfat & Peteraf, 2015). This conceptual approach has been supported in the literature. For instance, Hambrick and Mason (1984), argued that organizations reflect the values and cognitive basis of their CEOs. Recently, Yang et al. (2018) stated that CEOs' design strategies are based on their cognitions and perceptions. Therefore, it is crucial to understand how these cognitions enable them to adopt particular strategies.

Nonetheless, the role of managerial cognition in each managerial dynamic capability is different. We propose that each kind of managerial dynamic capability are supported by different cognitive variables. In managerial sensing, perceptual and attentional processes are relevant, since they allow the sense-making process of environmental changes (Helfat & Peteraf, 2015). Baron (2006) pointed out that pattern recognition is a key cognitive element in sensing opportunities and threats, and that this is the outcome of CEOs' perceptual process. However, these patterns depend on the mental model previously structured. Quick identification of patterns can translate into a competitive advantage for organizations, by capturing an environmental signal before their competition does.

Consequently, it is expected that cognitive resources that support CEOs' managerial sensing will enable them to be more focused on abilities to detect opportunities and threats in the environment, which would be expected to further develop dynamic capabilities in their organizations. This argument leads to the following hypothesis:

H1: Cognitive variables to support managerial sensing are significantly related to the development of dynamic capabilities.

In the case of managerial seizing, Helfat and Peteraf (2015) stated that problem-solving is an important cognitive process since it allows the coupling of resources and distinct ways of facing environmental demands. Likewise, the tendency to think quickly by applying heuristic rules, or to think slowly with more complex processes affects the time to respond to environmental challenges and also biases in the decision-making process (Kahneman, 2011).

Following this line, Weisenfeld et al. (2017) pointed out that the level of abstraction used by CEOs when planning a strategy influences their orientation. If the level of abstraction is high, the mental model will be more complex and the goals set will be of greater value, but will also need more time and effort; but if the level of abstraction is low, short and quick goals will be set. Thus, the abstraction level of the CEOs' mental model has a relationship with the strategies to mobilize organizational resources.

Therefore, it is expected that the cognitive resources of CEOs that support managerial seizing capability will be related to the mobilization of organizational resources to exploit opportunities. Thus, the following hypothesis is proposed:

H2: Cognitive variables to support managerial seizing are significantly related to the development of dynamic capabilities.

Finally, in managerial reconfiguration, mental structures regarding the sustainable coordination of resources and capabilities to maintain a competitive advantage have the greatest importance. The case of Polaroid illustrates this point. Although Polaroid was an organization with extraordinary capacities, a market leader with access to multiple resources it was close to going bankrupt because of the CEO's interpretation of the effect of digital technology on the photographic camera market (Tripsas & Gavetti, 2000). Mental structures that allow CEOs to understand current and future environmental demands allow them to align organizational resources and keep sustainable advantages in the market. Therefore, a final hypothesis is proposed:

H3: Cognitive variables to support managerial reconfiguration are significantly related to the development of dynamic capabilities.

Methodology

Sample

A search was performed in WOS, Scopus, Proquest, and EBSCO for quantitative papers published in peer-reviewed journals related to business and management. The search included papers up to May 31, 2021.

Figure 2 summarizes the selection process through three filters. First, abstracts, titles, and keywords were reviewed. It was not mandatory that the abstract used the word "cognition". Other terms such as "perception," "attention," "reasoning," "problem-solving," "mental schema," and "mental model" were also admissible. Neither was the use of the term "organizational capability" imperative, so words such as "organizational capacity,"

“organizational learning,” “innovation,” “absorption capacity,” “organizational strategy,” “strategic renewal,” and “competitive advantage” were allowed.

After the first filter, 270 papers were selected. The papers were read in depth to identify whether they adhered to the following inclusion criteria or not. Firstly, the managerial cognitive measure had to be in relation to the CEO or decision maker. Measures of medium or low decision makers were excluded. Secondly, managerial cognitive variable had to be individual. All team variables such as shared cognition or teams’ mental models were excluded. In this, researchers read the definition and operationalization of the variables to make a decision. Finally, papers had to inform the Pearson correlation between CEOs’ cognitive variable and organizational capacity. If this correlation was not found, the paper was removed. Regression models or dichotomous correlations were excluded. In this filter, there was no warranty that organizational capability was dynamic; this was carried out in the next filter.

Following this, 69 papers were selected but not all were used in the meta-analysis, because only some of them measured dynamic capabilities. Two external reviewers assessed whether these papers measured this variable. Reviewers were trained and used the next classification criteria:

Firstly, papers had to report a measure of dynamic capability, excluding measures of ordinary capabilities. No measure of financial performance was allowed as an indicator of an underlying dynamic capability, following the recommended by Laaksonen and Peltoniemi (2018), since this is a non-valid measurement of organizational capabilities and is supported in a tautological reasoning. Improving on performance is not a measure of dynamic capabilities. And secondly, Helfat et al. (2009) definition of the concept of dynamic capability was used. So, any

measure of creation, expansion, or modification of the resource base was accepted. This judged validation test had an agreement of .83 accords to Cohen's kappa index (Cohen, 1992).

The studies selected were reviewed by two experts in organizational strategy. They assessed whether the variables utilized in the papers were measures of dynamic capabilities. Also, they classified the dynamic capabilities in the three types proposed by Teece (2007): sensing, seizing, and reconfiguration. This exercise achieved a Cohen's kappa index of .89. The final pool was of 27 papers, published between 2007 and 2021. Samples of CEOs used in the papers were of companies in China, Ghana, New Zealand, Polish, South Africa, Spain, Sweden, South Korea, and USA.

<<FIGURE_3>>

Coding Process

In each paper, bibliographical and methodological information (design, sample size, and measurement reliability) was extracted, with descriptive variables of the sample (about the CEOs and the organization), and the Pearson correlation between managerial cognition and dynamic capability,

Some variables were categorized to facilitate moderation analysis. Firm size was classified according to the European Union's taxonomy used in reports to the OECD (OECD Observer, 2000). Fewer than 250 employees were small and medium enterprises (SMEs), and over 250 employees were large organizations. Industrial sectors were categorized for technological dynamism. High dynamism sectors were characterized by fast technological change, higher spending on R&D, and more knowledge workers. They had higher levels of turbulence and emerging ideas to break the market (Simerly & Li, 2000). Papers with samples in

biotechnology, information and telecommunications, and hardware and software were classified as high dynamism. If a paper used samples from various sectors, the highest percentage of sample in either the high or low dynamism was used for the classification. The age of the CEOs and the length of time that the firm had been in the market were analyzed as quantitative variables, whereas factors such as the sample country, firm size, sampling (random or not random), methodological design (cross-sectional or longitudinal), data collection (archive or self-report), and level of dynamism in the sector (high or low dynamism) were categorical.

Classification of Cognitive Variables

Three judges with expertise in organizational strategy and psychology carried out the classification of managerial cognitive variables in the three dynamic managerial capabilities. They were PhDs in Psychology, teaching, and research in management respectively. Seventeen managerial cognitive variables were identified in the papers selected. The classification was performed three times, and the results were discussed after each one to improve the classification. Finally, a rater agreement using the Kappa Fleiss index of .81 was achieved in the third round (Fleiss et al., 1979).

Data Analysis

The Pearson's correlation coefficient between the cognitive variables and dynamic capabilities was used as the effect size. Every correlation was corrected for reliability using the Hunter and Schmidt (2004) procedure. However, archive data and non-obtrusive measures (indirect) did not report reliability values. In the first case, archive data was imputed by the common parameter of reliability of 0.8 followed in the management literature (Dalton et al., 2003; Jiang et al., 2012). The second, non-obtrusive measure was imputed using the average of the reliabilities reported in the managerial capability to which the measure belonged.

A three-level random effects model was applied to synthesize the correlations (Cheung, 2014) because each paper reported two or more effect sizes, which would violate the assumption of independence (Hunter & Schmidt, 2004). The three-level model overcomes this problem by estimating two sources of variance, inter-study and intra-study (Cheung, 2014; Van den Noortgate et al., 2013; Wibbelink et al., 2017). Therefore, each correlation reported can be analyzed as a distinct effect without average the values of the same paper. The R package ‘metafor’ (Viechtbauer, 2010) was used with the tutorial by Assink and Wibbelink (2016) which describes the use of the three-level model.

Once ended the analysis, we build a structural equation model with meta-analytic data. It was a post-hoc analysis using the significant correlations identified. We used the univariate approach proposed by Viswesvaran and Ones (1995) conducting several univariate meta-analysis to each value of the correlation matrix. This matrix was used to estimate a structural model using Lavaan Package (Rosseel, 2012). The sample size used in the model was the harmonic mean of the samples reported in the papers, (n=134).

Results

The database search identified 27 published articles and 101 correlations from 2007 to 2021, representing 6,153 CEOs. Table 1 summarizes bibliographic information, the country in which the research was conducted, sample size, cognitive variable, and dynamic capability measured.

<<TABLE_1>>

An inter-judge agreement exercise was used for classifying the cognitive variables in the three types of managerial dynamic capabilities after a careful definition. Table 2 shows each definition of the cognitive variables and their classification.

<<TABLE_2>>

The conceptual guides by Helfat and Peteraf (2015) about managerial capacities were used in the classification process. Managerial sensing is the CEOs' capacity to scan the environment to recognize opportunities or threats in an unstructured and uncertain context. The support of this managerial capacity is the ability to interpret information (Helfat & Peteraf, 2015). Based on this conceptual scope, the cognitive variables associated with scanning the environment or interpreting environmental changes were classified as cognitive resources of managerial sensing.

As Helfat and Peteraf (2015) pointed out, perception and attention should be part of this managerial capacity, since they are the psychological processes responsible for scanning and interpreting the environment; consequently, it is observed that the cognitive variables in this category are perceptual or attentional processes. The variables identified were managerial attention, perceived business opportunity, perceived environmental hostility, perceived environmental uncertainty, perceived environmental dynamism, and entrepreneurial alert.

Managerial seizing was defined by Helfat and Peteraf (2015) as CEOs' ability to develop new products, processes, or services to take advantage of the opportunities. Therefore, CEOs develop a business model that strategically exploits the opportunity and investments resources. If the focus of managerial sensing is the interpretation of the environment, then the seizing is the mobilization of resources to take advantage of opportunities or threats identified.

Cognitive variables to support managerial seizing are mental structures that enable or inhibit the exploitation of opportunities, so they are particular ways in which CEOs approach opportunities. These refer to unique belief systems that affect the probability of mobilizing the organization's resources to exploit opportunities. Depending on their content, these cognitive variables enable or obstruct the mobilization of resources. Additional mention is needed of divergent thinking, a cognitive variable also classified as a resource of managerial seizing. Divergent thinking is not a belief system, but a style of thinking enabling the rise of original ideas that could be transformed into innovations and market advantages. This would be the support of alternative business models that exploit opportunities. Thus, cognitive variables in this category were managerial perceptions of pioneering advantages, managerial perceptions of pioneering disadvantages, proactive logic, divergent thinking, and attitude toward exports.

Finally, managerial reconfiguration is CEOs' ability to align tangible and intangible strategic assets that enable growth and sustainable profit. It refers to CEOs' capacity to "orchestrate assets," which involves the selection, configuration, alignment, and modification of tangible and intangible assets for a strategic purpose (Kor & Mesko, 2013; Sirmon & Hitt, 2009). In this category, cognitive variables are classified that support beliefs about the match between organizational resources and environmental changes. However, golden mean thinking is different. This variable has been studied by academic researchers in China. It refers to the "golden rule" proposed in Confucianism for seeking balance and moderation, avoiding extremes. It has been classified in this category because it captures CEOs' capacity to integrate external conditions and internal demands, keeping the balance. In sum, the variables classified as resources of managerial reconfiguration were perceived pressure, perceived social pressure, management focus on the environment, attitude to the environment, and golden mean thinking.

The complexity of the CEOs' mental model is a variable unclassified in any managerial capacities because it is transversal to all of them. This variable captures the breadth and variability that the CEOs' mental structure has over its context, commonly given by the presence of many concepts and the relationships between them. They are usually studied with mind maps in which the CEOs depict concepts and relationships between them. This variable was not included in any managerial capacity and was meta-analyzed independently.

On the other hand, we identified several dynamic capabilities, such as, pioneering, absorption capability, strategic change decisions capability, diversification, innovation, capability of firm change, flexibility, organizational ambidexterity, firm-level entrepreneurship and speed of strategic response. These capabilities show the organizational capacity to explore the business environment and change internal resources and ordinary capabilities. Next, we describe the correlations between cognitive variables and these dynamic capabilities.

Meta-Analysis

Correlation between CEOs' managerial cognition and dynamic capabilities was significant and positive, $r(101) = 0.18, p < .001$, 95 % CI [.08, .28], with a higher heterogeneity in both inter-studies $= .024, p < .001, I^2 = 37.87\%$, and intra-studies $= .036, p < .001, I^2 = 56.10\%$. There was a small positive relationship between CEOs' cognitive variables and dynamic capabilities according to Cohen (1992). There was no evidence of publication bias using the Egger et al. (1997) procedure; the intercept did not significantly deviate from zero, $z = -0.21, p = .83$.

This correlation should be carefully interpreted, because it aggregates the differential effects of the cognitive variables in each managerial dynamic capability. Table 3 summarizes the results in each managerial capability and the cognitive variables that support them.

<<TABLE_3>>

Dynamic Managerial Capability of Sensing

The cognitive variables to support the managerial capability of sensing showed a significant positive correlation with the dynamic capabilities, $r(61) = 0.19, p < .001$, which supports hypothesis 1. Those organizations managed by CEOs with greater resources to identify opportunities and threats showed more dynamic capabilities. There was no evidence of publication bias, $z = 0.77, p = .44$.

This correlation was supported by variables involved in the identification of opportunities, such as the perception of business opportunities and entrepreneurial alert, while the variables related to the negative perception of changes, such as perceived environmental hostility was not significant. The perception of business opportunities, $r(15) = .34, p < .001$ and

entrepreneurial alert, $r(5) = .39, p = .028$, had a moderate effect, hence the environmental changes interpreted as opportunities are associated with greater dynamic capabilities.

Variables related with the prediction of the environmental change were significant. The perceived environmental uncertainty $r(17) = .08, p = < .001$, and the perceived dynamism, $r(11) = .09, p = .033$ exhibited a small positive relationship. Therefore, environmental changes with unpredictable effects could force CEOs to strengthen the dynamic capabilities as a strategy to improve control and decrease ambiguity.

Managerial attention did not show any significant effect, $r(8) = .26, p = .072$. However, this result must be interpreted with caution because of the non-obtrusive measures used in the studies of managerial attention: the word count in the letters that CEOs send to stakeholders, because it lacks evidence of validity.

Finally, as noted above, the perception of hostility, $r(5) = -.03, p = .824$ did not have any significant effect on dynamic capabilities, so negative perception of the environment does not strengthen or weaken the dynamic capabilities of the organization.

Dynamic Managerial Capability of Seizing

The cognitive variables to support managerial capability of seizing had a positive and significant effect, $r(30) = .15, p = .007$; therefore, hypothesis 2 was supported. Thereby, those CEOs that typically have more resources to seize opportunities showed more dynamic capabilities in their firms. Again, there was no evidence of publication bias, $z = 0.38, p = .710$.

The analysis of the cognitive variables individually showed that managerial perception of pioneering disadvantages had a significant effect, $r(6) = -.18, p < .001$. Meanwhile, the managerial perception of pioneering advantages, $r(16) = .14, p = .139$, proactive logic, $r(3) = .08$,

$p = 0.688$, and the managerial attitude toward exports $r(4) = .24$, $p = .196$ did not result in any significant effect. Divergent thinking had only one effect reported, so it was not possible to calculate any intervals or significance tests.

Dynamic Managerial Capacity of Reconfiguration

The cognitive variables to support the managerial capability of reconfiguration also had a positive, small, and significant effect, $r(5) = .19$, $p = .016$, so that higher cognitive resources were associated with more dynamic capabilities, thus supporting hypothesis 3. A study publication bias was conducted, but no evidence was found of this, $z = 1.61$, $p = .107$. In this case, it was not possible to analyze each cognitive variable that made up this capability, because there was only one effect for each variable, and it was not possible to calculate any intervals or significance tests.

The analysis of strategic mental model complexity of the CEO, a cross-cognitive variable at the three managerial capacities, was not significant, $r(5) = -.46$, $p = .273$. Although the estimated correlation value was higher than other cognitive variables it had few correlations reported among papers.

Finally, we studied the differential effect of the managerial capabilities with the three types of dynamic capabilities. Managerial sensing had a significant correlation with sensing $r(17) = .23$, $p = .002$, and with seizing $r(22) = .18$, $p = .008$, but it was not significant with reconfiguration $r(22) = .170$, $p = .385$. In addition, managerial seizing was not significant with sensing $r(2) = .34$, $p = .443$ because only two correlations were reported in the papers, but it was significant with reconfiguration $r(27) = .14$, $p = .044$. The estimation of correlation between managerial seizing and reconfiguration could not be calculated because it had one correlation reported. Lastly, no correlation was reported by the association of the managerial reconfiguration with

sensing and only one in reconfiguration. We can estimate the correlation with seizing that was not significant $r(4) = .19, p = .080$.

Post-hoc analysis

As a final analysis, we build a model to integrate the significant correlations identified. We study the relationship between managerial dynamic capabilities and the three types of dynamic capabilities because it is more informative than the overall dynamic capabilities. Therefore, we use four variables in the model: managerial sensing, managerial seizing, sensing, and seizing. Managerial reconfiguration and reconfiguration were not used in the model because they were not significant or no one correlations was reported. Figure 4 depicted the results.

Managerial sensing had significant effect on sensing, $\beta = .19, p = .023$, and an indirect effect on seizing, $\beta = 0.069, p = .043$. There is a total mediation of managerial sensing on seizing through sensing; the significant direct effect on seizing disappear in the mediation analysis. In contrast, managerial seizing was not significant on sensing, $\beta = .16, p = .058$, and seizing $\beta = .11, p = .155$ neither. The direct effect showed in previous analysis disappear. Additionally, covariance between managerial sensing and managerial seizing was no significant, $\phi = .060, p = .488$. Finally, according to Teece (2007) there are a continuity process among sensing, seizing, hence, we draw a direct effect between them. It was significant, $\beta = .36, p < .001$.

<<FIGURE_4>>

Moderation Analysis

Variances inter- and intra-studies in managerial sensing and managerial seizing showed heterogeneity in their correlations, so it was imperative to account for this variability with a

moderation analysis. Tables 4 and 5 summarize the results by categorical variables moderating, and the quantitative moderators were reported in the text.

We did not find evidence of moderation on managerial sensing; no one variable reported in the table 4 was significant. Quantitative moderators, age of the CEO [$F(1,28) = 1.11$; $p = .309$] and organizational age [$F(1,51) = 0.33$; $p = 0.566$], did not have a significant effect. In contrast, the moderation analysis in the managerial capability of seizing showed that the type of data collected had a moderating effect, $F(1,29) = 4.88$, [$r_{\text{Archive}} = -.15$ - $r_{\text{Self-report}} = 0.31$], $p = .047$. However, this result needs careful interpretation because 29 correlations used self-report and only one used archive data. Regarding quantitative moderators, it was only possible to test the age of the CEO [$F(1,14) = 0.56$; $p = .465$], which did not show any significant effect.

<<TABLE_4>>

<<TABLE_5>>

Discussion

This study reveals the relationship between CEOs' managerial cognition and dynamic capabilities using a sample of 6,153 CEOs around the world. According to Bendig et al. (2018) managerial cognition triggers a micro-founded mechanism to foster the development of dynamic capabilities. Nonetheless, managerial cognition is a family of variables with different functions and differential effects on the types of dynamic capabilities. In this paper we have organized cognitive variables to identify their independent function.

Managerial cognition to support managerial sensing is significantly associated with the development of dynamic capabilities. This is because over 60% of the correlations analyzed correspond to this capability and four variables of this managerial capability were significant.

This managerial capability is composed of perceptual variables that allow the interpretation of environmental changes (Plambeck, 2012; Plambeck & Weber, 2010). Since the environment does not offer opportunities or threats intrinsically, interpretation of the CEOs is relevant. According to results it is a better strategy “*to see the glass half full*,” building positive interpretations around environmental opportunities because they are positively associated with the development of dynamic capabilities. Implementing the managerial sensing capability must rely on perceptual processes, especially those that identify environmental opportunities, such as business opportunity identification and entrepreneurial alert.

Nonetheless, managerial attention raises doubt about the actual effect. Although the effect was not significant, there was also a lack of evidence concerning the validity of the measure used, so the results should be analyzed with caution. Psychometric studies should be pursued to gather evidence of validity or to develop alternative methods of measuring it.

The cognitive variables to support the managerial capability of seizing are significantly associated with the development of dynamic capabilities, but the estimated correlation was lower than other managerial capabilities. Only managerial perception of pioneering disadvantages was significant. Apparently, although CEO’s managerial cognition triggers the micro-founded mechanism to foster dynamic capabilities (Bendig et al., 2018), contribution to managerial seizing is relatively little important because it does not give account of the ability to mobilize resources. As Gioia and Chittipeddi (1991) pointed out, sense-making is not enough, because a process of sense-giving is needed to mobilize other individuals, and this process is not captured by CEOs’ cognitive variables. It requires other approaches that involve social interaction and leadership skills.

Also, in reconfiguration, CEO's managerial cognition is related to dynamic capabilities. CEO's comprehension of the current and future challenges of the environment influence the enhancing, combining, protecting, and reconfiguring business assets. The strength of its correlation is similar to managerial sensing although the effects meta-analyzed were fewer.

Additionally, we can assert the differential correlation of the managerial capabilities with the three types of dynamic capabilities. The classification proposed by Helfat and Peteraf (2015) is supported in this meta-analysis because managerial sensing had a significant relation with sensing. In addition, managerial seizing was related with seizing. Unfortunately, we cannot offer support of the relationship between managerial reconfiguration and reconfiguration because only one correlation was reported in the papers. Classification of the dynamic capabilities can be extended to managerial dynamic capabilities.

Nonetheless, when we analyzed associations between managerial capabilities and dynamic capabilities in a structural model, the weight of managerial sensing was evident. It had a direct effect on sensing and indirect on seizing while the effect of managerial seizing disappears. From the cognitive approach defeats in this meta-analysis the relevance of managerial sensing in the development of dynamic capabilities is manifested.

Finally, the use of moderators highlighted insufficiencies vis-à-vis explaining the variance of the correlations. Some possible moderators are proposed by Adner and Helfat (2003): the social capital and human capital of CEOs. On an individual level, human capital variables could be a plausible option for identifying moderators, because changes in the experience and skills of CEOs could be associated with changes in managerial cognition. Also, the social capital of CEOs could interact with cognitive variables and modify their effects, because it is a source of strategic information that might offer new perspectives to the CEOs. Another plausible source of

moderators is organizational variables, such as organizational structure, culture, and organizational climate.

Theoretical Implications

This study identifies and organizes cognitive variables reported in the literature, building a conceptual framework which recognizes that they are incomparable because they have dissimilar functions. Ambiguity in the empirical results in the literature is solved when we classify the variables by their function. CEO managerial cognition have not contradictory results, there are variables with positive, negative or not related with different types of dynamic capabilities. For instance, we have showed that positive interpretations of the environments are related with the development of dynamic capabilities, in contrast, negative interpretations are not related.

A second theoretical implication is the building of bridges among concepts. We assert that managerial cognition is a resource of CEOs, but it is not a kind of managerial dynamic capabilities. In this paper we have asserted that managerial dynamic capabilities are a formative construct in the same way that organizations use capacities to transform resources into products. Therefore, CEOs use their managerial capabilities to transform their individual resources to perform their institutional tasks.

Since managerial cognition is a resource, but not a managerial capacity, scholars can explore the origin of those resources and how they can be best leveraged, optimized, and increased. CEOs obtain those resources through their education and labor experiences, however we do not understand the process.

The paper also contributes in the identification of the sources of dynamic capabilities. Results offer evidence that variables at an individual level have a relationship with organizational capabilities, hence sources of dynamic capabilities might be explored at an individual level. Results concerning organizational variables could be reinterpreted from a micro-founded view. Bendig et al. (2018) model can be extended to other resources as human capital of the CEOs or Social capital. Nonetheless, a micro-founded approach does not ignore interactions with organizational variables, but they are moderators or conditions that modify the effects of individual and team variables.

Finally, although this paper summarizes the managerial cognitive variables explored in the literature, this does not represent all the cognitive variables that could be studied. Emotional variables have not been explored, therefore emotional regulation, moods, and emotional traits need to be studied. Likewise, other cognitive variables such as reasoning, meta-cognition, memory, and decision bias need to be explored.

Practical Implications

This study offers two main practical contributions. First, CEOs' comprehension of the environment is related to organizational adaptation. Following this line, investments in training, and other ways to update CEOs' mental structures enable sense-making changes and generate a new comprehension of the environment. The second contribution addresses CEOs in SMEs. Managerial cognition has a prominent effect on SMEs because they lack other resources; therefore, CEOs' comprehension is a cornerstone of organizational adaptation. If CEOs do not understand the business environment, especially in SMEs, they are blind in the market. In sum, updating CEOs' mental structures that account for environmental changes is a good strategic decision to improve organizational adaptation.

Limitations

This meta-analysis is not without its limitations. First, the studies included were correlational, thus it is not possible to establish cause–effect inferences. The papers analyzed use cross-sectional designs and have the same source for independent and dependent variables which further compounds the inability to make causal inferences. Further, the results cannot discount reverse causality between variables, in that dynamic capabilities improve managerial cognition variables, because CEOs have a learning context with experiences, information, and feedback that strengthen their capabilities. Understanding and addressing the impact of this issue requires more robust research designs.

Second, it was not possible to account for variability in managerial sensing, seizing, and reconfiguration with the moderating variables used; other variables would need to be identified to explain this heterogeneity. Finally, the papers in the sample are biased towards the USA and China; other areas such as Europe, Africa, or Latin America are not adequately represented in the results. Different countries' macro-economic conditions might impact on key findings and, again, this warrants attention. And third, we have studied the first and the last ties of the causal mechanism depicted by Bendig et al. (2018), however, the micro-employee level is not analyzed.

Conclusion

This meta-analysis organizes the managerial cognitive variables reported in the literature and estimates their correlation with dynamic capabilities. This endeavor sheds light on the state of the art in this domain, furthering collective understandings. Managerial cognition is source of variability in the development of dynamic capabilities especially those cognitive variables that support managerial sensing.

References

- Abell, P., Felin, T., & Foss, N. (2008). Building micro-foundations for the routines, capabilities, and performance links. *Managerial and decision economics*, 29(6), 489-502.
- Adner, R., & Helfat, C. (2003). Corporate Effects and Dynamic Managerial Capabilities. *Strategic Management Journal*, 24(10), 1011-1025. <https://doi.org/10.1002/smj.331>
- * Adomako, S. (2021). Entrepreneurial alertness and product innovativeness: Firm-level and environmental contingencies. *International Journal of Innovation Management*, 25(2), 1 - 25.
- Ambrosini, V., & Bowman, C. (2009). What are dynamic capabilities and are they a useful construct in strategic management? *International Journal of Management Reviews*, 11(1), 29-49. <https://doi.org/10.1111/j.1468-2370.2008.00251.x>
- Arndt, F., & Pierce, L. (2018). The behavioral and evolutionary roots of dynamic capabilities. *Industrial and Corporate Change*, 27(2), 413-424.
- Assink, M., & Wibbelink, C. (2016). Fitting three-level meta-analytic models in R: A step-by-step tutorial. *The Quantitative Methods for Psychology*, 12(3), 154-174. <https://doi.org/10.20982/tqmp.12.3.p154>
- Baron, R. A. (2006). Opportunity recognition as pattern recognition: How entrepreneurs “connect the dots” to identify new business opportunities. *The Academy of Management Perspectives*, 20(1), 104–119.
- Bartlett, F. (1932). *Remembering: A study in experimental and social psychology*. Cambridge University Press.

- *Barrales-Molina, V., Benitez-Amado, J., & Perez-Arostegui, M. N. (2010). Managerial perceptions of the competitive environment and dynamic capabilities generation. *Industrial Management & Data Systems*, 110(9), 1355-1384.
- Bendig, D., Strese, S., Flatten, T. C., da Costa, M. E. S., & Brettel, M. (2018). On micro-foundations of dynamic capabilities: a multi-level perspective based on CEO personality and knowledge-based capital. *Long Range Planning*, 51(6), 797-814.
- Bitencourt, C., Santini, F., Ladeira, W., Santos, A., & Teixeira, E. (2019). The extended dynamic model capabilities: A meta-analysis. *European Management Journal*. 38(1), 108-120.
<https://doi.org/10.1016/j.emj.2019.04.007>
- * Chen, J., & Ling, Y. (2010). CEO golden-mean thinking, ambidextrous orientation and organizational performance in Chinese context. *Nankai Business Review International*, 1(4), 460-479. <https://doi.org/10.1108/20408741011082598>
- Cheung, M. (2014). Modeling dependent effect sizes with three-level meta-analyzes: A structural equation modeling approach. *Psychological Methods*, 19(2), 211-229.
<https://doi.org/10.1037/a0032968>
- Cohen, J. (1992). A power first. *Psychological Bulletin*, 112(1), 155-159.
<https://psycnet.apa.org/buy/1992-37683-001>
- Corrêa, R., Good, E., Kato, H., & Silva, L. (2019). Dynamic managerial capabilities: Scale development and validation. *Managerial and Decision Economics*, 40(1), 3-15.
<https://doi.org/10.1002/mde.2974>
- Coleman, J. (1990). *Foundations of Social Theory* Harvard Univ. Press, Cambridge.

- Coltman, T., Devinney, T. M., Midgley, D. F., & Venaik, S. (2008). Formative versus reflective measurement models: Two applications of formative measurement. *Journal of Business Research*, 61(12), 1250-1262.
- Covin, J., & Slevin, D. (1989). Strategic management of small firms in hostile and benign environments. *Strategic Management Journal*, 10(1), 7-26.
- Dalton, D., Daily, C., Certo, S., & Roengpitya, R. (2003). Meta-analyzes of financial performance and equity: fusion or confusion? *Academy of Management Journal*, 46 (1), 13-26.
- Di Stefano, G., Peteraf, M., & Verona, G. (2014). The organizational drivetrain: A road to integration of dynamic capabilities research. *Academy of Management Perspectives*, 28(4), 307-327.
- * Dibrell, C., Craig, J., & Hansen, A. (2011). How managerial attitudes toward natural environment affect the market orientation and innovation. *Journal of Business Research*, 64(4), 401-407. <https://doi.org/10.1016/j.jbusres.2010.09.013>
- Dixon, S., Meyer, K., & Day, M. (2014). Building dynamic capabilities of adaptation and innovation: A study of micro-foundations in a transition economy. *Long Range Planning*, 47(4), 186-205.
- Egger, M., Smith, G, Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, 315(7109), 629-634.
<https://doi.org/10.1136/bmj.315.7109.629>
- * Eggers, J., & Kaplan, S. (2009). Cognition and renewal: Comparing CEO and organizational effects on adaptation to technical incumbent change. *Organization Science*, 20(2), 461-477. Scopus. <https://doi.org/10.1287/orsc.1080.0401>

- Eggers, J., & Kaplan, S. (2013). Cognition and Capabilities: A Multi-Level Perspective. *Annals Academy of Management*, 7(1), 295-340. <https://doi.org/10.5465/19416520.2013.769318>
- Fahey, L., & Narayanan, V. (1989). Linking changes in revealed causal maps and environmental change: An empirical study. *Journal of Management Studies*, 26(4), 361-378.
- Fainshmidt, S., Pezeshkan, A., Frazier, M., Nair, A., & Markowski, E. (2016). Dynamic Capabilities and Organizational Performance: A Meta-Analytic Evaluation and Extension. *Journal of Management Studies*, 53(8), 1348-1380. <https://doi.org/10.1111/joms.12213>
- Felin, T., Foss, N., Heimeriks, K., & Madsen, T. (2012). Microfoundations of routines and capabilities: Individuals, Processes, and structure. *Journal of Management Studies*, 49(8), 1351-1374. <https://doi.org/10.1111/j.1467-6486.2012.01052.x>
- Felin, T., & Foss, N. J. (2005). Strategic organization: A field in search of micro-foundations.
- Felin, T., Foss, N., & Ployhart, R. (2015). The Microfoundations movement in strategy and organization theory. *The Academy of Management Annals*, 9(1), 575-632. <https://doi.org/10.1080/19416520.2015.1007651>
- Fernandes, B., Ferreira, J., Prado Gimenez, F., & Rese, N. (2017). The inception of dynamic capabilities in SMEs. *International Journal of Entrepreneurship*, 21(3), 1-13. <https://www.abacademies.org/articles/the-inception-of-dynamic-capabilities-in-smes-6661.html>
- Fernández-Ortiz, R., & Lombardo, G. (2009). Influence of the Capacities of top management on the internationalization of SMEs. *Entrepreneurship and Regional Development*, 21(2), 131-154. <https://doi.org/10.1080/08985620802176104>

- * Fernández-Pérez, V., García-Morales, V., & Pullés, D. (2016). Entrepreneurial decision-making, external social networks and strategic flexibility: The role of CEOs' cognition. *European Management Journal*, 34(3), 296-309.
- Fleiss, J., Nee, J., & Landis, J. (1979). Large sample variance of kappa in the case of different sets of raters. *Psychological Bulletin*, 86(5), 974-977. <https://doi.org/10.1037/0033-2909.86.5.974>
- Frank, H., Guettel, W., & Kessler, A. (2017). Environmental dynamism, hostility, and dynamic capabilities in medium-sized enterprises. *International Journal of Entrepreneurship and Innovation*, 18 (3), 185-194. <https://doi.org/10.1177/1465750317723219>
- Galvin, P., Rice, J., & Liao, T. S. (2014). Applying a Darwinian model to the dynamic capabilities view: Insights and issues1. *Journal of Management & Organization*, 20(2), 250-263.
- * Garrett, R., Covin, J., & Slevin, D. (2009). Market responsiveness, top management risk taking, and the role of strategic learning as determinants of market pioneering. *Journal of Business Research*, 62(8), 782-788. <https://doi.org/10.1016/j.jbusres.2008.06.006>
- Gavetti, G. (2005). Cognition and Hierarchy: Rethinking the Microfoundations of Capabilities' Development. *Organization Science*, 16(6), 599-617. <https://doi.org/10.1287/orsc.1050.0140>
- * Gerstner, W., König, A., Enders, A., & Hambrick, D. (2013). CEO Narcissism, audience engagement, organizational and adoption of technological discontinuities. *Administrative Science Quarterly*, 58(2), 257-291. <https://doi.org/10.1177/0001839213488773>
- * Gielnik, M., Krämer, A., Kappel, B., & Frese, M. (2014). Antecedents of business opportunity identification and innovation: Investigating the interplay of information processing and

information acquisition. *Applied Psychology*, 63(2), 344-381.

<https://doi.org/10.1111/j.1464-0597.2012.00528.x>

Gioia, D., & Chittipeddi, K. (1991). Sensemaking and Sensegiving in Strategic Change

Initiation. *Strategic Management Journal*, 12(6), 433-448.

<https://doi.org/10.1002/smj.4250120604>

Guilford, J. P. (1950). Creativity. *American psychologist*, 5(9), 444-454

Hambrick, D., & Mason, P (1984). Upper Echelons: The Organization as a reflection of its top managers. *The Academy of Management Review*, 9(2), 193-206.

<https://doi.org/10.2307/258434>

Helfat, C., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., & Winter, S. (2009).

Dynamic Capabilities: Understanding Strategic Change in Organizations. John Wiley & Sons.

Helfat, C., & Martin, J. (2015). Dynamic Managerial Capabilities: Review and Assessment of

Managerial Impact on Strategic Change. *Journal of Management*, 41(5), 1281-1312.

<https://doi.org/10.1177/0149206314561301>

Helfat, C., & Peteraf, M. (2009). Understanding dynamic capabilities: Progress along a path

developmental. *Strategic Organization*, 7(1), 91-102.

<https://doi.org/10.1177/1476127008100133>

Helfat, C., & Peteraf, M. (2015). Managerial cognitive capabilities and the Microfoundations of dynamic capabilities. *Strategic Management Journal*, 36(6), 831-850.

<https://doi.org/10.1002/smj.2247>

Hodgkinson, G., & Healey, M. (2011). Psychological foundations of dynamic capabilities:

Reflexion and reflection in strategic management. *Strategic Management Journal*,

32(13), 1500-1516. <https://doi.org/10.1002/smj.964>

Hunter, J., & Schmidt, F. (2004). *Methods of meta-analysis: Correcting errors and bias in research findings*. Sage.

Jiang, K., Lepak, D., Hu, J., & Baer, J. (2012). How does human resource management influence organizational outcomes? A meta-analytic investigation of Mediating Mechanisms. *Academy of Management Journal*, 55(6), 1264-1294.

<https://doi.org/10.5465/amj.2011.0088>

Kahneman, D. (2011). *Thinking, fast and slow*. Macmillan.

* Kaplan, S. (2008). Cognition, capabilities, and incentives: Assessing firm response to the fiber-optic revolution. *Academy of Management Journal*, 51(4), 672-695.

<https://doi.org/10.5465/amr.2008.33665141>

Kaplan, S. (2011). Research in cognition and strategy: Reflections on Two Decades of progress and to look to the future. *Journal of Management Studies*, 48(3), 665-695.

<https://doi.org/10.1111/j.1467-6486.2010.00983.x>

* Khan, K. U., Atlas, F., Xuehe, Z., Khan, F., & Khan, S. (2020). The mediating role of dynamic managerial capabilities: The interplay between dominant logic and small-and medium-sized enterprises performance in China. *Journal of Public Affairs*, 20(2), 1-11.

* Khan, K. U., Atlas, F., Ghani, U., Akhtar, S., & Khan, F. (2020). Impact of intangible resources (dominant logic) on SMEs innovation performance, the mediating role of dynamic managerial capabilities: evidence from China. *European journal of innovation management*. <https://doi.org/10.1108/EJIM-07-2020-0276>.

* Kiss, A., & Barr, P. (2015). New venture strategic adaptation: The Interplay of belief structures and industry context. *Strategic Management Journal*, 36(8), 1245-1263.

<https://doi.org/10.1002/smj.2285>

- Kor, Y., & Mesko, A. (2013). Dynamic managerial capabilities: Configuration and Orchestration of top executives' capabilities and the firm's dominant logic. *Strategic Management Journal*, 34(2), 233-244. <https://doi.org/10.1002/smj.2000>
- * Kreiser, P., Marino, L., Davis, J., Tang, Z., & Lee, C. (2010). Firm-level entrepreneurship: The role of proactiveness, innovativeness and strategic renewal in the creation and exploration of opportunities. *Journal of Developmental Entrepreneurship*, 15(2), 143-163. <https://doi.org/10.1142/S1084946710001488>
- Kurtmollaiev, S. (2017). Dynamic Capabilities and Where to Find Them. *Journal of Management Inquiry*, 29(1): 3-16. <https://doi.org/10.1177/1056492617730126>
- * McKelvie, A., Wiklund, J., & Brattström, A. (2018). Externally or internally generated acquired? Knowledge development and perceived environmental dynamism in new venture innovation. *Entrepreneurship Theory and Practice*, 42(1), 24-46. <https://doi.org/10.1177/1042258717747056>
- Laaksonen, O., & Peltoniemi, M. (2018). The Essence of Dynamic Capabilities and Their Measurement. *International Journal of Management Reviews*, 20(2), 184-205. <https://doi.org/10.1111/ijmr.12122>
- Miller, D., & Friesen, P. (1982). Innovation in conservative and entrepreneurial firms: Two models of strategic momentum. *Strategic management journal*, 3(1), 1-25.
- Mitchell, M., & Skrzypacz, A. (2015). A theory of market pioneers, dynamic capabilities, and industry evolution. *Management Science*, 61(7), 1598-1614.
- Miron-Spektor, E., Ingram, A., Keller, J., Smith, W., & Lewis, M. (2018). Microfoundations of Organizational Paradox: The Problem Is How We Think About the Problem. *Academy of Management Journal*, 61(1), 26-45. <https://doi.org/10.5465/amj.2016.0594>

Mostafiz, M., Sambasivan, M., & Goh, S. (2019). Psychometric evaluation of dynamic managerial capability in the context of scale early Internationalizing firms from an emerging economy. *Asia Pacific Journal of Business-Administration*, 11(4), 371-386.
<https://doi.org/10.1108/APJBA-06-2019-0140>

* Nadkarni, S., & Barr, P. (2008). Environmental context, managerial cognition, and strategic action: An integrated view. *Strategic Management Journal*, 29(13), 1395-1427.
<https://doi.org/10.1002/smj.717>

* Nag, R., Neville, F., & Dimotakis, N. (2020). CEO scanning behaviors, self-efficacy, and SME innovation and performance: An examination within a declining industry. *Journal of Small Business Management*, 58(1), 164-199.

Nelson, R., & Winter, S. (1982). The Schumpeterian tradeoff revisited. *The American Economic Review*, 72(1), 114-132. <https://www.jstor.org/stable/1808579>

Nonaka, I., Hirose, A., & Takeda, Y. (2016). 'Meso'-Foundations of Dynamic Capabilities: Team-Level Synthesis Leadership and Distributed Dynamic as the Source of Creativity. *Global Strategy Journal*, 6(3), 168-182. <https://doi.org/10.1002/gsj.1125>

OECD Observer. (2000). Small and Medium-sized Enterprises: Local Strength [Policy Brief]. Global Reach.

Ocasio, W. (2011). Attention to attention. *Organization Science*, 22(5), 1286-1296.
<https://doi.org/10.1287/orsc.1100.0602>

* Patel, P (2019). Opportunity related absorptive capacity and entrepreneurial alertness. *International Entrepreneurship and Management Journal*, 15(1), 63-73.
<https://doi.org/10.1007/s11365-018-0543-2>

- Peteraf, M., Di Stefano, G., & Verona, G. (2013). The elephant in the room of dynamic capabilities: Bringing two diverging conversations together. *Strategic management journal*, 34(12), 1389-1410.
- * Phua, FT (2007). Does senior executives' perception of environmental uncertainty Affect the strategic functions of construction firms? *International Journal of Project Management*, 25(8), 753-761. <https://doi.org/10.1016/j.ijproman.2007.03.003>
- Plambeck, N. (2012). The development of new products: The role of firm context and managerial cognition. *Journal of Business Venturing*, 27(6), 607-621.
<https://doi.org/10.1016/j.jbusvent.2011.08.002>
- Plambeck, N., & Weber, K. (2010). When the glass is half full and half empty: CEOs' ambivalent interpretations of strategic issues. *Strategic Management Journal*, 31(7), 689-710. Scopus. <https://doi.org/10.1002/smj.835>
- Ployhart, R., & Donald Hale, Jr. (2014). The Fascinating Psychological Microfoundations of Strategy and Competitive Advantage. *Annual Review of Psychology and Organizational Behavior*, 1(1), 145-172. <https://doi.org/10.1146/annurev-orgpsych-031413-091312>
- Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). *Journal of statistical software*, 48(2), 1-36.
- * Roundy, P., Harrison, D., Khavul, S., Pérez-Nordtvedt, L., & McGee, J. (2018). Entrepreneurial alertness as a pathway to strategic decisions and organizational performance. *Strategic Organization*, 16(2), 192-226.
<https://doi.org/10.1177/1476127017693970>
- Salvato, C., & Vassolo, R. (2014). The sources of dynamism in dynamic capabilities. *Strategic Management Journal*, 39(6), 1728-1752. <https://doi.org/10.1002/smj.2703>

- * Simon, M., & Shrader, R. (2012). Entrepreneurial actions and optimistic overconfidence: The role of motivated reasoning in new product introductions. *Journal of Business Venturing*, 27(3), 291-309. <https://doi.org/10.1016/j.jbusvent.2011.04.003>
- Simerly, R., & Li, M. (2000). Environmental dynamism capital structure and performance: A theoretical integration and an empirical test. *Strategic management journal*, 21 (1), 31-49. [https://doi.org/10.1002/\(SICI\)1097-0266\(200001\)21:1<31::AID-SMJ76>3.0.CO;2-T](https://doi.org/10.1002/(SICI)1097-0266(200001)21:1<31::AID-SMJ76>3.0.CO;2-T)
- Sirmon, D., & Hitt, M. (2009). Contingencies within dynamic managerial capabilities: Interdependent effects of resource investment and deployment on firm performance. *Strategic Management Journal*, 30(13), 1375–1394.
- * Song, M., Zhao, Y., & Di Benedetto, C. (2013). Do perceived advantages lead to pioneering first-mover decisions? *Journal of Business Research*, 66(8), 1143-1152. <https://doi.org/10.1016/j.jbusres.2012.03.010>
- Teece, D. (2007). Explicating dynamic capabilities: The nature and Microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350. <https://doi.org/10.1002/smj.640>
- Teece, D (2014). The Foundations of Enterprise Performance: Dynamic Capabilities and Ordinary in an (economic) Theory of Firms. *Academy of Management Perspectives*, 28(4), 328-352. <https://doi.org/10.5465/amp.2013.0116>
- Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning*, 51(1), 40-49. <https://doi.org/10.1016/j.lrp.2017.06.007>
- Tripsas, M., & Gavetti, G. (2000). Capabilities, Cognition, and Inertia: Evidence from digital imaging. *Strategic Management Journal*, 21(10-11), 1147-1161.

- Van den Noortgate, W., López-López, J. Marin-Martinez, F., & Sánchez-Meca, J. (2013). Three-level meta-analysis of dependent effect sizes. *Behavior Research Methods*, 45(2), 576-594. <https://doi.org/10.3758/s13428-012-0261-6>
- VandenBos, G. (2007). APA Dictionary of Psychology. American Psychological Association.
- Viechtbauer, W. (2010). Meta-Analyzes Conducting in R with the metafor Package. *Journal of Statistical Software*, 36(3), 1-48.
- Viswesvaran, C., & Ones, D. S. (1995). Theory testing: Combining psychometric meta-analysis and structural equations modeling. *Personnel psychology*, 48(4), 865-885.
- * Walrave, B., Romme, A. G. L., van Oorschot, K. E., & Langerak, F. (2017). Managerial attention to exploitation versus exploration: toward a dynamic perspective on ambidexterity. *Industrial and Corporate Change*, 26(6), 1145-1160.
- Wibbelink, C., Hoeve, M., Stams, G., & Oort, F. (2017). A meta-analysis of the association Between Mental disorders and juvenile recidivism. *Aggression and Violent Behavior*, 33(1), 78-90. <https://doi.org/10.1016/j.avb.2017.01.005>
- Wiesenfeld, B. M., Reynt, J.-N., Brockner, J., & Trope, Y. (2017). Construal level theory in organizational research. *Annual Review of Organizational Psychology and Organizational Behavior*, 4, 367–400.
- Wilhelm, H., Schlömer, M., & Maurer, I. (2015). How dynamic capabilities affect the effectiveness and efficiency of operating routines under high and low levels of environmental dynamism. *British Journal of Management*, 26(2), 327-345. <https://doi.org/10.1111/1467-8551.12085>

Winter, SG (2013). Habit, deliberation, and action: strengthening the microfoundations of routines and capabilities. *Academy of Management Perspectives*, 27(2), 120-137.

<https://doi.org/10.5465/amp.2012.0124>

*Wójcik, P., & Ciszewska-Mlinarič, M. (2020). The impact of cognitive and behavioral factors on the export performance: a dynamic capabilities perspective. *European Business Review*. 33(3), 427- 449.

* Yang, D., Wang, A., Zhou, K., & Jiang, W. (2018). Environmental strategy, institutional force, and innovation capability: A managerial perspective cognition. *Journal of Business Ethics*, 159(4), 1147-1161. <https://doi.org/10.1007/s10551-018-3830-5>

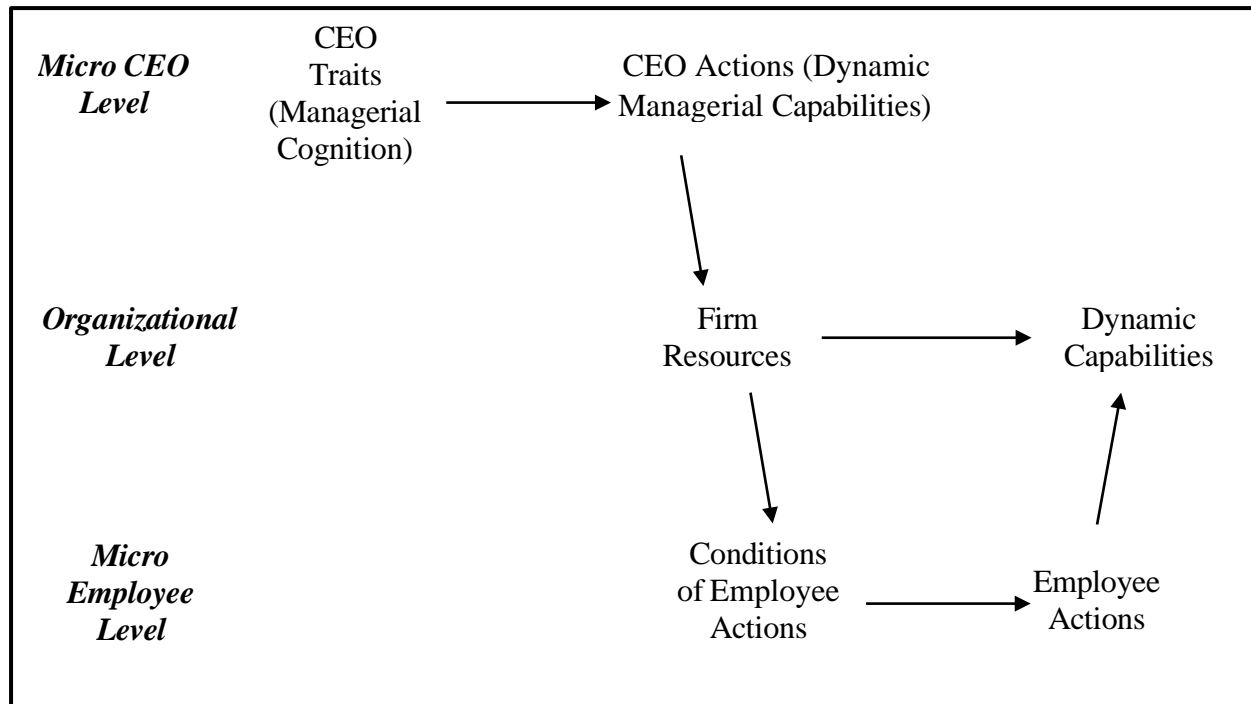
* Yu, Y., & Lindsay, V. (2016). Export commitment and the global financial crisis: Perspectives from the New Zealand wine industry. *Journal of Small Business Management*, 54(2), 771-797.<https://doi.org/10.1111/jsbm.12171>

* Zhao, Y., & Parry, M. (2012). Mental models and successful first-mover entry decisions: Empirical evidence from Chinese entrepreneurs. *Journal of Product Innovation Management*, 29(4), 590-607. <https://doi.org/10.1111/j.1540-5885.2012.00927.x>

Zhou, S. S., Zhou, A. J., Feng, J., & Jiang, S. (2019). Dynamic capabilities and organizational performance: The mediating role of innovation. *Journal of Management & Organization*, 25(5), 731-747.

Figure 1.

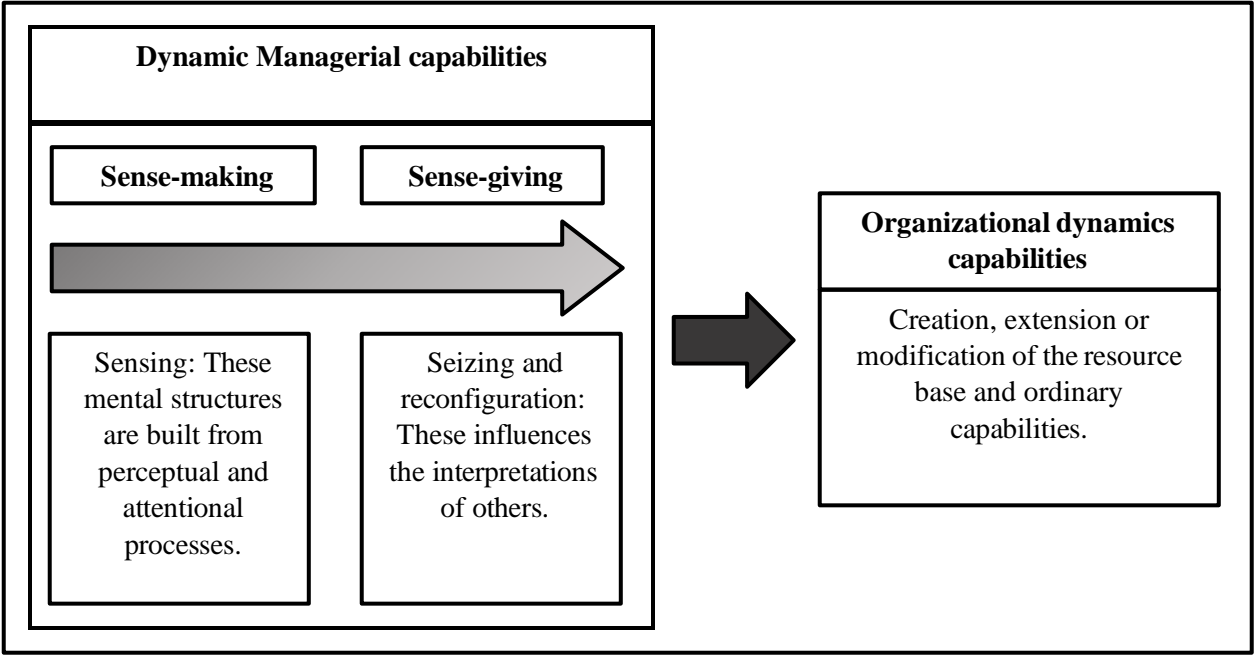
Model of Bendig et al. (2018)



Note. This model describes the micro-founded mechanism underlying dynamic capabilities. Adapted from “On micro-foundations of dynamic capabilities: a multi-level perspective based on CEO personality and knowledge-based capital” by Bendig, Strese, Flatten, da Costa, and Brettel, 2018, *Long Range Planning*, 51(6), 797-814.

Figure 2.

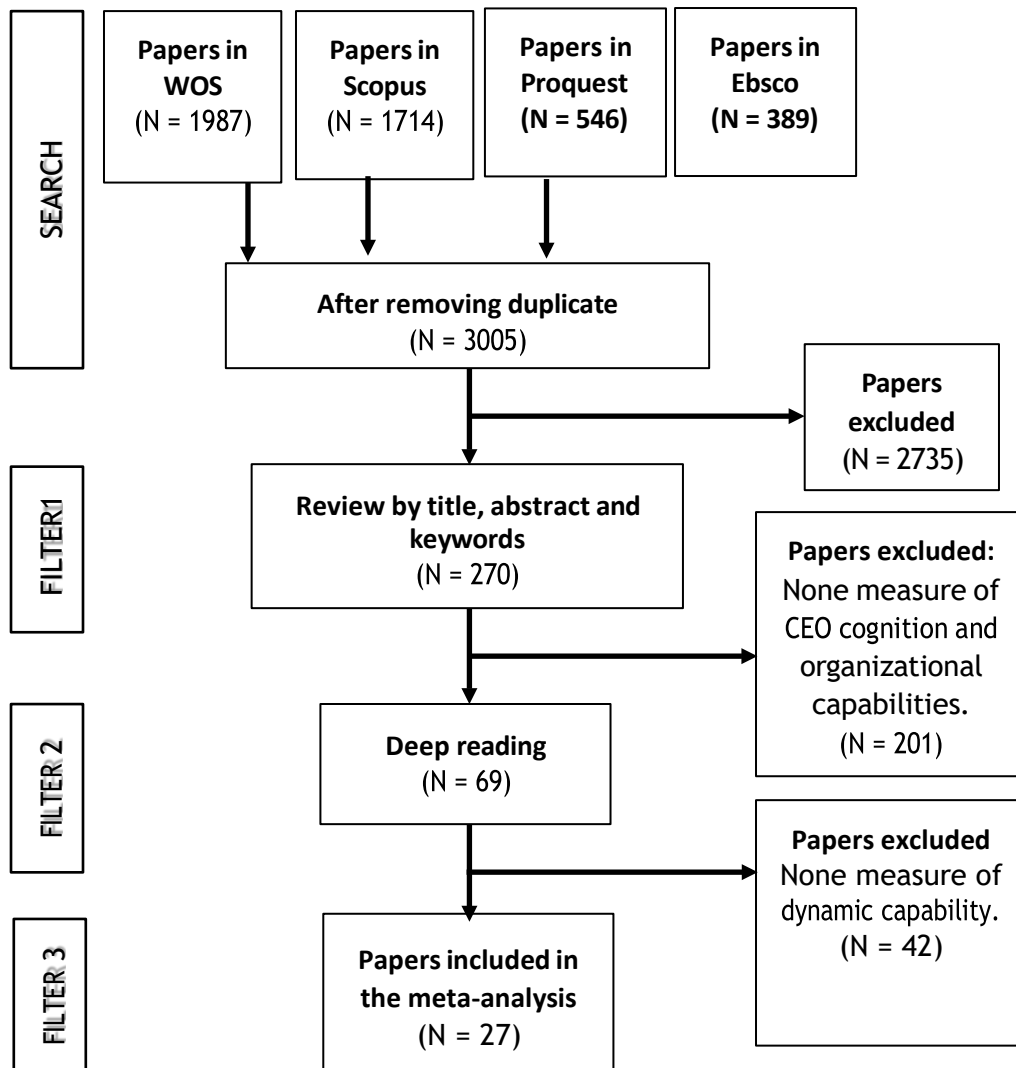
Mechanism to generate dynamic organizational capabilities



Note. The figure describe the mechanism by which cognitive resources are used in dynamic managerial capabilities and in turn they generate organizational capabilities.

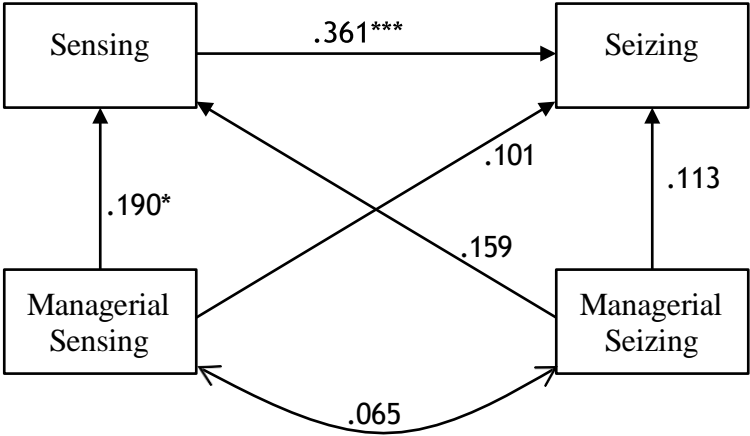
Figure 3.

Flowchart selecting papers



Note. Description of the selection process of papers. The flowchart PRISMA template was used.

Figure 4.



Note. Direct effect of Managerial Sensing on Seizing was significant $\beta = .18$, but the effect disappear in the model. There is a total mediation effect. Indirect effect = 0.069, $z=2.048$, $p=.043$. * $p < 0.05$. *** $p < .001$.

Table 1*Studies used in the meta-analysis*

Study	Country	Sample size	Cognitive variable	Organizational dynamic capability (measurement)
Song, Zhao, and Di Benedetto (2013)	USA	209	Managerial perceptions of pioneering advantages, disadvantages	Pioneering capability (first-mover decisions)
Eggers and Kaplan (2009)	USA	307	CEO attention	Absorption capacity (R&D/sales)
Zhao and Parry (2012)	China	302	Managerial perceptions of pioneering advantages, disadvantages	Pioneering capability (first mover decision)
Roundy et al. (2018)	USA	633	Perceived opportunity, perceived threat, perceived uncertainty, entrepreneurial alertness	Strategic change decisions capability (low cost and differentiation strategy)
Yu and Lindsay (2016)	New Zealand	65	Management attitude toward exports Perception of uncertainty	Diversification capability (international diversification)
Garrett, Covin, and Slevin (2009)	USA	111	Perceived environment hostility, perceived dynamism of the environment	Pioneering capability (market pioneering)
Gerstner, König, Enders, and Hambrick (2013)	USA	72	Managerial attention	Absorption capacity (R&D/sales)
Yang et al. (2018)	China	126	Perceived business pressure, perceived social pressure, management focus on the environment	Innovation capability (patents)
Phua (2007)	China	444	Perceived environmental uncertainty	Capability of firm change (frequency of change in products and operations; extent of changes)

				in firm's overall strategy)
Patel (2019)	Sweden	93	Entrepreneurial alertness	Absorptive capacity (assimilation, transformation, exploitation)
Kiss and Barr (2015)	USA	104	Mental model complexity Proactive logic	Innovation capabilities (frequency new venture actions)
Gielnik, Krämer, Kappel, and Frese (2014)	South Africa	100	Divergent thinking Business opportunity identification, entrepreneurial alertness	Innovativeness (innovativeness of products or services)
Kaplan (2008)	USA	71	Managerial attention	Innovation capabilities (optical patents as a percentage of all patents)
Dibrell, Craig, and Hansen (2011)	USA	284	Perceived industry dynamism, environmental attitudes	Innovativeness (product/service innovativeness)
McKelvie, Wiklund, and Brattström (2018)	Sweden	361	Technological dynamism (perceived)	Innovation capabilities (innovative output)
Simon and Shrader (2012)	USA	55	Industrial hostility (perceived), industry dynamism (perceived)	Pioneering capability (pioneering)
Fernández-Pérez, García-Morales, and Pullés (2016)	Spain	203	Strategic schemas	Strategic flexibility capability
Chen and Ling (2010)	China	193	Golden mean thinking	Organizational ambidexterity
Kreiser, Marino, Davis, Tang, and Lee (2010)	South Korea	250	Opportunity perceptions	Firm-level entrepreneurship (proactiveness; strategic renewal; innovativeness)
Nadkarni and Barr (2008)	USA	600	Attention focus Proactive causal logic	Speed of strategic responses

Note. The complete reference of the items is in the list of references marked with *.

Table 2.

Classification of cognitive variables

Sensing	Seizing	Reconfiguration
Managerial attention	Managerial perceptions of pioneering advantages	Perceived business pressure
The process of selective attention by which an individual processing information focuses on a specific sensory stimulus in a moment of time (Ocasio, 2011). In this case, CEOs use their cognitive resources to identify changes in the environment and the technology used in the economic sector.	CEOs' mental representation about the advantages of pioneering the market. CEOs believe that pioneering can allow them to develop, acquire, and manage resources before the competition, generating competitive advantages. Advantages can be of five types: performance advantages, advantages of market differentiation, preferential access to resources, leadership benefits, and costs (Zhao & Parry, 2012).	A type of institutional pressure from the constituents of the market, such as suppliers, customers, and competitors (Yang et al., 2018).
Business opportunity identification	Managerial perception of pioneering disadvantages	Perceived social pressure
The sense-making process to simplify the meaning of an exogenous change. To do so, CEOs engage in a search process that is a reflection of the resources currently possessed by the firm. Thus, issue categorization as opportunity refers to categorizing an event or issue as favorable because it is perceived to have a potentially positive effect on the organization (Roundy et al., 2018).	CEOs' mental representation about the disadvantages of being pioneers in the market. CEOs believe that pioneering can expose them to risk, rather than competition or open spaces that others can exploit with less investment (free riders). These disadvantages can be of two types: more risk perceived or more uncertainty (Zhao & Parry, 2012).	A type of institutional pressure not by constituents of the market such as the government, media, or public organizations (Yang et al., 2018).
Perceived environmental hostility	Proactive logic	Management focus on the environment

<p>An environment characterized by precarious environments in the industry, intense competition, severe weather, overwhelming commercial competence, and a relative lack of opportunities forexploitation (Covin & Slevin, 1989).</p>	<p>The belief that the strategy of the firm is a cause that influences the environment. It contrasts with deterministic causal logic, in which CEOs believe that the environment determines the strategy (Fahey & Narayanan, 1989).</p>	<p>CEOs' proactive stance in relation to care of the environment, reflected in the way resources are managed in the organization (Yang et al., 2018).</p>
<p>Perceived environmental uncertainty</p> <p>An individual's perceived inability to predict accurately the state of the environment, its effect on the firm, and the type of response options available. It is high when CEOs do not feel confident about the likelihood to predict the changes. Conversely, it is low when the environment is regarded as stable and the effect it has on the firm is predictable (Phua, 2007).</p>	<p>Divergent thinking</p> <p>The general ability of an individual to generate multiple original ideas (Guilford, 1950). It has been suggested in the literature that this is done by combining and reorganizing different pieces of information (Gielnik, Krämer, Kappel, & Frese, 2014).</p>	<p>Attitude to the environment</p> <p>Environmental attitudes toward resource allocation decisions regarding commercial efforts and environmental initiatives to protect the natural environment (Dibrell, Craig, & Hansen, 2011).</p>
<p>Perceived environmental dynamism</p> <p>CEOs' perception of the firm's rapidly changing environment (Miller & Friesen, 1982).</p>	<p>Attitude toward exports</p> <p>Belief in the value of export. Evaluation of CEOs with a strong vision of exporting as an inherently attractive idea for business (Yu & Lindsay, 2016).</p>	<p>Golden mean thinking</p> <p>Confucianism refers to the idea of staying in the middle, at equilibrium. It has been defined as a way of thinking in which the decision-making conditions integrate external and internal demands, allowing one to take appropriate decisions (Chen & Ling, 2010).</p>
<p>Entrepreneurial alertness</p> <p>A cognitive scheme that allows decision makers to be more sensitive to the</p>		

recognition of potential opportunities. This scheme is difficult to verbalize and often even treated as instinctive, but it is learned and developed. It allows rapid appreciation, prediction, and implicit answers. This scheme realizes the extent to which decision makers can perceive and anticipate business opportunities associated with current and future states of their business environment (Roundy et al., [2018](#)).

Note. Definitions are extracted from the articles identified in the systematic search of databases.

Table 3*Results of the meta-analysis*

Managerial dynamic capacity	No. of studies	No. of effects	<i>r</i> (error)	Confidence interval		<i>t</i>	<i>p</i>	Intra-studies variance	Inter-studies variance
	19	61	.188(.043)	.103	.270	4.393	<.001	.037***	.013
Sensing	15	43	.196 (.041)	.114	.274	4.808	<.001	.037***	.006
	5	8	.261(.126)	-.031	.512	2.120	.072	.120***	0
Managerial attention	4	7	.247 (.144)	-.099	.530	1.756	.120	.139***	0
	4	5	.393(.123)	.073	.640	3.369	.028	.017	.038
Entrepreneurial alertness	3	3	.387 (.185)	.045	.647	2.202	.159	–	.044
	6	15	.335 (.049)	.238	.425	7.094	<.001	.030 ***	0
Perception of opportunities	3	5	.385 (.060)	.235	.517	6.773	.003	.001	.007
	5	11	.092 (.037)	.009	.173	2.477	.033	.007*	.001
Perception of dynamism	4	8	.091 (.057)	-.043	.222	1.598	.154	.122*	.003
	3	5	-.032 (.137)	-.392	.335	-0.237	.824	.033*	.024
Perception of hostility	3	5	.007 (.132)	-.344	.357	.055	.959	.033*	.023
	4	17	.077 (.014)	.047	.107	5.350	<.001	<.001	0
Perception of uncertainty	3	14	.072 (.013)	.045	.100	5.667	<.001	<.001	0
	7	30	.153 (.041)	.071	.233	3.785	.007	.011***	.004
Seizing	6	27	.136 (.049)	.037	.233	2.819	.009	.006***	.008
	2	6	-.181(.025)	-.117	-.243	7.214	<.001	0	0
Pioneering disadvantages	2	6	-.185 (.024)	-.244	-.124	7.782	<.001	0	0
	2	16	.142 (.091)	-.052	.325	1.565	.139	.006**	.015*
Pioneering advantages	2	16	.162 (.091)	-.030	.343	1.799	.092	.006**	.015*
Divergent thinking	2	1	.010	–	–	–	–	–	–
	2	4	.241 (.149)	-.223	.616	1.657	.196	.076***	0
Management attitude toward exports	1	1	.236	–	–	–	–	–	–
	2	3	.084 (.181)	-.601	.698	.465	.688	.004	.054
Proactive logic	2	3	.040 (.173)	-.611	.659	.229	.840	.030	.535
	3	5	.188 (.047)	.060	.310	4.046	.016	0	.002
Reconfiguration	3	5	.170 (.044)	.051	.285	3.940	.017	0	.002
	4	5	.286 (.220)	-.308	.719	1.335	.253	0	.169
Strategic mental model complexity	2	3	-.460 (.321)	-.959	.732	-1.496	.273	0	.212

Table 4. Moderation in managerial sensing capability

Sensing	No. of studies	No. of effects	Correlation (error)	Confidence interval	<i>t</i>	<i>p</i>	Omnibus test	<i>p</i>	Intra-studies variance	Inter-studies variance
							<i>F</i> (1, 55) = 0.191	.664	.021***	.019**
Firm size							<i>F</i> (1, 25) = 5.04	.0343	.035***	.004
	12	36	.194 (.061) **	.074	.310	3.203	.002			
SMEs	8	17	.239 (.055)***	.128	.343	4.392	<.001			
	5	21	.150 (.084)	–	.309	1.813	.075			
Big	3	9	.022 (.082)	.016 –.145	.188	.271	.789			
							<i>F</i> (1, 42) = 3.105	.235	.034***	.009
Dynamism							<i>F</i> (1, 36) = 3.1051	.0865	.0374***	.002
	9	35	.117(.053)*	.011	.221	2.237	.031			
Low	7	29	.086 (.044)	–.002	.174	1.978	.056			
	5	9	.232(.083)**	.069	.383	2.848	.007			
High	4	8	.235 (.075)**	.088	.375	3.205	.003			
							<i>F</i> (1, 59) = 2.758	.102	.037***	.009
Sampling							<i>F</i> (1, 40) = .410	.526	.038***	.018
	9	32	.127 (.057)*	.013	.283	3.171	.002			
Random	9	32	.173 (.063)**	.045	.301	2.733	.009			
	10	29	.253 (.055)***	.149	.353	4.742	<.001			
Non-random	5	10	.230 (.092)*	.050	.396	2.563	.014			
							<i>F</i> (1, 59) = 0.214	.645	.037***	.014
Design							<i>F</i> (1, 40) = .015	.903	.038***	.019
	12	44	.177 (.056)**	.066	.283	3.171	.002			
Cross-sec	9	30	.187 (.066)**	.056	.312	2.864	.007			
	7	17	.217(.071)**	.078	.348	3.102	.003			
Longitudinal	5	12	.200 (.089)*	.023	.383	2.278	.028			
							<i>F</i> (1, 59) = 2.012	.161	.036***	.012
Data collection							<i>F</i> (1, 40) = 2.0316	.162	.038***	.014

	4	6	.327 (.107)**	.124	.503	3.167	.002		
Archive	3	5	.335 (.122)**	.101	.534	2.851	.007		
	15	55	.172 (.046) ***	.082	.260	3.802	<.001		
Self-report	12	38	.157 (.053)**	.051	.266	2.974	.005		
								$F(3, 57) = 1,534$.216 .037***
Country								$F(3, 38) = 1.073$.372 .037***
	10	26	.153 (.054)**	.045	.256	2.837	.006		.01
USA	8	21	.155 (.068)*	.018	.287	2.290	.027		
	1	12	.071 (.112)	–	.387	.064	.525		
China	1	12	.072 (.144)	.151 –.215	.348	.504	.617		
	4	15	.278 (.082)**	.121	.422	3.476	.001		
Europe	2	3	.387 (.154)*	.096	.617	2.649	.012		
	4	8	.299 (.090)**	.128	.452	3.441	.001		
Other	3	6	.251 (.119)*	.016	.460	2.160	.037		

Table 5. Moderation in managerial seizing capabilities

	No. of interval	No. of <i>t p</i>	Omnibus test	Confidence <i>p</i>	variance	variance	Intra-studies	Inter-studies	Seizing	studies	effect	<i>r</i> (error)
							$F(1, 20) = .647$.431	.013***		.003
Firm size							$F(1, 17) = 1.010$.329	.007***		.006
	3	3	.051 (.096)		-.148	.247	.599					
SME	3	3	.032 (.09)		-.159	.221	.355					
	3	19	.137(.049)*		.037	.235	2.384					
Big	2	16	.144 (.066)*		.007	.276	2.217					
							$F(1, 24) = .067$.798	.006***		.005
Dynamism							$F(1, 24) = .001$.975	.006***		.006
	3	4	.174 (.073)*		.028	.316	2.446					
Low	3	4	.169 (.073)**		.020	.310	2.345					
	2	22	.152 (.057)**		.035	.265	2.680					
High	2	22	.166 (.057)**		.050	.277	2.944					
							$F(1, 28) = 0.055$.817	.010***		.008***
Sampling							$F(1, 25) = 1.370$.253	.006***		.012*
	3	23	.158 (.068)*		.023	.290	2.247					
Random	3	23	.186 (.073)*		.038	.327	2.571					
	4	7	.136 (.071)		-.010	.275	1.914					
Non-random	3	4	.056 (.086)		-.120	.229	.657					
							$F(1, 28) = .030$.864	.010***		.006
Design							$F(1, 25) = 2.076$.162	.006***		.005
Cross-sec	4	6	.140 (.076)		-.014	.288	1.860					
Cross-country	3	3	.031 (.088)		-.148	.209	.355					
	3	24	.156 (.059)*		.037	.271	2.680					
Longitudinal	3	24	.174 (.049)**		-.075	.269	3.611					
							$F(1, 28) = 4.311$.047	.009***		.003
Data collection							$F(1, 25) = 4.884$.037	.006***		.004
	1	1	-.150 (.148)		-.425	.150	-1.024					
Archive	1	1	-.149 (.139)		-.410	.135	-1.081					
	6	29	.306 (.152)*		.004	.556	2.076					

Self-report	5	26	.166 (.038)***	.089	.242	4.380	<.001				
								<i>F</i> (3, 26) = 0.109	.954	.010***	.022
Country								<i>F</i> (3, 24) = .010	.990	.006***	.026
	2	10	.188 (.118)	-.053	.408	1.611	.119				
USA	3	11	.123 (.104)	-.090	.325	1.191	.245				
	1	14	.109 (.152)	-.200	.399	0.720	.477				
China	1	14	.109 (.164)	-.225	.420	.667	.511				
Europe	1	3	.226 (.171)	-.120	.524	1.348	.189				
	2	2	.152 (.188)	-.156	.432	1.014	.189				
Other	2	2	.140 (.150)	-.167	.422	.938	.358				

