
# Management Decision

Linkage between dynamics capability and knowledge management factors: A structural equation model

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# Linkage between dynamics capability and knowledge management factors

## A structural equation model

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### Abstract

**Purpose** – Organizations are currently set in a background of dramatic discontinuity, i.e., environments that require continuous change due to fierce competition and market latent demands. From this perspective, it becomes eminent for organizations to develop an organizational context that stimulates routines reconstruction and internal capabilities to continue to be a competitive organization. The purpose of this paper is to examine entry and exit relationships of knowledge management (KM). Entries are considered, in this paper, the foundation factors of KM, and exits are related to dynamic capability (DC).
**Design/methodology/approach** – Data were collected through a survey conducted with 550 companies of the automotive industry, which are registered in the database of SINDIPEÇAS (National Union of Automobile Component Industries) with return rate of 143 valid questionnaires. The hypothesis testing and analysis were conducted using structural equation modeling.
**Findings** – The research shows the organizational structure as the main contextual factor related to KM, that supports DC. Besides organizational structure, this paper also assesses the interaction between human resources and organizational culture related to DC.
**Practical implications** – The results may help managers of companies from the automotive industry to understand which initiatives promote DC and innovation.
**Originality/value** – This paper presents one of the few researches that compare contextual factors related to KM that support DC; and it also compares the connection among human resources, organizational culture and organizational structure related to KM.

**Keywords** Dynamic capability, Knowledge management, Automotive industry, Contextual factors, Structural equation

**Paper type** Research paper

## 1. Introduction

The main objective of Knowledge Management (KM) is to create an organizational context that encourages the development of new knowledge by exploration or exploitation learning (March, 1991) or by single or double loop (Argyris and Schön, 1978), as well as to create mechanisms that promote retention of explicit or implicit knowledge, and that disseminate knowledge among the individuals of the organization to put them into practice in organizational routines or in incremental improvement activities or innovation, producing dynamic capabilities and competitive advantage (López, 2005; Lee *et al.*, 2016; Tseng and Lee, 2014; Lee *et al.*, 2012).

However, the way an organization effectively acquires, retains and distributes knowledge in order to create and reuse it is determined by KM organizational capability (Soo *et al.*, 2002; Lee *et al.*, 2012). The KM capability is related to the development of factors that produce a context focused on learning.

With regard to organizational factors that support the KM capability, Mehta (2008) emphasizes that the key factors that contribute to effective KM are human, structural and technical. This study focus specifically on human and structural factors associated with

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knowledge generation, retention, sharing, and application. The technical factors, related to the use of information technology (IT) systems, are understood in this study as mechanisms to support the knowledge retention and sharing, assisting the processes of formalization and integration, which relate to the organizational structure.

Bollinger and Smith (2001) propose that human behavior is the key to success of KM activities, as KM involves an emphasis on organizational culture, teamwork, the promotion of learning, and the sharing of skills and competences. From this viewpoint, three supporting human-related elements for KM will be considered: human resources management (HRM), learning-oriented culture and organizational structure. The HRM should support the development of employees with knowledge and skills aligned with the organization core competencies (Aujirapongpan *et al.*, 2010). The learning-oriented culture is focused on developing an organizational environment focused on collaboration among individuals and stimulating the creative process (Gonzalez and Martins, 2014, 2015; Aujirapongpan *et al.*, 2010), and organizational structure must support knowledge sharing (Liao *et al.*, 2011). Organizational structure is responsible for establishing the explicit knowledge formalization, the level of employee autonomy, means to connect people, encouraging multidisciplinarity and communication channels among individuals, leveraging the knowledge flow (Rechberg and Syed, 2014; Gonzalez and Martins, 2015).

The development of factors that support KM aims the improvement of organizational performance. The lack of performance improvement in organizations shows inefficient KM process or the failure to development of factors that support this process (Aujirapongpan *et al.*, 2010; Cardoso *et al.*, 2012). Taking into account the tough competition in a globalized market and fast technological changes in products and processes, the ability of companies to reconstruct its capabilities, i.e., dynamic capability (DC) is fundamental so that companies achieve competitive advantage (Teece *et al.*, 1997 Teece, 2007; López, 2005).

The results of this study will show that organizational factors that support the KM are essential in order to capitalize on efforts made in DC. One of the most important contributions of this work is that the moderating effects are found in both HRM and learning-oriented culture, and organizational structure is the most relevant factor in order to stimulate DC. Being DC and KM emerging disciplines, empirical studies on the effect of factors that support KM on DC are necessary in order to establish a common and solid ground for researchers and practitioners (Barrales-Molina *et al.*, 2015). Although the number of these studies has increasingly grown in the last few years, many studies focus on the influence of KM capability over organizational performance (Lara *et al.*, 2012; Lee and Choi, 2003; Lee *et al.*, 2012) and the firm innovative capability (Chen *et al.*, 2010; Han and Li, 2015; Martín-de-Castro, 2015). However, little attention has been given to the relationship between organizational factors and DC. Furthermore, a large amount of them are qualitative-based and carried out through case study methodology (Chen and Huang, 2007; Zack *et al.*, 2009). One of the main contributions of this paper, therefore, will be a quantitative research regarding the impact of the three factors above that support KM, called KM entry factors, on DC, that consist in the KM result or KM output.

The automotive industry was chosen due to its relevance in the metal-mechanic industry and in the Brazilian industry. The companies of the automotive industry are responsible for an ample chain, that integrates a large amount of factories, assembly line factories and service companies, and according to ANFAVEA (2012) (National Association of Motor Vehicle Manufacturers), they employ 5.6 percent of the domestic industry workers and is responsible for 19.8 percent of the domestic industry GNP.

Besides its importance in the domestic economy, this industry was chosen for a study of the contextual factors that support KM due to its high intensity advances on technology that predominate in this industry. According to classification by UNCTAD (2005), the automotive industry is classified as an industry with medium-high technological intensity, i.e., it presents

R&D (R&D/Sales) intensity between 1.5 and 5 percent. Marsili (2001) describes the automotive industry as an industry that presents high degree of entry barriers due to knowledge, a high persistence with regard to technology innovation practices, complex knowledge and high cumulative and appropriation degree. Concerning appropriation, the constant contraction of lead-time, more than patents, has been a more effective mechanism for protection of innovations.

The organization of this paper is as follows. First, the theoretical background and the research hypothesis of this study will be established. Second, the empirical analysis will be presented along with the main results of the research. Next, the results of the study will be discussed. Finally, the main conclusions, limitations of the paper, and potential lines of research for the near future will be presented.

## 2. KM capability and DC

The resources based view of firm shows that resources and organizational capabilities are the main sources of competitive advantage (Kogut and Zander, 1992). Concerning this approach, there is a difference between resources and capability. Organizational resources, such as equipment, patents and money are basic input for competitive advantage. Organizational capability is a company's capability for acquiring and using resources to carry out activities that lead to competitive advantage (Grant, 1996). Whereas resources represent the main source of a firm's capability, capabilities are the primary source of competitive advantage (López, 2005).

The KM capability is related to a company ability to leverage acquired knowledge by means of continuous learning to produce new knowledge (Patterson and Ambrosini, 2015). The underlying concept about KM capability is that knowledge is inherent to people and can be developed to become organizational knowledge through the KM process, i.e., knowledge acquisition, retention and distribution that support knowledge transformation, enabling DC (Patterson and Ambrosini, 2015; Martín-de-Castro, 2015; Lee *et al.*, 2016). Thus, KM success depends on the development of factors that increase individual knowledge, stimulate knowledge sharing, and also promote integration of individuals (Rechberg and Syed, 2014).

Zollo and Winter (2002) argue that the learning process is responsible for two sets of organizational activities: operational routine that is related to functionality of a company and dynamic capabilities that facilitate routine improvement (modification of routine).

With regard to DC, Teece *et al.* (1997, p. 516), define as "[…] a company's capability to integrate and reconfigure its internal competences, to respond rapidly to environmental changes." An important implication of this concept is that companies compete not only in a perspective based on exploitation of its capabilities, but also support its competitive strategies in development and retention of its organizational competences. Zollo and Winter (2002) point out that activities of research and development, alliances and acquisitions, transfer of technology and routines as examples of DCs.

The link between DC and KM has been widely discussed (Arend and Bromiley, 2009; Patterson and Ambrosini, 2015; López, 2005). Anand *et al.* (2010) state that DCs are composed of creating, obtaining, integrating, and redeploying knowledge resources. Wang and Ahmed (2007) indicate that knowledge-based DCs include knowledge absorption and creation of knowledge through its exploration and exploitation in order to generate adaptive and innovative capability. Adaptive capability is a company's capability to identify and use potential market opportunities, and innovative capability is related to the capability to develop new products and/or markets by means of arranging the innovation strategic orientation with behavior and innovative processes.

Whereas organizations with higher levels of absorption capability tend to be more dynamic (Teece, 2007; Teece *et al.*, 1997; Zollo and Winter, 2002), i.e., able to explore opportunities in the environment, regardless of current performance, organizations with lower levels of absorption capability tend to be more reactive, because they search ways to

correct their mistakes, based on performance patterns that are not technological advances (Anand *et al.*, 2010).

Exploration and exploitation represent two different fundamental methods for organizational learning. The first results in a company's behavior based on research, discovery and experimentation; whereas the second is characterized by refinement, implementation, efficiency, production and selection (March, 1991; Volberda *et al.*, 2010). The returns associated with exploration are more variable and long-term, whereas the returns associated with exploitation are more accurate and short-term. In other words, firms that explore new knowledge result in greater variation of performance, whereas exploitation leads to a more stable performance (March, 1991).

There is a complementary effect between these two strategies: exploitation promotes static optimization; and exploration supports dynamic optimization (March, 1991). A firm's success in competing in stable environments is associated with exploitation of consolidated competences, whereas surviving in dynamic environments is associated with the exploration of new competences. Thus, both strategies are essential to maintain competitive advantage and their combination is implicit in current concepts that address organization's DC (Volberda *et al.*, 2010). Table I show organizational factors related to DC, extracted from the reference list about this subject.

Aujirapongpan *et al.* (2010) explained corporate KM capability based on the perspectives of resource-based and knowledge-based view of the firm. Resource-based capability refers to different types of resources to investigate KM capability and an assumption that possessing different resources will result in different KM capabilities and influence the infrastructure capability of KM capability, including technology, organizational structure, and culture (Kogut and Zander, 1992; Lee and Choi, 2003). Furthermore, the knowledge-based capability perspective particularly emphasizes intangible assets, in particular, the human resource expertise and learning capability (Grant, 1996). In this way, associating the resource-based view of the firm, which emphasizes the role of structural aspects, and the knowledge-based firm view that values intangible assets, this research considers three constructs that impact on the dynamic capacity of the firm: human resources, organizational culture and structure.

## 3. Research model and hypothesis

Previous studies suggest that KM capability, i.e., the capability for acquiring, retaining, distributing and using knowledge improves the firm's DCs (Tseng and Lee, 2014), and, as a consequence, its organizational performance (Lee *et al.*, 2012; Tseng and Lee, 2014). Other researches show that infrastructural factors of the organization are enabled from KM (Lee and Choi, 2003; Mahmoudsalehi and Moradkhannejad, 2012). However, currently, there are few studies that investigate the connection between organizational factors that support KM and DC.

Several factors promote KM process and also support the firm's DC. Gold *et al.* (2001) argued that a firm's predisposition to effectiveness KM lies in its KM infrastructure. The infrastructure

| Factor | Definition |
|---|---|
| Knowledge absorption (KAbs) | Related to the organizational capability to assimilate and apply knowledge for competitive advantage. (Anand *et al.*, 2010; Patterson and Ambrosini, 2015; March, 1991; Volberda *et al.*, 2010; Torugsa and O'Donohue, 2016) |
| Knowledge exploitation (EXPT) | Exploitation is related to the use of the same base of knowledge. (Ganzaroli *et al.*, 2016; March, 1991; Volberda *et al.*, 2010) |
| Knowledge exploration (EXPL) | Exploration involves research and discovery of new knowledge, leading to innovation. (Martín-de-Castro, 2015; Ganzaroli *et al.*, 2016; Volberda *et al.*, 2010) |

**Table I.** Factors related to dynamic capability (DC)

capabilities consist of three key capabilities: cultural, structural and technological. In the current study, we consider that the technology is a support infrastructure for the KM process, which assists in the knowledge retention and distribution. Thus, the technology is treated in conjunction with the structure. In addition to the infrastructural aspects cited by Gold *et al.* (2001), i.e., organizational culture and structure, this study also considers HRM to determine DC's effectiveness (Barrales-Molina *et al.*, 2015; Pandey and Dutta, 2013).

Some studies consider human resources as the main factor that explains DC's effectiveness (Barrales-Molina *et al.*, 2015; Arend and Bromiley, 2009). Recent studies indicate that the power of human resources learning at the workplace allows the firm to respond quickly to changes in the external context by improving and restructuring routines (Crick *et al.*, 2013; Matsuo and Nakahara, 2013). Human resources are responsible for managing and operating organizational routines, accumulating common knowledge that allows the absorption of new knowledge able to restructure internal competences (Barrales-Molina *et al.*, 2015; Gonzalez and Martins, 2015).

With regard to HRM, the knowledge age presents new and complex challenges, promoting changes in traditional people management, characterized by a bureaucratic and mechanistic bias, for a function-based management, supporting the KM process (Pandey and Dutta, 2013). In this new context, HRM should be understood as the set of policies, practices and systems that influence the behavior, attitudes and performance of the organization's members in order to increase learning capacity (Matsuo and Nakahara, 2013). By positioning of Barrales-Molina *et al.* (2015), the contemporary HRM should perform a set of functions that promote the increase of the organizational capability in rebuilding and changing due to environmental changes. This discussion addresses the first hypothesis of this research Table II:

*H1.* HRM positively influences the firm's DC.

Organizational culture is critical to the success of KM; however, developing a specific type of culture that encourages knowledge creation, knowledge sharing, and knowledge application is one of the biggest challenges to any KM effort (Cooper *et al.*, 2016; Gold *et al.*, 2001). Marsick and Watkins (2003, pp. 140-141) argue that the learning culture is in the "hearts and minds" of the employees and, that while necessary, the dimensions of "the learning organization (continuous learning, team learning, empowerment, and promoting dialogue and inquiry)" are not sufficient. Literature supports the notion that the mere KM alone is not enough to garner sustained DC. Instead, senior leaders and managers must be engaged in the KM process and create a culture of learning within the organization (Marsick and Watkins, 2003; Han and Li, 2015).

From organizational development viewpoint, a learning culture encourages employees to think more independently and creatively, stimulating innovation from the use of new ideas due to overcoming challenges, taking the opportunities, and sometimes make mistakes (Han and Li, 2015; Lefebvre *et al.*, 2016; Gonzalez, 2016). Learning culture also encourages

**Table II.**
Factors related to human resources management (HRM)

| Factor | Definition |
|---|---|
| Employee Recruiting (ER) | Organizations need new employees that contribute to learning and to the base of learning. (Cooper *et al.*, 2016; Singh and Rao, 2016; López *et al.*, 2006) |
| Training and development (TD) | Training and development are important mechanism for the process of knowledge acquisition. (Barrales-Molina *et al.*, 2015; Chen and Huang, 2007; López *et al.*, 2006) |
| Award and acknowledgement (AA) | Indicate behavior aspects valued by the organization. Must reinforce risk taking attitude and promote knowledge sharing (Cardoso *et al.*, 2012; Zimmermann *et al.*, 2016; López *et al.*, 2006) |
| Involvement and participation (IP) | Encourage employees to bring new ideas and exchange knowledge for innovative activities (Chen and Huang, 2007; López *et al.*, 2006; Cooper *et al.*, 2016) |

employees from all hierarchical levels to experiment with new alternatives to problem solving. Thus, if a company has a learning culture, i.e., aimed at learning and sharing of knowledge, there is a greater possibility of developing internal capabilities that generate innovation (Yu *et al.*, 2007; Li and Lee, 2015; Irani *et al.*, 2009) (Table III):

*H2.* Learning-based culture positively influences the firm's DC.

According to authors such as Chen and Huang (2007) and Liao *et al.* (2011) and Chen *et al.* (2010) the organizational structure is based on three elements: the formalization, centralization, and integration. The formalization refers to the codification levels of rules and procedures guiding employee behavior. In highly formalized organizations, the existence of formal documents inhibits the generation of ideas, and prevents the spontaneous behavior necessary to stimulate innovations (Tsai, 2002). The centralization is related to the decision-making power being directed toward higher hierarchical levels (Gonzalez and Martins, 2014). Centralization creates a non-participatory environment, by reducing communication, commitment, and involvement among employees (Mahmoudsalehi and Moradkhannejad, 2012), and also prevents employees from making decisions regarding their work; thus, causing inefficiency in the creation and sharing of knowledge (Liao *et al.*, 2011). In less centralized structures, employees can determine what actions are more important for the development of a project; therefore, stimulating innovation and knowledge creation (Tsai, 2002). Integration refers to the degree of inter-relations among individuals and sectors within the organization (Chen *et al.*, 2010; Chen and Huang, 2007).

It is noteworthy the role of IT in the flow of information through the organization. Organizations, divided into departments, units and subsidiaries depend on IT that store, formalize, and distribute explicit knowledge to the individuals (Faraj *et al.*, 2011; Leidner and Elam, 1995). Thus, this paper considers the IT as a facilitator of the KM process, leaving to the individuals the action itself, allowing this stored and distributed knowledge to bring value back to the organization (Gonzalez and Martins, 2014). Table IV show the main factors related to organizational structure construct:

*H3.* Organizational structure positively influences the firm's DC.

Figure 1 show the research model, and illustrates the connection among the constructs human resources, organizational culture and organizational structure with regard to DC, and also to the three hypotheses presented.

## 4. Methodology

### *4.1 Data collection*

The objective of this research is to investigate the influence of organizational factors (HRM, learning-based culture and organizational structure) on DC, so this study is focused on large

| Factor | Definition |
|---|---|
| Knowledge sharing (KS) | Knowledge culture main objective is to stimulate individuals to share knowledge, especially tacit knowledge (Cooper *et al.*, 2016; Lefebvre *et al.*, 2016; Skerlavaj *et al.*, 2007) |
| Management active participation (MAP) | Managers get involved in the process of dissemination of the knowledge culture. (Lefebvre *et al.*, 2016; Fey and Denison, 2003; Irani *et al.*, 2009; Skerlavaj *et al.*, 2007; Marsick and Watkins, 2003) |
| Risk taking and encouraging creative process (RCP) | Employees of all hierarchical levels are encouraged to exploit and explore knowledge acquired in activities of improvement and innovation, by trial and error (Irani *et al.*, 2009; Gonzalez, 2016) |

**Table III.** Factors related to learning culture (LC)

| Factor | Definition |
|---|---|
| Formalization (Form) | Related to the level in which activities of the organization have standards registered in formal documents. (Chen and Huang, 2007; Liao *et al.*, 2011) |
| Centralization (Cent) | Related to centralization of power and autonomy level (Lee *et al.*, 2012; Ramezan, 2011; Liao *et al.*, 2011; Pandey and Dutta, 2013) |
| Functional integration (FI) | Related to the degree an organization stimulates interaction among different individual and departments, promoting multidisciplinary activities that allow problem solving and innovation (Chen and Huang, 2007; Liao *et al.*, 2011; Tsai, 2002) |
| Use of IT to facilitate storage and spread knowledge process (IT) | IT is a tool that facilitates and increase processes of storage and distribution of knowledge (Lee *et al.*, 2012; Ramezan, 2011) |

**Table IV.**
Factors related to organizational structure (OS)



and medium-sized companies, because they have a more complex organizational structure and better defined HRM.

The questionnaire has two parts. The first part is about the characteristics of the company and respondent. The second part addresses the four constructs included in this study, as seen in the Appendix.

The companies researched were chosen from SINDIPEÇAS (National Union of Automobile Component Industries) database. In relation to the employee interviewed, this research considered senior management of the departments of production, engineering, quality and human resources.

The questionnaires were distributed through e-mail in the period from March to November 2016. To increase the rate of return, before sending the e-mail, a contact by phone was made with the company participating in the survey. A total of 550 questionnaires were sent to companies registered in SINDIPEÇAS database. Of these, 151 returned (27.45 percent), of which eight presented filling problems, resulting in a final rate of return of 143 companies (26 percent). Each questionnaire was sent to a single employee of the company. In this way, each questionnaire answered represents a company in the automobile sector.

A pilot test was conducted with 12 professionals, graduates in the areas of administration and engineering, who work in companies in the automotive industry. They answered the initial questionnaire and provided feedback from an individual meeting with the researcher by Skype. From the feedback of this step, the questionnaire was restructured in order to improve its understanding and its logical sequence. Four questions were rewritten, two questions were withdrawn and two other questions were added.

### *4.2 Measures*

The model presented in Figure 1 includes four constructs measured by adapting valid and reliable scales from the KM and DC literature (Appendix).

The questions or measurement items are assessed by respondents in a Likert scale of six points, from 1 (strongly disagree or not applied by the company) to 6 (strongly agree or applied with excellence by the company). The constructs consist of the following factors and corresponding measurement items:

- HRM: in this study, HRM was measured from nine items. These items were based on strategies related to the employee selection process (Singh and Rao, 2016) – HRM1 and HRM2; training and development of skills (Barrales-Molina *et al.*, 2015; Cardoso *et al.*, 2012) – HRM3, HRM4 and HRM5; Acknowledgement and award (Crick *et al.*, 2013; Barrales-Molina *et al.*, 2015) – HRM6 and HRM7; Involvement and participation (López *et al.*, 2006) – HRM8 and HRM9.

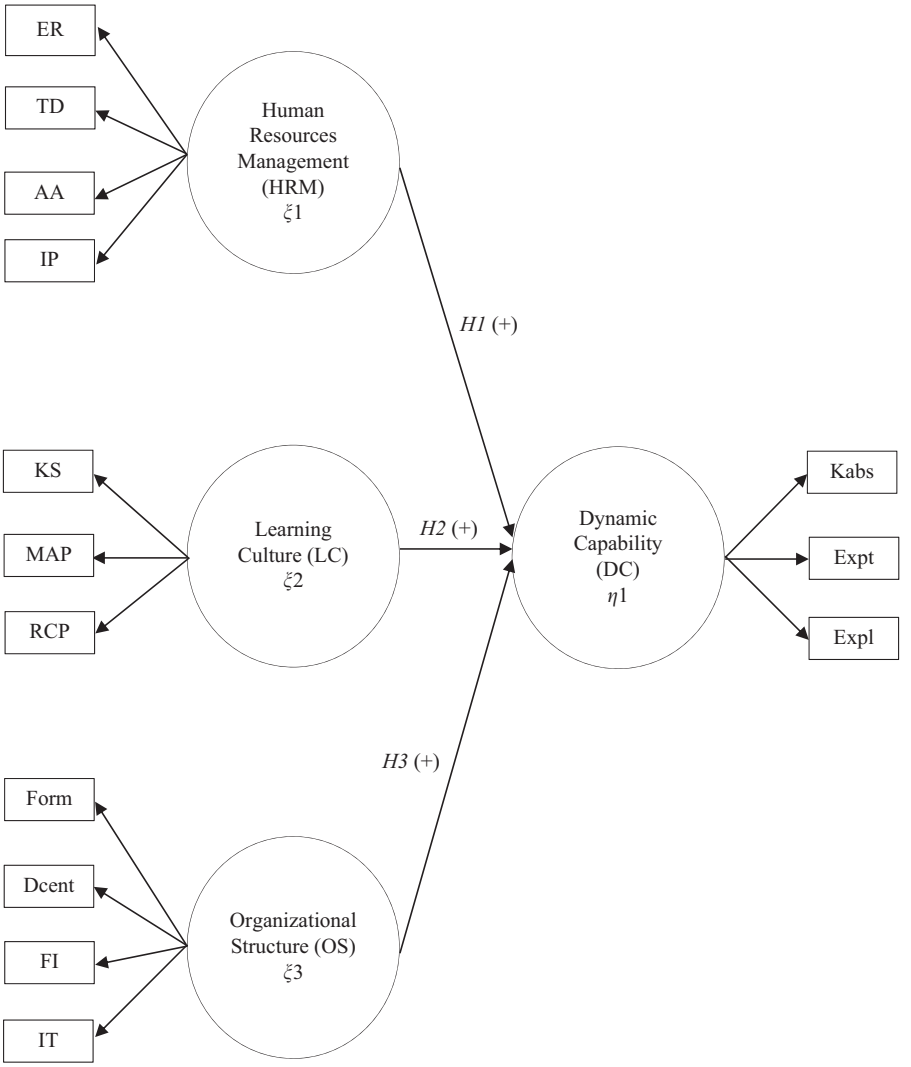


**Figure 1.**
Research model

- Learning-based culture: it is measured using six items. These items were based on concepts related to sharing culture (Cooper *et al.*, 2016; Li and Lee, 2015; Irani *et al.*, 2009) – LC1 and LC2; Management active participation (Cooper *et al.*, 2016; Lefebvre *et al.*, 2016) – LC3 and LC4 and culture of taking risks (Lefebvre *et al.*, 2016; Irani *et al.*, 2009) – LC5 and LC6.
- Organizational structure: this construct is measured from eight items. These items were based on the three aspects that define the organizational structure, according to Liao *et al.* (2011), Zheng *et al.* (2010) and Lee *et al.* (2012): formalization (OS1 and OS2); Decentralization (OS3 and OS4); integration (OS5 and OS6); and IT that support the knowledge flow (OS7 and OS8).

- Dynamic Capacity (CD): is measured from six items. These items were based on concepts related to the ability to knowledge absorption (Torugsa and O'Donohue, 2016; Teece *et al.*, 1997) – DC1 and DC2; (March, 1991); knowledge exploitation (March, 1991) – DC3 and DC4; and knowledge exploration (March, 1991) – DC5 and DC6.

### *4.3 Data analysis*

Data were analyzed using the partial least squares path modeling, following the general procedures suggested by Hair *et al.* (2013). PLS is a structural equation modeling (SEM) data analysis technique widely used in management research, including several studies based on organizational knowledge and KM (Khedhaouria and Jamal, 2015; Bontis and Serenko, 2007). The PLS can be considered an alternative to SEM, since it is a method with a lower level of restriction in relation to the distribution and normality of the data, and is also more suitable for large and small samples (Gefen *et al.*, 2000; Hair *et al.*, 2013). PLS is also considered appropriate for models with complex relationships (Fornell and Bookstein, 1982; Hair *et al.*, 2013). PLS is also appropriate for research that intends to predict a theory from certain constructs (Hair *et al.*, 2013), as is the case of this study that aims to analyze the relationship between the organizational constructs that support the KM and DC. SmartPLS version 3.0 was used to evaluate the measures and structural models of this research.

## 5. Results

### *5.1 Description of companies researched*

This research contemplates medium and large-sized companies, i.e., companies with more than 100 employees. The size choice is due to the fact that these companies have greater necessity for mechanisms that promote integration of employees of different functions, from different departments, and different characteristics with regard to structure and organizational culture that encourage and facilitate the retention and disseminations of organizational knowledge. Small-sized companies usually need higher levels of integration among employees because they have less complex structures that facilitate the knowledge flow.

The sample researched of the automotive industry included assembly lines (11.38 percent), strategic part suppliers (30.90 percent) and non-strategic part suppliers (57.72 percent). In this research, assembly lines and auto part manufacturers are contemplated due to the fact that the knowledge necessary for development and manufacturing of an automobile is divided among several companies of the industry's supply chain.

The assembly lines can be considered a leader group in the automotive industry, since they act as coordinators of the development process with the support of strategic suppliers. This small amount of companies has the role to innovate, explore new knowledge and dictate the course of technological development of the industry. Auto parts suppliers denominated as non-strategic perform the role of sustaining the production of parts developed by the first group.

All companies contemplated in this research are medium or large-sized, most of them have between 500 and 5,000 employees (47.97 percent), 41.46 percent of these companies have between 100 and 50 employees and 10.57 percent of these companies have more than 5,000 employees.

With regard to the period they have been in the automotive industry, the research contemplates companies that have been operating for at least five years. Data show a large amount of companies that have been operating from 10 to 20 years (33.33 percent) and more than 40 years (32.52 percent). The amount of companies that have been operating from five to ten years is smaller, around 7.32 percent.

The study of organizational constructs related to KM requires that the interviewee have a deeper view of the organizational context. Therefore, for this research the hierarchy levels considered are directors, and managers which are decision-making posts. Data collected show that most respondents are managers (67.48 percent), and 32.52 percent are directors.

*5.2 Reliability and validity*

Initially, the psychometric properties of the measurement scales are assessed regarding the reliability, convergent and discriminant validity using confirmatory factor analysis, employing all the items. Cronbach's $\alpha$ was the coefficient used to assess the inter-item consistency of the measurement items. All Cronbach's $\alpha$ values were acceptable, i.e., above 0.70 as in Hair *et al.* (2013), therefore, the measurements were reliable. The reliability of construct and factor load are shown in Table V.

Table V also shows the convergent validity, the degree to which multiple items that measure the same concept agree. Measurement scales have good convergent validity if the factor loadings of the items exceed 0.60 on their corresponding constructs and the average variance extracted (AVE) of the construct exceeds 0.5 (Hair *et al.*, 2013). The loadings for all items exceeded the recommended value of 0.60. Composite reliability (CR), the degree to which measurement items denote latent constructs, ranged from 0.756 to 0.944 (Table V), also exceeding the recommended value of 0.7 (Hair *et al.*, 2010). The AVE, which measures the variance captured by items in relation to measurement error, should exceed 0.50 to justify the use of a construct (Hair *et al.*, 2013). The AVE ranged from 0.615 to 0.885. The results showed that all the observable variables were acceptable for further analysis.

Table VI shows the assessment of discriminant validity, which can be obtained by examining the cross-loadings of indicators. Discriminant validity is ensured when the square root of the AVE for every construct is greater than the inter-correlation estimates (Hair *et al.*, 2013). The correlation matrix in Table II shows a good evidence of the discriminant validity.

| Factor | Item | Carga factorial | Cronbach's $\alpha$ | CR | AVE |
|---|---|---|---|---|---|
| Employee recruiting (ER) | HRM1 | 0.733 | 0.758 | 0.760 | 0.756 |
| | HRM2 | 0.687 | | | |
| Training and development (TD) | HRM3 | 0.676 | 0.823 | 0.893 | 0.822 |
| | HRM4 | 0.788 | | | |
| | HRM5 | 0.822 | | | |
| Acknowledgement and award (AA) | HRM6 | 0.766 | 0.867 | 0.783 | 0.733 |
| | HRM7 | 0.893 | | | |
| Involvement and Participation (IP) | HRM8 | 0.714 | 0.912 | 0.912 | 0.850 |
| | HRM9 | 0.733 | | | |
| Knowledge sharing (KS) | LC1 | 0.833 | 0.885 | 0.822 | 0.770 |
| | LC2 | 0.842 | | | |
| Management active participation (MAP) | LC3 | 0.751 | 0.733 | 0.756 | 0.615 |
| | LC4 | 0.725 | | | |
| Risk taking and encouraging creative process (RCP) | LC5 | 0.795 | 0.771 | 0.773 | 0.692 |
| | LC6 | 0.838 | | | |
| Formalization (Form) | OS1 | 0.844 | 0.805 | 0.928 | 0.681 |
| | OS2 | 0.895 | | | |
| Decentralization (Dcent) | OS3 | 0.912 | 0.822 | 0.836 | 0.744 |
| | OS4 | 0.755 | | | |
| Functional integration (FI) | OS5 | 0.863 | 0.740 | 0.875 | 0.786 |
| | OS6 | 0.805 | | | |
| Use of IT to facilitate the knowledge flow (IT) | OS7 | 0.925 | 0.779 | 0.944 | 0.705 |
| | OS8 | 0.833 | | | |
| Knowledge absorption (KAbs) | DC1 | 0.766 | 0.896 | 0.778 | 0.885 |
| | DC2 | 0.750 | | | |
| Knowledge exploitation (Expt) | DC3 | 0.791 | 0.873 | 0.893 | 0.826 |
| | DC4 | 0.770 | | | |
| Knowledge exploration (Expl) | DC5 | 0.822 | 0.902 | 0.865 | 0.730 |
| | DC6 | 0.756 | | | |

**Table V.**
Reliability and convergent validity

| Variable | ER | TD | AA | IP | KS | MAP | RCP | Form | Dcent | FI | IT | KAbs | Expt | Expl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ER | 0.869 | | | | | | | | | | | | | |
| TD | 0.245 | 0.907 | | | | | | | | | | | | |
| AA | 0.202 | 0.193 | 0.856 | | | | | | | | | | | |
| IP | 0.115 | 0.185 | 0.283 | 0.922 | | | | | | | | | | |
| KS | 0.192 | 0.133 | 0.163 | 0.180 | 0.877 | | | | | | | | | |
| MAP | 0.183 | 0.088 | 0.188 | 0.202 | 0.183 | 0.784 | | | | | | | | |
| RCP | 0.238 | 0.148 | 0.145 | 0.225 | 0.208 | 0.085 | 0.832 | | | | | | | |
| Form | 0.165 | 0.141 | 0.160 | 0.138 | 0.233 | 0.146 | 0.122 | 0.825 | | | | | | |
| Dcent | 0.133 | 0.189 | 0.213 | 0.155 | 0.228 | 0.220 | 0.258 | 0.098 | 0.863 | | | | | |
| FI | 0.128 | 0.067 | 0.159 | 0.168 | 0.131 | 0.173 | 0.275 | 0.145 | 0.302 | 0.887 | | | | |
| IT | 0.096 | 0.115 | 0.147 | 0.103 | 0.249 | 0.133 | 0.148 | 0.345 | 0.151 | 0.148 | 0.840 | | | |
| KAbs | 0.177 | 0.136 | 0.138 | 0.125 | 0.127 | 0.165 | 0.191 | 0.078 | 0.198 | 0.296 | 0.166 | 0.941 | | |
| Expt | 0.145 | 0.225 | 0.175 | 0.155 | 0.178 | 0.126 | 0.233 | 0.123 | 0.176 | 0.238 | 0.198 | 0.208 | 0.909 | |
| Expl | 0.148 | 0.190 | 0.086 | 0.191 | 0.136 | 0.165 | 0.228 | 0.151 | 0.215 | 0.185 | 0.143 | 0.366 | 0.280 | 0.854 |

**Table VI.**
Discriminant validity

**Note:** Diagonal elements are the square root of the AVE



The goodness of fit (GoF) value of the model and the $R^2$ measure of the endogenous variable are measures that validate the PLS model, evaluating the consistency of the measurement scale and the structural model. The GoF is used to determine the overall predictive power of the model, considering the parameters of the measurement scale and the structure (Hair *et al.*, 2005). The GoF determined for the model of this study is 0.480, exceeding the cutoff value of 0.290 for large effects of $R^2$ suggested by Tenenhaus *et al.* (2005), pointing out the model's excellent explanatory power.

### *5.3 Structural model*

Figure 2 shows the structural model regarding the three hypothesis tests considered in this research. The model has an endogenous variable (dependent variable), denominated DC and three exogenous (independent variable), denominates "HRM," "Learning-based culture" and "Organizational Structure." The model assesses the impact of three exogenous variables over organizational DC. In the results of the model tests, the three exogenous variables explain 76.4 percent of DC variance.

Evaluating the hypothesis test, the test *H1* indicates that HRM was significantly and positively associated with DC. The regression standardized coefficient for this construct was 0.209 ($p < 0.05$), supporting *H1*. *H2* investigated the effects of learning culture on DC. The test also allows to accept *H2*, indicates that learning culture ($\beta = 0.344$, $p < 0.05$). *H3* was the hypothesis better supported by the test, indicating that the construct organizational structure is significantly and positively associated with DC ($\beta = 0.566$, $p < 0.01$). Therefore, the study accepts the three tested hypothesis and concludes that the most important construct for organizational DC is organizational structure. Significantly, yet relatively inferior to the first construct, learning culture and HRM, in this order, are also significant to the development of DC.

Of the variables that compose the HRM construct, training and development with standardized coefficient of 0.491 ($p < 0.01$), followed by acknowledgment and award ($\beta = 0.388$, $p < 0.01$) and Involvement and Participation ($\beta = 0.344$, $p < 0.01$) are the ones that show more significant effects on HRM. In contrast, the variable employee recruiting ($\beta = 0.132$, $p > 0.05$) did not present significant effect in relation to the HRM.

With regard to learning culture construct, knowledge sharing ($\beta = 0.520$, $p < 0.01$) and risk taking and encouraging creative process with regression standardized coefficient of 0.475 ($p < 0.01$) present significant and positive effect on Learning culture construct.

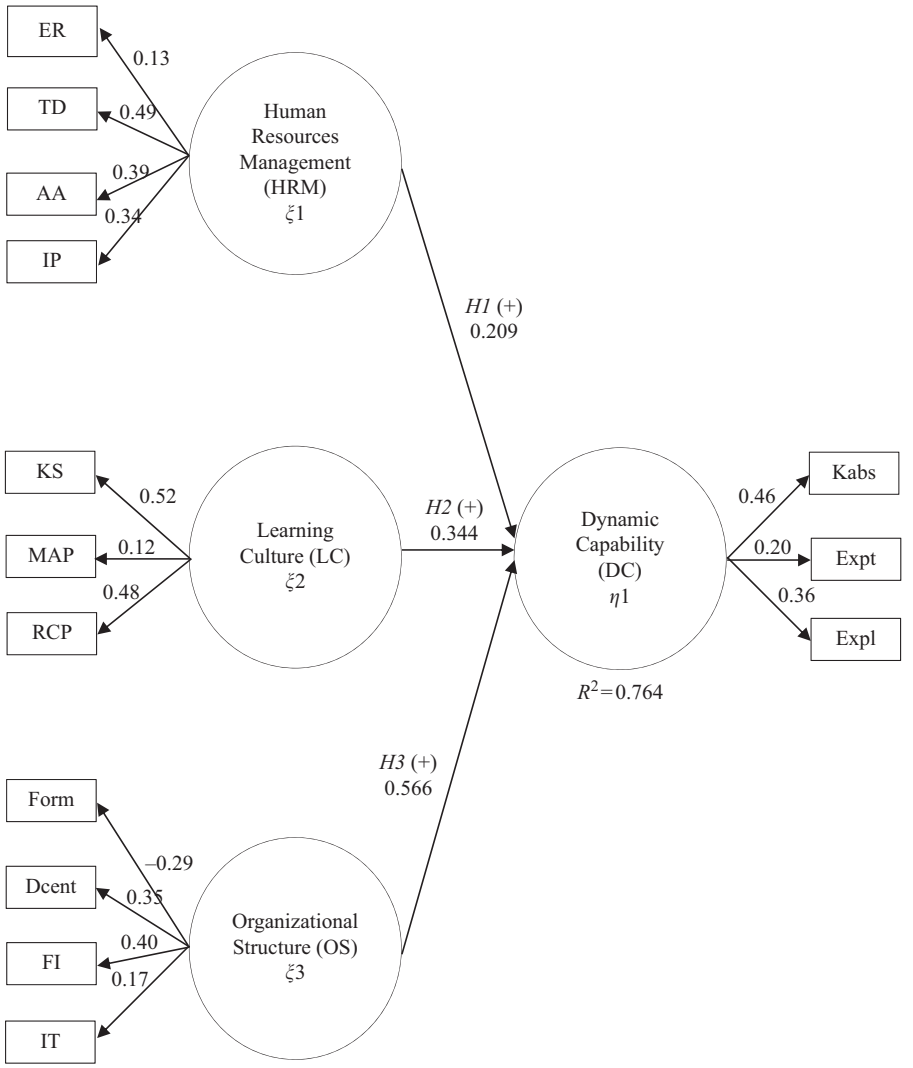


**Figure 2.**
Structural modeling for automotive industry

The factor management active participation did not present significant effect on DC ($\beta = 0.122$, $p > 0.05$).

Regarding to organizational structure, functional integration ($\beta = 0.395$, $p < 0.01$) and decentralization ($\beta = 0.347$, $p < 0.01$) had a significant and positive impact on DC. Formalization had a significant and negative impact on DC ($\beta = -0.285$, $p < 0.01$). And IT ($\beta = 0.170$, $p < 0.05$) was the variable with lowest significance level on DC. This result is in accordance with previous researches that highlighted the need to reduce hierarchical levels and intensify information flow among departments to improve KM performance and organizational DC. In addition, formalization has the role of rescuing and maintaining explicit knowledge. However, DC is directly related to the development of tacit knowledge (Teece *et al.*, 1997; Anand *et al.*, 2010; March, 1991).

At last, the analysis of DC construct shows that the factors knowledge absorption ($\beta = 0.455$, $p < 0.01$), and knowledge exploration ($\beta = 0.357$, $p < 0.01$) are the most significant in relation to the construct. Whereas the factor knowledge exploitation ($\beta = 0.198$, $p < 0.05$) shows less influence on DC. Therefore, the results indicate that organizations with greater ability in research, implementation and exploration of new technology will show higher DC, i.e., greater capacity to reconstruct its competences and gain competitive advantage. By contrast, the lower relative importance of the factor knowledge exploitation points that activities for incremental improvement, such as process efficiency, for example, are significant to DC, but with lower capacity to interfere in organizational dynamic.

### *5.4 Discussion and theoretical implications*

This study uses the PLS method to evaluate and prove the existence of a significant impact between organizational factors related to KM and the DC of the firm. The results of the study provided strong empirical support for the model, representing 76.40 percent of the verified variance for DC. The results of the hypothesis tests and the interactions between the variables and constructs are summarized in Table VII.

The structural model applied in the automotive industry points out that organizational structure is the most important construct in terms of DC ($\beta = 0.566$). Analyzing this construct, the integration between functional areas and decentralization with standardized coefficients of 0.395 and 0.347, respectively, are the most significant factors. The formalization variable also presented a significant impact but negative.

In the studies carried out by Chen *et al.* (2010) and Liao *et al.* (2011), it was verified that centralization acts negatively in relation to KM. In line with these results, this research points to positive relationship between decentralization and flexible organizational structure that, in turn, has a significant positive impact in relation to the DC of the firm. In decentralized structures, the processes of creation, distribution and use of knowledge are intensified, favoring the knowledge absorption, exploration and exploitation. Therefore, this result indicates that DC depends on a lean hierarchical structure in order to offer the employee sufficient autonomy in the decision process, and application of the knowledge in improvements.

The results also point to the need for the organization to present channels that promote the vertical and horizontal integration of knowledge and information, i.e., knowledge must

**Table VII.** Structural model assessment

| Path | $\beta$ | *t*-value | *p*-value | Result |
|---|---|---|---|---|
| HRM → CD (H1) | 0.209 | 2.125 | $p < 0.05$ | Supported |
| LC → CD (H2) | 0.344 | 2.629 | $p < 0.05$ | Supported |
| OS → CD (H3) | 0.566 | 6.703 | $p < 0.01$ | Supported |
| ER → HRM | 0.132 | 1.085 | $p > 0.05$ | Not supported |
| TD → HRM | 0.491 | 4.566 | $p < 0.01$ | Supported |
| AA → HRM | 0.388 | 3.181 | $p < 0.01$ | Supported |
| IP → HRM | 0.344 | 2.629 | $p < 0.05$ | Supported |
| KS → LC | 0.520 | 4.853 | $p < 0.01$ | Supported |
| MAP → LC | 0.122 | 0.914 | $p > 0.05$ | Not supported |
| RCP → LC | 0.475 | 4.221 | $p < 0.01$ | Supported |
| FORM → OS | −0.285 | −2.555 | $p < 0.05$ | Supported |
| Dcent → OS | 0.347 | 2.633 | $p < 0.01$ | Supported |
| FI → OS | 0.395 | 3.203 | $p < 0.01$ | Supported |
| IT → OS | 0.170 | 1.803 | $p < 0.05$ | Supported |
| KAbs → DC | 0.455 | 4.388 | $p < 0.01$ | Supported |
| Expt → DC | 0.198 | 1.995 | $p < 0.05$ | Supported |
| Expl → DC | 0.357 | 2.770 | $p < 0.01$ | Supported |

"cross" the departmental and hierarchical barriers, promoting its application in multidisciplinary projects that involve its exploration and/or exploitation.

The hierarchical structure supports the vertical knowledge flow through the chain of command, but inhibits the knowledge horizontal sharing, which must cross organizational boundaries. Studies by Barrales-Molina *et al.* (2015) and Gonzalez and Martins (2015) show that the most significant factor for DC and organizational KM is the HRM. Innovative firms have supported the creative process and the absorption of new knowledge through the development of idiosyncratic human capital (Singh and Rao, 2016; Barrales-Molina *et al.*, 2015; Bontis and Serenko, 2007). On the contrary, the results of current study point out that it is more important or significant for the organization to delineate a flexible structural context from the hierarchical and functional integration point of view than just developing people with complementary knowledge and skills, aligned with the organizational essential competencies.

The structural model shows that, after the organizational structure, the learning culture construct was the most significant in terms of DC. Both sharing culture ($\beta = 0.520$) and culture of risk taking and encouraging creative process ($\beta = 0.475$) presented high levels of significance in relation to this construct. This result points out that the key to increasing the value of human capital is investing in relational and organizational capital (Lefebvre *et al.*, 2016). From the point of view of organizational capital, in order to promote human capital coordination, organizations must develop a structure that promotes integration between individuals and departments by enhancing collaborative lateral relationships. In relation to relational capital, fostering a collaborative culture among individuals becomes essential. This culture allows the idiosyncratic knowledge developed by human resources is disseminated through group work strategies, reward systems based on group results and exchange programs. This finding can be explained by the fact that DC depends on the integration of individuals and functions, i.e., the development and reconstruction of internal competences, which characterizes the DC (March, 1991), are marked by the integration of multidisciplinary knowledge.

In addition to the learning culture, the culture of taking risk and individual creative process show that, in addition to creating an environment that support lateral relations, organizations must also develop a context that facilitates learning through experimentation and solution of problems based on trial and error.

Taking back the construct of the organizational structure, we observe the negative standardized coefficient of the formalization, pointing out that this variable acts negatively in relation to the flexible organizational structure and the DC of the firm. This result is in line with previous studies conducted by Lefebvre *et al.* (2016) and Mahmoudsalehi and Moradkhannejad (2012), and contrary to the results presented by Liao *et al.* (2011), pointing out that formalization is directly related to explicit codified knowledge, which is related to routine maintenance.

The absorption and exploration of new knowledge, which presented higher regression standardized coefficients in relation to the DC, 0.455 and 0.357, respectively, do not depend on procedures, rules and instructions. On the contrary, these forms of reconstruction of the internal competences are more related to the organizational creative process, focused on the use and sharing of tacit knowledge. In this context, the stimulus to the learning process, the offer of autonomy in the decision process, and the horizontal integration are more relevant to the DC of the firm.

## 6. Conclusion, limitation and directions for future research

This paper achieves its objective to analyze the connection among factors that support KM, denominated entry factors, and DC, denominated exit factors. The three tested hypothesis in the paper, were accepted, indicating a positive connection among human resources development, learning culture and organizational structure with regard to DC.

Within organizational structure construct, we highlight the functional integration and decentralization variables. The formalization presented a negative coefficient, i.e., this variable

acts negatively in relation to the DC, and IT presented the lowest regression standardized coefficient among all variables that compose the construct. These results allow us to conclude that organizational initiatives focused on explicit knowledge have less influence, as is the case of IT, or acts negatively, as in the case of formalization, in relation to DC. On the other hand, initiatives related to tacit knowledge, such as the functional integration and decentralization with respect to the organizational structure, and the sharing and taking risks culture, related to the learning culture are more relevant to DC.

Therefore, this study contributes with the literature on organizational constructs and DC pointing out that the isolated organizational action in the sense of developing idiosyncratic human capital does not increase the DC. In addition to developing strategies aimed at the development of human capital, organizations need primarily to develop a lean organizational structure from the hierarchical point of view, fostering autonomy and decision making by individuals, and also to intensify the interactions between individuals and departments, and the horizontal knowledge flow. In addition, organizational culture should be focused on learning, sustaining knowledge sharing, and fostering a context in which individuals are encouraged to experiment with new solutions from a trial and error perspective.

The study pointed out that DC is more related to the ability to knowledge absorption and exploration. Considering that these two strategies are focused on the sharing and use of essentially tacit knowledge, therefore, they depend on development of organizational context focused on interaction and the collaborative sense among individuals.

### *6.1 Limitations and directions for future research*

Although our study provides some interesting findings, it still faces some limitations that need to be addressed in future research. First, although a substantial amount of variance of DC can be explained in the model, the explanatory power could be improved. Many organizational factors that support KM are not included in the present study. For instance, organizational aspects as a strategic, innovation (Shang *et al.*, 2009), and development of teamwork (Yu *et al.*, 2007) have been shown to influence DC. Further studies are needed to replicate our model and introduce others organizational constructs to improve the explanatory power of DC.

Second, although our measurement strategy is unlikely to suffer from common method biases, more research is warranted. In particular, the data collection instrument makes use of self-reported measures. Self-reported measures based on perceptions may lead to biases, especially when data are collected at the same point in time. To overcome this issue, future research should collate different measures spread over time or use separate primary and secondary observations.

Third, our conceptual model does not take into account the specificity, the complexity and the characteristics of the companies. To overcome this limitation, further research is required for in-depth explorations.

Fourth, using automotive industry to be our subjects may limit the generalizability of our findings to other contexts. Further study is needed to assess the extent to which this study's results are applicable in diverse industries.

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## Further reading

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## Appendix. Constructs of the research and its respective measured variables

### Human resources management (HRM)

(1) Employee recruiting (ER):

- HRM1: recruitment process values creativity and entrepreneurship.
- HRM2: the company searches for employees with knowledge and abilities connected with its central competences.

(2) Training and development (TD):

- HRM3: the competences required from employee are deployed from the company core competences.
- HRM4: company has a structured method to evaluate employee's competences.
- HRM5: company often offers improvement courses and training for employees.

(3) Acknowledgement and award (AA):

- HRM6: the professional growth of an employee is linked to the good performance in his process.
- HRM7: company rewards employees for initiatives that have resulted in improved processes.

(4) Involvement and participation (IP)

- HRM8: employees are constantly encouraged to present new ideas.
- HRM9: company values proactivity in decision-making and problem-solving.

### Learning culture (LC)

(1) Knowledge sharing (KS):

- LC1: employees share information and knowledge about problems solved.
- LC2: when an employee presents an idea about an improvement project, there is the cooperation of the other colleagues.

(2) Management active participation (MAP):

- LC3: managers participate in improvement activities and problem-solving.
- LC4: managers have an essential role to guide their employees.

(3) Risk taking and encouraging creative process (RCP):

- LC5: company interprets mistakes made by employees in improvement initiatives as part of a learning process.
- LC6: company presents a culture that encourages its employees to make decisions and take risks in relation to their processes.

**Organizational structure (OS)**

(1) Formalization (Form):

- OS1: every time a process is changed, its procedures and instructions are reviewed.
- OS2: at the end of an improvement project, employees are encouraged to describe lessons learned.

(2) Decentralization (Dcent)

- OS3: the company has few hierarchical levels.
- OS4: the company offers autonomy for employees to solve the problems inherent to their processes.

(3) Functional integration (FI):

- OS5: it is common for the company to develop projects involving several sectors of the company.
- OS6: employees from different departments exchange information and knowledge in a fast and bureaucratic way.

(4) Use of IT to facilitate the knowledge flow (IT):

- OS7: best practices and lessons learned are kept in databases.
- OS8: the company provides IT resources for employees to exchange information and knowledge.

**Dynamic capability (DC)**

(1) Knowledge Absorption (KAbs):

- DC1: the company frequently monitors new technologies related to products and processes.
- DC2: the company anticipates market innovations.

(2) Knowledge exploitation (Expt):

- DC3: employees use their knowledge in incremental improvement activities.
- DC4: employees use their knowledge to solve problems in the processes.

(3) Knowledge exploration (Expl):

- DC5: the company acts in research of new technologies to implement in its processes and products.
- DC6: the company has easy access to new technologies by, for example, partnerships with other companies, universities, consultancy companies, etc.



## About the authors

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