How to enhance radical innovation? The importance of organizational design and generative learning

Abstract

While previous studies have tried to disentangle how the structure of an organization influences its capability to innovate, the results obtained to date are inconclusive and often contradictory. As a result, it is difficult to generalize the conclusions of previous research. In this regard, some authors have pointed out that it is necessary to consider mediating variables to explain how the structure of the organization or some of its characteristics affect innovation. Since the effects of an organic structure must be investigated in conjunction with firm-specific capabilities, such as those related to organizational learning processes, this study considered the role of generative learning as an explanatory variable. Generative learning has the potential to question the current norms of the organization, going beyond simple improvements, in a process that involves intuition, attention, dialogue and inquiry. Using a sample of 251 companies, this study provides empirical evidence of the mediating role of generative learning in the relationship between organic structure and radical innovation.

Keywords: organic structure; organizational design; generative learning; radical innovation

1. Introduction

The world today is experiencing major social, economic and technological changes. An industrial society, based on production, is in the process of becoming a post-industrial society, focused on knowledge. All this affects companies and organizations, which have to work in a constantly changing, increasingly unpredictable and difficult environment. In this context, companies must innovate to face growing competition and ensure their long-term survival.

This uncertain scenario is changing the classical way organizations work and is forcing them to reconsider their traditional leadership styles, labor relations or human resources policies, thereby transforming their structures. Organizational structure is a key element to generate innovations, and certain types of structure may facilitate or hamper it.

The most extended idea is that mechanistic structures hinder innovation, while organic structures promote it. However, a significant number of empirical studies obtained conflicting results (e.g., Cosh, Fu, and Hughes, 2012; Song and Chen, 2014). Accordingly, Cabello-Medina, Carmona-Lavado, and Cuevas-Rodríguez (2011) stated that the idea that organizations with organic structures are more innovative than those with mechanistic ones is too simplistic, and recommended (in view of the lack of conclusive findings) continuing to study these variables and their effect on innovation.

The present study was developed in response to the great deal of research that showed contrary or dissimilar conclusions. This suggested the need to study the mediating effects of additional factors that might better explain how organizational structures affect innovation. As stated by Menguc and Auh (2010), the development of different types of innovation involves more than an informal structure. Consequently, the study of the effect of organizational design on innovation demands the consideration of additional variables that may explain this relationship (Chen and Chang, 2012). Previous studies have tried to shed light on this issue, analyzing the effect of different mediating variables. For example, former research analyzed the mediating role of variables such as innovative behavior, cross-functional integration or organizational learning in the relationship between organizational structure and innovation (e.g. Dedahanov, Rhee and Yoon, 2017; Raj and Srivastava, 2013; Su, Chen and Wang, 2018). The present research follows the approach suggested by Mallén, Chiva, Alegre and Guinot (2015), who recommended studying the role played by organizational learning when analyzing the effects of organizational structures.

Although many studies have analyzed the relationship between organizational structure and innovation, past research has neglected how structural factors affect organizational learning (Chen and Chang, 2012). Furthermore, Espinosa and Merigó (2016) argued that few empirical studies have analyzed how the organizational design promotes or hinders learning in the organizations, and considered that the study of organizational design as a promoter of learning demands further analysis. Moreover, Wang and Chugh (2014) pointed out that more research is needed to determine which organizational contexts are more favorable to facilitate different types of learning.

On the other hand, the study of innovation must be conducted taking into account the different types of innovation, because both the antecedents that facilitate their appearance and the consequences for organizations are completely different (McDermott and O'Connor, 2002). Within the different typologies found in the academic field, one of the most widespread classifications is the one that distinguishes between incremental and radical innovation. Although radical is not such a frequent phenomenon, this type of innovation is particularly important because it has the potential to improve financial and non-financial outcomes of companies (e.g., Baker and Sinkula, 2007; Chandy and Tellis, 1998), becoming a theme of special interest for both scholars and practitioners.

Given that organizational learning is also one of the facilitators of innovation (Chiva and Alegre, 2009), the present research was focused on the mediating role of generative learning to explain the positive relationship between organic structures and radical innovation. Although previous research related generative learning to radical innovation (Chiva, Grandío, and Alegre, 2010), some authors have called for caution with regard to this relationship. Explorative learning processes and innovation outcomes have been interpreted differently, leading to inconsistent conclusions and generalizations. With the aim of overcoming this limitation, and following the approach suggested by Li, Vanhaverbeke and Schoenmakers (2008), this study analyzed generative learning by considering the processes and factors that characterize it, and measured the degree of radicalness of the innovation.

Although most literature seem to consider explorative and generative learning as similar concepts, some researchers (e.g. Chiva et al. 2010) consider that they are slightly different. Exploratory learning is a broader concept that refers to the acquisition and learning of new information and knowledge, and often involves experimentation, risk taking, variation or discovery (Chung et al, 2015; Kim and Atuahene-Gima, 2010; March, 1991). However, and according to Chiva et al. (2010), generative learning is associated with inquiry, intuition, attention and dialogue. Therefore, generative learning implies being able to see beyond the situation and questioning operating or other type of norms, procedures or principles (Argyris and Schön, 1974), which could be also linked to Senge's (1990) concept of metanoia that implies a profound shift of mind.

In the following sections, a review of the literature is conducted. Considering previous research, relationships among the variables are also established. Subsequently, the methodology used to analyze the proposed hypotheses is detailed. The study finishes with the presentation of results, conclusions, suggestions for future research, and evaluation of the limitations of the present research.

2. Conceptual framework

2.1 Radical innovation

Radical and incremental innovation classify innovations according to the degree of change or novelty they bring. Despite this distinction, different authors state that these typologies are not absolute categories and that innovation exists along a continuum, from incremental to radical (Gatignon, Tushman, Smith, and Anderson, 2002).

Gatignon et al. (2002, p.107) defined incremental innovations as those that improve price/performance advance at a rate consistent with the existing technical trajectory, while radical innovations advance the price/performance frontier by far more than the existing rate of progress. Although incremental innovation provides benefits for organizations (Sorescu and Spanjol, 2008), several authors have stressed the importance of radical innovation, because of its role in the survival and success of organizations in the long term (Chandy and Tellis, 1998), and emphasized the positive effects that it may have for businesses in comparison to incremental innovation (Sorescu, Chandy, and Prabhu, 2003). For example, radical innovations allow organizations to achieve competitive advantage in the market, challenge the dominant position of leader companies, improve the image of the organization or increase consumer loyalty, among other benefits (e.g., Baker and Sinkula, 2007; Chandy and Tellis, 1998). However, companies do not develop radical innovations so easily (Sorescu et al., 2003) because it is a very costly and complicated process, related to countless uncertainties (McDermott and O'Connor, 2002).

This type of innovation has a significant impact on a market and on the economic activity of firms in that market. However, it might not be apparent whether an innovation is disruptive until long after it has been introduced (OECD-EUROSTAT, 2005). Radical innovation can refer to a new product, service, or productive process (O'Malley, O'Dwyer, McNally and Murphy, 2014).

2.2 Organic organizational structure

Burns and Stalker (1961) differentiated between two types of organizational structures. A mechanistic structure is characterized by specialization of labor, hierarchy, top-down interaction, centralization in decision-making, and a rigid set of rules and norms. It is a highly formalized and rigid structure, based on authority. An organic structure is defined by being less hierarchical, having a scant division of labor, facilitating lateral communication among the members of the organization, etc.

In organic structures, people are on the same level, without classifications. Decision-making is delegated to all possible levels, giving employees more freedom to adapt to changing circumstances. Organic structures are characterized by the lack of specialization of jobs. In them, barriers between departments disappear and work teams are formed by experts from different areas that work jointly (Martínez-León and Martínez-García, 2011). Nahm, Vonderembse and Koufteros (2003) stated that, in organic structures, communication, both horizontal and vertical, takes place rapidly, easily and plentifully. Ramezan (2011, p. 92) noted that these structures promote informal communication and two loops of communications, downwards and upwards, between members with different ranks.

2.3 Generative learning

Organizational learning is one of the most referenced concepts in the academic and business fields (Chiva and Habib, 2015), and it can be considered one of the most relevant capabilities for organizations. The reasons why

organizational learning has become so important are related with technological change, growing competence between companies, globalization or the need for innovation (Chiva and Alegre, 2009).

Some authors maintain that the theory of organizational learning is not complete if it does not differentiate between types of learning (Edmonson, 2002). Senge (1990) distinguished between adaptive and generative learning. Adaptive learning is characterized by improving existing capabilities and routines, while generative learning reformulates situations, develops new capabilities, and resolves ambiguous problems, allowing organizations to explore and develop new capabilities. In other words, generative learning implies doing new things, unlike adaptive learning, which entails doing things better (Edmonson, 2002).

Generative learning is considered the most advanced form of organizational learning (Santos-Vijande, López-Sánchez and Trespalacios, 2012). It happens when organizations are prepared to question long-held assumptions about their mission, customers, capabilities or strategy. It requires a new way of looking at the world based on the understanding of key issues as well as their relationship (Slater and Narver, 1995). It occurs when core organizational competencies are unlearned and new competencies are explored in a proactive sense (Morgan and Berthon, 2008, p. 1331). Chiva et al. (2010, p. 116) defined generative learning as "a process that involves searching for (implicit) order, which is a holistic understanding of anything or anyone we interact with". Furthermore, "generative learning is developed individually or socially at the edge of chaos, through intuition, attention, dialogue and inquiry".

Intuition is defined as a process of coming to direct knowledge without reasoning or inferring; it stimulates the creative cognitions that are essential to the generation and exploration of novel problem solutions and ideas (Calabretta, Gemser and Wijnberg, 2017). Attention is a state in which the mind is constantly learning without a center, around which knowledge gathers as accumulated experience. Dialogue is an attempt to perceive the world through new eyes, and inquiry is the aim to question any explicate order or knowledge. Inquiry and dialogue refer to an organization's efforts to create a culture that supports questioning and provides opportunities for employees to help in the recognition of problems, express their concerns, and provide feedback without fear of negative consequences (Malik and Garg, 2017).

Finally, there are similar concepts in the literature, such as double-loop learning, radical learning, higher-level learning, exploration learning or second-order learning (e.g., Arthur and Aiman-Smith 2001; Fiol and Lyles 1985; Senge, 1990).

3. Hypotheses

We propose a conceptual model (Figure 1) in which the effects of an organic structure on radical innovation are better explained when the mediating effect of generative learning is considered.

3.1 Organic structure and generative learning

Organizational structure is one of the factors that determine organizational learning (Fiol and Lyles, 1985). Forms taken by organizations influence learning because they determine how companies search for and process information so as to be able to cope with an uncertain environment (Vera and Crossan, 2004). Authors such as Martínez-León and Martínez-García (2011) stated that an organic structure facilitates learning creation further than a mechanistic one.

Furthermore, depending on the organizational structure adopted, the learning style promoted may be different. Fiol and Lyles (1985) stated that a mechanistic structure tends to reinforce behaviors from the past, so people learn from their experience, while an organic structure boosts changes in beliefs and actions. Accordingly, McGill, Slocum and Lei (1992) linked the characteristics of an organic structure to generative learning and related mechanistic organizations to adaptive learning.

Generative learning needs an environment that supports change and the emergence of new ideas to question procedures, norms and organizational behaviors, change employees' beliefs, look beyond the current situation, and so forth. The context in which generative learning takes place is ambiguous and not defined, so the repetitive behaviors fostered by mechanistic structures do not make much sense. An organic structure makes changes in beliefs and actions possible, besides promoting a better assimilation of the new patterns that are proposed (Fiol and Lyles, 1985). Vera and Crossan (2004, p. 233) suggested that "open cultures, organic structures, adaptable systems, and flexible procedures facilitate the implementation of change and challenge institutionalized learning". So, at this point we propose the first hypothesis of the study:

Hypothesis 1: An organic structure has a positive effect on generative learning.

3.2 Generative learning and radical innovation

Generative learning is often associated to radical innovation, while adaptive learning is related to incremental innovation. Baker and Sinkula (2002) stated that higher-order learning processes (generative learning, double-loop learning) are the type of learning that facilitates radical innovation. Generative learning promotes an innovative perception of the world instead of an imitative view, which allows behaviors that inhibit new ways of doing things to be eradicated (Baker and Sinkula, 2007). Arthur and Aiman-Smith (2001) related second-order learning to radical innovation because it breaks the existing behavior and thinking patterns and facilitates the exploration of new forms of thinking and working. Slater and Narver (1999) stated that generative learning is, probably, the main force for radical innovation, ahead of other factors, and highlighted that adaptive learning is not enough to develop this kind of innovations. Herrmann, Gassmann and Eisert (2007) considered that the change in competences and markets demanded by radical innovation needs generative learning because it questions an organization's previous assumptions about its mission, customers, opportunities, etc., and which consequently breaks through learning barriers. Therefore, we pose the second hypothesis of the study.

Hypothesis 2: Generative learning has a positive effect on radical innovation.

3.3 Organic structure and radical innovation: the mediating effect of generative learning

Previous research has analyzed the effect of organizational structures on innovation both directly and using different mediating variables (Chen and Chang, 2012; Menguc and Auh, 2010). Some studies that analyzed the influence of organizational structure on innovation were focused on specific features such as formalization or centralization (Cabello-Medina et al., 2011; Chen and Chang, 2012), while few used scales to measure the degree of organicity in organizations. Although organizational structure has been identified as a factor that affects innovation, its effect varies depending on the type of structure. The seminal work by Burns and Stalker (1961) stated that organizations with an organic structure innovate more than those with a mechanistic structure. Some research has confirmed this assertion. For example, in a study conducted with commercial companies, Cooper (2005) concluded that organic structures enable innovation more easily than hierarchical structures, because these organizations empower employees and create trusting relationships, thereby facilitating creative and innovative processes.

Nonetheless, other studies have provided conflicting results. Cabello-Medina et al. (2011) stated that formalization has traditionally been negatively related to innovation because it is supposed that rules inhibit experimentation and creativity. However, the lack of norms and procedures may also be detrimental when it comes to innovating, and formal mechanisms may facilitate the management of the uncertainty related to innovation. Similarly, in organic structures, over-communication may lead to redundancy and time-wasting, thus hindering innovation. Likewise, Song and Chen (2014) found that both control and flexibility are necessary to trigger innovation. While flexibility encourages experimentation and risk taking, control-oriented actions establish strategic direction, clarify roles and promote coordination, which reduce uncertainty, avoid chaos and facilitate innovation. Furthermore, Cosh, Fu and Hughes (2012) demonstrated that formalization may be beneficial for innovation. Formality reduces role ambiguity, decreases the cost of coordination, and improves decision-making.

Regarding the relationship between the type of structure and the type of innovation promoted, organic structures seem to be related to radical innovation (e.g., OECD-EUROSTAT, 2005). Olson, Walker and Ruekert (1995) pointed out that more participative organizational structures are associated to radical innovation. These structures facilitate the flow of resources, communication, and knowledge and information transfer, which may help employees to face the challenges and uncertainties in the development of completely new products that have to be successful. Nahm et al. (2003) found that organizations with the characteristics of organic structures facilitate the successful implementation of radical innovations, as they broaden employees' understanding of problems and issues, encourage decision-making and knowledge transfer, etc. Moreover, some authors also highlight the negative effect of a mechanistic structure on radical innovation, considering that bureaucratic organizations promote short-term thinking, which leads to incremental improvements (e.g., Stringer, 2000).

Nevertheless, there are also contradictory results related with the different types of innovation promoted. Cabello-Medina et al. (2011) showed that a certain degree of formalization is needed to manage the complexity and uncertainty in the development of radical innovation, thus helping people to deal with risk. Cabello-Medina

et al. also quoted Hage's work (1980), who related organizations with mechanistic structures to radical innovation, and Jelinek and Schoonhoven (1993), who pointed out that radical innovation cannot take place in organic structures because this type of innovation needs both creativity and discipline, making a certain degree of formalization necessary. Moreover, Chen and Chang (2012) showed that a high degree of formalization within organizations increases the degree of innovativeness through a stronger absorptive capacity. In addition, Cardinal (2001) conducted a study that supported behavior and input and output controls to promote radical innovation in the pharmaceutical industry. It is true that the scientific nature of this sector dictates specific procedures and processes in the development of new drugs which might not be applicable to other sectors or contexts. Furthermore, and contrary to their expectations, Menguc and Auh (2010) found that organic structures have a positive relationship with incremental innovation but not with radical innovation, concluding that radical innovation requires more than an organic and flexible structure. Finally, Holahan, Sullivan and Markham. (2014) found that projects aimed at developing radical innovations are managed more inflexibly than incremental ones. More structure and less flexibility may help to face the risks associated with radical innovation.

This diversity in the results seems to indicate the existence of other factors to be considered when explaining the relationship between organizational structure and innovation (Menguc and Auh, 2010). Similarly, Chen and Chang (2012) stated that it is inadequate to relate organizational structures to innovation and consequently advocated for studying variables to mediate this relationship. Moreover, Droge, Calantone and Harmancioglu (2008) proposed that, although the literature recommends an organic structure to develop new products successfully, the effect of the organic structure on new product development is not direct and advocated for the mediation of other factors. The present research follows the approach adopted by Mallén et al. (2015), who considered that the effects of an organic structure must be investigated in conjunction with firm-specific capabilities, such as organizational learning.

Learning is an essential element to promote innovation (Alegre and Chiva, 2008), and generative learning questions established patterns as well as making it easier for organizations to go beyond simple improvements, which may trigger radical innovation (Chiva et al., 2010). Vera and Crossan (2004) stated that organizations that prioritize a democratic and open management style encourage innovation and double-loop learning. A flexible, decentralized, organizational structure with low formalization will favor a context that allows experimentation, reflection or the questioning of prevailing norms and values freely enough to promote radical innovation.

Organic structures remove barriers between departments, which will facilitate communication and multidisciplinary work teams, with a holistic view of the organization and a clearer knowledge of the external opportunities and threats (Slater and Narver, 1995). These teams can share, improve or create a broader variety of knowledge than working in isolation, which can promote new viewpoints that may result in creative and innovative ideas. In addition, with few hierarchical levels, employees will be motivated to take decisions. A stronger involvement of employees may promote critical thinking and innovation (Martínez-León and Martínez-García, 2011). In this vein, Nahm et al. (2003) considered that organic structures empower employees, so they

will be prepared to cope with intensive intellectual work to make decisions that enable firms to implement radical change.

Summing up, generative learning provides organizations with knowledge and ideas, while organic structures offer the appropriate system to optimally assimilate, share and use them to generate radical innovations. Therefore, this allows us to formulate our last hypothesis:

Hypothesis 3: The relationship between an organic structure and radical innovation is mediated by generative learning.

INSERT FIGURE 1 ABOUT HERE

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4. Research methodology

4.1 Data collection

The population under study was based on a group of lists and databases of companies that manage human resources excellently and are highly valued by their own employees. The overall population reached a total of 402 companies.

The questionnaire was addressed to human resources managers with at least two years' experience in the organization. Their position and experience in the organization make them a reliable information source, since they have a holistic and profound view of the company as a whole.

Since the data collected came from a single informant, some measures were taken in the preparation phase of the study to avoid the effect of common method variance and endogeneity. To promote participation and increase the reliability of the responses, all the participants in the study were contacted to explain the objectives of the research and guarantee their anonymity (MacKenzie and Podsakoff, 2012). Questions were asked in different moments, with a separation of three months between independent and dependent variables (from October to December 2010), the order of the questions being changed at random (Jean, Deng, Kim and Yuan, 2016; Podsakoff, MacKenzie and Podsakoff, 2012). We also committed ourselves to communicate the findings of the study to all the participants in the study, encouraging them to be honest in their answers.

The questionnaire consisted of 15 items that interviewees had to evaluate through a 5-point Likert scale, in which 1 represented “completely disagree” and 5 “completely agree”. As the profile of the interviewees, managers of important companies, is not easily accessible, the means chosen to conduct the surveys was through

phone interviews. The final sample was 251 valid questionnaires, which represented 62.44% of the companies in the population.

The questionnaire was addressed to the respondents in Spanish. The scales used to measure organic structure and generative learning were created in Spanish, while the radical innovation scale was originally developed in English. To ensure the accuracy of the translation, a double-back translation was utilized. In this method, the original Spanish scales were translated into English, then into Spanish once again. The final version was compared with the original one.

4.2 Measurement instruments

The measurement scales selected are based on previous studies. The appendix provides a detailed description of the measures used in this research. The reliability of the scales was assessed using Cronbach's alpha (Table 2).

Radical innovation

Gatignon et al.'s (2002) five-item scale was used to measure the degree of radicalness of an innovation, from incremental to radical. This scale has been applied by a number of empirical papers (e.g., Yang, Chou and Chiu, 2014). This construct demonstrated its reliability, with a Cronbach's alpha of 0.799.

Organic organizational structure

This scale was based on the work of Mallén et al. (2015). It measures the degree of organicity of the structure of a company, instead of analyzing certain specific variables of the organizational structure as in other studies. Although there are other scales to measure organicity in organizational structures, it was chosen because it was specially designed for studies that collect data through phone interviews, which is the method that was followed in the present research. The construct has a Cronbach's alpha of 0.845.

Generative learning

Although it is preferable to use previously validated scales, we decided to develop a new scale building on the work by Chiva et al. (2010), who, after reviewing the literature, analyzed the processes that characterize generative learning such as intuition, attention, dialogue or inquiry. This scale considers the processes and factors that lead to generative learning and that were not previously analyzed and incorporated into the organizational learning process. The scale is a response to the need to understand how generative learning takes place and is promoted within the organizations. Additionally, there are not many studies that have analyzed generative learning from a quantitative point of view. The existing scales that measure specifically generative learning did not meet the objectives of the present research. For instance, Morgan and Berthon (2008) studied generative learning through a scale that, with two dimensions, measured idea generation and risk taking. Other scales, such as Baker and Sinkula (2007), did not go into the characteristics of generative learning in depth. In this scale, interviewees had to distribute 100 points among three typologies of learning to indicate the relative preference of each typology. Finally, other scales, such as that of Sessa, London, Pingor, Gullu and Patel (2011), were focused on students. An exploratory factor analysis (EFA) was conducted and the results suggested that the five proposed items make up the construct of generative learning. It has a Cronbach's alpha of 0.777.

4.3 Control variables

It is important to include control variables that have been documented in the literature as having a potential effect on the studied outcome. Company size, sector, firm age and market share were selected as control variables due to their potential influence on innovation, as noted in previous research (e.g., Chandy and Tellis, 2000; Sorescu et al., 2003). The inclusion of these variables may alleviate endogeneity issues related to omitted variables (Jean et al., 2016).

In terms of company size, 61.3% were small and medium-sized companies (250 employees or less) and 38.7% were large firms (more than 250 employees). With regard to sector, a distinction was made between service and manufacturing services, with the following final distribution: 28.7% of the organizations belonged to manufacturing sectors, while 71.3% were from service sectors. In this vein, the sample is heterogeneous as it is composed of companies from very different sectors. For instance, manufacturing companies include organizations from sectors such as pharmaceutical, food industry, household appliances or construction, while service companies are those related to sectors such as tourism, banking, retailing or consultancy. In terms of firm age, the sample is distributed as follows: 10 years or less (14.7%), between 11 and 25 years (37.8%), between 26 and 50 years (29.1%), between 51 and 100 years (16.3%), and more than 100 years (2.0%). Regarding the market share, respondents had to classify their companies in comparison to their largest competitor. The final sample shows that 5.2% of the companies have a smaller market share, 51.0% have a similar market share, and 43.8% have a larger market share, compared to their largest competitor.

4.4 Analyses

The present study utilized structural equations to empirically validate the proposed model through the statistical software AMOS-23. The maximum likelihood (ML) estimation method was employed.

Given that the scales were developed using relevant items selected from a common survey, we conducted a Harman's single factor test (Podsakoff and Organ, 1986) to control for common method variance, endogeneity, and to deal with the potential social desirability of the responses. The results of the CFA with the 15 indicators loading onto a single factor (Chi-square = 688,835; p-value = 0.000; NFI = 0.547; NNFI = 0.506; CFI = 0.577; RMSEA = 0.163; Chi-square/d.f. = 7.654) showed a poor fit, suggesting that the single factor does not account for all the variance in the data.

Moreover, additional tests were conducted to check whether endogeneity was a problem due to simultaneity. Following accepted practices (e.g., Antonakis, 2010; Govindaraju, Krishnan and Pandiyan., 2013; Li, Vertinsky and Zhang, 2013), we performed an augmented regression test and a two-stage least square regression analysis. We did not find evidence to support endogeneity in our model.

Then we tested the structural models corresponding to the proposed hypotheses. In particular, we followed the approach taken by Baron and Kenny (1986). To assess the significance of the mediated effect we used bootstrapping (MacKinnon, Coxe and Baraldi, 2012).

5. Results

5.1 Descriptive statistics and psychometric properties of the measurement scales.

Table 1 shows data of means, standard deviations, and factor correlations. The psychometric properties of the measurement scales were evaluated by following accepted practices in the literature (Anderson and Gerbing, 1988).

Regarding the structure of the constructs, the common approach to assessing a full measurement model with all the variables was followed (Anderson and Gerbing, 1988). This method establishes the structure of the variables in the context of other variables measured in the study, ensuring that the measures used in the study are completely distinct from one another. The global fit of this general measurement model was: Chi-square (d.f.) = 141.214 (85); p = 0.000; CFI = 0.960; RMSEA = 0.051. The Chi-square statistic was non-significant and all the standardized estimates were significant and in the expected direction.

Reliability analyses also show satisfactory results. The values of Cronbach's alpha coefficient and the compound reliability values (Table 2) were above the minimum accepted value of 0.7 (Nunnally, 1978).

The selection of the measurement scales followed a procedure that supports content validity. The variables used to measure radical innovation were selected from the scale proposed by Gatignon et al. (2002). The organic structure items were taken from a scale validated by Mallén et al. (2015). Finally, generative learning was measured following the research by Chiva et al. (2010).

To assess convergent validity, we used normed fix index which value must be above 0.9 (Ahire, Golhar and Waller., 1996). All factorial loadings were above 0.4 (Hair, Anderson, Tatham, and Black, 1999) and their associated t-values were greater than 1.96 (Anderson and Gerbing, 1988). Both the NFI index (Table 2) and the factorial loadings suggest a high level of convergent validity for all the constructs.

For discriminant validity to exist, the AVE must be greater than the the square root of construct correlations, suggesting that each construct relates more strongly to its own measures than to others (Table 3).

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5.2 Testing the research hypotheses

The results of the direct effect model confirm the positive relationship between organic structure and radical innovation. The fit of the direct effect model is adequate: (chi-square (d.f.)= 109.85 (65); p-value = 0.00; NFI = 0.90; NNFI = 0.94; CFI = 0.96; RMSEA = 0.05). All the estimated parameters were significant and positive, with t-values exceeding the minimum threshold of 1.96, except in the case of the following control variables: size, sector and age.

The standardized parameter concerning the effect of organic structure on radical innovation was statistically significant ($\alpha = 0.421$; $t = 4.798$). With these results, the first condition to validate the proposed model was met, which allowed us to continue the analysis and test the hypotheses proposed in the mediating model (Figure 3).

Taking into account the chi-square values and the fit indices, it can be argued that the estimated mediating model showed good fit (chi-square (d.f.)= 215.71 (137); p-value = 0.00; NFI = 0.87; NNFI = 0.93; CFI = 0.95; RMSEA = 0.05). As in the direct effect model, all the estimated parameters were significant and positive, with t-values exceeding the minimum threshold of 1.96, except in the case of size, sector and age.

The mediating model explained more variance than the direct effect model (0.323 vs. 0.261). The significant relationship in the direct model ($\alpha = 0.421$, $t = 4.798$) decreased by including the mediating effect of generative learning but maintained its significance in the mediating model ($\beta1 = 0.309$, $t = 3.623$). Consequently, these results verify that the relationship between organic a structure and radical innovation is mediated by generative learning. There is also a significant relationship between organic structure and generative learning ($\beta2 = 0.401$, $t = 4.981$), and between generative learning and radical innovation ($\beta3 = 0.277$, $t = 3.544$). All the hypotheses were confirmed (Table 4) and, according to the results, the model shows a partial mediation.

The estimated indirect effect of organic structure on radical innovation is 0.111. The 95% bias-corrected confidence intervals for the indirect effect are between 0.036 and 0.204, with a p-value of 0.003 for the two-tailed significance test. Thus, the standardized indirect effect of organic structure on radical innovation is significantly different from zero and the null hypothesis of no mediation effect can be rejected.

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6. Discussion

There is an ongoing debate about the way in which the organizational design affects both innovation and learning within organizations. The hypothesis of the study is that organic structures promote generative learning which, in turn, favors radical innovation. Many of the assumptions about the relationships between these variables are still unclear This study attempts to overcome the problems and weaknesses detected by previous research and contributes to the debate by analyzing the processes that characterize generative learning and measuring the degree of organicity of the structures and the radicalness of the innovations.

Results were consistent with the hypotheses proposed in the model. This research highlights the key role played by generative learning, which appears to be an essential element to achieve radical innovation. Generative learning fuels the organization with new ideas and knowledge, and finds in the organic structure the best environment to promote radical innovation. However, this mediation is partial, which indicates that other factors not considered in the present study might, in turn, be affecting this relationship.

This research contributes to the organizational structure, organizational learning, and radical innovation literature. As there are few empirical studies that analyze the effects of organizational design on organizational learning (Espinosa and Merigó, 2016), this study widens the literature in this field by demonstrating the positive influence of organic structures on generative learning. An organic structure facilitates dialogue, the sharing of different points of view, the development of critical thinking, the contact between employees from different

departments, a high degree of autonomy, etc., all of which gives workers the opportunity to create new knowledge, search for new solutions, question organizational norms and values or introduce new ideas. In addition, unlike the vast majority of studies that have analyzed organizational structure using different structural dimensions, this is one of the few studies that measures the degree of organicity in the organization.

Additionally, this research clarifies the relationship between exploratory learning styles and innovation outcomes. According to Li et al. (2008) the different conceptualizations and level of analysis in the study of exploration and exploitation have led to inconsistent, ambiguous and weak conclusions. Sometimes, in previous research, exploitation and exploration were considered as synonymous of incremental and radical innovation respectively, while other studies considered that they were learning processes that lead to innovation. By studying the processes related to generative learning and the degree of radicalness of the innovation, it is possible to understand what the mechanisms and factors facilitate radical innovation. Another contribution is the development of a scale to measure generative learning, following the proposal by Chiva et al. (2010), who suggested the need to measure this type of learning in organizations in order to relate it to aspects like innovation. This scale measures different processes that characterize generative learning, such as intuition, attention, dialogue or inquiry.

6.1 Implications for practitioners

The study also has practical implications. Results suggest that an organic structure along with generative learning may help companies to develop radical innovations. As stated in the results, the mediating effect between these factors is partial. Thus, organizations must know that, to develop radical innovations, they will have to consider more factors because other elements not included in the study might influence this relationship.

However, managers should introduce the characteristic elements of organic structures into their companies if their objective is to develop radical innovation. For example, they could promote autonomous work, limit the number of hierarchical levels, reduce bureaucracy and control, or facilitate participative decision-making. Organizations will need employees with a holistic view of the company, not only from an internal point of view, but also with knowledge of the external environment. The aim is to have workers focused on not just one or a set of tasks that limit their view of the company. Multidisciplinary training and team work may help to achieve organizations with more horizontal structures. Flat organizations with few hierarchical levels may facilitate communication in all directions, thus promoting the flow of creative ideas that allow the development of radical innovation.

Additionally, organizations must facilitate a context that promotes critical and alternative thinking, giving employees freedom to rethink the way the organization works, and enabling the proposal of creative ideas. To achieve this environment, organizations should foster guidelines that facilitate intuition, attention, dialogue and inquiry.

Organizations may promote generative learning and radical innovation by taking care of their human resources policies. In the selection process, companies should seek workers that are able to work in freer environments

with egalitarian relationships. Moreover, leaders that display confidence in the capabilities of their employees, facilitate decision-making, and promote autonomy may be appropriate to lead organizations with these structures. Additionally, other policies such as promotion and evaluation should consider generative learning, measuring whether organizational members question current norms and rules, prefer routine and repetition, or go beyond simple improvements.

6.2 Limitations and future research

The present study was focused on the mediating effect of generative learning in the relationship between organic structure and radical innovation. Considering that this study found a partial mediation, further research is needed to disentangle what other factors may influence the relationship between these variables. In the future, further research may study the mediating role played by other concepts related to these variables, such as organizational learning capability, for its potential to promote innovation (Alegre and Chiva, 2008), and include additional control variables such as firm turnover.

Future research should include incremental innovation in order to determine whether results can be extrapolated to other types of innovation or are limited to radical innovation. It would be important to analyze whether generative learning is also related to incremental innovation, and adaptive learning to radical innovation. To this end, a more complex model that analyzes ambidexterity would be useful. Do organic structures foster generative learning, adaptive learning or both? Consequently, how do they relate to radical and incremental innovation? Moreover, the same approach might be considered for mechanistic structures.

Another field of interest for future research is the antecedents of generative and adaptive learning, going beyond organizational design. For instance, as leadership is one of the main promoters of learning within organizations, it would be relevant to analyze how different contemporary leadership styles such as servant or ethical are related to these types of learning. Moreover, focusing on specific features of these leaders, such as forgiveness, altruism, empowerment, humility, stewardship, etc., may also be highly interesting. The effect of these leadership styles and behaviors on innovation also needs to be studied, differentiating between radical and incremental innovation. Literature has highlighted the tension between the pursuit of new ideas that may lead to radical innovations and the exploitation of existing ideas that lead to continuous improvements and incremental innovations. Leaders play an essential role in managing this dilemma (Hunter, Cushenbery and Jayne, 2017). Therefore, comparing between innovation typologies may facilitate the understanding of how leaders manage potential conflicts in the development of both types of innovation.

Additionally, future research should investigate the effect of different organizational designs and learning types on other variables related to innovation, such as innovation success, firm innovativeness, innovation performance, product innovation, process innovation, etc.

Finally, scholars should continue to study the antecedents of radical innovation. For example, consideration should be given to determining which of the different factors or processes that make up generative learning is more important or has a stronger effect on radical innovation: intuition, attention, dialogue or inquiry.

The study was cross-sectional, so the relationships reflect a snapshot in time. Future longitudinal studies might evaluate the long-term effects of organic structures and generative learning on radical innovation. This study collected data from a single respondent, which may affect the results due to common method variance. Data obtained from different sources can help to solve this weakness (Podsakoff et al., 2012). Future research must be conducted addressing the questions to different members of the organization. For example, questions related to organic structure and generative learning could be answered by human resources managers, taking advantage of their overall view of the organization, while radical innovation questions could be addressed to R&D managers, due to their specific knowledge about innovation issues.

Additionally, the study focused on a particular type of companies, namely, those excelling in human resources management, which limits the results to these types of companies. Moreover, the study was conducted in Spain, which, according to the European Innovation Scoreboard (2017), is a moderate innovator country. Future research should be conducted in other countries in order to compare the processes followed in countries with a different innovative performance. Moreover, the sample is heterogeneous, with companies of different sizes, age, sectors, and market share. As processes related to organizational learning and innovation may differ between industries (Fernández-Mesa and Alegre, 2015), future research should focus on companies from the same sector. In addition, as organizational size influences innovation, future research should also concentrate on large companies or SMEs. Finally, centering attention on start-ups or incumbent companies might clarify the influence of firm age on the variables studied.

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Table 1. Factor correlations, means and standard deviations

	Mean	sd	OS	GL	RI
Organic structure	3.422	0.614	1		
Generative learning	3.720	0.483	0.315**	1	
Radical innovation	3.786	0.452	0.384**	0.331**	1

Notes: For the standard deviations and factor correlations, we used the mean of the items making up each dimension.

*** Significant correlation (p < 0.01). OS=organic structure; GL=generative learning; RI=radical innovation*

Table 2. Reliability of the measurement scales

Construct	Composite reliability	BBNFI	Cronbach's Alpha
Organic structure (5 items)	0.85	0.997	0.845
Generative learning (5 items)	0.82	0.981	0.777
Radical innovation (5 items)	0.81	0.972	0.799

Table 3. Discriminant validity

	EO	AG	IR
Organic structure	(0.53)		
Generative learning	0.09	(0.48)	
Radical innovation	0.14	0.11	(0.46)

Note: in parentheses, extracted mean variance. OS=organic structure; GL=generative learning; RI=radical innovation

Table 4. Structural equations to test the hypothesis that generative learning mediates the relationship between organic structure and radical innovation.

Structural equation	**R^2**
Direct effect model	
RI = 0.421*OS + 0.068*SIZE + 0.018*SECTOR+0.042*AGE+0.209MK	0.261
(t = 4.798) (t = 1.064) (t = 0.282) (t = 0.652) (t = 3.088)	
Mediation effect model	
RI = 0.309*OS + 0.277*GL + 0.042*SIZE+ 0.023*SECTOR+0.078*AGE+0.209MK	0.323
(t = 3.623) (t = 3.544) (t = 0.684) (t = 0.380) (t = 1.259) (t = 3.184)	
GL = 0.401*OS	0.161
(t =4.981)	

Figure 1. Conceptual model: organic structure, generative learning, and radical innovation

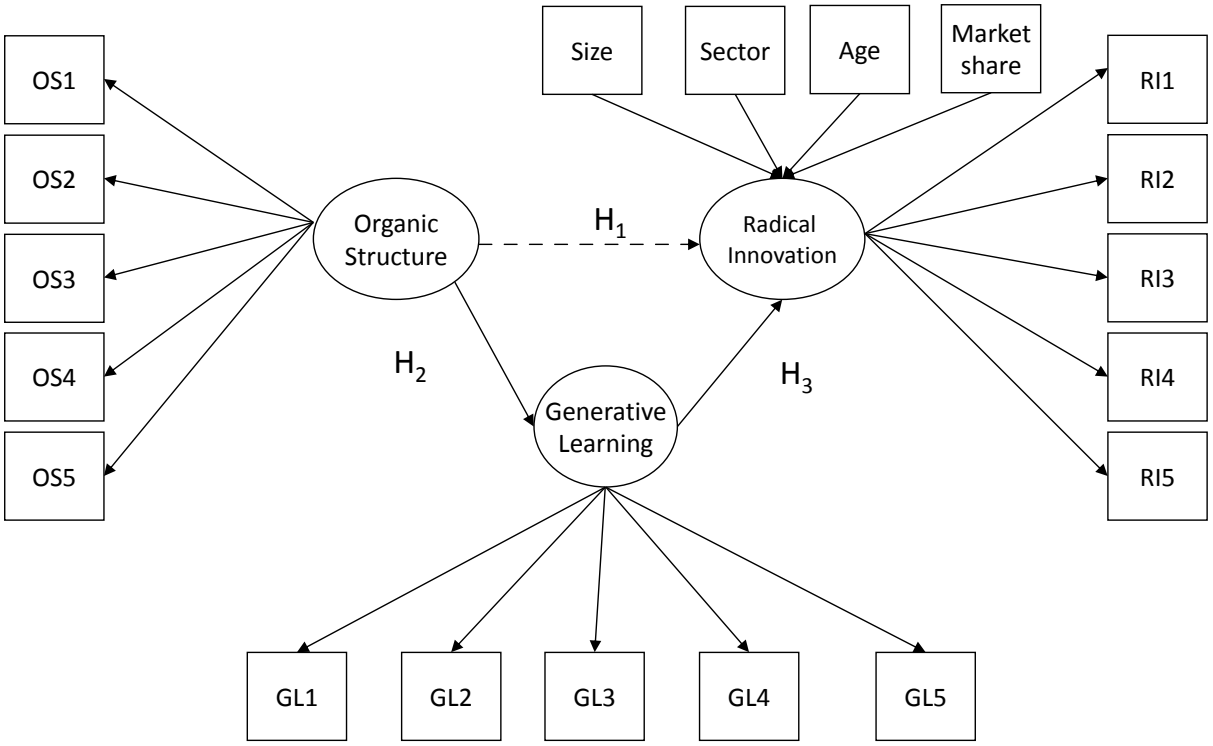
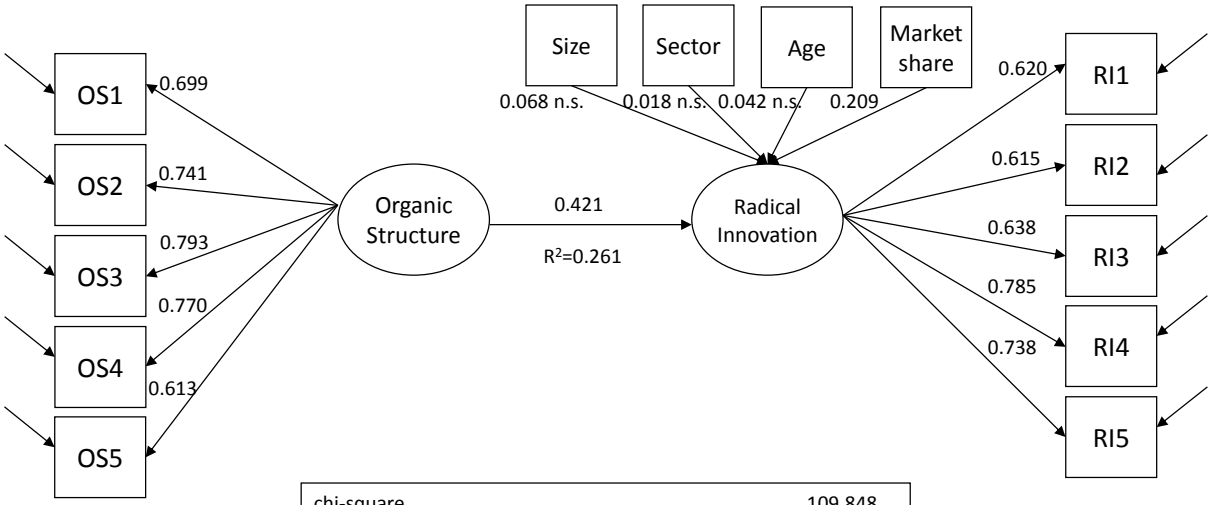
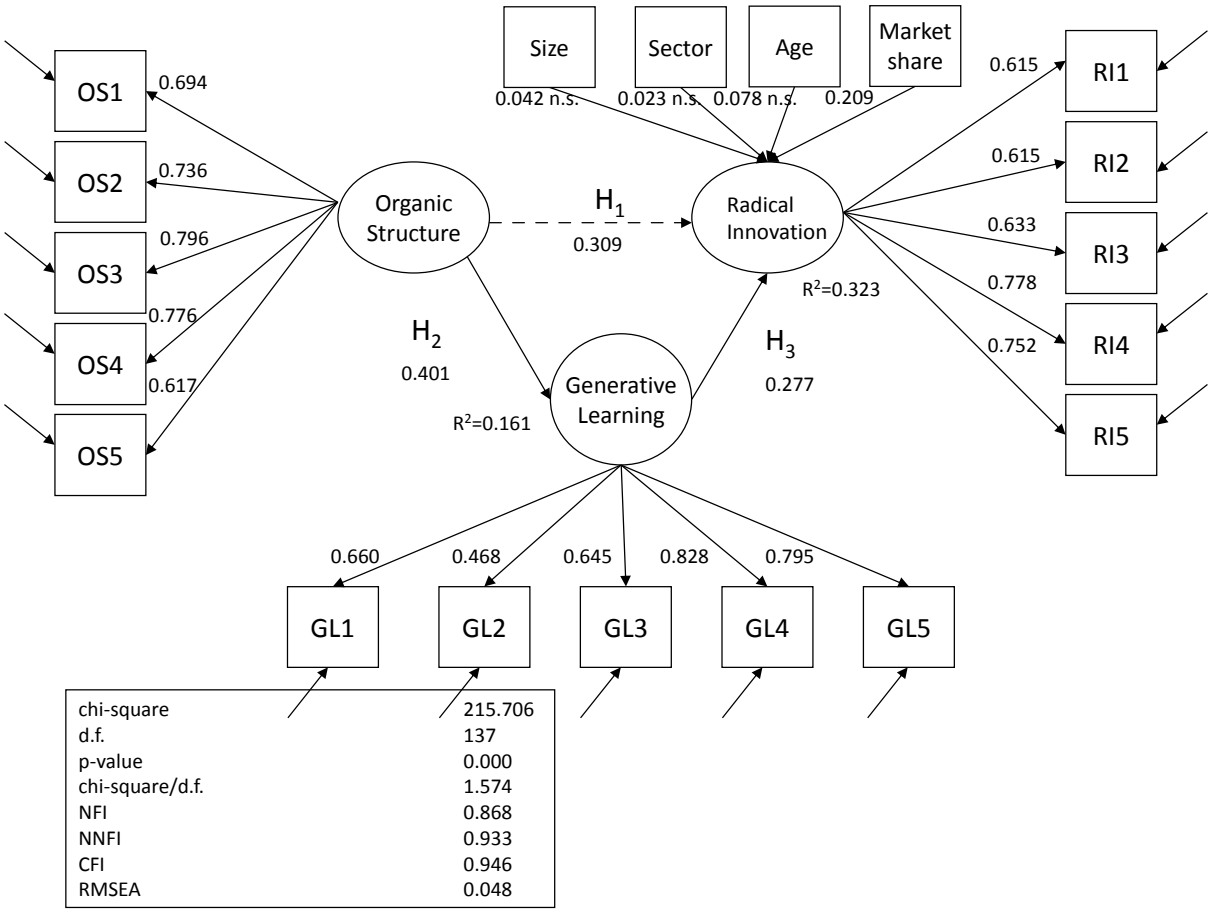


Figure 2. Direct effect model: organic structure and radical innovation



chi-square	109.848
d.f.	65
p-value	0.000
chi-square/d.f.	1.690
NFI	0.899
NNFI	0.937
CFI	0.955
RMSEA	0.053

Figure 3. Mediating effect model: organic structure, generative learning and radical innovation.



APPENDIX:

About organic organizational structure: Mallén et al. (2015)

OS1. Our organization has an egalitarian culture (non- hierarchical)	1-2-3-4-5
OS2. Our organization has a flat structure (few hierarchical levels)	1-2-3-4-5
OS3. Our organization avoids rigid departmentalization	1-2-3-4-5
OS4. Our employees are given autonomy	1-2-3-4-5
OS5. There is open communication throughout the organization	1-2-3-4-5

About generative learning: Chiva et al. (2010)

GL1. Our organization questions (inquires into) everything established	1-2-3-4-5
GL2. Our organization often uses intuition in decision-making	1-2-3-4-5
GL3. Our organization analyzes matters and problems in a global, systematic and holistic way	1-2-3-4-5
GL4. Our organization collectively reflects on matters and problems	1-2-3-4-5
GL5. Our organization goes beyond simple improvement	1-2-3-4-5

About radical innovation: Gatignon et al. (2002)

RI1. Innovation is a minor improvement over the previous technology	1-2-3-4-5
RI2. Innovation was based on a revolutionary change in technology	1-2-3-4-5
RI3. Innovation was a breakthrough innovation	1-2-3-4-5
RI4. Innovation led to products that were difficult to replace using older technology	1-2-3-4-5
RI5. Innovation represents a major technological advance in the subsystem	1-2-3-4-5