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organizational learning? A curvilinear relationship
revisited

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TECHNICAL INNOVATION: TRIGGER OR THREAT FOR ORGANIZATIONAL LEARNING? A CURVILINEAR RELATIONSHIP REVISITED

Abstract

Purpose (mandatory): Although most research considers organizational learning as an antecedent of innovation, the relationship is complex and could be reciprocal. Therefore, more research is needed on the profit gained from the learning an organization acquires from its innovation activities. Using the concept of fit, this paper aims to investigate whether organizational learning increases when an organization's technical innovation level exceeds that of its competitors (positive misfit), theorizing the curvilinear effect of positive technical innovation misfit on organizational learning.

Design/methodology/approach (mandatory): This paper uses regression analysis with survey data gathered from 202 European firms.

Findings (mandatory): The findings support the argument that positive technical innovation misfit has an inverted-U shaped effect on organizational learning.

Practical implications: The findings obtained should orient firm managers to developing a work environment that enables optimal levels of technical innovation and learning—levels at which the technical innovation developed drives learning among the organization's members but avoids becoming trapped in the organizational complexity involved in very high levels of positive technical innovation misfit.

Originality/value (mandatory): This study resolves conflicting views of the relationship between organizational learning and technical innovation and adds to the existing literature that indicates that proactive innovative firms can fail when becoming learners.

Keywords: Positive Technical Innovation misfit, organizational learning, curvilinear relation, survey.

"When we design and innovate, new ideas appear and learning comes out. Everything is closely connected" (Innovation Department member, Chiva et al., 2014, p. 699).

Introduction

Organizational learning and innovation have emerged in the literature as fundamental tools both for responding to the rapid changes currently occurring in the organization's environment and for obtaining long-term competitive advantage (Pavitt, 1991; Kale et al., 2000; Ellis and Shpielberg, 2003; Hult et al., 2004; Camps et al., 2016; Cake et al., 2020).

In today's competitive landscape, the ability to reconfigure organizational processes with technical innovations becomes crucial (Damanpour et al., 2009), as technical innovations provide "a basis for new products that create value for firms" (Zuo et al., 2019, p. 1166). What is more, technical innovation lies at the core of economic growth, acting as the main productive force (Wang et al., 2019). Technical innovation refers to innovation that is directly related to the organization's production activity as a means for changing and improving performance of its technical system (Damanpour and Evan, 1984). Pressures from competitive and institutional environments require organizations to acquire new knowledge that bolsters organizational capabilities and to refine existing processes and systems continually (Damanpour et al., 2018). Generating technical innovations is thus important to maintaining a sustainable competitive advantage over time.

Despite this scenario, research has yet to address how organizations respond differently to innovation demands in their environment (Hurley et al., 2005). Specifically, the interplay between an organization's level of technical innovation and that of its direct competitors, as well as the implications of this interplay for the organization's performance, requires in-depth analysis. To address this limitation, we introduce the concept of technical innovation fit - the (mis)match between an organization's level of technical innovation and that of its direct competitors. We classify organizations' response to their environment along a continuum

from one extreme misfit position to the other via more aligned positions (Wagner et al., 2012). When an organization's own level of technical innovation exceeds that of its direct competitors, positive technical misfit occurs; and when the technical innovation of its direct competitors exceeds that of the organization, negative technical misfit occurs. Although the alternatives on this continuum constitute viable ways of confronting environmental change, positive technical innovation misfit means that the organization is more capable of understanding the consequences of the changes in its environment and can respond better and faster to them.

Most studies have related organizational learning to technical innovation through a causal relationship in which organizational learning acts as an antecedent of technical innovation (Kogut and Zander, 1992; Nonaka and Takeuchi, 1995; Carneiro, 2000; Darroch and McNaughton, 2002; Crossan and Apaydin, 2010). New styles of thinking, in contrast, adopt a holistic approach, in which mutual reciprocal causality describes the relationship between both constructs (Freixanet et al., 2020) based on complexity theory. Applying this theoretical approach, authors such as Chiva et al. (2014, p. 690) believe that "innovation can also be viewed as a catalyst for new knowledge, since the very process of obtaining successful or unsuccessful consequences and feedback from it can lead to a new vision of the market or product". Along these lines, a member of a particular company's department of innovation interviewed by Chiva et al. (2014, p. 695) put this in this way: *Innovations make us learn.*

Since organizational learning is a process that implies "knowledge acquisition (the development or creation of skills, insights, and relationships), knowledge sharing (the dissemination to others of what has been acquired by some), and knowledge utilization (integration of learning so that it is assimilated and broadly available and can be generalized

to new situations)” (DiBella et al., 1996, p. 363), the very process that develops with technical innovation can be coupled with greater organizational learning. Developing technical innovations also involves experimentation and error, necessary aspects of achieving progress and knowledge generation. Furthermore, since organizations learn from experience (March et al., 1991), the experimentation inherent in developing greater technical innovations than competition –positive technical misfit- may also encourage such learning.

Whereas these theoretical and managerial perspectives assume that more innovation activities lead to higher organizational learning, we ask whether positive technical innovation misfit can be seen as a pathway to organizational learning by examining the possibility of nonlinear relationships between them. Positive technical innovation misfit could only drive organizational learning within a certain range, outside which “too little” or “too much” positive technical innovation misfit could harm organizational learning. Uncontrolled positive technical misfit can be risky; technical innovation can be unfocused, preventing the firm from obtaining gains from available knowledge and causing the loss of valuable resources and potential revenue, among other drawbacks. With “too much” positive technical misfit, organizations may enter into organizational and competitive complexity that has negative consequences (Connelly et al., 2017) for organizational learning. Along these lines, authors like Connelly et al. (2017, p. 1155) argue that “with respect to learning, an overly diverse and constantly changing competitive action repertoire” (such as too much positive technical misfit) “makes it difficult for managers to connect actions or sets of actions with particular outcomes.”

This goal of this study is thus to examine the nonlinear (quadratic) relationships between positive technical innovation misfit and organizational learning. We use the notion of (mis)fit

and complexity theory to achieve this goal. The notion of (mis)fit explains how firms' required technical innovation should be aligned with their competitive context. Complexity theory helps us to understand both the possible causality between positive technical innovation misfit and organizational learning (Chiva et al., 2014; Freixanet et al., 2020) and the dark side of having "too much" positive technical innovation misfit (Rosenbusch et al., 2011; Kobarg et al., 2019; Phan, 2019). We contribute to understanding the interdependences between positive technical innovation misfit and organizational learning, by showing how positive technical innovation misfit can act as either stimulus or threat to organizational learning.

To make this contribution, the rest of the paper is structured as follows. First, we analyze innovation using the notion of (mis)fit. We then develop the study hypothesis, following the relationships established among the variables studied using the lens of complexity theory. Next, we describe the sample and methodology of a field study for initial testing of our hypothesis. Finally, we present and discuss the findings and propose implications for future research and practice.

Theoretical background

Technical Innovation (Mis)Fit

Because the level of technical innovation that firms need is closely related to their environment, this level can be analyzed from the perspective of fit. The concept of fit has been studied under different theories, among them, contingency theory, institutional theory and the field of strategic management (Sabri, 2019) Contingency theory of organizations suggests that firms' capabilities and strategies should be aligned with the characteristics of the environment in which they operate in order to deliver competitive advantage (Lawrence and Lorsch, 1967; Powell, 1992; Donaldson, 2001). In the strategic management literature, organizational (mis)fit has mainly been viewed as aligning organizational resources, capabilities or strategies with environmental threats and opportunities (Miles and Snow, 1978; Pérez-Nordtvedt et al., 2008). A paradox exists, however: "the harder organizations attempt to fit to the early 21st-century business environment, the harder it becomes for them to remain competitive" (Voelpel et al., 2006, p. 258), as it is very difficult to predict the rapidly changing industry dynamics.

The notion of fit has also been applied to innovation studies (Kristoff et al., 2005; Prajogo et al., 2016; Ruiz Moreno et al., 2016). Innovations are the way organizations respond to changes in the environment (Damanpour and Evan, 1984). Voelpel et al. (2006) advance the notion of misfit in the arena of innovation, promoting purposeful creation of misfit to get ahead of competition. In the context of their study, once misfit succeeds, direct competitors attempt to fit themselves to the new situation. Managerial practice cites examples of companies like Starbucks (reinventing the espresso-bar) and Amazon (changing the style of online buying). Voelpel et al. (2006) also analyze the challenges of creating organizational misfit, recognizing that it can lead to organizational failure. Along these lines, our study empirically examines

whether organizations should strive to “match,” “align,” or “fit” their technical innovation activities to the competitive context in which they are situated (Lin et al., 2017).

Using a model of fit requires starting with a measure of the environment as a driving force in the fit equation (Naman and Slevin, 1993). This is why, following the procedure by Kristoff et al. (2005), we compare two measures, each representing the firm’s technical innovation activities and the environment’s technical innovation activities to assess technical innovation (mis)fit. A firm can only sustain the technical innovation introduced by the environment in a comparative framework if the innovation is related to the idea of excellent firms in the sector in which the organization operates (Llorens-Montes et al., 2005).

When the organization’s search for and introduction of new ideas, products, and services with new or significantly improved technical characteristics, use, or other functional characteristics are not aligned with those of the best direct competitors, misfit occurs. By conceptualizing fit as “matching” (Venkatraman and Prescott, 1990), we propose shifting analysis away from total (mis)fit between the organization’s innovation level and the level developed by direct competitors in the sector. Instead, we analyze what happens when organizations are proactive in their technical innovations, that is, when their technical innovation level is not aligned with their competitors’ technical innovation level because the organization is technically innovating more than the best direct competitors in its sector –positive technical innovation misfit.

Complexity theory

Complexity theory has gained attention in recent decades (Simon, 1996; Anderson, 1999; Dougherty and Dunne, 2011) as a way of obtaining a better understanding of organizations. According to complexity theory (Zhao, 2014; McElroy, 2000; Devereux et al., 2020)—which has evolved from systems theory—understanding complex systems requires studying the interactions among the components of a system, not only the individual components. Schneider and Somers (2006) maintain that a system becomes complex due to the interaction of the system's variables over time. These variables' complexity stems from their diversity because complex systems are composed of different interconnected elements (Chiva et al., 2014). Complex systems evolve under limited instability (Kauffman, 1993; Stacey, 1996; Anderson, 1999) that places them on the brink of chaos, where equilibrium between chaos and stability is reached.

To understand the relationship between organizational learning and innovation, we use the theoretical framework of complexity explained above to examine the interaction of these variables (Ferreira and Saurin, 2019). From the perspective of complexity theory, organizational learning and innovation are conceived as interrelated elements of a complex system, in which the behavior of either term is affected by the behavior of the other (Chiva et al., 2014). Both organizational learning and innovation can remain stable, adapt, or transcend, but the system evolves when one of its elements “reaches the edge of chaos” (Chiva et al., 2014, p.2), making the system unstable. We must also consider, however, that not all systems can evolve, especially those that are highly chaotic, as they cannot maintain behaviors and have too few stable components (Schneider and Somers, 2006). Such is the case under conditions of “too much positive technical innovation misfit.”

Hypothesis development

Linking positive technical innovation misfit to organizational learning: A curvilinear relationship

Using the concept of fit and grounding our argumentation in complexity theory (Chiva et al., 2014), this study seeks to examine the nonlinear (quadratic) relationship between two interrelated dynamic capabilities, technical innovation and organizational learning. We thus adopt a theoretical approach that goes beyond the traditional relationship of linear causality between organizational learning and positive technical innovation misfit (Jiménez and Sanz, 2011; García-Morales et al., 2012; Lee et al., 2013; Lee et al., 2016) and adopt a more complex and holistic paradigm to attempt to determine whether positive technical innovation misfit can be a catalyst of organizational learning.

Organizations must be careful to engage in optimal levels of positive technical innovation misfit to avoid the risk of “too little” or “too much” positive technical innovation misfit. We note that moderate levels of positive technical misfit can stimulate organizational learning. Further, positive technical innovation misfit should be thought of as both outcome and process (Kahn, 2018), as well as a cyclical learning process of exploitation and exploration (Ellström, 2010). The tasks of investigation, opportunity seeking, and decision-making inherent in positive technical innovation misfit can contribute to organizations’ ability to initiate new exploratory learning processes and, in the end, be considered as a form of social learning (Brown and Duguid, 1991) in which different actors participate, interact, and ultimately learn (Jérez-Gómez et al. 2005; Chiva et al., 2014). Moderate levels of positive technical misfit can thus enable “learning by doing” (Winter, 2003; Sosna et al., 2010; Lee and Walsh, 2016) in an organization. Likewise, the very process of and feedback from successful or unsuccessful consequences of positive technical innovation misfit demand an open

mentality and experimentation (Jerez-Gómez et al., 2005). Openness and experimentation are processes that underlie organizational learning (Lee and Walsh, 2016) because they can bring a new vision of the market or the product (Hurley and Hult, 1998) and modify the organization's knowledge base (Madsen and Desai, 2010).

Combining the foregoing with complexity theory, "too much positive technical misfit" could generate excessive levels of complexity in an organization's actions –i.e., too diverse, variable, and new (Burnes, 2005; Grobman, 2005)– leading to saturation of its employees. Complexity studies indicate that the most creative phase of a system –the point at which emergent behaviors arise inexplicably– lies somewhere between order and chaos (McElroy, 2000), such that systems coevolve to the edge of chaos (Anderson, 1999). The process of developing positive technical innovations is clearly complex and characterized by high risk (Rosenbusch et al., 2011). When "too much" positive technical innovation misfit exists due to this complexity, learning does not continue to develop with the same intensity because learning requires time to connect and integrate past experiences with present and future behavior of the organization's members (Berends and Antonacopoulou, 2014), even jeopardizing their development. Technical innovation thus consumes time and mental energy such that the disadvantages of positive technical innovation misfit can begin to outweigh its advantages when complexity reaches high levels. In addition, if firms try to be too far ahead of competitors in generating technical innovations, they could fail to orchestrate the associated managerial resources (Connelly et al., 2017). Along these lines, Hervás Oliver et al. (2018) argue that simultaneous integration of multiple knowledge areas involving many issues requires new routines and allocation of extra resources, imposing constraints on managers.

With “too much positive technical innovation misfit,” firms are forced to focus their effort and work toward the creation of new products, processes, and services, increasing the quantity and complexity of the activities needed to achieve high levels of technical innovation, due to not only to lack of clarity on tasks but also from inter-relationships and conflicts between them (Okwir et al., 2018). “Too much” positive technical innovation misfit makes transfer of knowledge derived from prior experiences more difficult within new complex content domains (Toft-Kehler et al., 2014). Excessive levels of complexity triggered by sub-optimal levels of positive technical misfit thus damage two of the three phases of organizational learning (Jérez-Gómez et al., 2005) –knowledge dissemination and knowledge integration.

In sum, although positive technical innovation misfit is expected to increase organizational learning in general, this effect may change beyond a certain point and result in lower organizational learning. We therefore propose verifying the following hypothesis:

H1: An inverted-U-shaped relationship exists between positive innovation misfit and organizational learning.

Research Method

Sampling and data collection

A sample of 1500 firms was randomly selected from the Duns and Bradstreet database -which includes the 50,000 European largest companies operating. We decided to use the managers as our key informants, as they receive information from a wide range of departments and are therefore a very valuable source for evaluating the different variables of the organization. Surveys were mailed to managers along with a cover letter. The managers are characterized as follows: 42% manage firms that classify their activity as services, 36% are industrial firms,

and 22% are both industrial and service firms. As to size, 72.1% of the firms were large and 25.9% medium-sized. To reduce possible desirability bias, we promised that we would keep all individual responses completely confidential and confirmed that our analyses would be restricted to aggregate level to prevent identification of any organization.

We mailed each manager who had not yet responded three reminders. Ultimately, 207 managers answered the questionnaire, but only 202 questionnaires were included in the research due to missing values. The response rate was 13.8%. The potential for non-response bias was analyzed following the procedure recommended by Armstrong and Overton (1977), who view later respondents as those most likely to be similar to non-respondents. We conducted a t-test to evaluate the difference between early and late respondents (102 and 100 respondents, respectively) with regard to the key variables used in this study. The t-test results affirmed the absence of non-response bias in the final results of the study ($p=0.05$).

Measures

Positive technical innovation misfit

The concept of innovation can be tackled in different ways: as process and as result (Crossan and Apaydin, 2010) or by type of innovation (product, process, administrative, technological, and non-technological) (Damanpour et al., 2018). Our study focuses on technical innovation, defined as the implementation of goods or services that are new or significantly improved as to their technical characteristics or use, or as to other functional characteristics, including improvements in deadlines or services (Manual de Oslo, 2018); with knowledge or technology, with improvements in materials, components, or integrated computer science; and which the firm introduces on the market over a period of time (Ziegler, 2015). Technical innovations are innovations that occur in the operating component and affect the team used

and the workers' production methods (Damanpour et al., 1989; Yang et al., 2019). Technical innovation is analyzed as the (mis)fit between the real level of technical innovation and the level of technical innovation an organization perceives as necessary based on best competitors in the environment adopting an innovation fit or alignment perspective (Lloréns et al., 2005; Ruiz et al., 2016).

To operationalize the measurement of technical innovation misfit, we designed a 7-category Likert scale (1 "disagree completely" to 7 "agree completely") of four items, based on the definition advanced by Damanpour (1991), Damanpour and Wischnevsky (2006), and Damanpour and Aravind (2012). Managers were asked to indicate the number of innovations introduced by the organization over a three-year period, using 1 to indicate a low number of innovations and 7 to indicate a high number of innovations. The questionnaire informed managers a priori how innovation is defined –the number of goods or services that are new or significantly improved as to their technical characteristics or use, or as to other functional characteristics, and that are introduced on the markets by the firm over a period of time. Subsequently, managers were asked to indicate the number of innovations introduced by best competitors in the environment (required innovation). We used precisely these firms because, according to Parasuraman et al. (1993), perceptions of what is required cannot indicate an infinite ideal point but, rather, a feasible ideal point that reflects the reality perceived by the manager interviewed. Fit can be analyzed as deviation from a profile. For example, Venkatraman and Camillus (1984) develop their ideal profile from the innovation decisions taken by firms that achieve the best results. In our study, innovation fit (IF) was measured as the difference between the organization's innovation level (OI) and the level required for "excellent" competing firms (RI). That is, $IF = OI - RI$, with higher values indicating

greater mismatch and lower values indicating closer match between the level required and the level developed by the organization. Since positive innovation misfit corresponds to a proactive attitude relative to the firms in the environment, we had to homogenize the data to be used by recoding it and transforming the scale into positive values ranging from 1 to 13, following the procedure described in Ruiz Moreno et al. (2016). The categories do not refer to level of agreement or disagreement with the statement included in each item but rather to level of difference between required and real values (from 13 to 1, where 13 reflects the highest magnitude of innovation and 1 the lowest). As one item's factor loading was less than 0.5, it was deleted (Hair et al., 2010). The remaining factor loadings ranged from 0.76 to 0.83 (PIM1. 0.83, PIM2. 0.83, PIM3. 0.84 and PIM4. 0.76), and a Cronbach's alpha of 0.83 indicated scale reliability.

Organizational learning

Organizational learning was measured as a multi-item scale with the first two items from the scale developed by Kale et al. (2000) and two additional items based on Edmondson (1999), as these scales possess closer links to our research and reflect the different prior trends well. The scales' validity was verified in detail, and the items have been used in studies by García-Morales et al. (2006) and Tamayo-Torres et al. (2016). The items were adapted to the present study. We used a Likert scale (1 "disagree completely" to 7 "agree completely") composed of items related to knowledge and abilities learned by the organization. The survey asked managers to indicate whether their organizations had learned or acquired new and relevant knowledge in the last three years, whether they had acquired any critical capabilities and skills, and whether the organization was a learning organization during the same time period.

The remainder of the factor loadings ranged from 0.87 to 0.90 (OL1. 0.87, OL2. 0.89, OL3 0.88 and OL4. 0.90) and a Cronbach's alpha of 0.91 indicated scale reliability.

Control variables

To account for the effects of extraneous variables, we considered number of employees, income, and sector as control variables. We used number of employees (1: <50 employees; 2: 50-250 employees; 3: >250 employees) and income (1: <7,000,000€; 2: 7,000,000-40,000,000€; 3: >40,000,000€) to measure firm size, since both are factors determining the capacity to commit resources and capabilities (Moorman and Slotegraaf, 1999) and thus the results of innovation in an organization (Sheng and Chien, 2016). In addition, sector (1=manufacturing; 2=services; 3=both manufacturing and services) was considered because of its effect on innovation-related outcomes (Naqshbandi and Tabche, 2018). The Appendix shows all scales and indicates the items from each that were used in the research.

Analysis and Results

Scale validation

Table I presents the descriptive statistics (e.g., means and standard deviations), correlations, and reliability coefficients. The CR values in Table I show a minimal value of 0.83, exceeding the recommended threshold of 0.7. Note that the correlations are all below the marginal threshold of 0.65. Table II presents the factor loadings, CR, and AVE values.

Insert Table I here

Insert Table II here

Second, we used structural equation modeling to evaluate the validity of our measures. The results indicated that our two-factor confirmatory measurement model had satisfactory fit to the empirical data ($\chi^2/df=2.82$; NFI=0.93; IFI=0.96; CFI=0.96; RMSEA= 0.08). The average

variance extracted (AVE) was greater than 0.5. More specifically, organizational learning (0.78) and positive innovation misfit (0.67) were all greater than the recommended minimum, confirming convergent validity. The square root of the AVE for each construct (organizational learning: 0.89, positive innovation misfit: 0.82) was greater than any correlation, providing evidence of discriminant validity. We also conducted pair-wise chi-square tests on all of the variables to assess discriminant validity, observing the presence or absence of significant difference among constrained and unconstrained models (Xiao et al., 2019). As all of the chi-square difference tests were significant, this approach again confirmed discriminant validity.

Common Method Bias

We performed methodological tests, starting with Harman's single-factor test. We loaded all variables in the exploratory factor analysis, constraining the number of factors to 1. As the first component accounts for less than 50 percent of all variables, common method variance is not a serious problem in our sample. As an alternative test, Chang et al. (2010) recommend confirmatory factor analysis (CFA). Following their suggestions, we constrained all items to load on only one factor in the CFA. As the fit statistics (RMSEA=0.21, NFI= 0.68, CFI=0.70, IFI=0.71, normed $\chi^2=14.6$) did not show good fit, we were able to conclude that a single factor does not account for all variance in the data.

Testing of the hypothesis

Multiple regression analysis was used to test the hypothesis. To assess the possibility of multicollinearity, we mean-centered the variable organizational learning before multiplying it to construct the quadratic term. The variance inflation factor (VIF) values for all regressions ranged from 1 to 1.32, values below the limit of 10, indicating the absence of multicollinearity.

Table III shows the results of an analysis of three models. Model 1 includes control variables only. In Model 2, we add the independent variable, positive technical innovation misfit, which positively and significantly affects learning (0.31, $p < 0.001$). In Model 3, we regressed the squared term of positive technical innovation misfit on organizational learning. Table II shows that the curvilinear relationship was statistically significant ($\beta = -0.14$; $p < 0.05$). R^2 also increases from Model 2 to Model 3 (0.02, $p < 0.05$). The relationship between positive technical innovation misfit and organizational learning showed an upward trend at lower levels of positive technical innovation misfit and a downward trend at higher levels of positive technical innovation misfit. As depicted in Figure 1, the shape of the relationship is consistent with Hypothesis 1, which proposed an inverted-U shaped relationship between positive technical innovation misfit and organizational learning. We calculated the inflection point following Aiken and West's (1991) approach and found that the inflection point of the innovation gap was 3.41. When the mean-centered positive innovation misfit was lower than 3.41 within the interval of -4.48 to 5.02, the trend of the relationship to organizational learning was upward. The relationship turned downward when positive technical innovation misfit was larger than 3.41.

Insert Table III here

Insert Figure 1. Inverted U-shape

Discussion

Complexity theory may be a useful starting point for understanding how innovation and organizational learning interact and evolve. This study investigates and confirms an inverted U-shaped relationship between positive technical innovation misfit and organizational learning. Given that most studies establish linear cause-effect relationships, finding a new

inverted U-shaped relationship between technical innovation and learning extends the extant literature in the following ways. The study not only enriches the literature on innovation and learning by studying the relationship between the two variables; more importantly, it deepens knowledge of how these variables perform depending on the level of innovation developed relative to their environment (fit/misfit), revealing a curvilinear relationship rather than the monotonous linear effect suggested by previous research (Cohen and Levinthal, 1990; Nonaka and Takeuchi, 1995; Mariano and Casey, 2015).

In contrast to prior literature that linked technical innovation to organizational learning, our findings show that the optimal level of technical innovation relative to the firm's competitors should be considered simultaneously, since firms can be positioned along a continuum from proactive to reactive innovative behavior. As hypothesized in H1, we provide empirical evidence of the influence of positive technical innovation misfit on organizational learning and the nonlinear relationship between these variables. We recognize that differences in innovation are inevitable between firms (Madsen and Desai, 2010; Rosenbusch et al., 2011; Hervás Oliver et al., 2018). We may be able to understand the reasons why most advanced companies learn less than other firms (Madsen and Desai, 2010; Tsinopoulos et al., 2019), because learning depends on how the innovation strategy is managed. In fact, our results show that "too much" positive technical innovation misfit is not the optimal way to foster organizational learning. Our results suggest that the right levels of positive technical misfit can stimulate organizational learning. These findings are in line with Kahn (2018) and Ellström (2010), who argue that optimal levels of positive technical innovation misfit should produce outcome, process, and learning processes. Similarly, for Lee and Walsh (2016) and Sosna et al. (2010), with these moderate levels, these organizations "learn by doing." Our results also

demonstrate, however, that “too much” positive technical innovation misfit could generate excessive levels of complexity in an organization’s actions (Burnes, 2005; Grobman, 2005) and thus provide no stimulus to organizational learning.

Implications and concluding remarks

Firms can be positioned along a continuum, from negative to positive technical innovation misfit (Wagner et al., 2012). This paper proposes and provides empirical evidence that moderate levels of positive technical innovation misfit are the best alternative for an organization to enhance its organizational learning. The paper now closes with the theoretical and practical implications, followed by limitations and future research directions.

Theoretical implications

The goal of this study was to examine the nonlinear (curvilinear) relationships between positive technical innovation misfit and organizational learning. Using the notion of (mis)fit and complexity theory as a conceptual framework, we tested the hypothesized relationship empirically with survey data. The results yielded the following conclusions, which advance and strengthen the body of knowledge in the management literature.

First, we shed light on the optimal level of technical innovations that organizations should develop relative to their environment. To do so, we apply the concept of (mis)fit to technical innovation, since adopting innovation is an organization’s means to adapt to the environment in order to increase or sustain its effectiveness and competitiveness (Damanpour and Gopalakrishnan, 2001). Although earlier studies have begun to analyze the influence of this variable on organizational learning, we introduce an alignment perspective on technical innovation. We extend the line of research developed by Voelpel et al. (2006) by

conceptualizing misfit in terms of the match between the organization's level of technical innovation and the level required by its competitors. Since most studies do not take the level of technical innovation required as a reference, analyzing technical innovation as misfit provides empirical evidence of how to manage the proactive behavior so necessary in today's environments, which are characterized by rapid technological change and global competition. In addition, our results should encourage researchers to consider possible applications of the concept of fit to advance the field of industrial marketing.

Second, we provide greater understanding of how positive technical innovation misfit can enable greater organizational learning. As mentioned above, prior empirical research focuses on the linear relationships between the two variables, in which learning acts as an antecedent of innovation (García-Morales et al., 2012; Lee et al., 2016). Our study starts, in contrast, from the two-way relationship between technical innovation and organizational learning since complexity theory disciplines the organization to focus on interrelationships and dynamic processes of change rather than on linear cause-effect chains (Senge, 1990; Boisot and McKelvey, 2010) extending the line of research of previous studies (Chiva et al., 2014; Freixanet et al., 2020). Adopting complexity theory, we confirm empirically that firms that show proactive technical innovation behavior provide a path to organizational learning. Because organizational learning is the natural connection between working and innovating, the composite concept of "learning-in-working" best represents the fluid evolution of organizational learning through the proactive practice of technical innovation (Brown and Duguid, 1991, Mora and Johnston, 2018). In addition, our results support and reinforce the conclusions achieved in previous studies such as Sosna et al. (2010), Lee and Walsh (2016), Kahn (2018) and Kumar et al, 2018) which stress that practice, the dynamic of

implementation, and the trial and error involved in the full technical innovation process activate learning mechanisms. In investigating the inverse relationship between positive technical innovation misfit and organizational learning under the lens of complexity theory, our study contributes to this research stream by showing that specific organizational variables, such as innovation and organizational learning, have a reciprocal relationship of mutual influence. In sum, we contribute to the literature on the relationship between the two concepts by showing the need for a more complex and dynamic approach to analyzing them. Third, we have gone beyond linear causality, providing empirical evidence of an inverted-U shaped relationship between the two variables. We demonstrate that it is essential that researchers consider the possibility that positive technical innovation misfit has a dark side, that “too little” or “too much” technical innovation misfit can be harmful for organizational learning. This result extends and provides empirical evidence to support the suggestions made in studies like Bolino et al. (2010) and Connelly et al. (2017), which propose that being a proactive innovator could have significant costs. As organizations are more proactive and depart from their competitors’ level of technical innovation, organizational complexity intensifies because technical innovation is complex in nature and depends on multiple company interfaces inside and outside the value chain (Kobarg et al., 2019). Although some theoretical and managerial perspectives stress that higher levels of technical innovation lead to greater organizational learning (Brown and Duguid, 1991; Hurley and Hult, 1998; Chiva et al., 2014; Freixanet et al., 2020), our results suggest and provide empirical evidence of the need to determine which levels of positive technical innovation misfit can act as a stimulus to organizational learning.

Managerial implications

In addition to making theoretical contributions, this paper has implications for management. First, based on the results of our study, managers should conceive innovation in terms of fit and understand innovation not only from a non-technical but also from a technical perspective.

Second, practitioners must be aware of the role technical innovation plays in organizational learning. When directing their organizations, managers should adopt a holistic perspective that constantly links technical innovation to organizational learning. Through this approach, they will understand that decisions they take about one element can have consequences for another. An organization that hopes to increase its organizational learning should thus pay attention to its technical innovation. In sum, our findings help practitioners to manage their interdependencies effectively.

Third, our study has practical implications that enable organizations to develop successful technical innovation strategies. The results show that these strategies must be managed by taking into account their (mis)alignment with their environment. We urge organizations seeking to increase organizational learning to be very cautious in defining the optimal level of technical innovation to develop relative to their direct competitors. Our results show that adopting an extreme position on the innovation continuum can be counter-productive. Entering into a process of “too much” positive technical innovation misfit can be tempting, given its potential benefits, but managers should be aware that “too little” and “too much” positive technical innovation misfit can reduce organizational learning. We recommend aiming for moderately positive technical innovation misfit. Managers should work not only to generate greater innovation to achieve better long-term sustainable results but also to balance the level of innovation achieved so as not to jeopardize other organizational

capabilities (e.g., organizational learning). They must avoid becoming trapped in the organizational complexity produced by very high levels of positive technical innovation misfit. Connelly et al. (2017) affirm that firms should probably implement competitive action repertoires near the optimum inflection point between simplicity and complexity. This optimum enables them to avoid the negative consequences of being highly proactive in developing innovations due to complexity generated, cognitive limitations, or time and energy consumed in the process (Miller, 2002; Bolino et al., 2010; Strauss et al., 2017). Similarly, Peschl (2019) argues that one of organizations' major challenges is finding a good balance between organizational stability and change. We thus recommend that practitioners manage the tension so that their organizations neither simply fit their direct competitors' level of technical innovation development nor enter a state of complete chaos. The process of developing technical innovation must be managed diligently to increase organizational learning.

Fourth, the findings give managers insight into how to develop strategies to manage the dark side of having "too much" positive technical innovation misfit. Simultaneously acquiring and cultivating skills that enable them to manage the complexity of these innovations could be a practical tool to mitigate these possible negative consequences. For instance, managers must strengthen their training in complexity management and incorporate these skills into decision making. Further, it is crucial for the members of the organization to understand the innovation processes in which they are immersed and to have the information on implementation of these processes necessary to assimilate them. Managers must provide their employees with greater analytic skills that enable them to face the complexity inherent in innovation processes in order to trigger organizational learning. Our results can guide

managers in creating the right work environment to make their organizations innovate and learn at an optimal level, the level at which the innovation developed encourages organizational learning.

Study limitations

This research is not without some limitations. First, the data were obtained from a single key informant although we confirmed that common method bias is not a problem in our study. Second, the study is cross-sectional, as it evaluates participants in specific situations at a specific moment in time. Third, the study variables could be the object of complementary analyses that examine different dimensions of organizational learning.

Directions for future research

Future empirical studies should consider the perspective of (mis)fit when performing research, since (mis)fit deepens the level of analysis and enhances research contributions.

Data from different informants (such as mid-level managers) and the workers themselves, as well as qualitative information obtained through in-depth interviews, will enrich the data obtained and enable more robust study of the relationship between technical innovation and organizational learning. Panel data from multiple respondents would enable investigation of how firms adjust their technical innovation strategies over time and how these adjustments affect organizational learning. Since innovation and learning evolve over time, future studies must perform longitudinal surveys to collect long-term data on organizations.

Many lines of research could extend the knowledge gained in this study on the relationship between technical innovation and organizational learning. It would be interesting to incorporate industry characteristics that influence the level of technical innovation that firms choose to seek. Similarly, we recommend analyzing whether any differences in model results

depend on the firm's age: Do younger firms manage the complexity inherent in "too much positive technical innovation misfit" better than older firms when it comes to organizational learning? Given that our study focuses on the private sector, we call on researchers to extend our findings to other contexts, such as public organizations or nonprofit organizations.

Further, it would be useful to investigate how specific moderating variables influence the curvilinear relationships. Studying the role of specific mechanisms or working conditions such as leadership style, absence of abusive supervision, or firm's tendency to open innovation (Westerlund and Rajala, 2010; Cheng and Chen, 2013; Roldán Bravo et al., 2017) could be valuable to inhibit the negative impact of positive technical innovation misfit on organizational learning. In addition, other organizational capabilities such as the organization's absorptive or desorptive capacity (Roldán Bravo et al., 2016, 2020) should be considered. Finally, future studies could perform mediating analysis to extend our findings (i.e., relational ties between networks [Bettis-Outland et al., 2020]).

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