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ARTICLE

Organizational knowledge actions and the evolution of knowledge environment: a micro-foundations perspective

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Abstract
This study proposes a new theoretical approach to conceptualizing the knowledge environment as a mosaic of knowledge components stemming from organizational knowledge actions. The pieces of this imaginary mosaic are the novel knowledge components incorporated in organizational knowledge actions and their sizes are determined by the extent of their influence on subsequent knowledge actions. I use the variation-selection-retention (VSR) and social mechanisms models to build my approach and I employ the patented knowledge environment as an exemplar. The deconstruction of the knowledge environment into its organization-level knowledge components embedded in organizational knowledge actions could provide scholars, managers, and policy-makers with a simple perspective to view the contribution of each organization to its knowledge environment.

Keywords Knowledge environment · Organizational actions · VSR · Social mechanisms

JEL Classification B52 · L20 · O30

1 Introduction

Organizations function in certain, dynamic environments by which they are determined and on which they have the ability to exert an influence. The issue of how an organization's actions and decisions affect and shape its environment is always a topic of great interest for management and organizational researchers. Although there exist theoretical perspectives that focus on the ability of organizations to shape their environment (e.g., institutional entrepreneurship, strategic choice), there is a gap in our understanding of

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how this shaping is realized. What are the mechanisms that transform organizational actions into environmental characteristics; how the organizations' environment is built step-by-step by organizational actions?

Taking an evolutionary, micro-foundations perspective, Nelson and Winter (1982), in one of the most influential works in social sciences, stressed the importance of this topic by positing that "the core concern of evolutionary theory is with the dynamic process by which firm behavior patterns and market outcomes are jointly determined over time" (1982, p. 18) and hoping that "perhaps in the future it will become possible to build and comprehend models of industry evolution that are based on detailed and realistic models of individual firm behavior" (1982, p. 36). Inspired by this view, this article endeavors to conceptually connect organizational-level actions with their resulting consequences on the evolution of a specific aspect of the organizational environment, namely the knowledge environment.

I use the social mechanisms approach to model the interactions between an organization and its environment (Hedstrom and Swedberg 1998) and I employ the VSR processes of evolutionary change to model the pattern of the knowledge environment's shaping by organizational actions (Campbell 1965; Zollo and Winter 2002). In particular, I propose that in their effort to adapt and respond to the perceived environmental conditions, organizations make certain actions using existing knowledge from their environment. The consequences of these organizational knowledge actions concern not only the organizations that generated these actions, but also their knowledge environment.

According to my proposal, the effect of organizational knowledge actions on knowledge environment follows the VSR pattern. More specifically, organizational knowledge actions, as potentially including novel knowledge components, add variations to the environment and, as using existing knowledge components, they alter their importance. These processes drive me to view knowledge environment as a mosaic of knowledge components whose pieces are the novel knowledge components incorporated in organizational knowledge actions and their sizes are determined by the extent of their influence on subsequent knowledge actions.

By viewing knowledge environment as a mosaic created by organizational knowledge actions, this paper advances theorizing on the organizations' ability to shape their knowledge environment. From my perspective, each organizational knowledge action inevitably affects the knowledge environment and it does so in two distinct ways; either by adding new knowledge components or by altering the importance of the existing knowledge components that are reproduced by each knowledge action. This perspective could stimulate a stream of research that will focus on the quantification of the impact of each organization on the evolution of its knowledge environment. The exemplar presented in Sect. 3, which analyzes how a subset of knowledge environment—the patented knowledge—is shaped by organizational knowledge actions, offers an initial step in this direction.

2 Theory

2.1 Co-evolution of organizations and their environment

The co-evolution of a unit and its environment is a fundamental issue that concerns the entire spectrum of social sciences. Management and organization studies are actively involved in the adoption and the development of co-evolutionary syllogism, a fact which is manifested by the application of this logic (explicitly or implicitly) in various co-evolving pairs either across different levels, such as individual–organization, group–organization, or organization–environment, or on the same level such as organization–organization, industry–industry and so forth (Rosenkopf and Tushman 1994; Dijksterhuis et al. 1999; Flier et al. 2003; Murmann 2013).

Focusing on the co-evolution of organizations and their environment, there appears to be a broad consensus around the view that organizations shape and are shaped by their environment in a permanent, co-evolutionary manner. For example, Lewin and Volberda (1999), major proponents of the co-evolutionary logic, eloquently described change within the organizational realm as the joint outcome of managerial intentionality and environmental effects. In the same vein, Barley and Tolbert (1997) argued that although institutions set bounds on rationality by restricting the perceived alternatives, individuals and organizations, through choice and action, can deliberately modify, create and even eliminate them. Moreover, Carney and Gedajlovic (2002) highlighted that actors are often capable of influencing institutional arrangements, but are nevertheless subject to constraints that limit their range of feasible and conceivable action. Finally, I refer to the work of Murmann (2013, p. 61) who stressed that "causality does not only run from the environment to the evolving entity but it also runs from the entity to the environment" and highlighted the case of the Internet where firms are not only dramatically affected by Internet technologies, but also certain firms like Microsoft, Apple, or Google have a huge impact on how Internet technologies evolve.

2.2 Organizations' Impact on their Environment

In general, micro-foundations research in social sciences investigates potential micro explanations of heterogeneous macro outcomes, locating the causes of a phenomenon at a level of analysis lower than that of the phenomenon itself (Felin et al. 2015; Liagouras 2017; Zilber 2020). Under this view, the explanations for the conditions of organizations' environment at time t must involve the organizational actions at time $t-1$.

Continuing with this line of reasoning, a constant complaint of the micro-foundations movement is that studies of how organizations influence their environment are rarer than studies of how they adapt to it (Stern and Barley 1996; Felin et al. 2015). The extant literature primarily has focused on how and why organizations tend to become isomorphic with their environments, whereas questions of how organizations systematically influence their environments are studied less (Baum and Singh

1994; Lewin and Volberda 1999; Felin et al. 2015). Attempting to explain this gap, Dieleman and Sachs (2008) stressed that scholars often assume that corporations are too insignificant to have an impact on their environment, while Barley and Tolbert (1997) underscored the difficulties of detecting and collecting data for documenting the effect of an organization's activities on its context.

Despite the lack of empirical investigations on the influence of organizations on their environment, important management and organizational theories acknowledge and build on the ability of organizations to shape their environment in their effort to adapt to it (organization-level adaptation). The extent to which each theory focuses on the organizations' capacity to affect their social landscape varies substantially. For example, the behavioral theory of the firm, although primarily focuses on the organizations' capability to change their goals, attention, and search procedures, secondarily suggests that firms can affect the external environment in which they operate (Lewin et al. 2004). Furthermore, both evolutionary economics and dynamic capabilities approaches accept the organizations' power to influence their environment. Evolutionary economics views firms as vehicles of innovation and drivers of change at the industry level (Lewin et al. 2004), while the firms' capability of manipulating their external context is a constituent part of dynamic capabilities (Teece 2009). In addition, the strategic choice approach explicitly assumes that firms, on the basis of managerial intentionality, have the ability to reshape their environment, rather than simply being passive recipients of environmental forces (Flier et al. 2003). Finally, the most representative approach on the shaping role of organizations is the concept of institutional entrepreneurship within the structure-agency debate (DiMaggio 1988; Garudet al. 2002; Smith and Cao 2007; Heugens and Lander 2009), which analyzes how actors can contribute to changing institutions, despite pressures toward isomorphism (Battilana et al. 2009). However, none of these theoretical perspectives goes inside the black box of transformational mechanisms. We have no clears insights about the mechanisms that transform organizational actions into environmental characteristics? This is exactly the research question that the proposed perspective attempts to address.

2.3 Organizations' knowledge environment

In this study, the focus is on a specific aspect of organizations' environment, the knowledge environment. Following Van Den Bosch et al. (1999), I define knowledge environment as the knowledge related to products, services, production processes, management, marketing, and markets, which is embedded in a wider world environment (Carney and Gedajlovic 2002). Knowledge environment consists of knowledge components and constantly changes as new knowledge components are being added while the importance (in terms of usefulness) of the existing ones is being altered.

2.4 Organizational knowledge actions

I define organizational knowledge actions as the making of organizational decisions by applying existing knowledge to solve specific problems (Vincenti 1994;

Brooks 1995; Lichtenthaler and Lichtenthaler 2009). Organizational knowledge actions inevitably generates novelty by reinterpreting, recombining, and transforming prior knowledge and by applying it to diverse contexts that constantly change at the firm, industry, and country-level (Dijksterhuis et al. 1999; Weeks and Galunic 2003; Nooteboom 2008). The degree of novelty varies from extremely low (e.g., repetitive organizational knowledge actions characterized by automaticity in the decision-making process (Zollo and Winter 2002)) to extremely high (e.g., radical innovations).

2.5 Proposed perspective

The main proposal of this paper is that the knowledge environment is formed exclusively by the knowledge actions of organizations (private or public), following the classic evolutionary paradigm of variation-selection-retention (VSR) (Campbell 1965; Zollo and Winter 2002; Weeks and Galunic 2003; McDonagh 2020). According to the VSR model, within an evolving population, the variation mechanism explains how novelty occurs within the population (e.g., novel artifacts or ideas), selection refers to the mechanism that causes the survival of some variations rather than others (e.g., dominance of a new technology over competing alternatives), and retention mechanism ensures that some useful information to particular problems is retained, passed on and reproduced (e.g., innovation adoption) (Hodgson and Knudsen 2006; Aldrich et al. 2008; Hodgson 2013; McDonagh 2020).

In particular, each organizational knowledge action, as creating novel knowledge components, adds variations into the population of knowledge environment. In addition, because every organizational knowledge action draws upon and uses prior knowledge, it selects and reproduces certain, existing knowledge components from the pool of knowledge environment, changing their importance and their reproductive success. These arguments lead us to imagine the knowledge environment as a changing mosaic whose pieces are the novel knowledge components generated by organizational knowledge actions while their sizes in the mosaic are determined by the extent of their impact on subsequent knowledge actions.

Although the broader institutional environment (e.g. regulations, industry standards, IP rights) does influence the knowledge environment, it does this indirectly, by influencing the organizations which are capable of taking knowledge actions. Broader institutional environment suggests which knowledge elements should be selected and used by organizations, but actually, only organizations, through their actions, can directly interact with the knowledge environment. For example, industry standards force organizations to use certain knowledge elements (instead of other alternatives) from the current knowledge environment when taking knowledge actions, substantially affecting, albeit indirectly, the evolution of knowledge environment.

In addition to the VSR, the proposed perspective is inspired by the concept of social mechanisms (Hedstrom and Swedberg 1996, 1998; Hanelt et al. 2020). Social mechanisms, rooted in James Coleman's macro–micro-macro model (Coleman 1986; Felin et al. 2015; Distel 2019), endeavors to conceptualize how a social

entity's actions are formed and how these actions are transformed into a collective outcome, given certain environmental conditions (Hedstrom and Swedberg 1998). According to Social Mechanisms, instead of analyzing relationships between phenomena on the macro level, social scientists should try to figure out the mechanisms that explain how macro-level conditions affect the individual (macro-to-micro), how the individual assimilates the impact of these macro-level events (micro-to-micro), and how the individual generate macro-level outcomes, as a result of its actions and interactions (micro-to-macro) (Hedstrom and Swedberg 1996).

An organization at any point in time is exposed to specific knowledge, market, and social conditions affecting it in a certain way (the phase of Situational Mechanisms according to the Social Mechanisms model). Trying to adjust and adapt to the perceived environmental conditions in the most appropriate way, the organization makes certain decisions and actions using existing knowledge from its environment (Chia and King 1998; Carney and Gedajlovic 2002; Hodgson 2013). Organizational knowledge actions are actually the responses and efforts to adapt to continuous changes in the knowledge environment (the phase of Action-Formation Mechanisms according to the Social Mechanisms model).

However, an organizational knowledge action has consequences not only for the organization that generated it. An organizational knowledge action also produces macro-level outcomes, as it transforms the knowledge environment by adding novel knowledge components and by altering the importance of the prior knowledge components that were used by the organizational knowledge action [the phase of Transformational Mechanisms according to the Social Mechanisms model (Reinecke and Ansari 2016)]. At this point, a new cycle of the evolution of knowledge environment starts, as the organizations now need to adapt to the new, transformed knowledge environment (again the phase of situational mechanisms).

The phase of Transformational Mechanisms is exactly where the VSR approach is applied, using the knowledge component as the unit of analysis. The logical point of departure for analyzing evolutionary change is the variation mechanism (Zollo and Winter 2002). For Astley (1985), variation is the primary evolutionary force and the direct cause of change, as is the one that creates diversity and determines the direction in which evolution progresses. As eloquently stated by the same author in his study on organizational evolution (Astley 1985, p. 239), "Strictly speaking, there is only one source of change, namely, organizational variation". In the same vein, organizational knowledge actions add variations into the knowledge environment by generating novel knowledge components, as a consequence of the reinterpretation, recombination, and application of the existing knowledge on the ever-changing environment.

Apart from contributing variations to the knowledge environment, organizational knowledge actions also redefine the importance of the existing knowledge components by selecting (i.e., selection mechanism) and reproducing (i.e., retention mechanism) some and rejecting others. Organizational knowledge actions actualize the environmental selection pressures by favoring the selection of certain prior knowledge components from the knowledge environment. Organizations choose among almost infinite prior knowledge components the most suitable for them and

reproduce them according to their purposes and needs, while rejecting the alternative ones (Grodal et al. 2015).

By selecting and reproducing certain prior knowledge components, organizational knowledge actions contribute to their diffusion and legitimacy (Dijksterhuis et al. 1999). In evolutionary terms, they act as their technological offspring, increasing their chances for survival and prevalence in the knowledge population (Weeks and Galunic 2003). From the perspective of the selection and retention mechanism, organizational knowledge actions reshape the knowledge environment, on the one hand, by increasing the visibility of the selected knowledge components, thereby improving their possibilities of being noticed, selected, and reproduced again by future knowledge actions, and on the other hand, by letting the rest knowledge components unaffected in obscurity, increasing the likelihood of disappearing into oblivion (Weeks and Galunic 2003).

A similar conceptual connection between the extent to which prior knowledge has been selected and retained and the extent of its value and importance has been described by Vincenti (1994). More specifically, viewing new management practices as variations, he noted that the extent of variations' selection and retention (i.e., the extent of their diffusion) "affects the value that change agents such as managers, management consultants, and academics attribute to existing solutions" (Vincenti 1994, p. 1253).

Summarizing, by responding and adjusting to continuous environmental changes, organizations make certain knowledge actions. Among all possible options and alternatives—options that are determined and constrained by the organizations' broader environment and characterized by different probabilities of realization, organizations make certain choices concerning what actions to make and upon which prior knowledge to build. These knowledge actions reshape the knowledge environment by adding new variations into the population of knowledge components and by reevaluating the importance of the existing knowledge components that were selected and retained by these knowledge actions. After each organizational knowledge action, a new cycle of knowledge evolution initiates that includes the new variations and the new values of the prior knowledge components. As such, the evolution of knowledge environment can be conceptualized as a mosaic of knowledge elements whose constituent parts are the novel knowledge components incorporated in organizational knowledge actions and their sizes and visibility are determined by the extent of their influence on subsequent knowledge actions.

3 Patented knowledge as an exemplar

To offer a better understanding of the proposed conceptualization of the micro-foundations of knowledge environment, I use the patented knowledge as an exemplar. I attempt to explain the evolution of the patented knowledge environment through the lens of our perspective, considering that the set of all technological knowledge components that are incorporated in patented inventions actually constitute the whole "path" of patented knowledge evolution.

The patent system is probably the most suitable knowledge system to which our model can be applied because each process of knowledge variation, selection, and retention is documented and guaranteed by patent offices. In particular, patents can be viewed as organizational knowledge actions that include one or more knowledge variations whose novelty is guaranteed by the examiners of the patent offices. In addition, patent citations (i.e., a list of references to all "prior art" upon which patented inventions are based) can be viewed as manifestations of the selection and retention mechanisms. They reveal the prior patented knowledge that an organization selected and reproduced in its effort to develop a new patented invention (Podolny and Stuart 1995). The reliability of the citation procedure is corroborated by the patent examiners, who guarantee that relevant patents will be cited and irrelevant patents will be omitted (Stuart 1998; Hoetker and Agarwal 2007).

More generally, organizations and their technological environment (i.e., the set of all technological knowledge components) are two co-evolutionary partners that interact from different levels, that is to say, the micro-level (organizations) and the macro-level (technological environment). Following the Social Mechanisms model, each inventing organization at any point in time, as being nested with a specific technological environment, is exposed to certain technological knowledge (i.e., Situational Mechanisms). In its effort to adapt, survive, and prevail, an organization has to make certain decisions either concerning what technology to adopt or what technology to develop (i.e., Action-Formation Mechanisms). Adopting an existing or developing a new technology is not only a step in the organization's evolutionary path, but at the same time, it is a step in the evolutionary path of the technological environment (i.e., Transformational Mechanisms). The causality does not only run from the technological environment to the evolving organization (i.e., all the existing knowledge upon which an organization can potentially be based to develop new technological inventions) but it also runs from the organization to the technological environment (i.e., the new technological inventions developed by the organization and the prior knowledge selected and reproduced) (Murmann 2013).

As our perspective proposes, the effect of organizations on the evolution of patented knowledge environment follows the VSR pattern. In particular, the event of a patent grant can be viewed as a manifestation of the variation mechanism. Every time a patent is granted, one or more new variations are introduced into the population of technological knowledge components. More specifically, each patent contains a set of claims, which are the list of the specific technological developments for which the patent assignee is claiming exclusive rights (Harhoff and Wagner 2006). Patent claims actually declare the specific novelties that are claimed to have been achieved by a particular patent (Markman et al. 2004). Consequently, each claim can be considered as a new piece of knowledge for which the patent assignee asks for protection, or as a new variation in the population of technological knowledge components. Its novelty is guaranteed by the patent examiners and its contribution is explicitly and precisely defined within the patent document. The set of all claims that are included within the patented technological inventions constitute the set of all variations of patented technological evolution and, thus, the "raw material" on which the selection mechanism operates. Although some scholars have already stressed that, in general, novel ideas or artifacts can be viewed as manifestations of

the variation mechanism in the social sphere (Cordes 2006; Murmann 2013), those variations cannot provide the guarantees of novelty and the precision of contribution, in the way the patents can.

Proceeding with the mechanism of selection, I argue that the event of a patent citation can be viewed as a manifestation of the selection mechanism. When a patent cites another patent, it increases the longevity, the fecundity, and the degree of adaptation of the knowledge components of the cited patent (i.e., patent claims), which are selected by the citing patent as a basis to draw upon. Whenever a patent citation takes place, a new patented technological invention explicitly declares the knowledge upon which it was built, or, using the evolutionary terminology, it declares its technological ancestors (Martinelli and Nomaler 2014). The event of patent citation enlarges the presence of particular knowledge components within the patented knowledge environment. The selected knowledge components exist in more technological inventions after the citation. Or, in other words, the selected knowledge components heighten their fitness in the population of patented knowledge components, as their technological offspring increases (i.e., new patents that incorporate the selected knowledge).

In the same vein, Murmann (2013) argued that in the academic realm the selection process comes about because researchers adopt in their work only a subset of the ideas available at a given moment in time, meaning that each idea always competes with other ideas for the attention of researchers who are willing to incorporate certain ideas into their work. It would also be useful to refer to Nooteboom (2008, p. 77) who noted that "ideas are subjected to survival or death in selection, by adoption, citation, rejection, or neglect by scientific and policy communities". By analogy, each piece of novel knowledge within a patented invention competes with other pieces of novel knowledge from different patented inventions for the attention of the inventors who are willing to incorporate the appropriate for them knowledge components into their work.

It is necessary to emphasize that each inventing organization operates in a certain institutional environment and in given market conditions that certainty affect the organization's decisions concerning which prior knowledge to rely upon. By this, I mean that the institutional or the market effect is to some extent embedded in the organization's decision with regard to which knowledge to draw upon.

Relatedly, and in agreement with Knudsen and Hodgson's (2006) view that the outcomes of the selection process are not necessarily optimal, technological evolution does not always move on the basis of the optimal technological solutions, but various non-technological, sociopolitical factors play a critical role in the dominance or rejection of a technology (Rosenkopf and Tushman 1994; Tushman and Murmann 1998; Munir and Jones 2004). As Astley (1985, p. 231) puts it, "the triumph of a technological breakthrough over competing adaptations depends on its timing and the resources available to its champions rather than on its intrinsic superiority". This phenomenon can be captured in the patent system in cases where a technologically superior patent receives less patent citations compared to a competing, technologically inferior patent.

Finally, the event of a patent citation also can be viewed as a manifestation of the retention mechanism. Each citation denotes the transfer of knowledge from the

cited to the citing patent. The citing patent replicates and reproduces one or more knowledge components from the novel knowledge components of the cited patent. A patent citation reveals that certain knowledge components of the cited patent are copied and passed on, through learning, to the organization of the citing patent, even though it cannot reveal the degree of exactness of the replication. The organization of the citing patent copies successfully knowledge components from the cited patent, and by combining them with different knowledge components from other cited patents, it achieves to create a new technological invention. A patent citation declares that the copied knowledge component has become rooted in the knowledge base of the follower organization and has been used in the development of a new technological variation. Buenstorf (2006) stressed that the imitation of technologies among organizations can be framed as a form of the retention mechanism, giving the example of the patent license, in which a substantial amount of transfer of technological knowledge among firms takes place.

So, the event of a patent citation incorporates simultaneously both the selection and the retention mechanism. It is an event that manifests that the organization that owns the citing patent has already chosen and reproduced some certain knowledge components from the cited patent. There cannot be a patent citation without a selected knowledge component or a reproduced knowledge component. On the one side, a patent citation declares that the organization of the citing patent selected some knowledge components included in the cited patent as the most suitable piece of knowledge to draw upon, among the whole population of knowledge components that are included within the patented inventions. On the other side, a patent citation discloses that the organization of the citing patent assimilated knowledge components from the knowledge that is incorporated within the cited patent and achieved to reproduce them in such a way that, in combination with other knowledge components, resulted in the creation of a new patented invention.

Summarizing, each time a new invention is patented, a series of events set patented technological evolution into motion. First, one or more new variations (i.e., patent claims), whose novelty is guaranteed by the patent examiner, are added to the population of knowledge components included in patented inventions. Second, patent citations change the importance and the degree of adaptation of the existing technological variations and redistribute the size of their presence. The cited technological variations increase their fecundity since they have been used as seeds for the creation of new variations. Third, each patent citation is a declaration of the reproduction of certain knowledge components that took place during the development of the new invention. Knowledge components (i.e., the replicator) that were incorporated in the cited patent were replicated by the patent assignee (i.e., the interactor), and they were used as a basis for new technological variations.

It is important to emphasize that our concept is applied to the knowledge components created by organizations and included within patents and not on the organizations. I do not examine the competitive selection of the organizations but the competitive selection of the knowledge that is developed by organizations. However, it is reasonable to believe that the organizations that prevail in the arena of knowledge have an advantage over the competitors in the final arena, where firms compete for market shares, growth, and profits.

This particular relation between the prevalence of knowledge and the prevalence of firms can be viewed as a multi-level evolutionary relation, where the competition at the level of knowledge components affects the competition at the level of organizations. Firms that own the knowledge components that prevail over competing knowledge components are in a better position to prevail over rivals, mainly by developing innovations that are based on the prevailing knowledge components, which, in turn, can lead to powerful competitive advantages in the market arena (Tywoniak 2007; Kim et al. 2020).

4 Conclusion

The goal of this paper is to propose a conceptual approach that would be able to explain how the knowledge environment is dynamically shaped by organizations. Employing the Social Mechanisms concept to analyze the interactions of organizations and their environment, I conceptualized the knowledge environment as a population of knowledge components that evolves through processes of variation, selection, and retention, where organizational knowledge actions add new variations while altering the importance of the existing ones. Schematically, the knowledge environment is likened to a mosaic of knowledge components whose pieces are the novel knowledge components incorporated in organizational knowledge actions and their sizes are determined by the extent of their influence on subsequent knowledge actions.

The ability of an organization to shape its knowledge environment can determine its survival and growth (Hagedoorn et al. 2017; Shu and Lewin 2017). Our theory could offer a theoretical approach to explain how organizational actions transform into environmental characteristics and to evaluate the contribution of each organization to its knowledge environment, either by measuring its variations and their impact or by measuring its actions of selection and retention among existing variations. Organizations that introduce variations into their knowledge environment that are selected and reproduced to a large extent by future organizational knowledge actions are in a more advantageous position to succeed in the market compared to organizations that introduce variations that are selected and reproduced to a lesser extent. As their knowledge components prevail, so do the products, services, procedures, or practices that have resulted from these components.

By viewing the knowledge environment as a mosaic of knowledge components generated by organizational actions, we reject to view the knowledge evolution as a mechanical, endlessly repeated process (i.e., a repetition of the variation, selection, and retention mechanisms), but we make an effort to better understand the certain directions that knowledge takes (i.e., why does knowledge move toward this direction and not other?). Despite environmental pressures toward certain variations and selections, I assume the presence of choice within organizational knowledge actions (Nelson 2006; Tywoniak 2007). Incorporating choice in our theorizing, the exclusion of the determinism and blindness of knowledge evolution's direction is emphasized while the "organizational responsibility" is stressed. What I mean by the phrase "organizational responsibility" is that different choices, decisions, and

actions lead to different knowledge environments. The responsibility for the fact that the knowledge environment is in a given state and not in another, alternative state can be attributed to the organizations that are capable of taking decisions.

In the previous section, I employed patented knowledge as an exemplar to facilitate the understanding of the proposed perspective. However, I must emphasize that the proposed approach can be applied not only to technological knowledge but to non-technological knowledge, such as management or marketing knowledge (Damanpour 2014; Volberda et al. 2014). That is to say, organization knowledge actions can generate novel knowledge components concerning administrative issues (e.g., new business practices, organizational structures, administrative systems, and types of corporate governance) and alter the importance of the existing administrative knowledge by selecting and reproducing certain knowledge elements and rejecting others. Although they do not view knowledge evolution in the exact same way as I do, there exist studies that acknowledge and analyze the ability of organizations to shape their administrative environment. For example, Huygens et al. (2001) demonstrated how firms in the music industry develop new competitive regimes by introducing new practices that replaced the existing business models and Cantwell et al. (2009) researched how multinational enterprises influence local organizational routines by transferring their best practices across countries.

In conclusion, this article tackled a general but important issue in organizational science concerning the dynamic construction of organizations' environment on the basis of organizational actions. Adopting the VSR and the Social Mechanisms frameworks and using patented knowledge as an exemplar, this study focused on the deconstruction of the knowledge environment into its organization-level knowledge components embedded in organizational knowledge actions, aiming at providing scholars, managers, and policy-makers with a simple perspective to view the contribution of each organization to its knowledge environment.

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