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Rethinking the implementation of enterprise risk management (ERM) as a socio-technical challenge

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ABSTRACT

ERM is currently the risk management approach intended to render an organization more anticipatory and effective in evaluating, embracing, and managing the myriad risks that it may face. Accordingly, ERM has been embraced by a number of large and medium-sized organizations worldwide. However, many of those companies, while they still believe in the concept of ERM, are frustrated by implementation issues that have impeded the expected benefits of ERM.Therefore, this paper develops a theoretical framework that identifies social factors - factors peculiar to organizational structure and roles, human behavior and quality of working within the organization - and technical factors - factors peculiar to the organizational work system which includes technology, policies, rules procedures and related knowledge among other aspects - that are critical to achieving successful ERM implementation from the perspective of ERM as a complex process innovation. More specifically, this research addresses a significant question: What factors are critical to achieving successful ERM implementation? Given the significant disparity between the adoption and actual implementation and use of ERM, this is an important question. Our conceptualization of ERM implementation draws on three theoretical perspectives: the sociotechnical, the mutual adaptation and the dynamic capability perspective to frame our theoretical foundation. Yet, theories of process-based innovation suggest that an array factors combine together in influencing the extent to which complex business processes such as Enterprise risk management are successfully implemented. Our study casts light on the role of particular socio-technical factors that influence the successful implementation of ERM, extends our understanding of ERM beyond its current narrow financial view, and relates ERM implementation more closely to the challenges of management practice.

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Introduction

Renderings of the new economy have tended to portray today's business environment as a global competitive environment characterized by volatile technological factors, decreasing life cycles, labor market liberalization, and financial crises. To cope with these challenges, organizations increasingly adopt complex strategies, such as industrial and international diversification, sophisticated capital structures, and collaboration with customers and suppliers, to develop new

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products. However, despite their potential contributions, such strategies may have drawbacks, and under their guidance, risks facing organizations proliferate.

The range of risks that organizations may face is so extensive that practitioners and scholars have searched for a risk management approach that can account for potential interdependencies between risks and enables organizations to consider the likely effects of all types of risk on their organizational processes, products, and services, among other facets. In this respect, enterprise risk management (ERM) holds promise. ERM combines all risk management activities into one integrated framework that facilitates the identification of such interdependencies (Hoyt and Liebenberg 2011). Proponents of integrated risk management approaches argue that ERM has the potential to outperform traditional risk management approaches because of the synergy that can arise from the consideration of interdependencies between individual risks. Indeed, whereas individual risk management activities reduce earnings volatility from a single source, ERM reduces volatility by preventing the aggregation of risk across different sources (Hoyt and Liebenberg 2011). Consequently, interest in the integrated concept of ERM has been growing significantly over the last years according to the 2009, 2011, 2013 and 2019 RIMS (The Risk Management Society) Enterprise Risk Management (ERM) Survey. The 2011 survey reported that 80% of organizations either have or are in the process of developing an ERM program. Results of the 2013 survey suggest that ERM has now reached critical mass (over 60 percent) which means that continued adoption of the innovation has become self-sustaining and will create further growth (Risk Management Society (RIMS) 2013, 2019). However, while most companies believe in the concept of ERM, many are frustrated by implementation issues that have impeded the expected benefits of ERM (Miccolis 2003). For example, in Canada ERM programs are widely present in organizations, but remain works-in-progress because of insufficient dedicated human, technological or financial resources (Côté-Freeman 2019). Although a few companies such as Lego and GM (Fraser, Simkins, and Narvaez 2014) have had a fair measure of success, "some organizations have tried and failed; some are still trying to get started; and many of those who start are struggling and doing a partial job" (Fraser and Simkins 2016, p.2). Similarly, the annual survey of the North Carolina State University on ERM shows how most companies struggle. The 2019 survey reports that "Twenty-three percent of respondents describe their risk management as "mature" or "robust" with the perceived level of maturity declining over the past two years. Further, more than two-thirds of organizations surveyed in 2018 still cannot yet claim they have "complete ERM in place. Regardless of variations across organizations of various sizes and types, the results acknowledge that a substantial number of firms in all categories have no ERM processes or are just beginning to investigate the need for those processes (Beasley, Branson, and Hancock 2019).

The occurrence of such issues is not surprising, since ERM implementation is inherently a complex and difficult process that involves an organization's technical and social systems. Hence, the implementation team must address, in addition to technological issues, social issues that are often outside its control. But, researchers often approach the subject of ERM implementation from the viewpoint of an applied problem by, for instance, assessing the value implications of ERM programs, determining an organization's risk appetite, or identifying and assessing risk from an ERM perspective. The prevailing description of ERM in technical terms tends to prevent both scholars and practitioners from being fully sensitive to the social issues associated with ERM implementation. Therefore, the ensuing research frequently devotes little attention to social theories about ERM implementation. This paper aims to fill this research gap by developing a balanced framework wherein both technical and social factors critical to achieving successful ERM implementation are contemplated. In doing so, this article aims primarily to contribute to 1) enriching the conversation on ERM by introducing relevant work on risk management, strategic management, organizational change and other relevant topics, as called for by Bromiley et al. (2015); 2) raise awareness about the importance of regarding ERM implementation as a socio-technical process that can easily fit into the traditional governance-oriented view; and 3) increase

the success rate of ERM implementation by drawing managers' attention to a series of often overlooked critical factors that must be considered for successful ERM implementation. Incidentally, by introducing the sociotechnical perspective into the conversation about ERM, this paper expects to foster the development of conceptual vocabularies and epistemological fundamentals that will enable both scholars and practitioners to better understand and interpret complex and multifaceted sociotechnical ERM phenomena.

The paper is organized as follows: Following this introduction, the literature on ERM implementation frameworks is succinctly reviewed. The next section describes the theoretical underpinnings of our model based on a conceptualization of ERM and ERM implementation. Then, the theoretical model and propositions are developed. Finally, the article concludes with a discussion of the paper's theoretical and practical contributions.

Literature review

ERM existing frameworks

With many organizations engaging in some aspects of ERM, the need for guidance in the implementation of ERM has emerged (Hexter 2007). In response, a number of frameworks have been introduced, the most widely known of which are: 1) COSO's Enterprise Risk Management—Integrated Framework issued in 2004 and updated in 2017 2) the Casualty Actuarial Society's (CAS's) framework in 2001; 3) and the ISO 31000 risk management framework in 2009 including the ISO 31000: 2018 Risk management - Guidelines.

By targeting risks related to strategic, operations, reporting, and compliance objectives and by involving all segments of the organization (Kimbrough and Componation 2006) , COSO's integrated framework aims to help organizations assess their existing risk management methods to draw a roadmap for ERM implementation (Hexter 2007). While the COSO's 2004 ERM framework defines and discusses essential enterprise risk management components, key ERM principles, and provides clear direction and guidance for enterprise risk management; the 2017 frameworks put a stronger emphasis on how enterprise risk management informs strategy and its performance by providing greater insight into the links between strategy, risk, and performance. It is intended to help organizations deal with risks that have become increasingly volatile and complex while facing increased regulatory pressures. The CAS framework similarly covers hazard, financial, operational, and strategic risks, which are managed through a systematic process across the entire organization. The ISO 31000 risk management framework concerns a more extensive list of risk categories.

Common to these frameworks is their underlying assumption that all risk management models follow a sequential process comprising stages such as risk identification, risk analysis/assessment, and risk response or treatment.

Despite their usefulness, these frameworks may be challenged on many grounds. First, they tend to be prescriptive and normative, and they adopt a rational model stance. Accordingly, they implicitly hold that organizational members have at their disposal all the information that is needed to identify and assess all the risks that the organization faces and to devise solutions aimed at mitigating those risks. These frameworks also implicitly assume that organizational members are sufficiently competent to collect, evaluate, and apply information in a rational manner to make decisions regarding risk management on the behalf of the organization. Consequently, they are silent about central concerns such as the involvement of employees, the willingness of organizational members to invest the time and effort to acquire new knowledge about risk management, the extent to which the organizational climate favors the changes induced by ERM implementation, and the extent to which various functional departments are ready to adapt their structures to accommodate ERM implementation. Because of their overreliance on a rational model, these frameworks oversimplify the complexities of human action in

context and fail to account for the human agency or social meanings by which actors interpret and act on the behaviors of others (Hirscheim 1985; Levine and Rossmoore 1993).

Second, these frameworks primarily focus on managing risks from the perspective of ERM governance. They aim not to guide the implementation of ERM but to provide a model that would be readily usable by organizations to manage all their potential risks in an integrated fashion. Because of the above limitations, many organizations have expressed dissatisfaction with the proposed normative and regulatory ERM frameworks (Beasley, Branson, and Hancock 2008).

In addition to these frameworks, the literature on risk management has provided a plethora of trade and business articles related to ERM and directed at top management. Moreover, although rare, some academic work on ERM exists. However, because ERM is relatively a new risk management paradigm, academic research in this area is fragmented, addressing various topics, such as the fundamentals of ERM (Hampton 2009), the determinants of ERM (Hoyt and Liebenberg 2011), the adoption of ERM practices (Paape and Speklé 2012), the relationship between ERM and firm performance and value (Florio and Leoni 2017; Kommunuri et al. 2016; Malik, Zaman, and Buckby 2020; McShane, Nair, and Rustambekov 2011), capital allocation decisions under ERM (Aabo and Simkins 2005; Ai et al. 2012), and the role of corporate boards and internal auditors in ERM (Brancato et al. 2011; Siti Munifah and Suryandari 2019).

ERM implementation

As mentioned previously, our study focuses on a relatively under researched aspect of ERM, its implementation, and particularly factors critical to achieving successful ERM implementation.

Implementation has been defined in many ways. It may refer to a dynamic never-ending process of mutual adaptation between an innovation and its environment to correct the usual misalignments between the innovation and the environment (Leonard-Barton and Deschamps 1988). Alternatively, it may refer to a process that begins with the initial idea for a new practice/approach or methodology and the changes that it conveys and terminates when the new practice has been successfully integrated with the organization's work systems (Lucas 1990). Synthesizing these ideas, we conceive of implementation as the process whereby target users adopt, accept, and routinize an innovation into their normal working procedures (Kwon and Zmud 1987).

In this regard, many studies have analyzed various aspects of ERM implementation. One such aspect is the relationship between ERM implementation and firm value, particularly the extent to which the level of ERM implementation positively affects the value of listed companies. For instance, some studies show that ERM implementation increases the firm value overall, regardless of the specific industry end user (Bertinetti, Cavezzali, and Gardenal 2013), and those organizations view ERM implementation as a strategic business initiative rather than a compliance requirement (Waweru and Kisaka 2012). Another topic of interest relates to factors associated with ERM implementation. Research on this topic aims to explain why some organizations respond to changing risk profiles by implementing ERM while others do not. Drawing on the hypothesis that strong corporate governance agents are likely to advocate for ERM implementation, Beasley, Clune, and Hermanson (2005) find that the stage of ERM implementation is positively related to the presence of a chief risk officer, board independence, apparent support for ERM by the CEO and CFO, the presence of a Big Four auditor, entity size, and operation in the banking, education, and insurance industries. Waweru and Kisaka (2012) find a significant relationship between the appointment of a chief risk officer and companies' level of ERM implementation but, contrary to what one might expect, do not find a significant relationship between the level of ERM implementation and variables such as firm's industry, board independence, size, and growth rate. Similarly, Desender (2010) finds that the position of the CEO on the board has an important influence on the level of ERM but that board independence by itself is not

sufficient to induce higher levels of ERM. Board independence is significantly related to ERM only when firms lack CEO duality, as firms with an independent board and no CEO duality show the highest level of ERM.

More recently, research attention has focused on the way that organizations actually implement ERM. For instance, Altuntas, Berry-Stölzle, and Hoyt (2011) examine the extent to which German property-liability insurance companies with premiums written in excess of 40 million Euros implement ERM, including the sequence of implementation for this evolving risk management process.

However thoughtful such studies may be, they nevertheless fail to capture the complexity of actual ERM implementation in organizations and neglect organizational features that may affect the success of ERM implementation. In particular, they fail to consider the social actors within the organization in terms of their concerns about the ERM integration requirements and their willingness and ability to contribute to such a complex endeavor. Moreover, no study has systematically proposed factors that are critical to achieving ERM implementation.

In trade and business publications, some action steps for ERM implementation have been documented, and although these guidelines are useful, their theoretical foundations remain unclear, leaving doubt about their reliability and validity. Therefore, theoretical frameworks have yet to explain how to successfully implement ERM. Such frameworks are needed to investigate both the technical and the social aspects of ERM implementation and to question the assumption that an ERM model will straightforwardly integrate an organization's work systems if the risk appetite is clearly defined, limits and monitoring procedures are in place, and the board and a set of risk committees at both corporate and business unit levels are involved.

Actually, our main argument is not that the extant integrated risk management body of knowledge with its concepts, methodologies and tools is of limited value, but rather that a more managerial approach is needed to enrich and extend ERM beyond its current narrow financial view, and relate its implementation more closely to the challenges of management practice.

Theoretical underpinnings

This section considers a number of broad theoretical questions that underlie the technical and social issues associated with ERM development and implementation. In this respect, particular attention is devoted to the conceptualization of both ERM and ERM implementation.

A major difference between ERM and traditional silo-based risk management methodologies relates to the integrated nature of ERM. Compared with traditional risk management approaches with a more specific locus, ERM spans multiple departments/divisions within an organization. Organizations use increasingly more sophisticated structures that comprise many disparate specialized units arranged into departments and divisions. In the process of implementing ERM, these specialized units must be integrated, or they must interact with one another both internally and externally. In large organizations, this amounts to bringing together numerous entities with divergent interests and competencies in risk management. Therefore, ERM may be conceptualized as a complex process innovation characterized by fuzzy boundaries, a hard core which comprises the irreducible elements of the approach itself, and a soft periphery which refers to the organizational structures and systems that are required for the full implementation of the innovation (Greenhalgh et al. 2004). In addition, ERM should be regarded not as a sole innovation but as a range of distinct risk management methods that must be logically integrated as part of an enterprise-wide implementation strategy. Accordingly, successful ERM implementation requires extensive effort to transform an organization's work system to allow for the cross-organizational integration of data, business processes, and policy. Such a transformation is highly dependent on operational managers and leaders' understanding of the meaning and purpose of integration considering the challenges involved. Actually, this integration process gives rise to

two potential challenges: The first challenge concerns business integration, that is management's ability to establish tighter coordination among the discrete business activities conducted by different individuals and work groups within the organization to form a unified business process (Markus and Tanis 2000). The second challenge concerns social integration and refers to the ability and willingness of different individuals, work groups or business units to work together in order to develop, establish and carry out operationally integrated processes (Elbanna 2007).

Finally, Despite the ambiguities and disagreements about what constitute ERM, there is a consensus that the goals of ERM include: managing the risk of a portfolio, incorporating not only traditional risks but also strategic ones, and seeking a competitive advantage from managing a particular risk (Bromiley et al. 2015). These position ERM as an artefact - something that is created with a particular purpose and will only be of value to the extent that if it provides the utility for which it was designed (Simon 1996). The nature of an artifact is such that the creation process , as well as the application process, take place in close cooperation with the human or social element. This synergy between the social aspect and the technological aspect (the design, creation and use of the object) gives rise to a socio-technical system (Scribante, Pretorius, and Benade 2019). As a socio-technical system, ERM can also be regarded as a practical system in which practical problems - a gap between the current state and the desired state, as is perceived by the social element involved - arise. These practical problems often have to do with ERM implementation challenges and hurdles.

Therefore, ERM implementation represents a socio-technical challenge.

Given our conceptualization of ERM implementation, we ground our theoretical foundation on three distinct lines of research. First, the socio-technical perspective offers insight into the nature and interrelatedness of the many organizational issues that are involved in ERM implementation. Next, the mutual adaptation perspective contributes to our awareness and understanding of the potential misalignments between ERM and the organizational environment including the range of potential corrective actions and contextual conditions that are likely required. Finally, the dynamic capability perspective to strategic management offers insight into the resources, competencies, and processes that facilitate the use of ERM. In the following sections, we briefly present relevant arguments from these three lines of research.

ERM implementation as a socio-technical challenge

The successful implementation of an ERM project may be a complex and difficult undertaking, as it involves changes in many organizational spheres, such as business processes or work practices, and requires collaboration among functional units, including a range of interrelated organizational issues. A systemic approach allows us to conceptualize the issues associated with the implementation of the ERM as a whole—that is, to identify the ERM features and their attributes, to determine the relationships among these features, and to account for the dynamics of the integrated risk management advocated by ERM. More specifically, ERM is better thought of as a socio-technical system, namely a network of people, tools, documents, and organizational routines (Bijker and Law 1992; Kling and Scacchi 1982).

As such, ERM can be described to comprise two interdependent subsystems: a technical subsystem and a social subsystem. The social subsystem concerns the attributes of people (e.g., attitudes, values, skills), the relationships among people, rewards systems, and authority structures, whereas the technical subsystem addresses the processes, tasks, and technology that are needed to transform input to output (Bostrom and Heinen 1977). Here, technology must be understood in a broad sense as the body of knowledge concerning the relationship between machines and the process by which the organization transforms input into output.

Mutual adaptation and dynamic capabilities: the interplay

An ERM development and implementation project usually follows a threefold procedure. First, business processes are analyzed and reconfigured into a new process architecture that matches the organization's value chain. Second, ERM system specifications are defined and developed. Finally, ERM is integrated into the organization's work system.

Despite the logic of this sequential procedure, misalignments between the organizational context and the ERM system are likely to occur (Leonard-Barton 1988a; Leonard-Barton 1988b) because specifying the requirements of the ERM system may be difficult at an early stage and because the configuration and content of the ERM system may evolve during the project lifetime (Jacobson and Booch 1999). Such misalignments are solved by either altering the ERM model or changing the environment—or both (Leonard-Barton 1988b). With regard to ERM development and implementation, changing the environment primarily involves modifying the organization's work process or work practices, whereas altering the ERM model involves substantially modifying its attributes in terms of content and configuration. Consequently, ERM is best implemented in a way that allows for progressive learning along with cycles of adaptation. More specifically, ERM implementation should be regarded as a process of mutual adaptation between the organizational context and the ERM system so that the process architecture and the ERM system are dynamically coupled together. Mutual adaptation recognizes the need for organizations to locally reinvent innovations so that they better match their norms and capacity (Berman et al. 1979). Indeed, previous research shows that mutual adaptation is associated with the successful implementation of innovations. However, managers' vigilance is required to avoid adaptations that are likely to render the ERM very different than originally envisioned and potentially compromise it.

While very significant, mutual adaptations cannot alone guarantee the success or failure of ERM implementation as the making of such adaptations relies on the proper coordination and integration of the underlying organizational processes. This makes it evident that to cope with the complex mutual adaptations inherent to ERM development and implementation, organizations have to leverage their capabilities to build, integrate, and reconfigure internal and external competencies (Eisenhardt and Martin 2000; Teece, Pisano, and Shuen 1997). In other words, since some of the adaptations will involve remodeling and optimizing operational routines and eventually developing new business models, dynamic capabilities geared towards coordination, reconfiguration, transformation and integration of resources will be highly needed. Indeed, the concept of dynamic capabilities as firm-level resources has been developed within the background of a need for capabilities in adaptation to volatile environments. However, some recent studies have found that endogenous factors such as internal pressures of the kind of mutual adaptations described above are likely to trigger dynamic capabilities (Zahra, Sapienza, and Davidsson 2006). Moreover, mutual adaptations for ERM implementation actually are deep and purposeful changes as they involve taking action towards reaching an envisioned end state (Sune and Gibb 2015). Undertaking such purposeful adaptive changes also require the ability "to reconfigure a firm's resources and routines in the manner envisioned and deemed appropriate by its principal decision-maker" (Zahra, Sapienza, and Davidsson 2006 p.918), as to reach the intended outcome.

The kind of dynamic capabilities needed is dependent upon the kind of change at stake. ERM implementation entails second-order changes (Watzlawick, Weakland, and Fisch 1974) since ERM reframes the silo-risk management problem into a holistic procedure, wherein the risk management system itself changes. The idea of a hierarchy of change mirrors that of a hierarchy of capabilities. In this regard, second-order capabilities (Collis 1994), also referred to dynamic capabilities (Zahra, Sapienza, and Davidsson 2006) can be associated with the kind of changes taking place when implementing ERM. More specifically, ERM implementation, given the very nature of the deep and purposeful changes involved, requires particular dynamic capabilities. That is, those capabilities involved in the transformation of an organization via the modification of its resource base such as the reconfiguration, leveraging, learning and creative integration processes

(Bowman and Ambrosini 2003) including the managerial capabilities required to bring profitable firm change and growth (Helfat, et al. 2007).

Framework development

Embedding the mutual adaptation and the dynamic capability perspectives into the socio-technical perspective highlights five social factors (strategic orientation, senior management support, coordination mechanism, stakeholder involvement, and organizational climate) and three technical capabilities (knowledge integration capability, information technology (IT) capability, and organizational change capability (OCC)) that are critical to achieving successful ERM implementation. Each of these critical success factors is described below.

Social subsystem

With regard to the social subsystem, a by-product of the socio-technical philosophy relates to ideas such as getting stakeholders involved in all deployment stages, providing a satisfactory work environment. In the context of ERM implementation, this raises awareness on the complex set of conflicting interests and power dynamics which call for not only a strategic orientation and senior management support, but also for coordination mechanism to be in place. The socio-technical perspective also raises concern about subtle issues regarding people experience with ERM in the organizational contexts such as their involvement and the organizational climate.

Strategic orientation framework

ERM implementation, for its complexity calls for the use of a strategic orientation framework which makes clear the vision and the business rationale of the project.

The vision serves to clarify the objectives and overall direction of the project. It should be established as early as the design phase of the project and should be consistent with the project definition, scope, objectives, and strategy. Previous research shows that business objectives and a clear vision are critical factors for the successful implementation of process innovation projects, such as Enterprise Resource Planning (ERP) and ERM, that span across an organization (Cooke and Peterson 1998).

The business rationale concerns the value propositions that promote the ERM project, including how it should be justified, funded, and legitimized. A compelling strategic rationale provides a range of criteria whereby the implementation project may be justified. It is commonly formulated and articulated by senior management to draw attention of the rest of the community of managers to the appropriate ways to incorporate the innovation into the organization's work system (Chatterjee, Grewal, and Sambamurthy 2002). As such, the rationale must highlight the expected benefits of the project, including the involved changes. Regarding ERM, despite its strategic character, the rationale must be disseminated at the operational project level so that it is understood by those responsible for implementing the ERM project (Cooke and Peterson 1998).

In summary, we propose that vision and business rationale combine to form a strategic orientation. The existence of this orientation will facilitate stakeholders' involvement in the ERM implementation project and consequently the implementation success

Senior management support

A number of barriers may render the ERM implementation process difficult. In particular, managers and employees may believe that the ERM project has no end in itself and that it merely serves to satisfy shareholder demands or to respond to institutional pressures from external entities, such as government agencies and consultants. Of course, a strategic orientation can help

overcome these barriers. However, conventional wisdom assumes that this influence can be weakened in the absence of top management support in the form of brokerage and championship. Several scholars have evidenced the critical role of top management support in the implementation of complex innovations (Armstrong and Sambamurthy 1999; Chatterjee, Grewal, and Sambamurthy 2002; Liang et al. 2007). For enterprise-wide innovations such as ERM, top management support is especially critical for building partnerships among functional unit executives (Doll and Vonderembse 1987). In particular, ideas from one group might solve the problems of another—but only if connections between existing solutions and problems can be made across the boundaries between them (Hargadon and Sutton 1997). Top managers, through their boundary-spanning roles, are well-positioned to help make these connections and to play a brokerage role by filling the gap in the information flow between functional units. As knowledge brokers, they are the first organizational members to see new opportunities created by the needs in one functional area that could be served by skills in another functional area (Burt 1992).

From a structural perspective, brokerage tends to benefit only brokers. Indeed, as they bridge different knowledge areas, brokers gain exposure to a larger range of ideas and obtain a vision advantage (Burt 1992) that may enhance their individual social capital. However, in the realm of ERM, brokerage should aim to enhance communal social capital—that is, the benefits that accrue to the collective owing connections among parties (Ibarra, Kilduff, and Tsai 2005). Brokerage in this alternate conception primarily entails closing the structural gap by connecting parties to facilitate coordination, collaboration, and common goal pursuit (Obstfeld 2005). Therefore, the collective benefits resulting from these connections may translate into "more systematic organizational endeavors such as knowledge transfer that allow task-relevant information and tacit understandings to permeate subunit boundaries"(Ibarra, Kilduff, and Tsai 2005). With regard to ERM, the brokering function of top management will involve the integration of new and old risk management methodologies in ways that allow ERM to function properly. Indeed, top managers are those charged with importing external knowledge and integrating internal knowledge (Mitchell 2006), and are the primary agents responsible for changing organizational structures and policies, including the norms, values, and culture within an organization (Liang et al. 2007). All these changes are needed for successful ERM implementation. Precisely because of their boundary-spanning role, top managers are endowed with sufficient authority to sponsor the types of changes that ERM development and implementation entails. Accordingly, managers will be more inclined to provide resources and to exert their authority to help the project succeed (Slevin and Pinto 1987).

In addition to brokerage, one can reasonably speculate that senior management championship (Chatterjee, Grewal, and Sambamurthy 2002), namely, senior managers' beliefs about and participation in ERM initiatives will shape the vision and strategies for ERM and therefore foster engagement among the targeted organizational actors in the ERM project. The extent to which top managers believe that ERM offers a strategic opportunity is likely to signal the managerial community that the organization's leaders view ERM as a valued and important initiative. Because top managers' beliefs strongly influence employees' beliefs and attitudes, operational-level managers will be prone to place the ERM project at the top of their priority list. In fact, through their beliefs, top management can provide departmental and functional unit managers with a vision of the purpose of the ERM system in terms of opportunity and risks (Chatterjee, Grewal, and Sambamurthy 2002). In addition to exhibiting their beliefs in the ERM project, top managers can participate by taking such actions as promoting the project, shaping the vision and strategies for ERM, allocating resources, and removing barriers. In so doing, they forcefully signal to other managers and targeted organizational members the extent to which they value the ERM project.

Coordination mechanism

Several studies have stressed the need for adapting the firm's operational structure to accommodate the implementation of an innovation. Such adaptations may purely refer to the adoption of

coordination mechanisms such as standard procedures, liaison roles and supervision teams or formal and informal integration mechanisms aimed to better manage operational activities (Tushman and Nadler 1978). Coordination mechanisms are deemed vital for sharing and integrating distributed knowledge across the firm (Grant 1996). In the particular context of ERM implementation, coordination is essential to integrate the specific knowledge developed and accumulated in the course of practice and deliberation by different functional units of the organization. The establishment of a liaison team in charge of coordinating the activities of the implementation project has proved effective in many cases cited in the literature. The literature also supports the practice of entrusting dedicated teams with the management of the innovation process. We presume that the establishment of coordination mechanisms is likely to promote the coupling of knowledge between different functions such as production, marketing, finance, etc. Thus, the coordination mechanisms would allow managers to develop transversal knowledge necessary for integrating ERM into the specific operations of their units. Accordingly, we anticipate that the use of appropriate coordination mechanisms will foster the successful implementation of ERM.

Employee involvement

Implementing ERM greatly expands the range of skills that agents involved in risk management should be proficient in. It also requires them to collaborate with other functional units' members and to give access to their *private garden*, that is, their information and know-how. Thus, ERM implementation entails considerable behavioral changes training, and learning. Consequently, merely adjusting the work system — the organizational structure and work practices — is insufficient; attitudes and behaviors also need to be addressed. Accordingly, targeted employees must make a personal investment, to which they will consent only if certain conditions are met. In particular, employees must feel involved in, cognitively preoccupied with, engaged in, and concerned with the ERM project (Paullay, Alliger, and Stone-Romero 1994). Indeed, highly job-involved employees devote substantial effort to achieving organizational objectives (Kahn 1990; Lawler 1986). Therefore, the more involved employees are in their job, the more prone they will be to engage emotionally, behaviorally, and cognitively in their effort to develop the knowledge, competencies, new attitudes, and behaviors that are critical to ERM development and implementation. Further, operational-level employees possess an invaluable understanding of their company and thus important knowledge for the company. These resources can be leveraged via the use of management practices that trigger and foster employee involvement. Accordingly, we propose that incorporating employee involvement programs into an organization is critical to achieving successful ERM implementation.

Organizational climate

Implementing ERM may substantially change the ways organizations usually conduct business, affecting functions ranging from operations to strategic management. Regardless of the nature of any change, its implementation is always contingent on the organization's culture (Kanter 1983). Indeed, some of the basic tenets of ERM seem particularly susceptible to the influences of cultural norms. ERM requirements include collaboration among all functional areas, transparency regarding risks, the establishment of a common risk language, the adoption of new procedures, and the ability to integrate ERM within management structure and processes. As these requirements relate more to the work environment than to organizational culture, we believe that it is the work environment and particularly the organizational climate that may enable or impede ERM development and implementation. In the literature, organizational culture is often confused with organizational climate and several scholars use the organizational culture construct when it

would be more accurate to refer to the organizational climate construct (Shadur, Kienzle, and Rodwell 1999).

In general, culture may be viewed as a system of values, norms, beliefs, and structures that are embedded into a group or community (Schein 2017). Organizational climate refers to organizational members' shared perceptions concerning the most salient features of the work environment, such as organizational policies and both formal and informal procedures (Reichers and Schneider 1990). In this regard, culture refers to the more deeply held assumptions that help guide an organization's members, while climate can be best thought of as the surface component or manifestation of culture (Schein 2017). Note that several climates can co-exist within a single organizational environment if individuals attach specific meanings to separate sets of organizational features (Schneider and Reichers 1983). For example, a work environment might be characterized by a climate of workplace safety, a climate of service, or a climate of self-fulfillment (Mikkelsen and Grønhaug 1999). Accordingly, what characteristics of organizational climate are deemed most relevant to ERM development and implementation? ERM development and implementation necessitate that organizational members who are involved in risk management continuously update their knowledge and competencies and demand that different functional areas work together. If deliberate integration strategies and mechanisms are implemented to this end, a climate of integration that promotes professional interdisciplinary and cohesion among knowledge area executives and teams is likely to emerge.

Empirical evidence shows that a supportive climate significantly predicts each of the three employee involvement variables, i.e., participation in decision making, teamwork, and communication (Shadur, Kienzle, and Rodwell 1999). Therefore, if organizations implement strategies to support learning and continuously upgrade their staff members' competencies, they will likely engender an organizational climate that is conducive to ERM development and implementation.

Technical subsystem

The technical subsystem is concerned with the devices, processes, tasks, and technology needed to transform inputs into outputs. As such, it comprises the set of physical and organisational elements formally organised on the basis of more or less standardised norms, rules and roles with a view to achieving predefined objectives. In the context of ERM implementation, the sociotechnical perspective draws attention to such capabilities that enable organizations to exchange information across internal and external boundaries, integrate various types of domain-specific knowledge, and manage interrelated changes initiatives.

Infact, we need to stress that there is no one-size-fits-all approach to ERM; hence, the development of an ERM program and the corresponding implementation strategy are unique to a particular organization, rendering their content and configuration unpredictable. Thus, as organizations strive to manage risks across the organization, they are prompted to develop an internally and externally focused integrative capability.

Activities related to ERM development are prone to span the boundary between the organization and its external environment and are related to external integration (Iansiti and Clark 1994). Indeed, because many risks originate from outside the organization, ERM development entails the design of mechanisms aimed at capturing the current and future states of the environment. Accordingly, an organization's external integrative ability, that is, the organization's ability to move information rapidly across its boundaries (Henderson and Cockburn 1994), is important for ERM development.

Risk management across an organization involves complex interactions among departmental and functional units. Hence, the ERM process needs to be linked to other organizational processes, routines, resources, and capabilities to embed ERM procedures into an organization's daily operations. Accordingly, ERM implementation relies on integration activities that are largely

internal to the firm, involving the integration of existing specialized skills, knowledge bases, and technical and managerial systems (Iansiti and Clark 1994). Internal integrative capability enables the organization to align its different processes and to exchange information effectively across the boundaries of functional and knowledge areas (Henderson and Cockburn 1994).

With regard to ERM development and implementation, an organization's knowledge integration capability, IT capacity, and organizational change capacity seem to be the most relevant integrative capabilities.

Knowledge integration capability

ERM cuts across various functional areas, such as marketing, production, and finance, in an organization. Each functional unit constitutes a center of excellence that assembles specialists in a particular field; and may be regarded as a "pocket of domain-specific knowledge" with its own ways of thinking, methods, tools, and vocabulary. Accordingly, interfaces between functional units conform to knowledge boundaries. In fact, the characteristics of knowledge leading to innovative solutions within a functional unit may actually hamper problem solving and knowledge creation across functions (Carlile 2002). Further, ERM follows sequential risk management steps, such as risk identification, assessment, and response or treatment. Interfaces between these various phases also constitute knowledge boundaries.

Carlile's (2004) integrative framework is particularly useful for examining the problems that functional units' specialized knowledge poses to ERM implementation. Three progressively complex boundaries — syntactic, semantic, and pragmatic (Carlile 2002; Shannon and Weaver 1949) — and three corresponding complex processes are generally defined in relation to the movement of knowledge. Further, three relational properties —difference, dependence, and novelty — characterize the varying circumstances that are possible at a given boundary (Carlile and Rebentisch 2003). Difference concerns the difference in the type of domain-specific knowledge that is accumulated over time in a functional area. Dependence refers to a condition wherein two or more entities pursuing the same goals must account for each other if they are to succeed. Novelty concerns how novel the circumstances are at a boundary. It often arises when there is a lack of common knowledge to adequately share and assess domain-specific knowledge at a boundary (Carlile 2004). As novelty increases, knowledge sharing and assessment between actors moves from the syntactic to the semantic boundary and finally to the more complex pragmatic boundary.

In the risk identification phase, the knowledge boundary can be considered syntactic. At this stage, the knowledge differences between agents are minimal in the sense that all agents, regardless of the functional area to which they belong, can agree on whether a potential event constitutes a risk. Similarly, we can assume that dependencies between actors are minimal because each functional area is responsible for identifying its own risks. The exchange or movement of knowledge across this boundary occurs through knowledge transfer, which requires only that the actors have a shared and stable lexicon. Thus, with respect to ERM, for the various functional areas to identify the risks facing an organization in an integrated way, the organization must have previously created a common language to describe risks. From a practical standpoint, the creation of such a common language could involve developing and implementing a risk definition methodology and terminology that is approved by all functional areas.

When novelty increases and thus renders some differences and dependencies unclear or some meaning ambiguous, the transition from a syntactic to a semantic boundary occurs (Carlile 2004). In such circumstances, the interpretation and relevance of knowledge differ between each side of the boundary, and a common syntax must be created to enable the exchange of knowledge across the boundary. In other words, knowledge specific to actors located on either side of the boundary needs to be translated for the benefit of the actors on the opposite side. Therefore, the knowledge exchange across the semantic boundary relies on a translation process.

This situation is comparable to that prevailing in the risk analysis and assessment phase. At this stage, the probability of the occurrence of risks and the severity of their effect on the organization's performance parameters are determined. Therefore, given their experience and their disciplinary mode of reasoning, functional areas can arrive at distinct points of view. In other words, risk analysis and assessment increases the degree of novelty and in so doing triggers the transition from a syntactic to a semantic boundary. At such a boundary, what is at stake is a matter of interpretation, as the differences and dependencies between actors are not known. Therefore, in addition to a common syntax or language, the organization must have the ability to translate knowledge regarding risk management that is specific to each of the functional areas so that it can be understood by others. Therefore, in the risk analysis phase, knowledge exchange relies on a process of translation.

Similarly, as novelty increases, conflicting interests between stakeholders eventually arise because differences and dependencies regarding knowledge engender negative consequences for actors from each functional area. Therefore, a change is needed to achieve a set of common interests. Pragmatically, such a change amounts to the transformation of knowledge specific to different functional areas to balance the competing interests. This situation corresponds to that prevailing in the risk mitigation stage of ERM.

In light of the preceding development, ERM successful implementation is premised on the firm's dynamic capability to integrate these disparate pockets of domain-specific knowledge, at least with regard to risk management. Knowledge integration capability, as a pivotal organizational capability to create a shared and stable risk management syntax, to generate a mutual understanding, and to transform existing knowledge as to balance competing interests is mandatory for successful ERM implementation.

IT capability

It is not redundant to reiterate that ERM is an organization-wide approach to risk management. Organizations can be regarded as open systems that nest a series of subsystems, each concerning a different sector of the organizational environment (Boulding 1956). Given the uncertain nature of their environment, organizations are compelled to seek information on which to base their actions. For the purpose of implementing and running ERM, the organization's departmental and functional units are engaged in tracking and making sense of myriad events originating from inside and outside the organization. However, the value conveyed by these scanning and sense-making processes is dependent on both the range and the quality of the information collected. Therefore, information obtained about the environment must be filtered before being processed and used. Organizations must therefore develop capabilities to scan the environment, process information, give meaning to data through translating events, developing a shared understanding between stakeholders, and finally devising risk solutions based on the interpretation of obtained knowledge (Daft and Weick 1984). These capabilities are far too complex to implement without IT support capabilities, such as well-designed IT infrastructure. Further, as the volume of information that organizations need to process exceeds the capacity of human processing, IT systems enable organizations to make sense out of information that would otherwise submerge them (Overby, Bharadwaj, and Sambamurthy 2006). Moreover, ERM infrastructure is affected by IT in many other ways. Enterprise information systems (EIS) help with not only the ERM process but also issues such as time-series modeling, correlations, and other advanced modeling techniques.

More specifically, digital options that are "a set of IT-enabled capabilities in the form of digitized enterprise work processes and knowledge systems" (Sambamurthy, Bharadwaj, and Grover 2003) are obviously part of the most relevant IT capabilities. Digitization with respect to processes refers to the extent to which IT-enabled organizational processes are connected and integrated. A basic premise of digital options theory is that IT enhances both the reach and the

richness of a firm's knowledge processes. Knowledge reach refers to the comprehensiveness and accessibility of codified knowledge that is available to a firm, including the interconnected networks and systems that enable knowledge sharing and transfer among individuals. With respect to that, a well-designed IT infrastructure is supposed to help firms access, synthesize, and exploit knowledge from a wide range of sources. IT creates digital options by extending processes' reach in the sense that digitized processes tie activity and information flows across departmental and functional units (Overby, Bharadwaj, and Sambamurthy 2006; Sambamurthy, Bharadwaj, and Grover 2003). Accordingly, organizations can be better integrated internally and externally with external customers, suppliers, and partners. Regarding ERM, organizations can therefore be better equipped to identify the range of potential risks that they face and to devise appropriate solutions.

Although the capability of identifying the range of complex risk relies on a process reach that allows for greater process participation among relevant ERM project stakeholders, the quality of both risk analysis outcomes and risk mitigation measures relies heavily on the richness of digitized processes. IT enhances knowledge richness by providing firms with high-quality information that is timely, accurate, descriptive, and customized to the recipient (Evans and Wurster 1999). In the context of ERM, such IT-enabled capabilities allow departmental and functional units to better share their specific risk management methodologies and to develop tacit knowledge owing to sustained interactions among organizational members.

Organizational change capacity (OCC)

Implementing ERM entails modifying the way that organizations usually conduct their affairs, including their business processes. The organizational change literature suggests that organizations should develop their change capability if they need to implement such changes. OCC enables organizations to lead and manage a cascading series of interrelated change initiatives that are consistent with an intended type of strategy dynamics (McGuinness and Morgan 2005). In this regard, OCC relates to how organizations can use their managerial and organizational capabilities to implement the kinds of changes that are needed to achieve ERM development and implementation. In fact, one important aspect of ERM concerns the combination of all risk management activities into one integrated framework that facilitates the identification of interdependencies between risks across activities. However, many of these risks originate from organizations' external environment, which comprises dynamic change conditions. Further, ERM is expected to render organizations more anticipatory and effective in evaluating, embracing, and managing the myriad risks that they face. Therefore, the viability of ERM relies on organizations' capability to monitor their external environment. Hence, an organization's capacity for change becomes increasingly important as the pace of change outside the firm increases. OCC, as a generalized dynamic organizational capability that enables an organization to react to environmental changes and/or anticipate opportunities (Judge and Elenkov 2005), is expected to allow the changes that are needed to implement ERM more easily and more completely within the organization.

Discussion and conclusion

This study offers our elaboration of a socio-technical framework for developing and implementing ERM. We note that ERM solutions share some properties of complex process innovations. Hence, their development and implementation should not be examined by focusing on a purely financial perspective only. Rather, ERM must be addressed holistically by adopting a socio-technical perspective that accounts for both the technical and the social aspects involved in ERM implementation. This starting point has elucidated many underlying considerations, including the

emergent and context-specific nature of ERM development and implementation, the range of top managers' key roles, and the importance of specific organizational capabilities.

Given that several major corporations, such as Hydro One and Walmart, have implemented ERM, one might expect that best practices regarding ERM would spread among enterprises and consultancy firms. Instead, companies have implemented the various techniques comprising the ERM approach in different ways. This situation highlights the difficulty of transferring best practices (Szulanski 1996). ERM development and implementation constitute a dynamic process in which each functional area experiments with new methods and procedures to establish integrated risk management routines and interacts with other functional areas. During this process, each functional area locally experiments with new procedures, learns from other areas, and adapts to them. ERM is not a one-size-fits-all solution, and it "cannot be reduced to building blocks which can simply be re-assembled in a different context and give rise to an identical outcome" (Mitleton-Kelly 2011). In each case, top management must decide the content and the configuration of the ERM solution based on both environmental parameters, such as the industry and competitive environment, and internal parameters, such as the organization's objectives and strategy. Furthermore, risks continuously change and evolve as the socio-economic and institutional environments evolve. Therefore, ERM development and implementation result from a co-evolutionary process wherein risk identification and risk analysis/assessment follow a dynamic cycle of continuous improvement and change, rendering ERM development and implementation an emergent and context-specific process. Accordingly, best practices related to ERM implementation are rarely transferred from one organization to another. In this regard, ERM development and implementation can be regarded as a particular stance of creative work involving novel combinations or rearrangements of risk management ideas, methods, and procedures (Fleming, Mingo, and Chen 2007). Accordingly, the conventional wisdom according to which the board should discuss the state of the organization's ERM with management, and provides oversight as needed offers a simplistic view of the actual role of top managers in ERM implementation, which includes a collaborative brokerage role.

In the context of a creative organizational endeavor, collaborative brokerage involves not only the transmission of ideas but also the management of integration, i.e., the selection, rejection, and synthesis of disparate ideas and contributions into a coherent whole (Lingo and O'Mahony 2010). In other words, work integration calls for methods to achieve the integration or synthesis of expertise and knowledge across functional units. Further, with respect to ERM, work integration may involve combining risk management ideas and methods of contributors in such a way that they are accepted as useful or satisfying by the various functional units.

Proponents of cohesive structures will contend that such an argument is unlikely to hold. In their view, brokered structures hinder the development of creative work owing to the difficulty of mobilizing people and resources, as would be the case in a cohesive network. However, we argue that top management involvement and participation likely counteract this effect by providing necessary conditions such as trust, easy information flow and processes, and collaboration norms. Further, as information flows more freely and redundantly in a cohesive structure, an increased number of collaborators in the social structure would acquire more complete information about the creative work. Therefore, cohesive collaboration should create a more distributed understanding of a new idea emerging from a collaborative effort than brokered collaboration. We suggest that attaching a project team to top management might be useful so that even if top management continues to be responsible for the integration of ideas, "more individuals are privy to the components, opportunities, and insightful combinations" (Fleming, Mingo, and Chen 2007). Such an approach would at the same time prevent top management from being the only source of complete knowledge. ERM development and implementation are distinguishable steps of the process of deploying ERM infrastructure. Logically, ERM cannot be implemented until its content and configuration are designed. Therefore, one would be tempted to think that the ERM development phase, which requires continued creative insight, may benefit from maintaining a

more brokered network, whereas the implementation phase, which requires more implementation and less insight, may benefit from a more cohesive network. However, development and implementation are also interdependent processes. The interrelationship or constraint between the two steps does not constitute a finish-to-start type of dependency in which ERM implementation cannot start until ERM development is completed. Rather, overlap between developers and implementers should be envisioned to enhance the likelihood of successful implementation. Not involving implementers in the development phase could hamper knowledge transfer, functional areas' commitment, and consequently the entire implementation process. Regarding promising avenues for further research, future studies could determine the stage of the ERM development phase during which implementers should be involved, investigate strategies for managing the co-existence of a brokered network and cohesive network, and examine whether such networks will conflict.

The argumentation in favor of such a hybrid structure rests on the premise that under some circumstances, the presence of a top manager broker may be highly needed. First, the process of refining and implementing management ideas, methods, and procedures involves a social process that relies on the cooperation of the various knowledge areas. Top managers' participation by chairing committees, contributing ideas, providing needed resources, and scanning progress reports usually encourages organizational actors to cooperate regardless of their motives to do so. Second, as the various functional areas devise new ideas and methods for managing risk in an integrated fashion, even in a cohesive structure, these ideas and methods may be ascribed different meanings, which may result in misunderstandings unless top managers as collaborative brokers help contributors manage potential ambiguity. A related situation concerns the knowledge transfer across boundaries between functional areas. Regardless of the knowledge boundary in place, the broker will play a crucial role.

In summary, this study clearly highlighted the value of regarding ERM as a sociotechnical system. This allowed us to capture the complexity of the adaptations that need to be carried out, including the kind of dynamic capabilities that the organization must leverage to achieve this. From this, it became possible to identify a number of sociotechnical factors critical to the successful implementation, regarded as a mutual adaptation process between the ERM and the organization. We make no claim to an exhaustive model. On the contrary, by incorporating such sociotechnical factors, along with other relevant factors as disclosed by the literatures on organizational and technological innovation, we believe that stronger models could be elaborated to explain the successful implementation of ERM. An empirical study aimed to test these factors through using partial least square structural equation modeling (PLS-SEM) is underway.

Additionally, we encourage other scholars studying ERM and ERM implementation to adopt a more systemic approach and to introduce to the discussion relevant work on risk management, strategic management, organizational change and other relevant topics. We expect future research to contribute to the development of conceptual vocabularies and epistemological fundamentals that will enable both scholars and practitioners to better understand and interpret complex and multifaceted sociotechnical ERM phenomena.

Disclosure statement

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