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The linkage between knowledge risk management and organizational performance

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Abstract

The purpose of this study is to examine the effect of knowledge risk management (KRM) on organizational performance, with measures considered as "softer" measures of performance, i.e. innovativeness, responsiveness, sustainability, and agility. Data were collected using an online questionnaire sent to private and public organizations located all over the world. The analysis and hypotheses testing were performed using structural equation modeling. The results showed that KRM positively affects organizational success, sustainability, growth, innovativeness, and agility, however, KRM does not show any positive effect on the responsiveness of organizations. The results can help managers and owners to a better understanding of the linkage between KRM and organizational performance. They could use the results to design their KRM practices accordingly. To the authors' best knowledge, this paper is the first empirical study that has investigated the relationship between KRM and organizational performance with a broad organization sample.

Keywords

Knowledge risk management, Knowledge management, Innovativeness, Agility, Sustainability, Organizational performance

The linkage between knowledge risk management and organizational performance

1. Introduction

The importance of knowledge in a knowledge-based economy is unquestionable and a plethora of previous studies have shown that knowledge and its management can bring positive results to many types of organizations (Choy et al., 2006; Edvardsson and Durst, 2013; Massingham and Massingham, 2014). However, as Zack (2002) stressed, the mere act of processing knowledge itself does not guarantee a strategic advantage, but knowledge must be managed, and this management should comprise both the upsides and the downsides of knowledge sources (Stam, 2009). Nowadays, knowledge is not only considered as an important asset and a source of potential competitive advantage of organizations (Berman et al., 2002; Quintas et al., 1997; Victer, 2014), but also as a source of various risks and hazards (Olander and Hurmelinna-Laukkanen 2015; Durst, Bruns, and Henschel 2016; Durst and Zieba 2017; Zieba and Durst 2018; Bratianu 2018). As this perception is still a relatively novel approach, there are not many studies dealing with the aspects of knowledge risks and their management. The available studies discuss only selected knowledge risks, for example, knowledge loss (Durst and Wilhelm, 2011; Massingham, 2008, 2018), knowledge leakage (Mohamed et al., 2007), knowledge waste (Ferenhof et al., 2015), knowledge hiding (Cerne et al., 2014; Connelly et al., 2012; Hernaus et al., 2019) or lost reputation (Aula, 2010; Louisot, 2004). Thus, our understanding of knowledge risks is rather fragmented. Given the specific relevance of knowledge for any type of organization, risks related to knowledge should form an essential part of any organization's risk management. Although some previous studies have integrated knowledge management (KM) as a tool for risk management (Perrott, 2007), there are no studies so far that have empirically examined how risks related to knowledge are managed in organizations (Durst and Zieba, 2017; Zieba and Durst, 2018a). Even though the study of risk management, in general, has attracted a lot of attention recently, it still is a young scientific field (Aven, 2016). Research on risk management in general is either focused on industries such as banking, insurance or utilities, which have historically invested in risk management due to heavy regulations (e.g., Callahan and Soileau, 2017) or areas such as supply chains/logistics (Cucchiella and Gastaldi, 2006; Juttner et al., 2003; Manuj and Mentzer, 2008; Choi et al., 2016), new product development (e.g., Salavati et al., 2016) or project management (see Project Management Institute:

https://www.pmi.org/learning/featured-topics/risk).

According to the authors of the present paper, this is an unsatisfactory state, as any organization is exposed to certain knowledge risks that have the potential not only to heavily compromise the organization's operations but also seriously delay or bring to a halt to their implementation. The increasing availability and use of new technologies and concepts such as the Internet of Things, Blockchain, Artificial Intelligence combined with an increasing e-connectivity of organizations are also likely to bring about new types of risks related to knowledge (Tupa et al., 2017). Thus, the authors of the present paper argue that any organization should invest in risk management. In line with the Institute of Risk Management, the authors of this paper are of the opinion that risk management should play an important role in all types of organizations, regardless of their field of operations, as a better understanding of the available sources will put them in a position to take more informed decisions; this refers both to a public body, as well as a newer, smaller firm. Against the relevance of knowledge sources to organizations, this risk management should have a particular focus on knowledge risks.

In response to the above, the aim of this paper is to examine the effect of knowledge risk management (KRM) on organizational performance in different types of organizations. More precisely, the paper examines the effect of KRM on "softer" measures of performance such as innovativeness, responsiveness, sustainability, and agility. A better understanding and managing of the organization's specific knowledge risks reduce the downside of performance volatility, while at the same time accomplish the organizational goals set (Callahan and Soileau, 2017). Consequently, improved decisions are possible and scarce resources could be allocated more sufficiently (Mohammed and Knapkova, 2016). By focusing on the link between KRM and organizational performance the authors take into account the critical importance of organizational performance to the survival and success of organizations (Richard et al., 2009). By focusing on softer measures of performance, the authors of the paper acknowledge that organizations have more objectives in mind than only the typical accounting and financial market measures such as profit margin, return on investment or market value (Richard et al., 2009; Bromiley et al. 2015).

The paper is structured as follows. In the next section, an overview of knowledge and risk management is given, which provides the basis for discussing KRM. Then the concepts of interest are introduced, and hypotheses are formulated. This section is followed by a description of the methodology used. After that, the analysis and results are presented. The

paper terminates with discussion and conclusion sections.

2. Knowledge and Risk management

Having access to knowledge that is relevant and up-to-date is critical for all organizations in meeting present and future challenges. However, it is also known that knowledge is not always positive, i.e. something of value, but has a risky side as well (Durst and Wilhelm, 2013). Organizations, regardless of type and size, are exposed to a number of risks related to knowledge, for example, risks related to human resources, relational risk, risks related to decision making regarding new strategies, markets, products as well as other important business issues, risks related to knowledge gaps or risks related to the outsourcing of business functions (Durst and Ferenhof, 2016).

To elaborate on knowledge risks management, it is necessary to define the basic term, which is 'knowledge risk'. Perrott (2007) defines knowledge risk as a likelihood of any loss resulting from the identification, storage or protection of knowledge that may decrease the operational or strategic benefit of a company. Durst and Zieba (2017) divide knowledge risks into internal and external ones to highlight the risk's main occurrence. Internal risks such as knowledge attrition, knowledge waste or knowledge hoarding are primarily connected with an organization's internal situation, while knowledge risks such as knowledge leakage or knowledge spillover address an organization's interactions with its external environment. Knowledge risks can result in several negative consequences, such as failing to offer high quality solutions (Demian and Fruchter, 2009), costly disruptions of performance or operations, loss of competitive advantage or even tragic accidents (Martins and Meyer, 2012). All types of organizations face (knowledge) risks, but not always the same type or intensity (c.f., Kim and Vonortas, 2014). Moreover, there is an interdependence of risks, that is, one risk may lead to various other risks (Venkatesh et al., 2015).

Thus, to manage critical knowledge, which is the knowledge that is most at risk of being lost (Frigo, 2006), in its best possible way, organizations should make sure that the knowledge risks they are exposed to over time are firmly anchored in their risk management. Risk management is a strategic process (Clarke and Varma, 1999) "whereby organizations methodically address the risks attaching to their activities with the goal of achieving sustained benefit within each activity and across the portfolio of all activities" (Institute of Risk Management, 2002, p. 2). The Project Management Institutes views risk management as one of the ten knowledge areas. Following Vaughan and Vaughan (2001), the risk

management process consists of four steps, which are: 1) identification of risks; 2) quantification and thus evaluation of risks; 3) management and control of risks, and 4) continued reporting on the development of risks. The risk management process should be accompanied by risk management vision and strategy that is derived from the organization's risk environment (Clarke and Varma, 1999). Risk management is intended to support organizations in maintaining a balance between risk and return and has been found to have an impact on company performance (Mohammed and Knapkova, 2016).

Over the years, the requirements for risk management approaches have increased significantly and several calls for broader and more integrative approaches have been made (Kallenberg, 2009). Smallman (1996) proposed a holistic risk management that is characterized by three main aspects: 1) a continuous monitoring of all sources of risk; 2) a combination of qualitative and quantitative techniques on risk assessment and risk monitoring; and 3) organizational learning where one learns from past errors and disasters and where a culture allows for a positive approach to dealing with mistakes and not punishing employees for mistakes is established in the company. The significance of risk management approaches is also stressed in quality standards such as ISO-9000, ISO-12207 / ISO-15504, Capability Maturity Model (CMM) and Capability Maturity Model Integration (CMMI). The new ISO 9001: 2015, for example, underlines the relevance of incorporating approaches to knowledge and risk management in a firm's quality management system to master current and future business challenges. The importance of KM is highlighted in a new clause #7.1.5, which stresses that firms should identify, manage and make available all knowledge that is necessary to ensure process results that are in line with quality and conformity requirements (ISO 9001 Revision, 2015).

Even though companies are expected to focus on all types of risks (i.e. financial and non-financial risks) and thus their management, there is a tendency to focus on financial (monetary) risks, and thus quantitative approaches, which can be explained by greater experience with this type of risks (Louisot, 2004).

KRM is a systematic way of applying tools and techniques to identify, analyze and respond to risks associated with the creation, application, and retention of organizational knowledge (Durst et al., 2016). Given this definition, KRM focuses on all type of organizations and is thus not limited to private organizations such as companies from the banking and insurance industries (Callahan and Soileau, 2017). Against the strategic importance that is assigned to knowledge (Grant, 1996) it is, however, surprising that the study of KRM or risks related to

knowledge, in general, is still in its infancy (Massingham, 2010; Lee et al., 2014; Durst et al., 2016; Durst and Zieba, 2017). Durst et al. (2016) conducted a literature review of KRM and identified only 24 papers. These papers addressed KRM related issues such as KRM awareness, KRM complexity, KRM identification and classification, KRM strategy, KRM protection, and KRM practices. In point of research methods, conceptual/theoretical papers and empirical ones appear broadly balanced. The available research on different aspects of KRM clarifies that it has not been examined from an integrated perspective but the available studies discuss only selected risks or their consequences. For example, in the studies by Massingham (2008, 2018), the author examined the impact of knowledge loss on the organization. Yet, he did not take into account other aspects of knowledge risk management (e.g. various types of knowledge risks and their consequences). In another paper by Massingham (2010), the author seems to view knowledge risk management as KM tools and techniques used for the management of organizational risk.

The literature on the relationship between risk management and performance, in general, appears to focus on listed companies (e.g. Mohammed and Knapkova, 2016; Callahan and Soileau, 2017), thus excluding other relevant organizations, such as smaller non-listed private organizations or public ones. Mu et al. (2009) found a positive relationship between risk management strategies targeting organizational risk factors and new product development (NPD) performance. Additionally, empirical studies on the impact of risk management on firm performance are scarce (Tse et al., 2018) and limited to financial institutions (Callahan and Soileau, 2017). Callahan and Soileau by addressing the latter showed the link between higher levels of Enterprise Risk Management process maturity and higher operating performance involving a broad industry sample.

As (knowledge) risk management is a rather complex and resource-intensive function (Callahan and Soileau, 2017), organizations of any kind should be interested to see the clear advantages of their risk management approaches, regardless of regulatory requirements, which may require some organizations to produce and publish risk reports (ACCA, 2014). As organizations make a tradeoff between risk and benefits (Tang et al., 2011), it can be expected that a positive link between KRM and organizational performance would send a clear signal to organizations and their efforts; to smaller organizations, in particular (Henschel and Durst, 2016). Moreover, having established a clear link between KRM and its impacts may induce managers or other executive staff to integrate KM more closely with the organization's strategic management (López-Nicolás and Merono-Cerdán, 2011), or by

borrowing Neef's (2005) words a clear link may, finally, provide "the knowledge management movement with a much-needed and revitalizing boost" (p. 123). In the following sections, organizational performance is going to be described together with the used measures.

2.1 Organizational performance

Organizational performance is essential to survival and organizational success (Richard et al., 2009) and consequently, its measurement is expected to be critical for all types of organizations to evaluate the actions taken by firms and managers (Asree et al., 2010). More precisely, measuring performance provides organizations the necessary feedback regarding both the efficiency and effectiveness of their activities and efforts and thus more informed decisions will be possible (Adams et al., 2002). Depending on the organization, organizational performance may encompass elements such as customer service, cost management, quality, productivity and asset management performance. Thus, they can be of an objective or a subjective nature. Objective measures of organizational performance are accounting measures such as return on equity, return on investment, profit margin, market share or cash flow from operations or financial market measures such as earnings-per share, stock price, market value/capitalization (Richard et al., 2009). Mixed accounting/financial market measures are also used such as internal rate of return, cash flow per share or economic value added as they are better in balancing risk against operational performance issues (Richard et al., 2009). Recent developments in organizations to include items such as sustainability or employment conditions have further increased the multidimensionality of performance and in turn, increased interest in more subjective measures of performance. Consequently, performance systems of organizations should consider both objective and subjective measures (López-Nicolás and Merono-Cerdán, 2011). Yet, it appears that studies on risk management focus on objective measures (e.g., Quon et al., 2012; Callahan and Soileau, 2017).

In the following sections, the measures used in this study are presented.

2.1.1 Innovativeness

Innovativeness can be broadly defined as "an organization's tendency to master, implement, and develop processes or products new to the organization, although the processes or products may not be new to its local or foreign competitors" (Luk et al., 2008, p. 590). It is a continuous and systematic process, developed over time, and which focuses on the

transformation of ideas into "successful reality" (Bessant and Tidd, 2007, p. 26). Innovativeness is described by the development of new products or services, by using new technologies or by the art of the design (Covin and Slevin, 1991; Schollhammer, 1982). In 1977, Hurt and Teigen postulated that organizational innovativeness is a uni-dimensional construct, with an underlying continuum of perceived organizational willingness-to-change. Innovativeness can be determined by the number of innovations adopted by firms (Subramanian and Nilakanta, 1996).

There are several factors that determine the innovativeness of organizations and among them, there is a propensity for risk-taking (Das and Joshi, 2007). From an organizational perspective, risk-taking propensity concerns an organization's eagerness to engage in risky projects, and a preference for bold (in contrast to cautious) acts to achieve a firm's objectives (Miller, 1983). At the same time, a firm with risk-taking propensity is potentially more successful in the promotion and development of behaviors leading to process improvements and new products/services development with innovative techniques (Gilley et al., 2002). However, as the study of Alvarez (2007) shows, high levels of risk-taking may be linked with a higher likelihood of failure and the potentially most beneficial to firms' performance are the moderate levels of risk-taking (Kreiser et al., 2013). This is valid from the point of view of knowledge risk management. KRM, being a systematic way of applying tools and techniques to identify, analyze and respond to risks associated with the creation, application, and retention of organizational knowledge, may help organizations in better handling the uncertainty associated with innovation. If an organization deals with its knowledge in a systematic way and identifies risks related to it, it is not only placed in a better position regarding their innovative activities but also reduces the risk of failure in the introduction of innovations. Therefore, it is proposed that

H1: KRM positively impacts the innovativeness of organizations

2.1.2 Responsiveness

Responsiveness is "the extent to which a firm responds to market changes, and it results from a firm's proactive interaction with its external environment" (Wei and Wang, 2011, p. 270). Yet, according to Bernades and Hanna (2009, p. 42), "responsiveness refers to the actions or behavior of a system using a series of capabilities to address changes triggered by stimuli". Timely responses matter; it has been argued that a suboptimal but timely response can be more profitable in the long run than a delayed correct response (Nemkova et al., 2015).

Delays in responding to external changes, specifically in international business, may lead to the loss of local presence. Based on a review of definitions of responsiveness used in operations management, Bernades and Hanna (2009) identified three traits responsiveness seems to exhibit, namely external stimuli, time and the notion of awareness. Responsiveness is also linked with the evaluation of the over- or under fulfillment of goals and the following corrective actions (Kohli et al., 1993). According to Homburg et al. (2007), it can consist of two elements, namely customer-related responsiveness and competitor-related responsiveness. The former can be defined as the extent to which an organization responds quickly to customer-related changes, while the latter is the extent to which an organization responds quickly to competitor-related changes. Asree et al. (2010) discuss responsiveness from two separate functional perspectives: service marketing and operations management. As far as the service-marketing perspective is concerned, it is linked with "the willingness to help customers and to the speed of the service rendered" (p. 505) and from the operations management perspective, it is "more related to the speed and variety of product/service offered" (p. 505). Thus, the strong link to customers becomes clear. Customer orientation focuses on understanding and satisfying customer's needs that ideally results in higher profits. This, however, requires an ability to react quickly to changing needs to remain competitive (Appiah-Adu and Singh, 1998).

Additionally, by the constant monitoring of the risks in the environment, organizations might reduce their impact and, at the same time, undertake some steps to turn them into an opportunity. As Verdú (2009) stated, "*organizational flexibility is the main capability that enables companies to face environmental fluctuations, as it makes the organization more responsive to change"* (p. 668).

Extant literature has stressed that in order to response to environmental threats and opportunities timely and effectively, organizations should engage in KM (e.g., Winter 2000; Lee et al., 2009). Lee et al. (2009) have shown that market responsiveness is the direct and indirect result of both information system integration and knowledge codification. As the responsiveness of an organization is likely to be influenced by both the quality and quantity of knowledge and information (Hodgkinson et al., 2012), the organization needs to manage its knowledge to be in the position of making informed information about its use. Hence, we argue that KRM can support this by providing necessary information about the positive and negative risks related to extant knowledge sources. Therefore, it is proposed that

H2: KRM positively impacts the responsiveness of organizations

2.1.3 Agility

Agility can be defined as the organizational ability of an organization constantly to detect competitive opportunities and threats and respond through innovative actions in the form of new product introductions, new process improvements, new alliances, or other similar competitive actions (Kamhawi, 2012). In other words, agility refers to the speed with which an organization detects and responds to environmental threats and opportunities (Tallon and Pinsonneault, 2011). An agile organization applies previous knowledge while learning from current experience to facilitate the delivery of products which are in strong demand (Jyothi and Rao, 2012). Agility can also be defined in terms of customer responsiveness, business partnership, and operations (Sambamurthy et al., 2003). The concept of agility has become one of the major imperatives for business success (Doz and Kosonen, 2008) and by some authors, it is viewed as "some form of new manufacturing paradigm" (Bernades and Hanna, 2009, p. 35). Bernardes and Hanna (2009) concluded that the literature seems to use agility as a "concept coined to address competitiveness in the current fast-paced and unpredictable industrial environment" (p. 42). These authors, in their efforts to propose a conceptual differentiation of the terms flexibility, agility and responsiveness", concluded that "agility refers to the system capability to rapidly reconfigure in the face of unpredictable changes, while responsiveness is the system's actual and purposeful change in behavior or outcome caused by a stimulus" (p. 43). Recent research showed that agility is vital to both innovation and performance (e.g. Ravichandran, 2018). For example, Ravichandran (2018) demonstrated that the level of agility is determined by an organization's innovation capability.

Over the years, many researchers have started viewing agility as a necessary element of business operations in the face of turbulent environments and all the demands they generate (Overby et al., 2005; Sambamurthy et al., 2003). Yet, the application of agile practices and methods are according to Gothelf (2014) primarily in product development teams; regarding software engineering, in particular, indicating that agility has not yet reached its likely potential.

Given the dynamic nature of agility, it could be argued that KRM can help balance out the differences between actions taking place in predicable environments and those taking place in unpredictable environments. Additionally, KRM can help organizations in the identification of the best approaches in given circumstances. Through the constant managing and controlling of risks, organizations might be able to be more agile, i.e. they can undertake better actions in a shorter time. Without KRM, this would be more difficult and related to a

higher failure rate. Therefore, the following hypothesis is proposed

H3: KRM positively impacts the agility of organizations

2.1.4. Organizational success

Organizational success is an integrative term encompassing various aspects of organizational functioning. For example, according to Flamholtz and Aksehirli (2000), organizational success may have several dimensions, such as: identification and definition of a solid market niche; development of products or services for the selected market niche; acquisition and development of resources necessary to run the firm; development of day-to-day operational systems; development of the management systems necessary for the long-term functioning of the organization; and finally, development of the organizational culture crucial to guide the firm (Flamholtz and Aksehirli, 2000). Measuring organizational success has been a challenge for both managers and researchers for several decades. While financial measures were of uttermost importance for many years, new approaches have emerged in recent years that extend organizational perspectives beyond traditional financial measures (Maltz et al., 2003). In general, organizational success can be measured in a variety of ways, depending for example on the sector or stage of development. In order to overcome potential differences in this measurement, it is justified to measure organizational success in comparison with other similar entities. Risk management can be thought of helping organizations to minimize their risks while maximizing their possibilities for success. For example, according to Mu et al. (2009, p. 170), "understanding, identifying, managing, and reducing risk is of strategic importance for firms (…) and appropriate risk management strategies can significantly improve the odds of new product development success". It can be expected that successful knowledge risk management may prove helpful in the achievement of organizational success. Therefore, the following hypothesis is proposed:

H4: KRM positively impacts the success of organizations

2.1.5. Organizational sustainability

Sustainable business development has been subject to an increasing number of organizations. In contrast to the past, the overall business activities of organizations reveal a stronger emphasis on societal and environmental issues compared to a unilateral focus on economic issues which dominated in many organizations. Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Economic Development

(WCED) 1987, p. 43). From the perspective of organizations, sustainability can be defined as "the result of the activities of an organization, voluntary or governed by law, that demonstrate the ability of the organization to maintain viable its business operations (including financial viability as appropriate) whilst not negatively impacting any social or ecological systems" (Smith and Sharicz, 2011, pp. 73–74). In order to perform in a sustainable way, organizations are supposed to adopt social, economic, and environmental development in their business operations (Chow and Chen, 2012). Van Kleef and Roome (2007) stress that these three aspects need to be considered as one entity rather than as separate entities, representing a delicate balancing act and tradeoffs must be made among the economic, environmental, and social aspects. Organizations in order to avoid scandals and disasters, need to focus not only on their financial outcomes but also on integrating the above mentioned aspects (Smith and Sharicz, 2011). Knowledge and KM are regarded as central to sustainable business development and thus organizational sustainability (Gloet 2006; Robinson et al. 2006). Knowledge can help organizations to address the balancing act regarding the three elements of sustainability addressed before (Mohamed et al., 2009). With better access to knowledge and the ability to use it, organizations might be able to identify key actions to undertake to meet the requirements of being sustainable. For example, Chen et al. (2008) suggest that with the support of institutional pressures, information systems can help organizations in achieving eco-efficiency, eco-equity and eco-effectiveness through automating, informing (up and down) and transforming organizations, respectively (Chen et al., 2008). The study of Lopes et at. (2017) proves that the concept of knowledge management and organizational sustainability are intertwined (Lopes et al., 2017). Potentially, with the implementation of KRM organizations may better and easier fulfill their sustainability requirements, as KRM may prove useful in the identification of certain risks and eliminating them (e.g. the risk of environmental or social scandals/disasters).

Against this background, the following hypothesis is posed

H5: KRM positively impacts the sustainability of organizations

2.1.6. Organizational growth

Organizational growth depends on the usage of entrepreneurial and managerial knowledge configured as resources (Penrose, 1959). These two types of resources are necessary for different purposes: entrepreneurial resources are valid for opportunity recognition and innovation, while managerial ones are crucial to delivering systems and processes for

opportunity exploitation (Macpherson and Holt, 2007). For example, according to the study by Autio et al. (2000), it is knowledge about international markets and operations, together with the efficiency of this knowledge learning by an organization, that determines international sales growth for entrepreneurial firms (Autio et al., 2000). Knowledge has become a crucial resource for organizations willing to grow also because nowadays the intangible assets may stand for nearly 80 percent of the value of the company and the natural way to increase organizational growth might be the successful management and development of the intangible assets (Salojärvi et al., 2005). As the study of Salojärvi et al. (2005) shows, in case of the examined Finish SMEs knowledge management positively influenced organizational growth. As knowledge risk management constitutes an element of knowledge management and is devoted to better knowledge handling, it can be expected that KRM should positively influence organizational growth. Therefore, the following hypothesis is proposed:

H6: KRM positively impacts the growth of organizations.

In the following section, the methodology of research testing the above hypotheses will be presented.

3. Methodology

3.1 Sample and data collection

The data for the present study were collected between September 2017 and January 2018 in the form of an online questionnaire, using the software QuestionPro. The questionnaire consisted of 23 mainly closed-ended questions and was divided into four sections. As the topic in focus has not previously been addressed, it was not possible to rely on existing questionnaires. Thus, new items were developed or existing ones from related areas (such as risk management) were amended. Apart from the sections related to knowledge risks and their management, supplementary demographic data were collected, such as the year of organization foundation, type of organization, location, or the number of employees.

After the construction of the questionnaire, it was pre-tested to check the order of questions, its comprehensibility and appropriateness to be answered in a certain period (max. 30 minutes). The pre-test also described a means to moderate the weaknesses of self-administered surveys (Saunders et al., 2007). Thereby, the questionnaire was pretested with two management professors and two respondents from companies.

By using a survey disseminated to 200 KM experts worldwide, Heisig et al. (2016) demonstrated that the gap between KM in general and business performance is still one of the major shortages within global KM research. Inkinen (2016) also stressed the need for more research on the link between KM in general and firm performance. Taking this into account and the present study's explorative, the authors of the study followed the approach by Heisig et al. (2016) and gathered data from an international sample including participants from 40 countries.

To access possible participants, convenience sampling was used, i.e. respondents were informed about the survey through LinkedIn and Facebook. Additionally, Company Lists were used. In total, 623 responses were collected from managers and owners of companies, being knowledgeable about the issues in question. To ensure the quality of the data, only fully completed questionnaires entered the analytical stage, which resulted in a final set of 179 questionnaires, equating to a valid response rate of 28.7 percent.

Respondents from Latin America have a predominance in the sample which accounted for 49.6% (countries involved are Brazil, Colombia, Cuba, Mexico, Paraguay, Peru, Uruguay, and Venezuela), followed by Europe with 25.9% (countries involved: Austria, Belgium, Czech Republic, Denmark, England, Finland, France, Germany, Greece, Iceland, Italy, Liechtenstein, Luxembourg, Netherlands, Poland, Romania, Scotland, Spain, Sweden). In addition, participants from Australia, Bahrain, Bangladesh, China, India, Iran, Kazakhstan, Malaysia, Pakistan, Saudi Arabia, Turkey, United Arab Emirate, and the United States of America participated in the survey.

Convenience sampling is a common technique in research devoted to knowledge management (Ali et al., 2018; Chong et al., 2011; Lin et al., 2012; Wang and Yang, 2016). This non-probability sampling technique is very useful in collecting a general overview of the phenomenon of interest (Chong et al., 2011). There is a growing problem with establishing access to study participants and a general low response rate of quantitative studies (Bryman and Bell, 2011), therefore, a mix of methods to get to the respondents was applied which enabled the collection of a larger number of responses.

Finally, a concern with self-constructed questionnaires arises from the common method variance (CMV), although the survey incorporated a number of response options such as yes/no answers, matrix questions or different Likert scales. Consequently, Harman's single-factor test including all independent and dependent variables in an explanatory analysis was

executed (Love et al., 2014). CMV is present if one single factor accounts for the majority of the covariance among the measures (Podsakoff et al., 2003). However, as the factor that emerged account for 44.7 percent of the variance, and thus for less than the majority, CMV does not seem to be a drawback in the present study.

3.2 Measures

The major constructs in this study include KRM and organizational performance including the sub-dimensions innovativeness, responsiveness, agility, organizational success, organizational sustainability, and organizational growth.

KRM draws upon two survey questions which asked respondents about their KRM activities. Consequently, the participants were asked whether the organization does KRM and if yes, what knowledge risks are addressed in their KRM. The latter question consisted of a list of 16 different knowledge risks (see Appendix 1 for a full list of knowledge risks addressed), which was derived from previous research on knowledge risks (e.g., Durst and Zieba, 2017). To create the variable, the scores of all knowledge risks were summed to create an index that measures in a sum the extent of knowledge risks addressed in the KRM ranging from 0 to 16.

To measure organizational performance, this study used subjective measures of organizational performance. More precisely, subjective self-report measures were used. Even though subjective measures have been typically viewed with a great reservation, empirical findings suggest that this reservation is unfounded (Richard et al., 2009). Vij and Bedi (2015), for example, analyzed 171 companies listed on Bombay Stock Exchange and demonstrated a high positive correlation between subjective business performance measures in comparison to main competitors and objective business performance measures. The authors conclude that in case of non-availability of archival data or limited access to objective measures, subjective business performance measures may be recommended as well. Additionally, the use of subjective measures may also overcome the time dependence-issue many objective measures suffer from. Finally, the authors believe that the use of subjective measures is more appropriate when different types of organizations are involved.

Therefore, respondents were asked whether their organization is more innovative, has better responsiveness to changes in the external environment, is more agile, is more successful, is growing faster, is more profitable, and is more sustainable compared to their key competitors; measured on a 7-point Likert scale.

Following previous research on risk management, this study controlled for organizational

characteristics that could have an influence on the relationship between KRM and organizational performance. As organizational performance is the outcome of applying a broad and differentiated knowledge base (Zollo and Winter 2002), firm size (in terms of the logarithm of the number of employees) was included into the model. Additionally, the authors controlled for the age of an organization (i.e., its level of maturity with regard to both KM and risk management) as it may influence an organization's attitude to both KM and risk management (c.f. Hoffmann et al., 2013). Therefore, this study incorporated age (in terms of the logarithm of the number of years since its foundation) as a second control variable.

3.3 Statistical method

To test the hypothesized relationship between KRM and organizational performance, a structural equation modeling (SEM) approach was applied using the AMOS software, version 23. SEM is viewed as an appropriate technique to study multiple correlated independent and dependent variables (e.g. Wei et al., 2008). To evaluate model fitness, the authors followed the suggestion of Hu and Bentler (1999) and used a multi-index presentation format including the standardized root mean squared residual (SRMR), the Tucker-Lewis Index (TLI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). The Chi-Square statistics are reported as well, although previous research reported a lack of power for smaller samples (Kenny and McCoach, 2003), which is the case in the present research, for why it is no longer used as a basis for acceptance or rejection (Vandenberg, 2006). Therefore, for a good model fit, Hu and Bentler (1999) suggest an SRMR below 0.08, an RMSEA below .06, a TLI above .95, and a CFI above .95.

4. Analysis and results

Table 1 reports the means, standard deviations, and correlations among the major study variables.

-- Take in Table 1 --

Turning to the variables of interest, the table reports a significant positive correlation between the number of knowledge risks addressed and whether the organization employs KRM at all ($r = .281$, $p < .01$). Additionally, the number of knowledge risks addressed in KRM is positively correlated with all dimensions of organizational performance except responsiveness (correlation coefficients ranging from .277 to .337, $p < .01$). However, there is

no correlation between the performance dimensions and whether the organization utilizes KRM. Finally, all performance dimensions are highly positively correlated with each other (coefficients ranging from .342 to .780, $p < .01$).

The path diagram in Figure 1 illustrates the entire structural model.

-- Take in Figure 1 --

Results show that all model fit indices report a good model fit (SRMR < .08; RMSEA < .06; CFI > .95; TLI > .95). Additionally, the Chi-square test shows a non-significant test statistic and thus, indicates a good model fit as well. Therefore, it was concluded that the structural model provides a good fit for the data in the study.

Turning to the hypotheses, it was proposed that KRM positively affects the performance of organizations respectively its subdimensions innovativeness (H1), responsiveness (H2), agility (H3), organizational success (H4), organizational sustainability (H5), and organizational growth (H6). However, as it can be seen, the results show only partial support for hypotheses H1, H3, H4, H5, and H6 as the mere existence of KRM has no positive effect on the subdimensions of organizational performance, but the more knowledge risks addressed in the KRM of an organization, the better the innovativeness ($r = .34$, $p < .01$) and agility ($r = .34$, $p < .01$) of an organization and the better the organizational success ($r = .30$, $p < .01$), sustainability ($r = .28$, $p < .01$), and growth ($r = .31$, $p < .01$). However, the results do not show any support for hypothesis H2 ($r = .14$, $p > .05$).

5. Discussion and implications

This study shows that KRM has the power to act as a critical lever for increasing organizational performance by positively influencing the innovativeness, agility, success, sustainability, and growth of organizations.

Previous research has already demonstrated that knowledge (and its management) plays a crucial role in the innovation process of organizations (Rigby and Zook, 2002; Kaya and Patton, 2011), which is particularly true when it comes to radical innovations (Miller et al., 2007). The present study further shows that the management of the risks associated with knowledge resources involved in the innovation process can significantly impact the innovativeness of organizations. Thus, KRM does not only have a safeguarding function in terms of knowledge protection and compliance but it also helps to increase the innovative

capacity of organizations. This seems reasonable as innovativeness is, amongst others, determined by the propensity of organizations to take risks (Das and Joshi, 2007). Although a certain level of risk-propensity is associated with higher levels of innovativeness (Gilley et al., 2002), Alvarez (2007) showed that high levels of risk-taking are also associated with a higher likelihood of failure. Consequently, organizations are not only forced to systematically deal with the knowledge resources involved in the innovation process, but also to systematically identify, analyze, and respond to the risks associated with these resources.

A systematic KRM approach will then help organizations to increase their sustainability and, consequently, their overall organizational success. Additionally, as knowledge has become a crucial resource for organizations willing to grow, as it accounts for nearly 80 percent of the company's values, knowledge management in general positively affects organizational growth (Salojärvi et al., 2005). The present study confirms this positive relationship as it shows that a systematic approach to the risks associcated with the knowledge found in organizations will further support them in achieving their growth objectives. This is attributed to the safeguarding function of KRM in general, and to the positive effects on innovativeness and agility which have been previously identified to positively influence organizational growth (e.g., Cho and Pucik, 2005).

A systematic KRM approach further means it can be used as a tool for interacting with the organizations' internal and external environment proactively and it, apparently, helps them to be more agile compared to their competitors. It seems that KRM acts as a stabilizing element for more uncertain actions and behaviors needed in organizations to act and survive in environments that are characterized by constant change and falling predictability and thereby reducing the downside performance volatility (Callahan and Soileau, 2017).

However, KRM does not seem to influence positively the responsiveness of organizations, which underlines that responding to external stimuli does not automatically increase the innovativeness of organizations. This underlines the strength of the definition of responsiveness by Bernades and Hanna (2009) that stresses actions or behavior of a system that comprises a series of capabilities to address external stimuli. Further, Wei et al. (2014) and Nemkova et al. (2015) showed in their studies that increased responsiveness does not seem to positively impact organizational performance. Rather, organizations are forced to address these external stimuli proactively by taking the initiative to discover and exploit new opportunities (Lumpkin and Dess, 1996). This highlights the importance of speed with which organizations can detect and respond to environmental threats and opportunities (Tallon and

Pinsonneault, 2011).

The results of this study also show that the mere existence of KRM is not sufficient to improve organizational performance. Rather, the positive effects of KRM on organizational performance come with an increase in the knowledge risks addressed by the KRM. This makes sense because if KRM does not address as many organization specific knowledge risks as possible, the risks of both knowledge loss and, consequently, financial loss are increased.

Additionally, the more risks addressed in KRM, the more comprehensive the picture of the knowledge interactions in an organization and thus the more effective the organization's KRM. However, as information overload leads to a reduction in decision quality (Gross, 1964), it is not just about addressing as many knowledge risks as possible. Rather, it is about how organizations use the information/insights obtained from their KRM to manage their knowledge risks more effectively in order to utilize proactively this understanding to cope better with environmental changes and to balance risk and return. Lumpkin and Dess (1966) already noted that risk-propensity, as a reasonable awareness of the risks involved as well as an attempt to manage these risks, can positively affect organizational performance. This is in line with KRM, which aims to support organizations in identifying and managing critical knowledge in its best possible way. Consequently, KRM can be viewed as an entrepreneurial tool to manage the risk-taking, innovativeness, as well as proactiveness of organizations to enhance their organizational performance.

6. Conclusions

KRM is still in its infancy. As Durst and Zieba (2017) stressed, there are few studies on this topic available and they provide only a fragmented understanding of the concept.

The present paper allows us to draw conclusions relevant to academics and practitioners. The research finds and explains that KRM improves organizational performance. Empirical evidence is provided about the consequences of KRM on different measures of performance. Thus, the paper's findings develop research in the field of KM where the link between KRM and performance has not been built. The findings also contribute to the study of risk management by showing the benefit of focusing on knowledge risks in particular. By focusing on all types of organizations, the present study expands the extant literature on risk management which tends to focus on large private organizations (Kim and Vonortas, 2014).

Accordingly, one of the main conclusions of the present research is that KRM has been found as a significant mechanism to enhance organizational performance. Managers or other

executive staff can use these findings as an argument to communicate the benefits of implementing both KM and specific KRM activities.

The study has several limitations. First, the authors want to highlight a bias that may have been created through the use of personal contacts, which covers people (organizations) with a particular interest in KM. Second, the diversified sample, consisting of respondents from various countries may have created a certain bias which calls for more analysis regarding cultural differences. Thirdly, the items related to organizational performance are based on subjective perceptions, more objective performance measures would contribute to the validity of the findings. Finally, the study was based on a cross-sectional approach thus changes over time could not be controlled.

The issues presented above can already form the basis for future research. Yet, there is a variety of further research avenues that can be examined. First, the study could be replicated in other contexts, e.g. regions or sectors. Second, the analysis of potential ROI in KRM actions could be performed. Third, the differences between specific sectors could be further elaborated to verify whether some sectors are more prone to KRM than others. Additionally, it could be studied whether those companies that must publish a risk report by law show significant differences regarding KRM compared with those companies who do not have to publish such a report. Future research should also analyze the interrelationships between knowledge risks. As risk changes with time, future research may take into account the temporal dynamics of knowledge risks and its consequences for organizational risk-taking. Also, the study of risk reporting/risk communication to present and describe the results of KRM appears to be a promising idea for future research.

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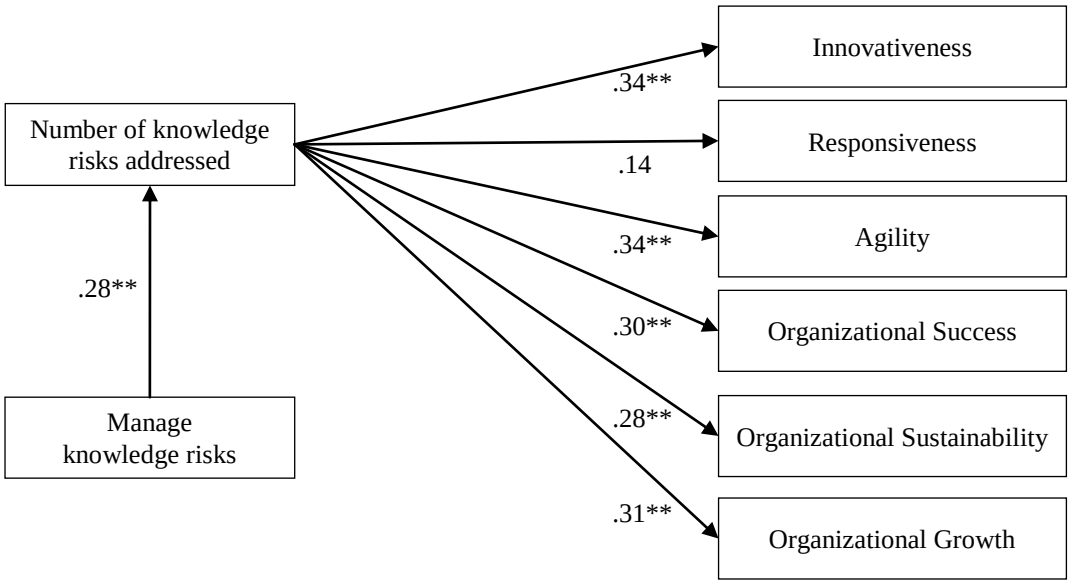
Figure 1 Structural Model of Knowledge Risk Management and Organizational Performance



Notes: n = 179; standardized coefficients significant at ** p < 0.01, * p < 0.05

Controls: firm size (log), firm age (log)

Model fit: χ^2 = 29,716, *df* = 21, SRMR = .057; RMSEA = .048, CFI = .987, TLI = .972

Table 1 Means, Standard Deviations, and Correlations among Variables

Variable	*Mean*	*S.D.*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1. Firm age [a]	2.77	1.40	1.00									
2. Firm size [a]	4.60	3.36	.426**	1.00								
3. Manage knowledge risks [b]	1.13	1.14	-.188*	-.068	1.00							
4. Number of knowledge risks addressed	3.82	4.17	.071	.160*	.281**	1.00						
5. Innovativeness	4.19	1.79	-.035	-.007	-.062	.336**	1.00					
6. Responsiveness	4.10	1.43	-.075	-.064	-.077	.141	.435**	1.00				
7. Agility	3.96	1.85	-.075	-.092	-0.61	.337**	.694**	.571**	1.00			
8. Organizational Success	4.39	1.66	.032	.070	-.006	.277**	.607**	.376**	.587**	1.00		
9. Organizational Sustainability	3.93	1.73	-.076	-.007	-.075	.279**	.712**	.478**	.780**	.560**	1.00	
10. Organizational Growth	4.23	1.75	.008	.074	.050	.313**	.629**	.342**	.475**	.568**	.508**	1.00

Note: n = 179; correlation coefficient is significant at * p < .05 (two-tailed), ** p < .01 (two-tailed)

[a] Firm size is calculated by the natural log of the total number of employees; Firm age is calculated by the natural log of years since firm foundation

[b] Dummy-coded

Appendix 1 List of Knowledge Risks addressed

Risks related to digitalization	Knowledge waste
Risks related to cyber-crime	Knowledge loss
Risks related to social media	Knowledge leakage
Risks related to forgetting	Knowledge spillover
Risks related to unlearning	Knowledge outsourcing risks
Risk of using disinformation or unreliable information	Knowledge hoarding
Risk of improperly applying knowledge	Knowledge hiding
Risks related to knowledge gaps	Relational risks

The linkage between knowledge risk management and organizational performance

Research Highlights

- Knowledge risk management has a significant effect on organizational performance
- Focusing on knowledge risks is beneficial for both public and private organizations
- Knowledge risk management helps organizations to be more sustainable and to improve their innovativeness and agility

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