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Knowledge risks inherent in business sustainability

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ABSTRACT

Since the connection between business sustainability and knowledge risks has not been established in the literature so far, this paper provides a conceptual framework to demonstrate the possible impact of various knowledge risks on business sustainability and offers potential ways to manage and overcome these risks. The aim of this conceptual paper is to address two main questions: What are the potential effects of knowledge risks on the three dimensions of sustainability in organizations? and How can organizations cope with knowledge risks to become truly sustainable? Taking insights from both the theories of knowledge management and business sustainability, it proposes a research agenda both for researchers and practitioners.

1. Introduction

Present business environment that is defined by shorter product life cycles (Hall and Andriani, 2003; Stonehouse and Pemberton, 2002), greater demands from consumers for sustainable (Taherparvar et al., 2014) and eco-friendly products and services (Lin and Chen, 2017) constitute a major challenge for all organizations. Thus, organizations willing to be continuously successful in a constantly changing market, need to rethink their existing business models and put a stronger emphasis on innovation towards sustainability (Bocken et al., 2014). Furthermore, to cope not only with the present challenges but also with the future ones, organizations are required to constantly observe developments both in markets and society. Talking about the latter, organizations are increasingly challenged by climate change, migration, youth unemployment, political and economic risks, which in turn calls for an even more rigorous approach to knowledge management (Chew and Gottschalk, 2013; Gupta et al., 2000; Johnson, 2017; Lopes et al., 2017; Quintas et al., 1997).

Knowledge management (KM) can be helpful in the proper identification, gain, application, and dissemination of crucial knowledge, which in turn can serve for the organization's sustainability. For example, KM can support organizations in developing Circular Economy business models, by which sustainable organizational performance can be achieved (Jose et al., 2019). Moreover, knowledge exchanges in organizations, and between organizations and the environment can foster social change (Singh et al., 2019a) and by that, help organizations in better fulfilling a sustainable approach. As it has been proved by Singh et al. (2019b), knowledge value and knowledge sharing practices influence open innovations and therefore, can support the development of environmental innovations as well. The study of Pham et al. (2019), for example, has shown that to reach environmental innovativeness, an important prerequisite is external knowledge integration (one of the key elements of KM). Taking into account that the implementation of eco-innovation is being implemented by an increasing number of organizations to increase their return on investment, but also to manifest their socio-ecological responsibility by reducing the negative impact of their operations on the natural environment, KM can support organizations in their efforts towards sustainability. Of similar opinion are Lopes et al. (2017), who claim that organizations may leverage KM to an asset so that it supports sustainable innovations. This in turn leads to organizational sustainability. KM processes have also been proved to positively

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influence the operational, quality and innovation performance of the public sector (Al Ahbabi et al., 2019), which can contribute to the enhanced sustainability in this sector. For sustainability-oriented small and medium-sized enterprises, Johnson (2017) stressed the crucial ability to acquire and continuously develop knowledge for the implementation and application of environmental management systems and other related tools.

At the same time, organizations need to consider a change in their approach towards KM into the one that perceives knowledge as a dynamic resource which may also have a decreasing half-time (Jackson, 2010) and the one that takes into account the increasing opportunities provided by new information and communication technologies (ICTs). With regard to the former, there is an increasing probability that knowledge that has once been an organization asset, i.e. something of value, has turned into something of reduced value or has become even worthless in the worst-case scenario (Tan et al., 2006). While addressing the latter, the increasing amount of available data needs to be analyzed, yet that cannot longer be done manually but requires systems that can handle a bulk of complex and different types of data (Gandomi and Haider, 2015). Therefore, it can be concluded that KM and its different elements are crucial for the sustainability of organizations.

Business sustainability can be perceived as the fulfillment of the so-called "triple bottom line", i.e. social, environmental and financial outcomes (Gupta and Kumar, 2013) or people, planet and profit orientation (Dyllick and Muff, 2016). By integrating sustainability in their business processes, organizations may gain benefits, such as positive image, enhanced trust from stakeholders, more efficient resource management, or higher returns on investments and profitability (Horak et al., 2018). At the same time, as a study among corporate managers has shown, although 90% of the managers understand that having a sustainability strategy is important for the sake of their businesses, only 60% declare the implementation of any kind of sustainability strategy (Kiron et al., 2017).

Integrating and managing sustainability in organizations is a balancing act between opportunities and risks (Krysiak, 2009). The organization may be exposed to reputational risk due to investments in projects with potentially damaging environmental consequences. For example, although countries like China or India have made great achievements with regard to their economic growth over the past years, their natural resources are heavily exploited and both countries have begun to suffer from significant environmental damage (Liao, 2018). In those countries which still have large numbers of poor population groups, it is more difficult for the governments to justify large investments in more sustainable-driven activities that may reduce the costs related to the economic growth.

However, a lack of knowledge or its improper usage can bring various risks to sustainability in organizations. When an organization has only inadequate knowledge of sustainability, the opportunity of benefiting from the sustainability prospects decreases while, at the same time, the danger of making wrong decisions or no decisions at all increases. A lack of knowledge (e.g. resulting from the lack of KM in an organization) may also result in a failure to comply with specific product-related regulatory requirements (Yusup et al., 2015). The consequences of this situation are easy to imagine. The increasing use of ICTs for communicating with different stakeholder groups also opens the danger of cyberattacks (World Economic Forum, 2019), representing another incident which could put the organization's sustainability at stake.

Taking into account the above-mentioned, the following research questions appear: 1) What is the potential effect of knowledge risks on various sustainability dimensions of organizations? and 2) How can organizations cope with knowledge risks to preserve their sustainability?

In an attempt to develop an integrated theory to address the research questions, the authors of the present paper relied on the literature devoted to business sustainability and knowledge management. For better clarity, the authors followed Jabareen (2009) and his suggestions regarding the process of creating conceptual frameworks for multidisciplinary phenomena related to different bodies of knowledge.

Hence, the aim of this conceptual paper is to provide sufficient context by listing and presenting a number of knowledge risks to which organizations aimed at operating in a sustainable manner are exposed to. More precisely, different knowledge risks will be assigned to the three dimensions of business sustainability and ways to address them will be proposed. Thus, the purpose of the paper is to show the potential contribution of knowledge risk management (KRM) as an approach for sustainable organizations. KRM is a recent stream of research that tries to bring knowledge into balance by highlighting its possible up- and downsides (Durst and Ferenhof, 2016). The idea is based on the changing perception of the concept of knowledge, which since the origin of KM has been considered primarily as an asset, potentially bringing positive results to the organization (Massingham, 2010; Stam, 2009). Yet, in the face of digitalization and societal challenges, this conventional wisdom has to be modified, as extant knowledge may no longer mean an asset, but a negative burden preventing organizations from mastering their challenges (PWC, 2019).

Even though some researchers have started to examine various types of knowledge risks, such as:

- *risk of knowledge loss* (e.g. Durst and Wilhelm, 2011; Joe et al., 2013);
- *risks related to outsourcing* (e.g. Williams and Durst, 2019);
- *knowledge leakage* (e.g. Parker, 2012; Ahmad et al., 2014);
- *knowledge hiding* (e.g. Arshad and Ismail, 2018; Cerne et al., 2014);
- *knowledge hoarding* (e.g. Holten et al., 2016; Leonard, 2014);
- *or knowledge spillover* (e.g. Feinberg and Gupta, 2004);

our understanding is still fragmented, and the extant studies have not provided insights into the influence of potential knowledge risks and their management on business sustainability (with its three dimensions). The authors of the present paper are only aware of one paper that has empirically shown the link between KRM and sustainability in both private and public organizations, which is the one by Durst et al. (2019), yet studying sustainability was not the primary focus of this study. Against the relevance of both topics, this situation can be assessed as unsatisfactory and this paper offers the missing link. This is also one of the aspects of the novelty of the present study.

The article first commences with a description of the challenges faced when conducting research of this nature, and an outline of the adopted approach. Secondly, the theoretical review of knowledge risks and their management is provided. Thirdly, the concept of a sustainable organization is discussed. Next, the framework for managing knowledge risks in sustainable organizations is proposed. As the phenomenon of knowledge risks and their management is still at an early stage of development, the research reported here is of preliminary character. Finally, conclusions with a research agenda are proposed, which originates from the analysis presented in the early sections of the paper.

2. The research approach adopted

This paper is of conceptual character. In addition to empirical papers, conceptual papers are relevant to advance fields or

disciplines (MacInnis, 2011). Although the use of conceptual research methods could potentially provide a significant improvement in the state of the art and allow building valid theories (Meredith, 1993), it is linked with a variety of challenges. The main aspect to consider is the methodological clarity, which has to be provided. For this purpose, the authors first conducted a contextual review of relevant areas of interest. A conceptual framework was then generated, whereby the potential relation of the researched areas was indicated in the form of a table. This table offers the guideline on how the two concepts of organizational sustainability and knowledge risks can be researched, understood and interrelated.

The analysis was based on a wide range of sources (i.e., this included relevant prior research conducted by the authors). As a starting point, two recent systematic literature reviews were examined: one concerning knowledge risks by Durst (2019) and one devoted to knowledge management in the context of sustainability by Martins et al. (2019). On the basis of these two reviews, it was concluded that so far there has not been any study published that would link knowledge risks with the issue of sustainability. Against the relevance of both risk management and knowledge, the authors of the present paper argue that the inclusion would advance the understanding of sustainability and thus, could contribute to reaching the UN sustainable development goals. Therefore, it was necessary to prepare a solid theoretical background based on the available literature on knowledge risks, knowledge management, and sustainability.

For this purpose, an iterative process of analysis was performed, in which the collected materials (i.e., articles, books, and book chapters) were examined step by step, adding new ones related to the discussed aspects. The superior concept was sustainability with its three dimensions and knowledge risks were examined from the perspective of their potential influence on sustainability.

It needs to be kept in mind that, generally, a conceptual framework provides not a causal/analytical explanation of the reality but rather an interpretative approach. Additionally, instead of providing a theoretical explanation, as quantitative approaches do, conceptual frameworks offer an understanding (Jabareen, 2009). In other words, as Meredith (1993) stated, conceptual approaches are based mostly on the description and explanation and they offer a better balance between theory-building and theory-testing. The present paper aims to contribute both to theory and practice in one of the general conceptual goals proposed by MacInnis (2011), i.e., in envisioning new areas of organization's operations which should be examined for the purpose of achieving organizational sustainability. To envision new ideas, following MacInnis (2011), the authors identified (to see that the phenomena exist) and revised (to see phenomena that have been identified in a new way; to reconfigure and shift them) the present state of the art. The outcome of the paper is a novel framework with a revised perspective, linking knowledge risks and their potential influence with business sustainability and proposing ways to overcome knowledge risks by organizations aiming at sustainable performance.

3. Knowledge risk management – theoretical review

Knowledge and its significance for sustainability has been relatively neglected in the extant literature. There is a stream of research devoted to knowledge (e.g. local knowledge) and its potential influence on environmental risk management and natural hazards. For example, Birkmann and Teichman (2010) point out the importance of having knowledge and information base for disaster risk reduction. This is similar to Gaillard and Mercer (2012), who indicate the usefulness of local and scientific knowledge for the same purpose. Corburn (2003) explains how local knowledge can be useful in the process of planning by communities endangered with environmental and health risks, while Failing et al. (2007) highlight the importance of local and scientific knowledge for environmental decision making.

From the knowledge-based view (KBV), knowledge and organizational learning are perceived as the most crucial elements (Castro et al., 2011; Grant, 1996) for helping the development of innovations, including sustainable ones as well (Pham et al., 2019). There is an interesting study by Hörisch et al. (2015), in which the authors have proven that knowledge can act as an important mediator to promote sustainability management in organizations. In another study, Cegarra-Navarro et al. (2013) have shown the positive effect of environmental knowledge on performance in hospitality companies. Although there are few studies about the influence of knowledge on the sustainability of organizations, not much is known about the risks related to knowledge and how they may hinder business sustatainability.

Knowledge risk management is a novel approach, which concerns the management of various risks related to knowledge that can be faced by organizations. Knowledge risk management can be defined as a systematic activity devoted to the application of a variety of tools and techniques required to detect, examine and react to risks related to the production, usage, and detainment of knowledge (Durst et al., 2016). This approach has not been discussed extensively in the literature so far due to the fact that knowledge has been considered mainly as a valuable organizational asset (Quintas et al., 1997; Victer, 2014), rather than a threat to organizations (Bratianu, 2018; Hurmelinna-Laukkanen, 2015). Knowledge risk can be defined as "a measure of the probability and severity of adverse effects of any activities engaging or related somehow to knowledge that can affect the functioning of an organization on any level" (Durst and Zieba, 2019, p. 2). Taking that into account, organizations should be interested in both proper identification and elimination or reduction of knowledge risks that could hinder their operations. If not, a worst-case scenario would be bankruptcy, for example, as a result of a hacker attack where the company's customer database with fragile information has been leaked and, in turn, led to irreversibly loss of both trust and market position. In a recent study, Durst et al. (2019) have shown the effect of KRM on organizational performance in private and public organizations. By using "softer" measures of performance, the authors provided some proof on the positive effect of KRM on the organizations' sustainability.

In an attempt to highlight differences between knowledge risks, Durst and Zieba (2019) proposed to divide knowledge risks into three categories: human, technological and operational knowledge risks. The first category, human knowledge risks concern a plethora of individual factors, such as personal, social, cultural and psychological, as well as human resources management. The examples of such risks are knowledge hiding, forgetting or unlearning. The second category, technological knowledge risks are related to the usage of a variety of technologies by organizations, including information and communication technologies. Examples could be risks related to cybercrime or social media. The third and last category (operational knowledge risks) result from the regular activities of organizations, such as for example cooperation with suppliers or other entities, outsourcing, etc. Among such risks, there are knowledge waste, risk of using obsolete/unreliable knowledge, or knowledge acquisition risks (Durst and Zieba, 2019).

The largest category constitutes operational knowledge risks, which are in many cases a natural consequence of everyday operations of organizations. Thus, particular attention should be given to this category to avoid expensive and detrimental interruptions.

4. Business sustainability

Activities around developing and managing sustainable organizations are gaining more and more attention. For example, Baumgartner and Rauter (2017) in their theoretical paper have provided some guidelines for businesses on how sustainability issues can be integrated into corporate activities and strategies. According to Eccles et al. (2012), sustainable organizations are more successful than their less-sustainable counterparts and they engage intensively with their internal and external stakeholders. The view of enhancing corporate value through sustainability is shared by Soyka (2012), who in his seminal book provides guidelines on how to create a sustainable organization.

Sustainability is said to be achieved and maintained by balancing the three aspects of social, economic and environmental development (Johnson, 2017). Consequently, organizations have to take a broad approach when analysing their business practices to achieve this balance (MacDonald, 2011). Tideman et al. (2013) have explained the attention to sustainable operations by increasing the awareness about the growing population which, at a global level, cannot be mastered with limited resources. Thus, a short-term orientation that is primarily based on self-interests is no longer tenable. 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" (WCED, 1987) (p.43). In order to achieve sustainable development, organizations are supposed to integrate social, economic, and environmental development into their business operations (Chow and Chen, 2012). Van Kleef and Roome (2007) stress that these three aspects need to be considered as one entity instead of three separate ones, highlighting again that a balancing act and trade-offs will be among these aspects of sustainability. Van Kleef and Roome (2007) further emphasize the crucial role of cooperating strongly with all the stakeholders to reach sustainable objectives.

Business sustainability, in contrast to sustainable development that focuses on the macro level, is located on the micro level of organizations. In this way, Dyllick and Muff (2016) conclude that without a connection between these two levels, business sustainability improvements will not contribute significantly to the improvement of the global situation. In order to address this situation, the authors have proposed a typology for business sustainability. This typology consists of four types of business sustainability: business-as-usual, Business Sustainability 1.0, Business Sustainability 2.0, and Business Sustainability 3.0. The latter type is considered to be real business sustainability because, according to Dyllick and Muff (2016), organizations which have reached this type of development have changed its perspective from seeking to reduce the negative impacts of their operations to working on positive operations that are vital for the society and the entire world. Those organizations have a clear outward-focusedview and then in a further step ask themselves internally what could be done to overcome the present societal challenges. Thus, in contrast to the other three types, the Business Sustainability 3.0 firm has a clear outside-in perspective.

Working with such a perspective brings a number of new challenges to organizations. For example, performance must not only be evaluated in terms of economic performance (e.g., cost savings or profitability) but also in terms of non-economic aspects, such as eco-efficiency in the form of reduction of waste and pollution levels (Iasevoli and Massi, 2012) or the organizations' contributions to overcoming societal challenges, e.g. reducing youth unemployment or increased entry of refugees into the working world, or finally, stronger focus on sustainable consumption. Presumably, the outcomes of a sustainable business are better covered by the term organizational effectiveness (Richard et al., 2009).

In these conditions, the concept of Cleaner Production (CP) is gaining more and more attention (e.g. Cardoso et al., 2019; Zhang et al., 2018). CP can be defined as a preventive, integrated and continuous environmental approach concerning processes, products and services and aiming at the improvement of the overall efficiency and the reduction of risks to people and the whole environment (UNEP, 1996). This approach is useful for potentially any industry or any area of company's operations. The application of CP can help organizations in the conservation of the environment, improvement of the efficiency of resources' usage, reduction of waste and wastage of materials, as well as the promotion of environmentally friendly actions (Yusup et al., 2015). It is expected that CP supports the application of environmental management systems and that it contributes to the improvement of organizational and environmental outcomes (Stone, 2006). Thus, CP can help organizations in their efforts becoming a Business Sustainability 3.0 firm.

When business sustainability is concerned, one needs to consider also the constituent dimensions of sustainability, namely scope (narrow vs. broad), substitutability (weak vs. strong) and goal orientation (absolute vs. relative) (Lankoski, 2016). In the case of the first dimension, narrow sustainability means that it is considered only in the context of environmental issues, while broad sustainability covers also social and economic issues (Montiel, 2008). As far as the second dimension is concerned, namely substitutability, it can be considered as weak when poor performance in one aspect of sustainability can be covered with good performance in other aspect(s). In the case of strong sustainability, the substitution is prohibited and organizations need to meet performance standards in all the areas of sustainability (Dietz and Neumayer, 2007; Hediger, 1999). The third and last dimension concerns the benchmark against which sustainability is assessed. In absolute sustainability, the benchmark is set by a critical outcome, while in relative sustainability it happens by comparing the own organization/own organizational values with other organizations/values (Lankoski, 2016). These three dimensions may potentially influence knowledge risk management, as depending on the standards of dimensions the organization aims to meet, it needs to consider a greater or smaller variety of knowledge risks.

Against this background, knowledge and KM can be viewed as crucial for sustainable organizations and their continuity (Gloet, 2006). As Robinson et al. (2006) have postulated: KM is inseparably linked to corporate sustainability. Knowledge can help organizations to address the balancing act regarding the three elements of sustainability addressed before (Mohamed et al., 2009). At the same time, the ability to create, disseminate and exploit knowledge assets starts to be perceived as one of the crucial factors for achieving long-term success by both the public and private sectors (Ruhanen, 2008). According to Bounfour (2003), KM is "a set of procedures, infrastructures, technical and managerial tools, designed towards creating, circulating (sharing) and leveraging information and knowledge within and around organizations" (p. 156). KM has a long-term orientation and thus fits properly with the aspect of durability regarding sustainability and sustainable management (Chow and Chen, 2012). KM practices, e.g. knowledge creation or knowledge retention, are expected to support the continued management of up-to-date and relevant knowledge. Consequently, a systematic approach to KM allows organizations to address current and future business challenges (Durst and Edvardsson, 2012). This, in turn, can help organizations in meeting their sustainability-related objectives (Gloet, 2006). Hence, organizations should engage in sustainable knowledge management which brings together KM and sustainability; where, by integrating social, economic, and environmental areas, the

primary task of KM is to use the current and future knowledge sources in a sustainable way (Ansari et al., 2010). To make this possible, however, organizations need to be aware of the likely downsides of knowledge as well and thus, the consequences of knowledge risks for sustainable business management over time.

5. Managing knowledge risks in sustainable organizations

By bringing together the concepts presented above, the authors of the present paper were in the position to envisage what kind of knowledge risks may potentially affect particular areas of sustainability in organizations. If organizations want to become and remain sustainable, they need to analyse the potential knowledge risks they may face and to determine which sustainability dimension(s) is (are) endangered. For this purpose, they may turn to Table 1, which lists knowledge risks and the dimensions of sustainability they potentially affect. This can be considered the first step in the implementation of KRM, namely the identification of potential knowledge risks and their probable consequences.

The table clarifies that all the mentioned types of knowledge risks may hinder the economic dimensions of organizational sustainability, which is not very surprising. Various knowledge risks are related to some sort of inefficient or improper usage of knowledge and as such, they may damage the economic sustainability of a company. For example, in the case of espionage the company may lose the competitive advantage and in the long run, drop out of the market. Similar may be the case with missing/inadequate competencies of organizational members or knowledge hiding – they may result in a reduced ability to deal with organizational tasks or undertakings, depriving an organization of its economic sustainability. What is also worth mentioning is that the economic dimension of sustainability can be perceived as the basic one for the survival of the organization – if an organization is not economically sustainable, it will not stay in the market in the long run. It can, therefore, be considered as elementary and being the base for the following two dimensions. Additionally, knowledge risks seem to affect significantly the environmental dimension of sustainability. For example, risks related to cybercrime can end up tragically if the subject of the cyber-attack will be a power plant or a different organization with a potentially negative influence on the environment. Also, in the case of merger and acquisition, there is a risk that environmental issues will be hindered if the company that takes over another one does not pay attention to this area of operations. The dimension of sustainability least affected by knowledge risks seem to be the social dimension. Still, there are several risks that can potentially make an influence. For example, knowledge hiding can result in a reduced willingness to collaborate and trust in the organization which in turn is likely to reduce the social climate in the organization which can also affect the relationships with external stakeholders. Risks related to knowledge gaps may have a negative influence on the well-being of organization's employees if the management is not aware of the working conditions in its overseas factories. Poor communication can also address the social dimension as it may lead to frustration, anger or stress.

After the proper identification of knowledge risks, organizations need to determine which knowledge risks could lead to serious problems; more precisely, the probability of occurrence and the expected size of the loss need to be determined. Based on that, concrete actions are required to be initiated to address these risks. These actions are especially crucial in case of risks which can seriously affect organizations' survivability, leading them for example to bankruptcy. In Table 2 the authors of the present paper propose some examples of actions to be taken to address the knowledge risks identified in Table 1.

It needs to be kept in mind that not all organizations have the necessary means to manage all the knowledge risks mentioned in Tables 1 and 2. This can be the case especially in small and medium-sized firms, which often suffer from resource scarcity, as well as a lack of knowledge and capabilities regarding both knowledge management (Desouza and Awazu, 2006; Zieba et al., 2016) and risk management (Henschel and Durst, 2016). This, in turn, underlines the importance of identifying those risks that potentially have the most severe effects on the business operations and working on their elimination or reduction. The undertaken actions should be adjusted to the characteristics of the company and its possibilities (e.g. the possessed knowledge, available financial and

Table 1
Effect of knowledge risks on organizational sustainability dimensions.

Knowledge risk/Sustainability dimension	Environmental sustainability	Economic sustainability	Social sustainability
Human knowledge risks			
Knowledge hiding	X	X	X
Knowledge hoarding	X	X	X
Unlearning		X	
Forgetting		X	
Missing/inadequate competencies regarding sustainability among organizational members	X	X	X
Technological knowledge risks			
Risks related to cybercrime	X	X	
Risks related to old technologies	X	X	
Risks related to digitalization	X	X	X
Risks related to social media		X	X
Risks related to waste and pollution (due to resource-wasting machines etc.)	X	X	X
Operational knowledge risks			
Knowledge waste	X	X	X
Risks related to knowledge gaps	X	X	X
Relational risks		X	
Knowledge outsourcing risks	X	X	X
Risk of using obsolete/unreliable knowledge	X	X	X
Risk of improper knowledge application	X	X	
Espionage	X	X	
Continuity risks		X	
Communication risks	X	X	X
Knowledge acquisition risks	X	X	X
Knowledge transfer risk	X	X	
Merger & Acquisition risks	X	X	

Table 2
Knowledge risks and examples of actions to address them.

Knowledge risk	Actions to address knowledge risks
Human knowledge risks	
Knowledge hiding	- motivational aids highlighting the importance of knowledge sharing; - creating a culture of trust within and outside the company; whereby the managers/entrepreneurs will need to set a good example for the employees, the other stakeholders to follow; - eliminating power distances between the requestor and the knowledge hider (Connelly et al., 2012); - implementation of knowledge management systems and knowledge policies (Serenko and Bontis, 2016).
Knowledge hoarding	- preventive and damage limitation actions to reduce and finally eliminate negative conduct by focusing on increasing social exchange/interactions, quality at work (Holten et al., 2016); - building employee reputation through knowledge sharing (Webster et al., 2008).
Unlearning	- for unnecessary unlearning: knowledge documentation, knowledge exchange with peers, job rotation; - for required unlearning (for example to make space for new knowledge, changes of routines in organizations): supporting change management, showing the benefits of new knowledge for the individual employee (Cegarra-Navarro et al., 2011).
Forgetting	- maintain an organizational memory as a strategic imperative (Holan and Phillips, 2004); - link the new habits to the old ones (Holan and Phillips, 2004).
Missing/inadequate competencies of organizational members	- determination and analysis of required competences and the possessed ones; - offering training and further education to fill the competencies gap; - hire new staff with the missing competencies.
Technological knowledge risks	
Risks related to cybercrime	- application of protection mechanisms (e.g. anti-virus software; keep software updated; password management application); - crucial data duplication in various locations; - support from professional agencies.
Risks related to old technologies	- up-date of technologies, when required; - analysis of available options.
Risks related to digitalization	- balancing the application of technologies and reliance on human resources; - keeping in mind all the three dimensions of sustainability when adapting solutions, not only the economic dimension.
Risks related to social media	- monitoring of social media activities; - seeking for legal actions in case of fake as well as other detrimental incidents; - have a social media policy.
Operational knowledge risks	
Knowledge waste	- knowledge storage, retention, and dissemination in order not to reinvent the wheel (Ferenhof et al., 2015).
Risks related to knowledge gaps	- analysis of possessed knowledge and the required one for company operations; present and future ones (Perrott, 2007); - obtaining missing knowledge from external sources (e.g. partners, clients, suppliers, etc.).
Relational risks	- careful selection of partners (Delerue, 2005); - protection mechanisms against opportunistic behaviours (e.g. legal agreements); - the reduction of the scope of partners to collaborate with (Durst and Ferenhof, 2014).
Knowledge outsourcing risks	- maintain all business functions to some basic extent; - careful selection of outsourcing partners (Agndal and Nordin, 2009).
Risk of using obsolete/unreliable knowledge	- double-checking of knowledge resources; - application of verified/up-dated knowledge.
Risk of improper knowledge application	- seeking expert advice in case of doubts; - training and further education for better knowledge skills.
Espionage	- trust building (Chan, 2003); - protection of key knowledge and information; - legal measures (Crane, 2005).
Continuity risks	- actions to retain knowledge; - motivational measures to reduce the turnover of employees (Lambe, 2013).
Communication risks	- emphasis on trust, understanding, listening and feedback gaining; - development of cultural sensitivity; - careful selection of communication channels and paying attention to communication conditions.
Knowledge acquisition risks	- strategic orientation towards new knowledge gain; - careful selection of knowledge sources.
Knowledge transfer risk	- focus on people-to-people processes (Tangaraja et al., 2016); - concentration on culture, a commitment of management to make available resources and time, incentives provided, context (Durst and Zieba, 2019).
Merger & Acquisition risks	- concentration on knowledge exchange and making knowledge available; - protection of knowledge that can be lost in the process.

non-financial resources, potential solutions, etc.).

Consequently, each organization should put an emphasis on the identification, analysis, and mitigation of those knowledge risks that have the highest probability of endangering its sustainability. For this purpose, it can start with the knowledge risks described in Table 1 to determine which areas of sustainability are endangered with the existing or potential knowledge risks. The relevant risks identified should then be integrated into the organization's approach to (knowledge) risk management and actions to mitigate the risks should be identified, initiated, monitored and reported. In the third step, the modification of the KM approach should be made, so that it corresponded with the KRM approach. In case the organization has not implemented KM before, this step should concern the implementation of a KM approach that is aligned with the organization's (knowledge) risk management.

Thereby, organizations may use the following step-by-step guide:

1. Identification of possible knowledge risks.
2. Analysis of the potential impact (i.e., determining the possibility and severity of the impact) of the identified knowledge risks on the three sustainability dimensions.
3. Focus on those knowledge risks with the most probable and severe impact on sustainability.

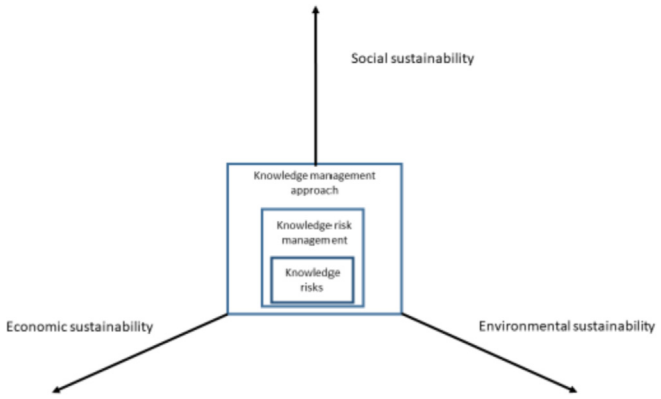

Fig. 1. Integrated knowledge management approach with knowledge risk management and the three dimensions of sustainability. Source: Authors' own compilation.

4. Identification and selection of ways to either eliminate or reduce the impact of identified knowledge risks, together with the specification of the required resources and organizational changes needed to implement the solution(s).
5. Design and implementation of a KRM plan that specifies the knowledge risks currently of importance, the ways/solutions chosen to address these risks, as well as their monitoring (counter-measures in case the chosen solutions do not work) and the reporting methods to the organization's main stakeholders.
6. Concurrently watching out for new risks and preventive actions.

By having addressed these steps as a dynamic and ongoing process, the organization should have a tool at hand that contributes to the aims of sustainable business development, i.e. better understanding and handling of likely risks related to the three dimensions of sustainability (Fig. 1).[1]

The application of KRM may also support organizations' activities dedicated to Cleaner Production to address the environmental dimension of sustainability. As Kjaerheim (2005) stated, a production that is both efficient and environmentally friendly requires not only the investment in technology, which is often too expensive to be covered by a company, but also a concentration on people, their skills, motivation, experience they have, and the existence of systems that are implemented and the holistic organization perspective. In such a case, the analysis of knowledge risks may prove to be useful for companies, as it concentrates on all these aspects and helps to find solutions to common problems.

6. Conclusions

To conclude, the paper offers a new perspective on business sustainability, i.e. the perspective of knowledge risks and in a broader sense, KM. On the basis of the presented analysis, it seems that the underlying notion of KM is predestined for the underlying notion of sustainable business development. The paper also enriches the concept of business sustainability with a relatively new perspective which considers knowledge not only as a valuable asset, but also as a potential threat or hazard, which in turn underlines the need for reconsidering approaches to risk management.

[1] Fig. 1 represents a kind of conceptual map which shows the concepts of interest and its connection (Whetten, 1989).

6.1. Implications for theory and practice

The paper analyses the aspect of business sustainability from the perspective of knowledge risks and their management. The plethora of knowledge risks that may potentially endanger the sustainability of an organization makes their identification a problematic issue, not to mention ways to reduce or eliminate their impact. Against the underdeveloped state of research that links these two relevant and topical issues, this paper develops further the current body of knowledge by offering this missing link between knowledge risks and business sustainability and its three dimensions (the economic, social, and environmental). In the era of growing environmental risks and natural disasters (Birkmann and Teichman, 2010; Gaillard and Mercer, 2012), it is necessary to extend the common thinking about business sustainability and the ways it can be affected by knowledge risks. For example, knowledge related threats targeting the energy sector, e.g. unauthorized people hack the functioning of power-grids will be detrimental not only to companies but also to the wider community.

Additionally, the contribution of this conceptual paper results from the fact that it offers a variety of actions/measures which could be taken by organizations to mitigate knowledge risks. Depending on the type of knowledge risk, these actions may be related to knowledge processes (Serenko and Bontis, 2016), cooperation paradigms (Agndal and Nordin, 2009), legal actions, motivational aspects (Lambe, 2013) or concentration on various key areas in organizations (Durst and Zieba, 2019). Having an awareness of potential actions, organizations are in a better position to select proper ones which, in turn, can contribute to the organizations' sustainability. By focusing on knowledge risk management, which can be viewed as a specialization of risk management, the paper contributes to the latter research efforts in the areas of cleaner production and environmental issues (e.g. Wu et al., 2013).

Moreover, the links between KM and sustainability have not been examined extensively so far (Martins et al., 2019). As potential research areas, Martins et al. (2019) have listed, for example, the analysis of KM implementation in different sectors and branches; ways of promoting KM as a systematic tool for exchanging information; or using KM to build organizational capacity.

The present paper deals with the last area – capacity building on KM as it proves that by the analysis of knowledge risks and their management, organizations may potentially improve their approaches to/strategies of sustainability. Finally, by emphasizing sustainability practices in organizations the present paper is in line with latest research within this realm (e.g. D'Souza et al., 2020); it also underlines the possible practical utility of the paper.

6.2. Study limitations and further research avenues

There are some limitations to the presented study. First of all, being a conceptual paper, it does not offer empirical evidence on the impact of KRM on business sustainability. Yet, the recent findings by Durst et al. (2019) can be named in order to strengthen the material presented in this paper, as the mentioned study has shown the positive effect of KRM on sustainability in both private and public organizations. Second, the list of knowledge risks may appear to be incomplete and there could be more risks that are relevant for addressing sustainable business development and the three dimensions respectively. This may be caused by the fact that every day new potential knowledge risks may appear, for example as a result of new technologies or a changing environment in which companies operate. Third, risks typically do not act in isolation but can affect/lead to other risks too, and these linkages need to be understood, particularly with regard to the three dimensions of sustainability.

Thus, researchers interested in the topic could benefit from these limitations as starting points for their research projects. Additionally, one can recommend the execution of both qualitative and quantitative studies (even mixed methods approaches) to identify and examine relevant knowledge risks and their influence on business sustainability. Thereby, the emphasis could be on a particular dimension or ideally on all three dimensions of sustainability. The research could be conducted in organizations from various sectors, of various sizes and cultural contexts. Another potentially promising research theme would be to design longitudinal research projects to study the potential contribution of KRM to business sustainability over time, e.g. towards a Business Sustainability 3.0 firm. Does KRM contribute to becoming a truly Business Sustainability 3.0 firm? Does KRM contribute to the three dimensions of business sustainability and which dimensions in particular? Moreover, as this conceptual paper provides only one type of contribution among the four general conceptual options as defined by MacInnis (2011), there is a new field for exploration in future studies. Future research could try and cover the next types of conceptual contributions, i.e. explicating, relating and debating, in order to further the field's advancement and offer new insights, both for researchers and practitioners. Finally, it should also be clarified whether there is a link between the typology of sustainability and knowledge risks. This would help organizations in better understanding how the knowledge risks they face and deal with may influence various types of sustainability.

Authors contribution

The authors have contributed equally in all the stages of article preparation.

Susanne Durst: Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing.

Malgorzata Zieba: Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

Agndal, H., Nordin, F., 2009. Consequences of outsourcing for organizational capabilities: some experiences from best practice. Benchmarking Int. J. 16, 316–334. https://doi.org/10.1108/14635770910961353.

Ahmad, A., Bosua, R., Scheepers, R., 2014. Protecting organizational competitive advantage: a knowledge leakage perspective. Comput. Secur. 42, 27–39. https://doi.org/10.1016/j.cose.2014.01.001.

Al Ahbabi, S., Singh, S., Balasubramanian, S., Gaur, S., 2019. Employee perception of impact of knowledge management processes on public sector performance. J. Knowl. Manag. 23, 351–373. https://doi.org/10.1108/JKM-08-2017-0348.

Ansari, C.F., Holland, A., Fathi, M., 2010. Advanced knowledge management concept for sustainable environmental integration. In: 2010 IEEE 9th International Conference on Cybernetic Intelligent Systems. IEEE, pp. 1–7.

Arshad, R., Ismail, I.R., 2018. Workplace incivility and knowledge hiding behavior: does personality matter? J. Organ. Eff. People Perform. 5, 278–288. https://doi.org/10.1108/JOEPP-06-2018-0041.

Baumgartner, R.J., Rauter, R., 2017. Strategic perspectives of corporate sustainability management to develop a sustainable organization. J. Clean. Prod. 140, 81–92. https://doi.org/10.1016/j.jclepro.2016.04.146.

Birkmann, J., Teichman, K. von, 2010. Integrating disaster risk reduction and climate change adaptation: key challenges — scales, knowledge, and norms. Sustain. Sci. 5, 171–184. https://doi.org/10.1007/s11625-010-0108-y.

Bocken, N.M.P., Short, S.W., Rana, P., Evans, S., 2014. A literature and practice review to develop sustainable business model archetypes. J. Clean. Prod. 65, 42–56. https://doi.org/10.1016/j.jclepro.2013.11.039.

Bounfour, A., 2003. The Management of Intangibles: the Organisation's Most Valuable Assets. Routledge, London, UK.

Bratianu, C., 2018. A holistic approach to knowledge risk. Manag. Dyn. Knowl. Econ. 6, 593–607. https://doi.org/10.25019/MDKE/6.4.06.

Cardoso, G., Neto, D.O., Manoel, J., Correia, F., Silva, P.C., Gaiola, A., Sanches, D.O., Lucato, W.C., 2019. Cleaner Production in the textile industry and its relationship to sustainable development goals. J. Clean. Prod. 228, 1514–1525. https://doi.org/10.1016/j.jclepro.2019.04.334.

Castro, G.M., López-Sáez, P., Delgado-Verde, M., 2011. Towards a knowledge-based view of firm innovation. Theory and empirical research. J. Knowl. Manag. 15, 871–874. https://doi.org/10.1108/13673271111179253.

Cegarra-Navarro, J.G., Sánchez-Vidal, M.E., Cegarra-Leiva, D., 2011. Balancing exploration and exploitation of knowledge through an unlearning context: an empirical investigation in SMEs. Manag. Decis. 49, 1099–1119. https://doi.org/10.1108/00251741111151163.

Cegarra-Navarro, J., Martinez-Martinez, A., Ortega Gutiérrez, J., Luis Leal Rodríguez, A., 2013. Environmental knowledge, unlearning, and performance in hospitality companies. Manag. Decis. 51, 341–360. https://doi.org/10.1108/00251741311301858.

Cerne, M., Nerstad, C.G.L., Dysvik, A., Skerlavaj, M., 2014. What goes around comes around: knowledge hiding, perceived motivational climate, and creativity. Acad. Manag. J. 57, 172–192.

Chan, M., 2003. Corporate espionage and workplace trust/distrust. J. Bus. Ethics 42, 45–58. https://doi.org/10.1023/A:1021611601240.

Chew, E.K., Gottschalk, P., 2013. Knowledge organizations and dynamic organizational capabilities. In: Knowledge Driven Service Innovation and Management: IT Strategies for Business Alignment and Value Creation: IT Strategies for Business Alignment and Value Creation. IGI GLOBAL, pp. 84–105. https://doi.org/10.4018/978-1-4666-2512-9.ch003.

Chow, W.S., Chen, Y., 2012. Corporate sustainable development: testing a new scale based on the mainland Chinese context. J. Bus. Ethics 105, 519–533.

Connelly, C.E., Zweig, D., Webster, J., Trougakos, J.P., 2012. Knowledge hiding in organizations. J. Organ. Behav. 33, 64–88. https://doi.org/10.1002/job.737.

Corburn, J., 2003. Bringing local knowledge into environmental decision making improving urban planning for communities at risk. J. Plan. Educ. Res. 22, 420–433. https://doi.org/10.1177/0739456X03253694.

Crane, A., 2005. In the company of spies: when competitive intelligence gathering becomes industrial espionage. Bus. Horiz. 48, 233–240. https://doi.org/10.1016/j.bushor.2004.11.005.

Delerue, H., 2005. Relational risk perception and alliance management in French biotechnology SMEs. Eur. Bus. Rev. 17, 532–546. https://doi.org/10.1108/09555340510630563.

Desouza, K.C., Awazu, Y., 2006. Knowledge management at SMEs: five peculiarities. J. Knowl. Manag. 10, 32–43.

Dietz, S., Neumayer, E., 2007. Weak and strong sustainability in the SEEA: concepts and measurement. Ecol. Econ. 61, 617–626. https://doi.org/10.1016/j.ecolecon.2006.09.007.

D'Souza, C., McCormack, S., Taghian, M., Chu, M.-T., Sullivan Mort, G., Ahmed, T., 2020. An empirical examination of sustainability for multinational firms in China: implications for cleaner production. J. Clean. Prod. 242, 118446. https://10.1016/j.jclepro.2019.118446.

Durst, S., 2019. How far have we come with the study of knowledge risks? VINE J. Inf. Knowl. Manag. Syst. 49, 21–34. https://doi.org/10.1108/VJIKMS-10-2018-0087.

Durst, S., Bruns, G., Henschel, T., 2016. The management of knowledge risks: what do we really know? Int. J. Knowl. Syst. Sci. 7, 19–29.

Durst, S., Edvardsson, I.R., 2012. Knowledge management in SMEs: a literature review. J. Knowl. Manag. 16, 879–903. https://doi.org/10.1108/13673271211276173.

Durst, S., Ferenhof, H.A., 2016. Competitive strategies for small and medium enterprises knowledge risk management in turbulent times. In: North, K., Varvakis, G. (Eds.), Competitive Strategies for Small and Medium Enterprises. Springer International Publishing, Cham, pp. 195–209.

Durst, S., Ferenhof, H.A., 2014. Knowledge leakages and ways to reduce them in small and medium-sized enterprises (SMEs). Information 5, 440–450. https://doi.org/10.3390/info5030440.

Durst, S., Wilhelm, S., 2011. Knowledge management in practice: insights into a medium sized enterprise's exposure to knowledge loss. Prometheus 29, 23–38. https://doi.org/10.1080/08109028.2011.565693.

Durst, S., Zieba, M., 2019. Mapping knowledge risks : towards a better understanding of knowledge management management. Knowl. Manag. Res. Pract. 17, 1–13. https://doi.org/10.1080/14778238.2018.1538603.

Durst, S., Hinteregger, C., Zieba, M., 2019. The linkage between knowledge risk management and organizational performance. J. Bus. Res. 105, 1–10. https://doi.org/10.1016/j.jbusres.2019.08.002.

Dyllick, T., Muff, K., 2016. Clarifying the meaning of sustainable business: introducing a typology from business-as-usual to true business sustainability. Organ. Environ. 29, 156–174. https://doi.org/10.1177/1086026615575176.

Eccles, R.G., Perkins, K.M., Serafeim, G., 2012. How to become a sustainable company. MIT Sloan Manag. Rev. 53, 43–50.
Failing, L., Gregory, R., Harstone, M., 2007. Integrating science and local knowledge in environmental risk management: a decision-focused approach. Ecol. Econ. 64, 47–60. https://doi.org/10.1016/j.ecolecon.2007.03.010.
Feinberg, S.E., Gupta, A.K., 2004. Knowledge spillovers and the assignment of R&D responsibilities to foreign subsidiaries. Strateg. Manag. J. 25, 823–845. https://doi.org/10.1002/smj.396.
Ferenhof, H., Durst, S., Selig, P., 2015. Knowledge waste in organizations: a review of previous studies. Brazilian J. Oper. Prod. Manag. 12, 160–178. https://doi.org/10.14488/BJOPM.2015.v12.n1.a15.
Gaillard, J.C., Mercer, J., 2012. From knowledge to action: bridging gaps in disaster risk reduction. Prog. Hum. Geogr. 37, 93–114. https://doi.org/10.1177/0309132512446717.
Gandomi, A., Haider, M., 2015. International Journal of Information Management beyond the hype : big data concepts , methods , and analytics. Int. J. Inf. Manag. 35, 137–144. https://doi.org/10.1016/j.ijinfomgt.2014.10.007.
Gloet, M., 2006. Knowledge management and the links to HRM: developing leadership and management capabilities to support sustainability. Manag. Res. News 29, 402–413.
Grant, R.M., 1996. Toward a knowledge-based theory of the firm. Strateg. Manag. J. 17, 109–122.
Gupta, B., Iyer, L.S., Aronson, J.E., 2000. Knowledge management: practices and challenges. Ind. Manag. Data Syst. https://doi.org/10.1108/02635570010273018.
Gupta, S., Kumar, V., 2013. Sustainability as corporate culture of a brand for superior performance. J. World Bus. 48, 311–320.
Hall, R., Andriani, P., 2003. Managing knowledge associated with innovation. J. Bus. Res. 56, 145–152. https://doi.org/10.1016/S0148-2963(01)00287-9.
Hediger, W., 1999. Reconciling "weak" and "strong" sustainability. Int. J. Soc. Econ. 26, 1120–1144.
Henschel, T., Durst, S., 2016. Risk management in Scottish, Chinese and German small and medium-sized enterprises: a country comparison. Int. J. Entrep. Small Bus. 29, 112–132. https://doi.org/10.1504/IJESB.2016.078048.
Holan, P. M. De, Phillips, N.W., 2004. Managing organizational forgetting. MIT Sloan Manag. Rev. 45, 45–51.
Holten, A.-L., Robert Hancock, G., Persson, R., Marie Hansen, Å., Høgh, A., 2016. Knowledge hoarding: antecedent or consequent of negative acts? The mediating role of trust and justice. J. Knowl. Manag. 20, 215–229. https://doi.org/10.1108/JKM-06-2015-0222.
Horak, S., Arya, B., Ismail, K.M., 2018. Organizational sustainability determinants in different cultural settings: a conceptual framework. Bus. Strateg. Environ. 27, 528–546. https://doi.org/10.1002/bse.2018.
Hörisch, J., Johnson, M.P., Schaltegger, S., 2015. Implementation of sustainability management and company size: a knowledge-based view. Bus. Strateg. Environ. 24, 765–779. https://doi.org/10.1002/bse.1844.
Hurmelinna-Laukkanen, P.I.A., 2015. Proactive HRM for reducing knowledge risks—evaluating commitment and trustworthiness. Int. J. Innov. Manag. 19, 1–20. https://doi.org/10.1142/S1363919615400113.
Iasevoli, G., Massi, M., 2012. The relationship between sustainable business management and competitiveness: research trends and challenge. Int. J. Technol. Manag. 58, 32–48.
Jabareen, Y., 2009. Building a conceptual framework: philosophy, definitions, and procedure. Int. J. Qual. Methods 8, 49–62.
Jackson, P., 2010. Capturing, structuring and maintaining knowledge: a social software approach. Ind. Manag. Data Syst. 110, 908–929.
Joe, C., Yoong, P., Patel, K., 2013. Knowledge loss when older experts leave knowledge-intensive organisations. J. Knowl. Manag. 17, 913–927. https://doi.org/10.1108/JKM-04-2013-0137.
Johnson, M.P., 2017. Knowledge acquisition and development in sustainability-oriented small and medium-sized enterprises : exploring the practices, capabilities and cooperation. J. Clean. Prod. 142, 3769–3781. https://doi.org/10.1016/j.jclepro.2016.10.087.
Jose, C., Jabbour, C., Sarkis, J., Beatriz, A., Sousa, L. De, William, D., Renwick, S., Kumar, S., Grebinevych, O., Kruglianskas, I., Godinho, M., 2019. Who is in charge ? A review and a research agenda on the 'human side' of the circular economy. J. Clean. Prod. 222, 793–801. https://doi.org/10.1016/j.jclepro.2019.03.038.
Kiron, D., Unruh, G., Reeves, M., Kruschwitz, N., Rubel, H., ZumFelde, A.M., 2017. Corporate sustainability at a crossroads. MIT Sloan Manag. Rev. 58.
Kjaerheim, G., 2005. Cleaner production and sustainability. J. Clean. Prod. 13, 329–339. https://doi.org/10.1016/S0959-6526(03)00119-7.
Krysiak, F.C., 2009. Risk management as a tool for sustainability. J. Bus. Ethics 85, 483–492.
Lambe, P., 2013. Four types of knowledge risk: knowledge continuity risks, knowledge acquisition risks, knowledge outsourcing risks and knowledge articulation risks, 1–3 [online]. http://www.greenchameleon.com/uploads/Four_Types_of_Knowledge_Risk.pdf. Access Date: Mar 5, 2017.
Lankoski, L., 2016. Alternative conceptions of sustainability in a business context. J. Clean. Prod. 139, 847–857. https://doi.org/10.1016/j.jclepro.2016.08.087.
Leonard, D., 2014. How to prevent experts from hoarding knowledge. Harv. Bus. Rev. December 18.
Liao, Z., 2018. Environmental policy instruments, environmental innovation and the reputation of enterprises. J. Clean. Prod. 171, 1111–1117. https://doi.org/10.1016/j.jclepro.2017.10.126.
Lin, Y.-H., Chen, Y.-S., 2017. Determinants of green competitive advantage: the roles of green knowledge sharing, green dynamic capabilities, and green service innovation. Qual. Quantity 51, 1663–1685. https://doi.org/10.1007/s11135-016-0358-6.
Lopes, C.M., Scavarda, A., Hofmeister, L.F., Thomé, A.M.T., Vaccaro, G.L.R., 2017. An analysis of the interplay between organizational sustainability, knowledge management, and open innovation. J. Clean. Prod. 142, 476–488. https://doi.org/10.1016/j.jclepro.2016.10.083.
MacDonald, D.B., 2011. When risk management collides with enterprise sustainability. J. Leadersh., Account., Ethics 8, 56–66.
MacInnis, D.J., 2011. A framework for conceptual contributions in marketing. J. Mark. 75, 136–154. https://doi.org/10.1509/jmkg.75.4.136.
Martins, V.W.B., Rampasso, I.S., Anholon, R., Quelhas, O.L.G., Filho, W.L., 2019. Knowledge management in the context of sustainability : literature review and opportunities for future research. J. Clean. Prod. 229, 489–500. https://doi.org/10.1016/j.jclepro.2019.04.354.
Massingham, P., 2010. Knowledge risk management: a framework. J. Knowl. Manag. 14, 464–485. https://doi.org/10.1108/13673271011050166.
Meredith, J., 1993. Theory building through conceptual methods. Int. J. Oper. Prod. Manag. 13, 3–11.
Mohamed, M., Stankosky, M., Mohamed, M., 2009. An empirical assessment of knowledge management criticality for sustainable development. J. Knowl. Manag. 13, 271–286.
Montiel, I., 2008. Organization separate pasts, common futures. Organ. Environ. Times 21, 245–269. https://doi.org/10.1177/1086026608321329.
Parker, H., 2012. Knowledge acquisition and leakage in inter-firm relationships involving new technology-based firms. Manag. Decis. 50, 1618–1633. https://doi.org/10.1108/00251741211266714.
Perrott, B.E., 2007. A strategic risk approach to knowledge management. Bus. Horiz. 50, 523–533. https://doi.org/10.1016/j.bushor.2007.08.002.
Pham, D.D.T., Paille, P., Halilem, N., 2019. Systematic review on environmental innovativeness: a knowledge- based resource view. J. Clean. Prod. 211, 1088–1099. https://doi.org/10.1016/j.jclepro.2018.11.221.
PWC, 2019. Talent trends 2019. Upskilling for a digital world. https://www.pwc.com/gx/en/ceo-survey/2019/Theme-assets/reports/talent-trends-report.pdf. Access Date: Oct 1, 2019.
Quintas, P., Lefrere, P., Jones, G., 1997. Knowledge management: a strategic agenda. Long. Range Plan. 30, 385–391. https://doi.org/10.1016/S0024-6301(97)90252-1.
Richard, P.J., Devinney, T.M., Yip, G.S., Johnson, G., 2009. Measuring organizational performance. J. Manag. 35, 718–804. https://doi.org/10.1177/0149206308330560.
Robinson, H.S., Anumba, C.J., Carrillo, P.M., Al-Ghassani, A.M., 2006. STEPS : a knowledge management maturity roadmap for corporate sustainability. Bus. Process Manag. J. 12, 793–808. https://doi.org/10.1108/14637150610710936.
Ruhanen, L., 2008. Progressing the sustainability Debate : a knowledge management approach to sustainable tourism planning. Curr. Issues Tourism 11, 429–455. https://doi.org/10.1080/13683500802316030.
Serenko, A., Bontis, N., 2016. Understanding counterproductive knowledge behavior: antecedents and consequences of intra-organizational knowledge hiding. J. Knowl. Manag. 20, 1199–1224.
Singh, S.K., Mittal, S., Sengupta, A., Pradhan, R.K., 2019a. A dual-pathway model of knowledge exchange: linking human and psychosocial capital with prosocial knowledge effectiveness. J. Knowl. Manag. https://doi.org/10.1108/JKM-08-2018-0504.
Singh, S.K., Gupta, S., Busso, D., Kamboj, S., 2019b. Top management knowledge value, knowledge sharing practices, open innovation and organizational performance. J. Bus. Res. 1–11. https://doi.org/10.1016/j.jbusres.2019.04.040.
Soyka, P.A., 2012. Creating a Sustainable Organization. Approaches for Enhancing Corporate Value through Sustainability. PH Professional Business, Upper Saddle River, New Jersey.
Stam, C.D., 2009. Intellectual liabilities: lessons from the decline and fall of the roman empire. Vine 39, 92–104. https://doi.org/10.1108/03055720910962470.
Stone, L.J., 2006. Limitations of cleaner production programmes as organisational change agents I. Achieving commitment and on-going improvement. J. Clean. Prod. 14, 1–14.
Stonehouse, G., Pemberton, J., 2002. Strategic planning in SMEs – some empirical findings. Manag. Decis. 40, 853–861. https://doi.org/10.1108/00251740210441072.
Taherparvar, N., Esmaeilpour, R., Dostar, M., 2014. Customer knowledge management, innovation capability and business performance: a case study of the banking industry. J. Knowl. Manag. 18, 591–610. https://doi.org/10.1108/JKM-11-2013-0446.
Tan, H.C., Carrillo, P., Anumba, C., Kamara, J.M., Bouchlaghem, D., Udeaja, C., 2006. Live capture and reuse of project knowledge in construction organisations. Knowl. Manag. Res. Pract. 4, 149–161. https://doi.org/10.1057/palgrave.kmrp.8500097.
Tangaraja, G., Mohd Rasdi, R., Abu Samah, B., Ismail, M., 2016. Knowledge sharing is knowledge transfer: a misconception in the literature. J. Knowl. Manag. 20, 653–670. https://doi.org/10.1108/JKM-11-2015-0427.
Tideman, S.G., Arts, M.C., Zandee, D.P., 2013. Sustainable leadership: towards a workable definition. J. Corp. Citizsh. 49, 17–33.
UNEP, 1996. Cleaner production. A training resource package [WWW Document]. http://www.unep.fr/shared/publications/pdf/WEBx0029xPA-CPtraining.pdf. Access Date: Feb 7, 2019.
Van Kleef, J.A.G., Roome, N.J., 2007. Developing capabilities and competence for

sustainable business management as innovation: a research agenda. J. Clean. Prod. 15, 38–51. https://doi.org/10.1016/j.jclepro.2005.06.002.
Victer, R., 2014. The strategic implication of knowledge attributes: understanding the conditions in which knowledge matters to performance. Manag. Decis. 52, 505–525. https://doi.org/10.1108/MD-04-2013-0235.
WCED, 1987. Our Common Future. Oxford University Press, Oxford.
Webster, J., Brown, G., Zweig, D., Connelly, C.E., Brodt, S., Sitkin, S., 2008. Beyond knowledge sharing: withholding knowledge at work. Res. Pers. Hum. Resour. Manag. 27, 1–37. https://doi.org/10.1016/S0742-7301(08)27001-5.
Whetten, D.A., 1989. What constitutes a theoretical contribution? Acad. Manag. Rev. 14, 490–495.
Williams, C., Durst, S., 2019. Exploring the transition phase in offshore outsourcing: decision making amidst knowledge at risk. J. Bus. Res. 103, 460–471. https://doi.org/10.1016/j.jbusres.2018.01.013.
World Economic Forum, 2019. The cybersecurity guide for leaders in today's digital world. October 2019. http://www3.weforum.org/docs/WEF_Cybersecurity_Guide_for_Leaders.pdf. Access Date: Oct 27, 2019.
Wu, D.D., Olson, D.L., Birge, J.R., 2013. Risk management in cleaner production. J. Clean. Prod. 53, 1–6.
Yusup, M.Z., Mahmood, W.H.W., Salleh, M.R., Rahman, M.N.A., 2015. The implementation of cleaner production practices from Malaysian manufacturers' perspectives. J. Clean. Prod. 108, 659–672. https://doi.org/10.1016/j.jclepro.2015.07.102.
Zhang, P., Duan, N., Dan, Z., Shi, F., Wang, H., 2018. An understandable and practicable cleaner production assessment model. J. Clean. Prod. 187, 1094–1102. https://doi.org/10.1016/j.jclepro.2018.03.284.
Zieba, M., Bolisani, E., Scarso, E., 2016. Emergent approach to knowledge management by small companies: multiple case-study research. J. Knowl. Manag. 20, 292–307. https://doi.org/10.1108/JKM-07-2015-027.