Knowledge risks – towards a taxonomy

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Abstract: The paper aims to identify, describe and analyse knowledge risks organisations might face and based on this, proposes a taxonomy of knowledge risks. To achieve this goal, a literature review was conducted. After the analysis of the existing material, it was possible to divide knowledge risks into two categories: internal (originating from the inside of the organisation) and external (originating from the outside of the organisation). Some of the presented knowledge risks appear to have an incidental character (e.g., knowledge spillover, knowledge leakage or knowledge waste), while others are of a continued nature (e.g., knowledge attrition or risks connected with knowledge work).

Our study is not only timely but also relevant for initiating increased and rigorous research activities in the field of knowledge risks. The proposed taxonomy will also help organisations in concentrating on their crucial knowledge and in finding ways to prevent or reduce these risks.

Keywords: knowledge risk management; knowledge risks; taxonomy; knowledge management.

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1 Introduction

Recently, several researchers have started to examine various types of knowledge risks, such as risk of knowledge loss (e.g., Treleaven and Sykes 2005; Durst and Wilhelm, 2011; Martins and Martins, 2011; Joe et al., 2013), knowledge leakage (Mohamed et al., 2007; Parker, 2012; Ahmad et al., 2014), or knowledge hiding (Connelly et al., 2012; Connelly and Zweig, 2014; Cerne et al., 2014). This is a promising development, but given the fact that the study of knowledge risks is a recent phenomenon (Massingham, 2010), these studies have addressed very specific issues and thus, produced a fragmented understanding of the topic.

Against this background, there is a clear need to classify knowledge risks to better guide research initiatives. Therefore, the present paper aims to identify, describe and analyse knowledge risks and, based on this, proposes a taxonomy of knowledge risks. Having such taxonomy is intended to support more rigorous research on the topic. Additionally, this taxonomy will help organisations in concentrating on their crucial knowledge, i.e., knowledge that is most at risk of being lost (Frigo, 2006) and in finding ways to prevent or reduce risks to occur with regard to this knowledge.

The paper is organised as follows. Section 2 briefly introduces to knowledge management (KM). In Section 3, knowledge risks and their potential impact are illustrated. Section 4 presents the knowledge risks taxonomy, while Section 5 concludes the paper and discusses study limitations and possible future research avenues.

2 Knowledge management

Many researchers argue that knowledge has become the most valuable resource of an organisation (Grant, 1996; Zack, 1999). Therefore, it is not surprising that organisations pay more and more attention to its proper management, as organisations that manage knowledge successfully are able to evaluate their core processes better, become aware of what they find, integrate their skills and experiences, innovate, and implement new ideas more quickly (du Plessis, 2005).

During the last few decades, KM has been examined in various contexts, in the beginning mostly in large entities and meanwhile also in small and medium-sized enterprises (SMEs) and non-profit organisations. However, until now not much attention has been given to the issue of knowledge risks (Massingham, 2010; Durst and Ferenhof, 2016).

The few studies available show that knowledge risks have been discussed in a rather fragmented way. For example, Trkman and Desouza (2012) discuss knowledge risks from the perspective of a networked environment and knowledge sharing. Durst and Ferenhof (2016) propose a framework for knowledge risk analysis in the context of SMEs. Massingham (2010) offers a conceptual framework for knowledge risk management by applying KM tools and techniques to the management of organisational risk. Even though these activities can be assessed as promising, they are insufficient with regard to a detailed description of all potential knowledge risks and they lack a clear distinction.

3 Knowledge risks and their potential impact

There is disagreement over defining the various knowledge risks organisations are exposed to and often the terms are used interchangeably (e.g., knowledge attrition and knowledge loss). In this section, we present a variety of the terms used in previous studies and, on this basis, we develop a knowledge risk taxonomy intended to help better organise research in this area (see Section 4).

Business Dictionary defines risk in general as a probability or threat of damage, injury, liability, loss, or any other negative occurrence that is caused by external or internal vulnerabilities, and that may be avoided through pre-emptive action. In economic terms, risk can be defined "by the adverse impact on the profitability of several distinct sources of uncertainty" [Bessis, (1998), p.5] and refers to both positive and negative outcomes, although in everyday language it appears that risk is mainly associated with danger (Lupton, 1999).

As far as the definition of knowledge risk is concerned, the authors of this paper have decided to follow the definition of Perrott (2007), who defined 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 (Perrott, 2007).

3.1 Overview of knowledge risks

3.1.1 Knowledge loss

Knowledge loss is considered to be a challenge to organisations that wish to remain competitive (Martins and Martins, 2011). This results from the fact that the risk of knowledge loss is unavoidable due to phenomena such as increasing employee turnover or the aging of labour force and resulting retirement schemes.

Apart from employee turnover, either voluntary or involuntary (Shaw et al., 1998), there can be other potential causes of knowledge loss. For example, employee poaching, this happens when employees are 'stolen away' by other organisations, often competitive ones. In such a case, it can be assumed that the knowledge that is lost is of particular importance and its lack will cause serious problems at company level.

Companies may also face some unexpected crises, triggered by a disease, an accident or a death of an organisation member (Durst and Wilhelm, 2011). The resulting short or long-term absence of the individual can result in severe consequences, especially in

smaller firms which often having difficulties with employee substitution due to labour shortage.

Apart from the human aspect, knowledge can also be lost in the technical environment.

For example, if there is a database with clients, enriched with personal notes on each customer and this database is lost (e.g., due to a system failure), this can be also treated as a knowledge loss (Zieba, 2016). An example of such a case was presented by Durst et al. (2015), where a crash of the entire computer system resulted not only in financial costs but also in partial knowledge loss in the examined company.

3.1.2 Knowledge attrition

The word 'attrition' means *loss of a material or resource due to obsolescence or spoilage* (Business Dictionary). Knowledge attrition is considered as a process where knowledge is becoming obsolete (e.g., due to new inventions, progress in the state-of-the-art, becoming of historical value only, etc.) or corrupted (e.g., caused by inappropriate use or waiting too long to use the knowledge, etc.). The difference between knowledge loss and knowledge attrition is that knowledge loss is a fact, a sort of result of certain phenomena (e.g., employee rotation), while knowledge attrition is a gradual process that can be stopped at each point and can either lead to knowledge loss or not.

3.1.3 Knowledge leakage

Knowledge leakage can be viewed as a sub-form of knowledge loss (Durst et al., 2015) and defined as "the deliberate or accidental loss of knowledge to unauthorized personnel within or outside of an organisational boundary" [Annansingh, (2012), p.269].

Knowledge leakage is associated with knowledge sharing and knowledge exchange involving various parties from both inside and outside the organisation. For example, Chan et al. (2006) proposed in their analytic framework five key drivers of knowledge leakage: suppliers, customers, competitors, non-competitive organisations, and human resources. Knowledge interactions with these five types of actors could result in intentional or unintentional knowledge leakage.

The easiness of knowledge leaking from the organisation depends very much on the type of knowledge that is being transferred or shared in an organisation. Tacit knowledge is difficult to transfer, while explicit knowledge could easily move out of the organisation (Mohamed et al., 2007).

As knowledge leakage can be considered as a sort of knowledge loss, there is a difference in the qualities of the risk as reported by Durst et al. (2015). Knowledge loss primarily means that the organisation has lost its knowledge, often in an accidental and unplanned manner, but this knowledge has not been used for the benefit of another organisation or competitor. In the case of knowledge leakage, however, the critical knowledge of the organisation is used to its disadvantage.

3.1.4 Knowledge spillover

Knowledge spillover takes place when valuable knowledge spills out of the organisation to competitors who use this knowledge to gain competitive advantage. The level of

spillovers may result from the strength of patents within an industry, the efficacy of protective mechanisms, and/or first-mover advantages (Cohen and Levinthal, 1990).

Knowledge spillovers are often examined from the perspective of their influence on innovativeness or growth of companies or industries (Tseng et al., 2011; Schoonjans et al., 2013). Companies may try to prevent themselves from knowledge spillovers by formal protection strategies (e.g., patenting) as well as strategic actions (e.g., secrecy, lead time, complex design) (de Faria and Sofka, 2010).

Knowledge spillovers are considered to be an inevitable result of involvements in alliances or networks, despite the efforts of firms undertaken to protect their knowledge (Inkpen, 2000).

3.1.5 Knowledge waste

Knowledge waste means not making use of the available and potentially useful knowledge in the organisation. In other words, knowledge waste takes place when certain knowledge is available in the organisation, so the organisation could make use of it for some advantages (e.g., saving time, money, efforts, etc.), but for various reasons it is not doing so. Thus, knowledge waste means not using the full knowledge capacity and presents itself in a variety of ways: e.g., reinvention, lack of system discipline, underutilised people, scatter, hands-off or wishful thinking (Ferenhof et al., 2015).

It is different from knowledge loss that in the case of knowledge loss the knowledge is not available anymore, while in the context of knowledge waste, it is available, but the organisation does not aim at making use of it.

3.1.6 Knowledge hiding

Knowledge hiding can be defined as "an intentional attempt to withhold or conceal knowledge that has been requested by another person" [Connelly et al., (2012), p.65]. Despite undertaking various actions to facilitate knowledge transfer in organisations, some employees might simply not be willing to share their knowledge, not because they do not have it, but because they want to keep it for themselves. Knowledge hiding can be determined by a number of reasons such as prosocial, instrumental or personal (e.g., laziness); while a lack of knowledge sharing is likely to be caused by an absence of the knowledge itself. Additionally, situational factors play a significant role – employees are more likely to present hiding behaviours when the knowledge is complex, when it is not task-related, and when, in their opinion, there is no climate for knowledge sharing in their organisation (Connelly et al., 2012).

Knowledge hiding does not cover cases when an employee fails to share knowledge by mistake, accident, or ignorance. It describes a situation when an employee is asked for certain knowledge, but does not reveal it, pretending not to have it (Connelly and Zweig, 2014).

3.1.7 Knowledge hoarding

Knowledge hoarding is the act of accumulating knowledge that may or may not be shared at a later date (Connelly et al., 2012), and this knowledge has not been asked for by another individual. For example, an employee keeps personal information and knowledge confidential as an act of omission that is not addressed to a particular person (Webster

et al., 2008). Knowledge hoarding is stated to take place due to 'a knowledge is power' syndrome and is often reported within functional silos in organisations, or where competition exists between various business units (Hargadon and Sutton, 2008).

Knowledge hoarding is similar to knowledge hiding in the sense that they both can be classified as withholding knowledge. In the case of knowledge hiding, however, an employee has been asked for specific knowledge but did not reveal it, while in the case of knowledge hoarding, knowledge has not been directly requested (Webster et al., 2008).

3.1.8 Other knowledge risks

In addition to the knowledge risks presented above, the following can be mentioned.

- *Knowledge risks due to unlearning*. Unlearning means an intentional loss of knowledge stored in the individual's long-term memory to make room for accepting new knowledge (Cegarra-Navarro et al., 2013). Therefore, unlearning is considered as a necessity for change or renewal (Akgün et al., 2007). The process of unlearning, however, also bears the risk of losing critical knowledge.
- *Knowledge risks due to forgetting*. Forgetting can be divided into accidental and deliberate forgetting (De Holan and Phillips, 2004). An example of accidental forgetting is memory loss, i.e., a form of forgetting that is typical when knowledge is used infrequently. On the other hand, failure to capture new knowledge can be considered as an example of deliberate forgetting. It occurs when new knowledge is acquired and developed by one individual or a small group of workers, and which, through not becoming institutionalised, becomes forgotten or lost by the wider organisation.

  While forgetting can be accidental (bad memory), unlearning is an intentional withdrawal by an individual from what he/she knows, and occurs only if there are already learned routines, rules, tasks, policies, values and strategies that must be relinquished (Cegarra-Navarro et al., 2013).
- *Knowledge outsourcing risks* refer to risks that are the outcome of transferring a business activity or function from an organisation to an external contractor who takes control of the activity inputs, then performs that function, and sells it back to the organisation (Tadelis, 2007). This strategy can result in several serious issues such as dependency on the external contractor but also losing skills and capacities needed to perform central knowledge processes (Agndal and Nordin, 2009), to name a few.
- *Risks related to knowledge gaps* describe a mismatch between what an organisation must know, and what it actually does know, and which may hamper the organisation in meeting its objectives (Perrott, 2007). This situation may also lead to an overestimation of the one's own capabilities. On the other hand, it opens the need for collaborative agreements.
- *Relational risks* are associated with the probability and consequences of having dissatisfactory cooperation and/or opportunistic behaviour by partners (Delrue, 2005). Relational risk also comprises the risk related to knowledge sharing, which may end in the strengthening of the partner at the expense of the company's own competitive standing (Coras and Tantau, 2013).

Finally, one can conclude with the risk categories specified by Lambe (2013):

- *knowledge continuity risks* which are closely linked to both an organisational ability to keep its core capabilities over time and its ability to maintain its performance and competitive position at consistent levels regardless of the human resources available
- *knowledge acquisition risks* relate to an organisational ability to gain new knowledge needed for the implementation of a new strategic direction (e.g., development of a new product or entrance to a new market)
- *knowledge articulation risks* relate to the ability of an organisation to mobilise, exploit, combine and leverage the existing knowledge capabilities.

3.2 Potential impact of knowledge risks

All the above-mentioned knowledge risks can result in negative and positive consequences for companies, irrespective of their size. Their actual impact will also vary, ranging from minor to catastrophic (Massingham, 2010).

For example, the loss of knowledge in the form of expertise and skills, e.g., due to the departure of employees, retirements, poaching or corporate restructuring, often causes huge gaps in the relevant knowledge-base, which are difficult to identify or remain undetected until quality problems, mistakes, costly disruptions in performance or operations, loss of competitive advantage and even tragic accidents occur (Martins and Meyer, 2012). Additionally, when an employee leaves a firm, their relational capital with customers, suppliers, stakeholders and strategic alliance partners can be lost (de Pablos, 2002). The actual direct (e.g., recruitment costs) and indirect (e.g., disruptions of the workflow) financial costs of losing a valuable employee are also related to the hiring and on boarding process (Durst and Wilhelm, 2011).

Moreover, negative psychological impacts have been observed with the employees staying in the organisation after downsizing. Examples of these impacts are job insecurity and anger, which manifest themselves in areas such as performance, motivation, job satisfaction and organisational commitment (Massingham, 2008). However, staff turnover *per se* is not negative but provides the basis for new ideas and avoids a standstill in the company (e.g., Chalkiti and Sigala, 2010).

Knowledge attrition may result in reduced competitiveness of a company over its competitors (Hoecht and Trott, 2006a), for example, due to a lack of relevant in-depth know-how necessary for improving existing products or developing new ones.

Although knowledge leakage is generally perceived as a negative phenomenon (Mohamed et al., 2006), its consequences do not have to be harmful to the company. As Mohamed et al. (2007) stated, the company may also benefit from knowledge leakage. Intentional (and thus positive) knowledge leakage can be expected as an outcome of collaborative activities between cooperation partners (Ferdinand and Simm, 2007).

As far as knowledge spillover is concerned, companies can either lose if their knowledge spills out, or they may gain from the knowledge spilled out from other entities. Therefore, the consequences of knowledge spillover may be negative, especially if strategic knowledge spills out and is applied by competitors, or positive when it happens to a competitor and helps an organisation in improving its competitive standing.

Knowledge waste may result in a continued reinvention process and the loss of valuable financial and non-financial resources (Ferenhof et al., 2015), while knowledge

hiding not only prevents organisation members from generating new ideas, but potentially influences negatively the creativity of the 'knowledge hider' (Cerne et al., 2014). It may even happen that when employees hide their knowledge, that they create a reciprocal distrust loop with the result that their colleagues are unwilling to share knowledge with them as well.

Also, knowledge hoarding has some negative consequences, as it is considered to be the major obstacle to establishing a KM culture. Knowledge hoarding may take place especially during periods of economic decline when internal competition for scarce resources increases (Tzortzaki, 2014).

Knowledge risks due to unlearning can be positive if they allow the companies and its members to address new ideas, approaches, or strategies (Markóczy, 1994; Gharajedaghi, 2007). It might, however, be negative in cases where unlearning prevents firms from doing their business due to a limitation of the original knowledge-base (Wensley and Navarro, 2015). Forgetting, on the other hand, leads to situations in which organisation members are required to recreate former skills and knowledge and, consequently, the organisation faces disruptions and/or flawed workflows (Tukel et al., 2008).

Examples of knowledge outsourcing risks are: a risk of losing skills and capacities needed to perform central knowledge processes (Agndal and Nordin, 2009), a degradation from leading edge expertise to industry standard, or a risk of forgoing the development of the knowledge-base (Hoecht and Trott, 2006a, 2006b). Thus, the outsourcing decision should be the outcome of an intensive cost-benefit analysis.

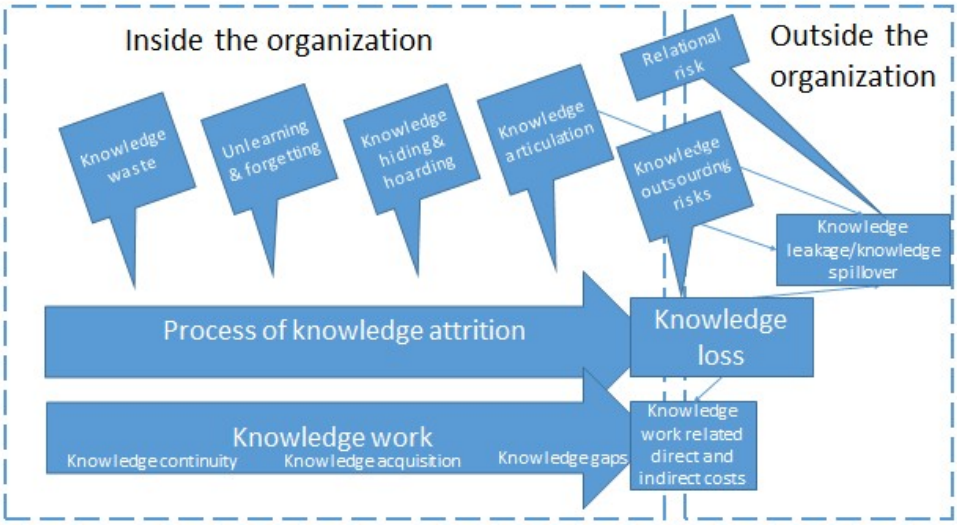
Knowledge continuity risks can present themselves as business disruptions caused by machine or system downtimes. Knowledge acquisition risks may occur due to missing absorptive capacities, contextual issues or organisational capital and result in organisational disability of acquiring the knowledge in question. Knowledge articulation risks are closely linked to the previous ones and may be the result of knowledge stickiness, cultural and language issues, time constraints, or other priorities (Davenport and Prusak, 1998; Jackson, 2010; Szulanski, 1996). All these in turn increase the likelihood of miscommunication between the actors involved and thus, reduce the realisation of the objectives.

Based upon this discussion, it can be concluded that knowledge risks potentially have severe, mainly negative, impacts on the functioning of organisations and therefore, they should be analysed, managed and, if possible, eliminated at the company level.

4 Taxonomy of knowledge risks

The discussed knowledge risks can be divided into two categories: internal risks (originating from the inside of the organisation) and external ones (originating from the outside of the organisation). As it can be seen in Figure 1, some risks are entirely connected with the situation or factors inside the organisation, e.g., knowledge attrition, knowledge waste or knowledge hoarding. Other ones, e.g., knowledge leakage or knowledge spillover, are related to the external environment and the company's interactions. There is also a group of risks that can be identified at the intersection of the organisation and its external environment (e.g., knowledge outsourcing risks or knowledge loss).

Figure 1 Knowledge risks inside and outside the organisation (see online version for colours)



Some of the presented knowledge risks have an incidental character (e.g., knowledge spillover, knowledge leakage or knowledge waste), while others are continuous processes (e.g., knowledge attrition or risks connected with knowledge work).

Knowledge risks may also be divided with regard to their origin, which can be employees (e.g., knowledge loss, forgetting, knowledge hiding and hoarding, knowledge waste), co-operants (e.g., knowledge outsourcing risks, knowledge spillover and leakage), or competitors (e.g., knowledge loss, knowledge spillover, and leakage).

Some knowledge risks encompass a number of factors that cause them (e.g., knowledge loss), while other risks are situation-specific and have only one potential cause (e.g., knowledge outsourcing risks).

All these knowledge risks can be analysed using several other dimensions, such as the knowledge type they are connected with (tacit versus explicit) or the control/influence the company has (i.e., to what extent the company can control risk appearance). For example, some risks can be eliminated almost completely through some preventive actions in the organisation (e.g., knowledge waste or knowledge hoarding), while on other risks the company has only an indirect influence (e.g., to reduce knowledge spillover a company may spend extra time on searching and selecting partners, nevertheless it will not rule out the risk) or no influence at all (e.g., unlearning and forgetting).

5 Conclusions

In the last years, the field of KM has been given considerable attention, however, when knowledge risks are considered, then the opposite is true: there is a lack of research. The few studies available provide only a fragmented understanding of the concept. Against this background, the aim of this study was to identify and describe different types of knowledge risks and bring them together to propose a knowledge risk taxonomy. This type of research is not only timely but also relevant for initiating increased, rigorous

research activities in this field in order to expand and complement our understanding of KM.

The identification of knowledge risks and their presentation in the form of a taxonomy is beneficial also for managers and company owners. Even though the potential and actual costs of knowledge risks are difficult to measure in financial terms, the consequences might be severe for organisations. That is why managers and owners need to be aware of potential knowledge risks and initiate and implement actions to minimise the possible negative consequences of these risks.

Based on the discussion provided above, there are many resulting research possibilities in the area of knowledge risks. The first topic that could be examined concerns the awareness of particular knowledge risks among organisations. The second one could be to find out which knowledge risks, from the standpoint of organisations, are the most crucial ones and why. A third area would be to examine the actions undertaken by organisations to address knowledge risks and/or to reduce their consequences. In this context, it would be particularly interesting to study organisations approaches to (knowledge) risk management to get an understanding whether and how the issues discussed in the present paper are incorporated into business operations. Fifth, it would also be useful to examine the efficacy of preventive actions in reducing knowledge risks and their consequences. A sixth issue that requires further investigation are financial and non-financial costs related to the analysis and management of knowledge risks and their justification. Finally, a quantitative study on knowledge risks faced by organisations, differentiated by size, ownership, sector of operation, or country could provide further insights into the state of the art.

To conclude, the topic of knowledge risks offers an enormous potential for research and our taxonomy constitutes a solid ground for further research and development.

As it is the case with any study, our study has some limitations. The main limitation of this paper is that the taxonomy has not been empirically validated. Our next step will be to address this limitation and test the taxonomy among a number of selected organisations. This will also help in checking the taxonomy for completeness as some types of knowledge risks might still be missing or others may need a clearer elaboration.

Acknowledgements

Malgorzata Zieba gratefully acknowledges support from the National Science Centre (Poland) in the context of a research project “Knowledge management strategies and their determinants in companies from the knowledge-intensive business service sector” (No. 2016/21/B/HS4/03051).

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