

Recognizing Knowledge Leakage and Knowledge Spillover and Their Consequences

Helio Aisenberg Ferenhof, Universidade Federal de Santa Catarina and Complexo de Ensino Superior de Santa Catarina, Florianópolis, Brazil

ABSTRACT

This paper, is interested in reviewing the literature on knowledge leakage and spillover together in order to understand their existence on organizations, establish the current body of knowledge and, on this basis, suggest some promising avenues for future research. The study consists of a systematic review of peer-reviewed articles addressing knowledge leakage and spillover in organizations. As result a better understanding of the differences and similarity as well as challenges and opportunities of knowledge leakage and knowledge spillover that could assist practitioners to better cope with risks when developing innovation is shown in a conceptual model. From an academic perspective, the paper may provide a starting point for new researches that are interested in knowledge at risk.

KEYWORDS

Knowledge at Risk, Knowledge Leakage, Knowledge Risk Management, Knowledge Spillover, Literature Review

1. INTRODUCTION

The work of Durst, Aggestam, and Ferenhof (2015) presents a literature review on knowledge leakage. It underlines that organizations should establish strategies to enable better knowledge management actions to compensate for the negative effects of knowledge leakage and improve the chances of the positive ones. Given the relevance of the topic, this paper is interested in going further in understanding the existence of knowledge leakage and knowledge spillover in organizations. The former is divided by Durst and Ferenhof (2014) into knowledge and capability shortages, and knowledge exposure. The former refers mainly to turnover, whereas the latter occurs in situations when organizations enter into strategic alliances, outsource parts of their business functions, or where parts of its core knowledge are shared with others. On the other hand, knowledge spillover as stated by Alborno *et al.* (2009), refers to knowledge overflows, which can support innovation and contribute to productivity growth and/or competitiveness. This may happen when companies transfer knowledge that encompasses both technology and know-how of foreign affiliates by some kind of leaks and which is absorbed by those firms. According to Jost and van der Velden (2008), knowledge leakage and knowledge spillover are related and can have both positive and negative impacts on organizations, depending on the way they occur and the quality of the exchange.

In the era of innovation, many companies regardless of size are being pushed to outsource, make joint ventures, transfer knowledge to other business partners, or develop new businesses or additional companies (Jost & van der Velden, 2008). Taking a holistic perspective of knowledge—seeing knowledge as both as an asset and a liability—the purpose of this paper is to review extant empirical research on both knowledge leakage and knowledge spillover in organizations to establish our current body of knowledge. According to Jost and van der Velden (2008), only small levels of spillover must

exist in industries because spillovers may reduce the positive profit effect arising from competition. Supporting that line of thought, Czarnitzki and Kraft (2012) highlighted that incoming knowledge spillover is expected to have a positive impact on firms. Conversely, knowledge spillover going out to rivals will most likely have a negative effect on the originating company. Against this backdrop, the present article's aim highlights the importance of having a better understanding of knowledge spillover and knowledge leakage. The author believes that both theory and corporate practice will gain a better understanding and ultimately benefit from it.

As already stressed by Durst *et al.* (2015), there is a need for more studies on knowledge leakage, and this paper intends to assist in this issue.

2. THEORETICAL BACKGROUND

There is a slight difference between knowledge spillover and knowledge leakage, relating to the way the knowledge exceeds company boundaries. Knowledge spillover, as stated by Albornoz *et al.* (2009), may happen when companies transfer knowledge that encompasses both technology and know-how of its foreign affiliates by some kind of leak and which is then absorbed by those firms. On the other hand, as stated by Durst and Ferenhof (2014), knowledge leakage may occur in situations when parts of their business functions are outsourced, or parts of the core knowledge are transferred to others. In the case of knowledge spillover, the knowledge overflows from one company to the companies' affiliate(s). They are sharing the same location or those that are nearby at the perimeter, normally associated with an ambient of trust. However, knowledge leakage does not necessarily rely on proximity alone. It could occur through any disclosure of core knowledge to external entities. According to Jost and van der Velden (2008), knowledge leakage and knowledge spillover are related and can have both positive and negative impacts on organizations, depending on the method and quality by which they occur. One example of a positive aspect is a joint venture where, in an effort to win a patent depends on the R&D investments of all firms together. On the other hand, if there are complete spillovers throughout the industry (the entire market), the investments in R&D will not result in competitive advantage, and instead have a negative impact on the business. According to Albornoz *et al.* (2009), the positive spillover effect occurs when domestic exporters use their absorptive capacity to get knowledge from outsiders or within multinational corporations. Bhattacharya and Guriev (2006) describe the positive impact as the cooperation among the companies, but the negative impact is the risk that further information may be disclosed to a competitive player.

Albornoz *et al.* (2009) highlight that the productivity spillover literature assumes that multinational corporations (MNCs) transfer knowledge comprising both know-how and technology to foreign affiliates, which then somehow leaks and is absorbed by firms in the domestic economy. In the words of Albornoz *et al.* (2009), when MNCs spillover, it increases the productivity growth and/or competitiveness of the domestic company that absorbed that knowledge, leading to economic gains. However, one of the motives assumed for the lack of productive spillovers is that foreign firms attempt to minimize knowledge leakage, as stated by Albornoz *et al.* (2009, p. 136), to prevent "the propagation of technology to possible competitors." At this point, it is significant to emphasize that understanding the potential danger of knowledge leakage is important because it can cause immense direct and indirect costs to the firm (Durst & Wilhelm, 2011).

What is highlighted by the current article is that knowledge spillover, if not planned and managed, can do harm to the business; whereas, if it is planned and managed, it could improve company results. As stated by Czarnitzki and Kraft (2012), spillovers play an important role, as they can increase productivity of an entire industry. The authors also presented microeconomic analyses that show

that spillovers may encourage firms to accomplish innovative activities. Incoming and outgoing spillovers influence both productivity and profitability. Incoming spillovers (from partners or rivals to the company) are more likely to have a positive impact; and, conversely, outgoing spillovers (from the firm to rivals), are expected to have a negative effect on profitability as companies active in the same market may improve their competitiveness.

3. METHODOLOGY

This work adopted the principles of a systematic review as recommended by Jesson, Matheson, and Lacey (2011), namely: 1) mapping the field through a scoping review, 2) comprehensive search, 3) quality assessment, 4) data extraction, 5) synthesis, and 6) write-up.

Durst *et al.* (2015) set a list of criteria to establish the basis for a descriptive and analytic overview of research in knowledge leakage. As this paper aims to extend that work—more precisely, with the intention of understanding the existence of knowledge leakage and knowledge spillover together in organizations—those criteria formed the basis for data extraction and synthesis.

The first step in achieving this objective was to put in place the research plan. It was composed of the research questions of interest, the keywords, and a set of inclusion and exclusion criteria. The query for this research was ([knowledge] AND [leakage] AND [spillover]). The inclusion criteria were peer-reviewed academic papers in English, Portuguese, French, and Spanish languages, and the databases used were Compendex, Ebsco, Scopus, and Web of Science, which executes the query on the topic, keywords, or abstracts. Gray literature such as reports, books, and non-academic research, and content in languages other than the presented ones, were represented as exclusion criteria. Moreover, a spreadsheet was produced consisting of key aspects related to the research aim. In the given case, these were names of the author(s), year of publication, research aim/objectives, theoretical perspective/framework, method, main findings, and the name of the journal. The search was conducted on January 20, 2015, and resulted in 26 documents to be analyzed.

The second step consists of three procedures. First, the author checked for duplicated documents, eliminating all but 15 documents. Secondly, the author worked through the abstracts to make sure that they actually covered the predefined scope, reducing the research field to 12 documents. Thirdly, the resulting papers were analyzed and the relevant data regarding the research purpose was entered into the spreadsheet sheet.

Finally, the author went through each data entry and edited the content, coding it according to the criteria listed in Table 1. This revision enabled the author to categorize the findings under themes, which in turn helped clarify what could be learned about the consequences of knowledge leakage and knowledge spillover.

The final stage of the review process was devoted to writing up the findings.

3.1. Specification of Criteria

The intention of each criterion is briefly defined as follows.

3.1.1. Date of Publication

Captured by the year of publication of each paper to identify precisely when the current body of knowledge was made available.

3.1.2. Country of Authors' Institutions

Coded as the country of the first author's institution in order to determine where the body of knowledge related to knowledge spillover and knowledge leakage had been established together.

Table 1. Description of criteria used to analyze research on knowledge spillover and leakage

Criteria	Meaning	Code description
Date of publication	Year of publication of the article	Stating of year
Author's nationality	Country where the first author's institution is located	Stating of country
Research team	Number of authors	1, 2, 3, or more
Journal of publication	Category of the journal	1) Economics, 2) Economics and Business, 3) Business
Topic	Main topic explored in the study	1) Intellectual Property; 2) R&D&I; 3) Knowledge Accumulation, Spillovers and Innovation; 4) Cluster; 5) Environmental Management; 6) Investments, 7) Risk Identification
Disciplines	Disciplinary background of study	1) law, 2) economics, 3) engineering, 4) sociology, 5) social psychology, 6) management
Number of disciplines	Number of disciplines used in the same study	1, 2, or 3
Theoretical aim	Nature of the theoretical aim of the paper	1) exploratory, 2) development or elaboration, 3) testing, 4) other
Research setting	Continents of the empirical setting of the study	1) Europe, 2) North America, 3) South America, 4) Asia, 5) Australia, 6) Africa, 7) multi, 8) not available
Number of research settings	Number of countries in the empirical setting	1) national, 2) multi-national, 3) not available
Research methods	Instrument of data collection	1) Interviews, 2) participant/observation, 3) archival & documentary, 4) survey, 5) experiment, 6) focus groups, 7) others
Number of methods	Number of different methods of data collection	1) single source, 2) multi-source
Level of analysis	Level of analysis of the study	1) individual, 2) group, 3) firm, 4) national, 5) relational, 6) multiple

Adapted from Durst, Aggestam, and Ferenhof, 2015, p. 5

3.1.3. Size of the Research Team

The size of the research team was noted to determine whether the existing work represents individual research or a synthesis of different individuals' knowledge.

3.1.4. Journal of Publication

The journals were classified according to three broad categories to identify the fields from which the existing body of knowledge emerged:

1. Economics;
2. Economics & Business;
3. Business.

3.1.5. Topic

Because the study of knowledge spillover and leakage is a recent one, previous topics were not specified. This allows them to emerge from the theoretical background in each paper through the author's perception and subsequent decisions to join related discussions.

3.1.6. Disciplines

Knowledge spillover and leakage is the "umbrella" topic that can be seen from different perspectives. Thus, it would be helpful to know which discipline addresses it, and how it deals with knowledge leakage and spillover. Those perspectives can be used to understand the phenomenon. This factor was coded for law, economics, engineering, sociology, psychology, and management.

3.1.7. Number of Disciplines Involved

Scholars may be able to benefit from more than one discipline in order to study and comprehend the complexity of knowledge spillover and leakage. Consequently, each article was coded as covering one, two, three, or more disciplines.

3.1.8. Theoretical Aim

To comprehend the maturity of the research field as well as the limitations of the topic, each item was coded by the nature of the theoretical as exploratory research, development or elaboration, testing, or other. It can help to determine whether the scholars are exploring the phenomenon, or developing or validating theories.

3.1.9. Research Setting

Each item was coded for continent of origin; i.e., Europe, North America, South America, Asia, Australia and Africa. The idea is to understand the extent of influence of national culture on the research topic of knowledge spillover and leakage.

3.1.10. Number of Research Settings

This code was included to determine if there was more focus on national or multinational studies related to knowledge spillover and leakage.

3.1.11. Research Methods

The main objective of these criteria is to understand what kind of instruments had been applied to collect data. It also contributes to determine if there are any favored research approaches (i.e., quantitative over qualitative research).

3.1.12. Number of Research Methods

These criteria have been checked if the researcher(s) is using a combination of research methods, providing the opportunity to offset the weakness of one method with the strength of another one (Bryman, 2012).

3.1.13. Level of Analysis

Knowledge spillover and leakage can occur at different levels: individual, group, firm, national, relational, and multiple levels of analysis. Consequently, it is important to comprehend what level the researchers tried to capture. It was coded for the level of focus in each article.

4. RESULTS

The results of our analysis are shown below, presenting insights into the study of knowledge spillover and leakage.

4.1. Date of Publication

From the resulting bibliographic portfolio, 12 papers served as the basis for our analysis. The oldest publication is from 2000 and the most recent ones are from 2014. The corpus of research was primarily created in the 2004 to 2009 timeframe. This elucidates the fact that this topic remains in its youth. It also explains that knowledge spillover and leakage can be assessed together as an under-researched topic.

4.2. Country of Authors' Institutions

The analysis of the resulting papers showed that authors mainly from Europe are interested in the combined topics of knowledge spillover and leakage together. The UK appeared at first with four papers, followed by Italy with two, then Belgium, Netherlands, Spain, Germany, and the Czech Republic with one. In addition, a paper from China was analyzed.

4.3. Size of Research Team

Regarding the composition of the research team, the results show that three or more authors produced three articles. The majority of papers, however, had been the product of two researchers (5 papers), and four articles had a single author. Articles that have more than one author published double the quantity of papers, which was expected given the amount of effort, time, and resources required to enhance research. Furthermore, collaborative research may avoid the bias of a single author. It also may include diverse perspectives, which, in turn, can reduce the bias and take a more holistic approach regarding the study of knowledge spillover and leakage.

4.4. Journal of Publication

The journals that published research on knowledge spillover and leakage together fall in the areas of economics and business management. The majority of works were published on economics—nine papers—followed by two papers on business and one in a journal of business and economics. The *Journal of Economic Geography* and the *Journal of Development Economics* published two papers each; the other journals (*International Game Theory Review*, *Journal of the European Economic Association*, *World Economy*, *Oxford Economic Papers*, *EuroMed Journal of Business*, *Small Business Economics*, *Journal of Economics and Business*) had one paper each.

4.5. Topic

The analysis shows a significant interest in studying the impact of knowledge spillover-leakage, for example, in identifying knowledge risk (Tong, 2009). In addition, it has highlighted concerns about avoiding knowledge spillover-leakage in developing intellectual property, patents, and trade secrets (Bhattacharya & Guriev, 2006; Žigić, 2000) as well as R&D risk in innovation, mergers, and knowledge brokers (Hinloopen, 2004; Jost & van der Velden, 2008). Another concern is how to deal with knowledge accumulation, spillovers, and innovation, in how to measure it (Bischi & Lamantia, 2004), their effect (Czarnitzki & Kraft, 2012), and the location behavior it influences (Mariotti, Piscitello, & Elia, 2010). Another topic associated with the phenomenon of knowledge spillover-leakage is R&D investments and foreign direct investment. It can narrow the need for investment when companies utilize their absorptive capacity to acquire knowledge from other firms (Kugler, 2006; Potter, Moore, & Spires, 2002). On the other hand, firms with higher R&D investment prefer to isolate themselves and avoid clusters to prevent any local leakage from them that could benefit their rivals (Diez-Vial & Fernández-Olmos, 2014).

Another topic that appeared was the environmental spillover that encourages firms to establish informal industry working groups to deal with this environmental issue, hoping to benefit the whole community (Albornoz *et al.*, 2009).

The knowledge that is spilled over and/or leaked from a company, if not identified, will hardly be acquired, retained, and assimilated as organizational knowledge. Authors such as Bischi and Lamantia (2004), Kugler (2006), Albornoz *et al.* (2009), Mariotti *et al.* (2010), and Czarnitzki and Kraft (2012) state that absorptive capacity is essential for firms to get knowledge from other individuals and companies, and thus to internalize it. Following Cohen and Levinthal (1990), absorptive capacity is the ability to exploit knowledge from outside the company and transform it into organizational knowledge. In sum, it is the firm's ability to obtain, transfer, assimilate, and exploit knowledge, and turn it into real actions. Therefore, many companies elaborate their own strategies to sense contemporaneous knowledge spillover and/or leakages. The authors of the papers reviewed had shown that more studies that deal with this issue should be conducted. For instance, it would be interesting to figure out what is leaked and what is absorbed, to identify how companies can protect themselves from leaking and, on the other hand, how to improve the capture of knowledge spillover. The framework by Durst and Ferenhof (2014) that addresses areas of knowledge leakages in small and medium-sized enterprises provides some ideas regarding concrete forms of knowledge leakage and ways to reduce this type of risk exposure.

4.6. Disciplines and Number of Disciplines Involved

The results show that the study of knowledge spillover associated with leakage is dominated by economic background (ten articles). The remaining articles can be assigned to law and knowledge management (one article each). However, regarding the number of distinct disciplines applied, the data reveal that the authors made use of more than one discipline. For instance, all ten of the articles that had an economic background, used at least two different disciplines, adding, for example, knowledge management, business management, or environmental management.

4.7. Theoretical Aim

There are various modes to develop a theory or to contribute to its further progress. The findings showed that the majority of papers (seven articles) focused on advancing research, followed by five articles that concentrated on exploring the phenomenon. This emphasizes that the subject of knowledge spillover-leakage is still in its youth, which suggests that further studies are needed.

4.8. Research Settings and Number of Research Settings

The majority of the studies were conducted in Europe (five articles), where the first author is from Europe. Four papers do not present information about research settings or were based on literature review. Two papers are coded to multinational setting and, one article was researched in South America (Argentina).

4.9. Research Methods

This criterion reveals the instruments used for collecting and analyzing knowledge spillover and leakage. The data show that the instrument most used was survey with six articles, followed by five papers coded as "other," and the remainder were coded as archival and documentary papers. The articles coded as "other" used instruments such as dynamic systems, workshops, and math modeling methods. We discovered a broad mix regarding the specification of the research methodology when coding this criterion. Some articles were missing the mandatory transparency regarding of the instruments used in the course of their research method. Other articles, however, were specific and crystal clear describing the research approach and the data collection instruments used. Therefore, the observations presented should be taken with caution.

4.10. Number of Research Methods

Additionally, the twelve articles were coded for the number of data collection instruments applied. One article used a mixed-methods approach and the additional eleven articles were based on a mono-method approach. This could indicate an opportunity to provide more in-depth insights into knowledge spillover and leakage using wider vision applying mixed-method studies to improve further comprehension of knowledge spillover and leakage.

4.11. Level of Analysis

Research on knowledge spillover and leakage provides the opportunity to approach it from many different levels of analysis. The findings show that seven papers were built at the firm level, followed by two papers on national and multi-national levels each; and one paper was done at the regional level. None of papers deals with the question as an individual or group level. This is unexpected, as it is a human factor—mostly the individual—who originates the knowledge spillover-leakage process.

4.12. Consequences of Knowledge Spillover and Knowledge Leakage

The consequences of these phenomena could have a positive or negative impact on the business, depending on the perspective, receiver and sender, as can be seen in the following.

4.12.1. Consequences Regarding R&D

Firms can benefit from spillovers from the R&D activity carried out by another firm (Žigić, 2000). Corroborating that thought, Jost and van der Velden (2008) state that spillover lowers the R&D investment spent in each firm resulting in equilibrium. In turn, Kugler (2006) states that both positive spillover and the negative rivalry effect may occur in the analysis of technology diffusion between firms associated with R&D.

4.12.2. Consequences Regarding Localization / Cluster

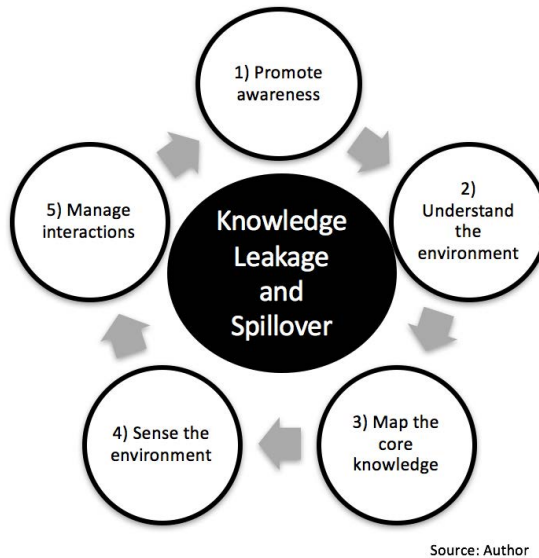
First of all, it should be recognized that there might be leakage or spillovers from one region to another (Potter, Moore, & Spires, 2002). Companies have greater opportunities to benefit: collective reputation effects, regional knowledge spillovers, qualified employees and local institutions that support the industry in highly concentrated spaces (Diez-Vial & Fernández-Olmos, 2014). In non-competing and complementary sectors, if technical knowledge is leaked from the subsidiary to domestic producers, such spillovers are more likely to generate productivity improvements (Kugler, 2006). On the other hand, the interaction of collocated firms does not necessarily lead to positive spillovers. It does significantly impact firms located near one another by learning and speeding the flow of ideas (Mariotti *et al.*, 2010). Concerning knowledge mobility, even if the technology can be protected by intellectual property rights, it could be easily leaked and duplicated, for the purpose of grabbing personalized and innovative knowledge-based workers creating the flow of the conditions and ecosystem (Tong, 2009).

5. CONCEPTUAL FRAMEWORK TO UNDERSTAND KNOWLEDGE SPILLOVER-LEAKAGE AND PROMOTE RESPONSIVENESS

Bringing together the discussion above, Figure 1 displays a systemic conceptual framework to understand knowledge spillover-leakage and promote responsiveness that comprises five steps:

1. Promote awareness, which is designed to show the importance of managing knowledge spillover-leakage inside of the company. One way of promoting it is to make oral narratives, seminars, and meetings showing the importance of information/knowledge sharing, telling of cases of consequences for the business when knowledge spillover-leakage occur.

Figure 1. Conceptual framework to understand knowledge spillover-leakage and promote responsiveness



2. Understand the environment, identify the partners, rival companies, and organizational structure. First, it's important to map the process of the company, preferably using a process mapping method like Business Process Modeling (BPM) or Value Stream Mapping (VSM). Second, from the information contained on the map, identify other players in the market that the company can trust to develop products such as goods or services together. Finally, explore the market for other companies that can benefit from the knowledge gained in the process of developing products.
3. Map the core knowledge that is created to unceasingly detect the knowledge that makes a difference, the one that should not be disclosed. Use tools and techniques of knowledge management, more precisely knowledge mapping tools (K-Map). Knowledge mapping, according to Folkes and Quintas (2004), is identified as the process of associating items of information or knowledge, preferably, visually, in such a way that the mapping itself also creates additional knowledge. The benefits are huge as listed by Yasin and Egbu (2010, pp. 805-806):
 - a. Identification of knowledge location and flow: knowledge mapping enables the tacit and explicit knowledge to be located and the flow of the knowledge to be captured. It enables teams or individual evaluators to locate that knowledge and the path of its flows.
 - b. Highlight and link the experts and islands of expertise: Performance evaluations are typically carried out by a group of expert teams with different areas of specialization. Knowledge maps help in the form of providing a so-called "yellow pages" of experts, while indicating their area of specialization and providing links between them.
 - c. Rapid access to information: Links to the tacit and explicit knowledge within organization or across the organization, in the form of virtual maps and/or physical maps, provide quicker access to the information.

- d. Knowledge assets inventory: Provides inventory of the intellectual and intangible assets. The inventory also helps in defining the gaps in the organizational knowledge base.
 - e. Developing community of practice (COP): Developing a group of multi-expertise in a common domain, with a genuine interest in each other's expertise based on their own practice. Involve a member of a core group as an experienced facilitator and junior evaluators to sustain the organizational knowledge structure.
 - f. Improve decision-making and problem-solving: Providing applicable information comprehensively, quickly, and accurately will lead to robust decision-making, recommendations, and solutions for the problematic issues in evaluation.
 - g. Provide access to knowledge: Make the various form of knowledge accessible for exploitation within the organization or across organizations, excluding classified areas.
 - h. Identify knowledge sharing and barriers: Acknowledge the knowledge sharing opportunity and its possible barriers. On the other hand, knowledge mapping is only considered successful if the knowledge being mapped is effectively shared and exploited.
4. Structure the environment based on others' core knowledge, in order to capture it. According to Teece (2007), it's an analytical system used to filter, shape, and calibrate opportunities, composed of four processes: 1) processes to identify target market segments, changing customer needs, and customer innovation; 2) processes to tap supplier and complement innovation; 3) processes to tap developments in exogenous science and technology; 4) processes to direct internal R&D and select new technologies.
 5. Managing interaction is the step used to manage and control the opportunities and threats of knowledge spillover-leakage. As the players are aware of knowledge spillover-leakage, the internal and external environments are mapped along with the core knowledge. Based on that, the opportunities and threats are identified and the efforts can be directed to prevent the threats and boost the opportunities.

As new knowledge, partners, rivals, and employees may appear, the system should be iterative, and the occurrence of new interactions will depend on those. It is expected that the use of this framework will promote responsiveness to knowledge spillover-leakage.

6. RESEARCH OPPORTUNITIES IDENTIFIED

The following sections propose opportunities for researchers that are interested in conducting studies on knowledge spillover-leakage. These insights came from the literature review and other findings presented previously.

6.1. Disciplines

Additional disciplines like psychology and pedagogy could bring additional insights to deal with knowledge spillover and knowledge leakage. For example, psychologists could apply their perceptions of how 'the human factor' can impact or be impacted on leaking or spilling-over knowledge. The pedagogy perspective could include how to improve learning from what is leaked, adding in other disciplines that could assist in promoting a universal comprehension with different visions, perceptions, and a way of thinking and dealing with the subject.

6.2. Research Methods

The findings have indicated that researchers should address the phenomenon with a more rigorous approach. It means demonstrating clearly and transparently the instruments used as part of their research method. In addition, the study of knowledge spillover-leakage would improve from the use of different approaches and different perspectives; e.g., a holistic perspective using mixed methods

to capture tacit and explicit knowledge. The use of content analysis could assist researchers in understanding the motives of knowledge leakage and/or spillover and complement it with statistical analysis. Additionally, a structural equation model could be used to confirm theories related to the knowledge spillover and leakage phenomenon that have already been researched using exploratory factor analysis. Furthermore, assuming that knowledge spillover-leakage and its consequences do not necessarily appear immediately, we recommend designing longitudinal studies to address this issue.

6.3. Level of Analysis

Regarding the level of analysis, future research should also focus on the individual level, as human factors frequently initiate the knowledge spillover/leakage process. The human factor at work is aligned with Cacciabue (2013) as a concern about the analysis and optimization of the relationship between people and their activities, including management systems, plants (industrial plant), and the behavior of human beings.

One example of future research at the level individual or group analysis is to understand what happens when persons from Research and Development and Innovation (R&D&I), as well as groups that deal with innovation as part of their day to day work, interact with marketing competitors, partners, clients, and the whole company. Do they capture knowledge spillover and/or leakage?

6.4. Need for Theoretical Conceptualization

Future works should address the clarification of the definition of both terms—knowledge spillover and knowledge leakage—based on differences and similarities. For example, how they occur, if it is intentional or not, what benefits and disadvantages they drive, and propose ways to deal with it. Furthermore, researchers may address the distinction from other terms, such as knowledge waste, knowledge loss, and knowledge attrition. Such proceedings would require interdisciplinary investigation to establish existing knowledge; however, it should be based on previous works in order to avoid reinvention. This is consistent with Durst *et al.* (2015) who state that more theoretical development related to knowledge leakage is needed. It is also aligned with Tong (2009) who highlights that more studies concerning knowledge at risk (i.e.; risk of assets, risk of knowledge spillovers, knowledge conversion, leakage risks, contractual risks, and moral hazard) should be addressed.

6.5. List of Possible Research Questions

A mapping of the field through a systematic review may demonstrate that some questions are not well explored or still not being answered. It could be a great kick-start for future research.

What are the motives behind personal knowledge disclosure? Do these motives incentivize knowledge leakage or spillover? Is there a statistical correlation between the motives and the spillover-leakage?

Does the geographical environment make knowledge spillover-leakage more or less propitious? Is it beneficial or negative for companies to collocate with rival companies and business partners?

Is there a significant difference between the impact of a knowledge spillover versus knowledge leakage?

Is there any way to maximize the benefits of knowledge spillover-leakage and minimize the disadvantages?

7. CONCLUSION

The aim of this paper was to gain a better understanding of the existence of knowledge spillover and knowledge leakage by extending the extant body of knowledge regarding this phenomenon and attending to the need for more studies presented by Durst *et al.* (2015). Definitely, it can be said that without understanding knowledge spillover-leakage and the probable consequences for business, knowledge of management actions will be depreciated and less effective. Subsequently, this work

used the method of a systematic literature review of extant research on knowledge spillover-leakage. Based on the review, this work has developed a conceptual framework to understand knowledge spillover-leakage that may assist companies to promote responsiveness.

What can be understood is that knowledge spillovers-leakage is an involuntary leakage of useful technological information (Bischi & Lamantia, 2004). It is not unidirectional, as it may derive from either inflows or outflows of knowledge (Mariotti et al., 2010). It is also the knowledge voluntarily exposed that may leak to competitors when organizations make strategic alliances such as with contract consultants, joint ventures, outsourcing parts of business functions, or in a situation where parts of the core knowledge are transferred to others (Durst & Ferenhof, 2014).

The results have both practical as well as theoretical implications. From a practical perspective, this paper does not simply highlight the consequences of not managing knowledge spillover-leakage, but it also offers insights in how to handle the phenomenon. Moreover, it may assist in having a better understanding that knowledge may spillover or leak *from* the company or *to* the company, so knowledge spillover-leakage should be taken into consideration when planning knowledge management actions. From a theoretical point of view, this paper is offered as a contribution to a more holistic view of knowledge management, bringing a bilateral perspective that knowledge spillover-leakage may have positive or negative impacts on the business depending on the eye of the beholder (Czarnitzki & Kraft, 2012; Jost & van der Velden, 2008; Kugler, 2006). Furthermore, the findings provide suggestions for future research to complement previous studies.

In conclusion, the present paper observes that managing knowledge spillover-leakage is a prosperous step for the advancement of knowledge management practices and theory. The author is aware that the present study is not without limitations. Because of the selected research procedures, including the decision to use works that contain both keywords (knowledge spillover and knowledge leakage), this review might not have enabled ample coverage of all empirical articles that deal with the phenomenon of knowledge spillover-leakage. Nevertheless, based on the systematic research method employed, it is reasonable to assume that the review process covered a large share of available research.

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