Abstract: The importance of knowledge and knowledge management for organizations has been widely discussed in recent years. Historically, the lion’s share of organizational knowledge was generated internally, e.g., by a company’s R&D department. Today, only few firms can sustain their competitiveness and innovativeness by focusing exclusively on internal knowledge sources. In order to keep track of recent trends, they are increasingly drawing in knowledge from external sources. Managing highly specific knowledge from customers, technologies, markets, etc. is a key to innovation. Its importance is widely reflected in research on, e.g., “user innovation”, “collective invention” or “interactive added value”. However, integrating external knowledge to foster innovation faces companies with a number of challenges. Open innovation as paradigm shift in innovation management and strategic approach to include the outside world into internal innovation processes is widely regarded as a promising approach in current research.

The present article examines the role of external knowledge in the field of open innovation. By carrying out a systematic literature review the author develops eight categories with 19 sub-categories of potential external knowledge sources. A systematization of the identified sources investigates a variety of assets and drawbacks that can be associated with the integration of such knowledge. Thereby, the article shows that (a) the current research on open innovation is already highly concerned about the role of external knowledge, but (b) mainly focuses on just a few categories/subcategories and (c) tends to neglect many positive and/or negative influences on creativity and innovativeness.

The study illustrates that selecting external sources of knowledge is one of the main challenges of open innovation. Therefore, the author provides a set of strategic recommendations: Firms must concentrate on the most valuable sources, limit their number, provide the necessary means to acquire that knowledge and accurately measure if such additional external knowledge does not over-expand the complexity of innovation processes.

Keywords: innovation management; knowledge management; external knowledge; open innovation; literature review

1. Introduction

The importance of knowledge and knowledge management (KM) is widely discussed in research (e.g., Lehner, 2009; Probst, Raub, & Romhardt, 2010). Following the knowledge-based view, knowledge is the most valuable resource in an organization (Cohen & Levinthal, 1990). Traditionally, the lion’s share of this resource was developed within the borders of the company. Today, few companies can maintain their competitiveness and innovativeness by focusing only on internal sources (Powell, Koput, & Smith-Doerr, 1996). They are increasingly relying on externally conducted research and developed technologies.

The understanding of innovation processes has changed in recent years. Therefore, this work is based a modern conception of innovation (Reichwald & Piller, 2006). The employed concept relies on the innovation paradigm open innovation (OI). OI tries to untighten traditional innovation processes in order to integrate external ideas and actors (Chesbrough, 2006a, 2006b). By opening their doors and integrating external knowledge (EK) bearers (Kang & Kang, 2009) companies can cope with shorter innovation cycles, rising R&D costs, and a lack of resources (Gassmann & Enkel, 2004) turning OI into a “frequently dominant competitive factor” (Piller & Hilgers, 2008).

In a recent study on over 4.500 European companies Filippetti (2011) reveals that the most important sources of innovation are internal design activities (43%), internal R&D (54%), and the acquisition of mechanical equipment (83%). Not surprisingly, the study also illustrates that external research (35%) and external know-how (59%) play an equally important role. Such figures prove that innovative ideas can be found within the organizational limits as well as outside its borders (e.g., Chesbrough, 2006b; Laursen & Salter, 2006). Consequently, companies increasingly innovate with the aid of customers, suppliers, universities and even competitors. The broader and deeper they search for innovative ideas and EK the more successful their endeavors will be (e.g., Chen et al., 2011; Laursen & Salter, 2006).

Research lacks a concise understanding of influences on knowledge exploitation and exploration (Lichtenthaler, 2011, p 86). Therefore, the present study tries to shed a light on how EK exercises its influence on OI processes or innovativeness in general. The author develops meaningful categories of EK and maps positive as well as negative influences that can be associated with these sources. Hence, the study helps to identify potential
sources of EK and facilitates the allocation of advantages and disadvantages that can be attached to the categories.

2. External knowledge

Current research already highlights the value of EK (Bergman, Jantunen, & Saksa, 2009). Research on user innovation (von Hippel, 1986), collective invention (Allen, 1983), or interactive value creation (Reichwald & Piller, 2006) are just a few examples to be named. Many of these studies focus on certain bearers of knowledge (e.g., Ahrweiler, Pyka, & Gilbert, 2011; Bogers, 2011; Kang & Kang, 2009; Tether & Tajar, 2008), branches (e.g., Hughes & Wareham, 2010; Lorentzen, 2005; Rohrbeck, 2010), company types (e.g., Laursen & Salter, 2006; Roberts, 2010; van Gils, Vissers, & de Wit, 2009), regions (e.g., Cantner, Joel, & Schmidt, 2009; Huggins & Johnston, 2009; Love, Roper, & Bryson, 2011), company sizes (e.g., Fletcher & Harris, 2011; Huggins & Johnston, 2009; Lichtenhalter & Ernst, 2007) or a combination of two or more categories mentioned above. Due to the fact that EK manifests itself in various types and contents or is provided by different bearers, companies must know how to concentrate on the right amount and mix of sources. Thus, the importance of KM as a discipline that organizes the handling of knowledge in an economic context has gained dramatically (e.g., Davenport, 2008; McAfee, 2006). EK is increasingly regarded as a capital (Carneiro, 2000) and thereby as a fostering but also limiting factor (Kang & Kang, 2009) regarding innovativeness (e.g., Gassmann & Enkel, 2006) and competiveness (Chen et al., 2011; Cohen & Levinthal, 1990, p 128). Nevertheless, there is still some uncertainty concerning the positive and negative effects that can be attributed to certain sources or bearers of knowledge (Chen et al., 2011). Research lacks a generalizing view on the role of EK and its potential impact on innovation processes.

3. Open innovation and external knowledge

Innovation is commonly known as “the outcome of an interactive process between the firm and its environment, as the result of the collaboration between a wide variety of actors, located both inside and outside the firm” (Mention, 2011, p 44). In order to develop an overview on the potential influences of EK and its bearers on OI, the author focuses on the interactive process described by Mention (2011) which can be divided into several steps. Figure 1 illustrates the five steps of innovation as pointed out by Desouza et al. (2009).

Figure 1. Innovation process after Desouza et al. (2009)

Generation and Mobilization as the starting point of the circular process is responsible for the development of ideas, such as new concepts, process developments, etc. (Desouza et al., 2009, p 12). Due to the fact that ideas can also be generated outside the firm (in an OI context) mobilization comprises the (physical or logical) transfer of ideas within as well as outside the organization. That includes the possibility of transferring ideas to new domains, e.g., in order to cut new/additional development.

In the following Advocacy and Screening phase innovators estimate the potential value a certain idea can add to the company value and possible issues that may occur during the realization of that idea (Desouza et al., 2009, p 17). Not every idea is worthy to be commercialized. Some may be too risky, e.g. from a financial point of view, others could cause defensiveness and therefore need people (e.g., employees, customers) advocating them.

If an idea passes the second phase the prototypical realization can begin (Desouza et al., 2009, p 20ff.). By Experimentation ideas are evaluated if they fit to the organization’s portfolio. Through an iterative process the prototype is examined regarding its implementability, practicability, etc. resulting in a collection of potentially realizable ideas that the firm can commercialize now or in the future.

Commercialization is all about implementing an idea for the internal or external value creation. Typically, in this phase of the innovation process the firm develops new products of services – not just by demonstrating the practicability but convincing potential customers and consumers.

The subsequent Diffusion and Implementation phase focuses on the distribution and supply of resources that are needed for a long-term development of the innovative idea (Desouza et al., 2009, p 25) or product/service.

Research illustrates that sources of EK can contribute to every phase of the above-mentioned process – either positively or on a negative way. OI – as the central unit of analysis of this study – can be regarded as a paradigm shift in traditional innovation management and even as an own “strategy of innovation management” (Reichwald & Piller, 2006, p 96). Openness is associated with “the number of different external sources of knowledge that each firm draws upon in its innovative activities” (Laursen & Salter, 2004, p 1204). Therefore, OI is devoted to the strategic use of such sources and the inclusion of the outside world into innovation processes (Gassmann & Enkel, 2004). Hence, like any other corporate asset (Carneiro, 2000) EK can significantly con-
tribute to innovative performance (cf. Gassmann & Enkel, 2006) and competitiveness (cf. Chen et al., 2011), as mentioned above.

4. Research method and analytical framework

Before answering the research objective (cf. Chapter 1) the following paragraphs describe the analytical framework of this paper. After a brief introduction into the research method this chapter provides a description of the data collection process and the sources that where into account.

Central objective of this research paper is the analysis of data from textual sources, i.e. available literature in order to investigate the various influences of EK on OI processes. Due to the enormous amount of literature in this domain, such as scientific books and papers, magazines, conferences proceedings, etc. the author carries out a structuring content analysis (cf. Mayring, 2008) based on a literature review (cf. Webster & Watson, 2002). This approach allows a data collection that not only follows a deductive but also inductive procedure.

The aim of the SCA is to identify structures in existing (textual) material and to extract them based on a pre-defined system of categories. The initial concepts on which the researcher concentrates her/his identification at the beginning can be changed and enhanced during extraction. Hence, one of the main advantages of the SCA is that (a) the researcher is able to refer to her/his previous knowledge and that (b) she/he does not need a completely elaborated category system before starting the analysis.

Figure 2. Procedure of a structuring content analysis (Mayring, 2008, p 84)

Step 1: Identification of analysis material. As stated above, Mayring’s procedure (cf. Figure 2) mainly relies on textual sources. Therefore, step one starts with the identification and selection of the material. In this case the present study only focuses on the analysis of electronic sources (as of 10/2011) that deal with OI and KM. Intentionally, the author only examines scientific journals, because they are supposed to best represent the state of research in a particular domain and in a particular period of time. This study does not attempt to provide an overview on the available material in its entirety. Hence, the author aims to develop a list of scientific articles that does not exceed about 200 hits.

Initially, a sequence of superficial queries was conducted to generate rough hit lists and to gain an overview on the amount of existing literature. The author used two public library databases: the catalogues of the ‘Sächsische Landesbibliothek – Staats- und Universitätsbibliothek Dresden’ (SLUB) and the ‘John Rylands University Library Manchester’ (JRUL). For additional in-depth queries four renowned scientific databases and search engines (ScienceDirect, Emerald, EBSCOhost, Wiley and Microsoft Academic Research (MAS)) were employed. In a stepwise process and by refining and/or expanding the search strings relevant literature was isolated and extracted.

For a better orientation and a systematic extension of the number of hits certain journals and prominent works were utilized as a point of reference (cf. Webster & Watson, 2002). After that the search strings were evaluated based on a superficial scan of the results. Logical connectors (Boolean operators) were used to link certain strings and narrow the hit list.

The basic inquiry illustrates that a sufficient specification of initial general queries delivered manageable results. However, the results – if the same queries would be carried out on all the selected databases – still proved to be too generic. Hence, the query had to be rendered more precisely. In the end the author chose a combination of the strings ‘open innovation’ and ‘external knowledge’. The number of hits among the above-mentioned databases is divided as follows: EBSCOhost (19 hits), Emerald (61), JRUL (32), ScienceDirect (123), SLUB (39) and Wiley (102). After eliminating duplicates 314 articles remained.

In the next step to reduce the number of results to roughly 200 hits, the review was limited to most relevant (e.g., European Journal of Innovation Management, Journal of Knowledge Management) and high quality journals. The present sample of journals was based on their individual position in academic rankings (cf. Harzing, 2012). Finally, the selected studies were examined regarding their fit to the objectives of the present research. This lead to a further elimination of articles, which were identified by queries but did not provide a significant contribution to problem solving. The final list of literature included 210 individual articles. Therefore, the initial goal of about 200 papers was reached.

Step 2: Definition of structuring dimensions. During the second step of Mayring’s SCA basic structuring dimensions must be defined. Focusing on two unit of analysis (sources of EK and influences of EK on OI processes) the author developed two different structures:
• The basic dimensions for sources of EK are based on differentiations that can be found in research. Freeman (2010, p 25), one of the leading researchers on stakeholder theory, names governments, customers, competitors, media, suppliers, employees, environmental and other interest groups, communal organizations and owners as the basic stakeholders of an organization. The present study solely concentrates on external sources of knowledge and therefore on external stakeholders eliminating the last four groups proposed by Freeman (2010). Those groups are either internal stakeholders or cannot contribute to OI processes.

• In addition to the source perspective, this research sheds a light on the potential influences of EK in an OI context. The initial structure for this facet starts with the differentiation between positive and negative influences.

Step 3: Definition of category system. The set of categories contains all inductively and deductively defined categories and their respective relation to each other. In this study the relationship type is reduced to “is a” relations. Subordinated nodes can only be related to a concept of a higher level. Every node from a certain category represents a concept that is standing in for a phenomenon of the real world (in this case extracted from literature) or an aggregation of multiple phenomena. Each phenomena identified by reviewing the material is represented by a single word, phrase or paragraph (Strauss & Corbin, 1998). Using unique labels, the author can work with these concepts later on. This approach is often referred to as coding (Miles & Huberman, 1994, p 55). Each concept that was identified was assigned to exactly one structuring dimension. Starting with the basic set of dimensions the author enhanced the initial categorization by adding more detailed dimensions resulting in a more detailed assignment.

Step 4: Definition of coding approach. As illustrated above, the coding process relies on the definition of abstract concepts. In order to facilitate the assignment of certain concepts to extracted phenomena a dictionary of codes (or coding manual) was developed that defines the rules to be followed. Mayring also points out that this approach supports the researcher during the extraction process and adds the required comprehensibility for readers. He suggests three elements that each concept should include:

• an accurate definition that provides a comprehensible description for each concept and a short form, which is used to highlight the phenomenon in the text,

• a set of examples that illustrate the assignment of certain concepts to a category and can be used to compare an extracted fragment with the already assigned ones and

• additional coding rules which allow an exact assignment if definition and examples cannot support the differentiation between potential categories.

Step 5/6: Screening of material and extraction of fragments. In the following step the material previously selected must be read through. Parallel to this, the author used the pre-defined categories and the coding manual to annotate findings in the texts. First, the author mainly focused abstracts and conclusions, because these parts usually contain the new findings, their interpretation and the value added. Nevertheless, the author thoroughly read through the other parts as well in order to grasp the whole picture of the particular paper.

In detail, a stepwise approach was conducted. First, 20 randomly picked articles were analyzed and the accuracy of the categories, definitions, examples, and coding rules were tested (Mayring, 2008, p 83). This test run allowed an adjustment of the definitions based on the sample avoiding a re-review of the 200+ articles after prescreening the whole material. If a phenomenon could not be assigned to a concept a new concept could be included. Following an inductive approach, this step is partly based on Grounded Theory (Glaser & Strauss, 1967; Strauss & Corbin, 1998). Mayring (2008, p 84) refers to this procedure as “open coding”. After that, the review was started all over again, now, focusing on the entirety of the articles. Considering the plentitude of articles the author conducted only a single run through the material without re-runs.

Step 7: Revision of categories. Before presenting the result of the SCA in step 8 some adjustments of the initial categories had to be made. If a textual fragment could not be assigned to one of the developed categories but was considered valuable for answering the question a new category was introduced. In any other case the fragments were assigned to existing categories.

5. External Knowledge in open innovation processes

Based on Freeman’s stakeholder theory this research provides a comprehensive overview on possible bearers of EK. In addition to the initial set of categories the author developed several sub-categories that allow a more accurate allocation of the extracted fragments. Figure 3 illustrates the potential sources of EK identified during the review.

Due to the limited capacity of this paper the full list of examples and references that were extracted from literature had to be left out. Nevertheless, Figure 3 still shows that the range of potential sources of EK goes far beyond the group of basic stakeholders as they are referred to in current research. The author developed 7 categories and 20 sub-categories. In addition to sources derived from Freeman’s stakeholder theory the results include forms of collaboration, such as science networks, R&D alliances, industrial alliances and other contract agreements. Though the range covers a great deal of sources, not every knowledge bearer can contribute equally to competitiveness and innovativeness. Still, current research highlights that some sources are taken into considera-
tion more often (i.e. academic institutions, customers and suppliers) in comparison to others (i.e. standards, innovators, patents, etc.).

In a second step the author analyzed potential influences of EK on OI processes. The results concentrate on the impact of EK regarding its transfer into the organization and initially differentiate between positive and negative influences. Research frequently focuses the (quantitative) output of certain initiatives involving EK and lack a process-oriented view (Sparrow, 2011). If the impact of EK, e.g., from a university, is to be measured, the evaluation usually takes quantitative measurements, such as the number of patent applications or licensing procedures into consideration. In order to calculate the ROI these numbers have to be set off against grants, wages, project costs, etc. To avoid such a strictly quantitative view this study includes changes in innovation process and hardly measurable influences. Due to the complexity, the author waives assumptions concerning comparative values or quantifiable impacts.

The categorization is based on the five steps of innovation processes as illustrated in Figure 1 and additional cross-process influences. From a general point of view, EK strongly influences the generalization and mobilization as it allows the introduction of external ideas and new perspectives. Advocacy and screening can be influenced as well, but regarding the fact that this step commonly relies on personal experiences and internal knowledge the potential impact is comparatively low. A similar observation can be made in the following phase. Nevertheless, experimentation and designing – as long as it directly involves customers, external employees, etc. – can be influenced in various ways. In the subsequent steps of the innovation process, literature indicates that the potential influence increases. In addition to EK impacts that can be related to a certain phase of the innovation process there are influences that occur across the whole process. The following table (Table 1) sums up the potential positive as well as negative effects that were extracted from literature without in any way claiming to be exhaustive.

Table 1. Positive and negative influences of external knowledge in open innovation processes

<table>
<thead>
<tr>
<th>Phase</th>
<th>Positive Influence</th>
<th>Negative Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation and Mobilization</td>
<td>Compensate low R&amp;D resources&lt;br&gt;Skimming von Spillover from EK bearers&lt;br&gt;Increase innovativeness&lt;br&gt;Increase number of ideas and degree of novelty&lt;br&gt;Generate new knowledge</td>
<td>Cannot guarantee uniqueness of EK&lt;br&gt;Increases dependency on EK bearers&lt;br&gt;Cannot automatically increase innovativeness</td>
</tr>
<tr>
<td>Advocacy &amp; Screening</td>
<td>Facilitate radical innovation&lt;br&gt;Support technological innovation&lt;br&gt;Allow selection of complex innovation</td>
<td>Cause nonobservance of opportunities&lt;br&gt;Leads to miss of chances</td>
</tr>
<tr>
<td>Experimentation</td>
<td>Shorten time to develop&lt;br&gt;Increase/Improve innovation quality&lt;br&gt;Enable new combinations (e.g., of EK and technology)</td>
<td></td>
</tr>
<tr>
<td>Commercialization</td>
<td>Decrease risk and insecurity&lt;br&gt;Increase mutual benefit in collaborative agreements&lt;br&gt;Increase probability of successful realiza-</td>
<td>Increase risk and insecurity&lt;br&gt;Cannot automatically increase business value&lt;br&gt;Cause IPR problems</td>
</tr>
</tbody>
</table>

Figure 3. Sources of external knowledge
Increase Return on R&D Investment  Increase cost for search, acquisition, integration of EK  Cannot exclusively belong to organization
Shorten time to market

<table>
<thead>
<tr>
<th>Diffusion &amp; Implementation</th>
<th>Deregulate loss/outlet of knowledge</th>
<th>Cause conflict between sharing and protection  Impede exchange by over-protection  Pollute internal body of knowledge</th>
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<tbody>
<tr>
<td></td>
<td>Increase number of new products</td>
<td></td>
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<tr>
<td></td>
<td>Increase number of new processes</td>
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<tr>
<td></td>
<td>Increase number of patents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avoid redundancies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enhance organizational knowledge base</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incorporate new abilities/capabilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enhance existing skills</td>
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</tbody>
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<table>
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<tr>
<th>Cross-process</th>
<th>Depend on previous knowledge/R&amp;D</th>
<th>Cannot replace internal R&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Complement internal knowledge/R&amp;D</td>
<td>Cannot secure correctness of EK  Cause internal knowledge to seep out  Require cultural changes</td>
</tr>
<tr>
<td></td>
<td>Integration develops into core competen-</td>
<td>Require organizational changes</td>
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<td></td>
<td>ceity</td>
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<tr>
<td></td>
<td>Increase flexibility and visibility</td>
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<td></td>
<td>Increase financial savings</td>
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<tr>
<td></td>
<td>Shorten innovation process</td>
<td></td>
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<tr>
<td></td>
<td>Facilitate acquisition/transfer of EK</td>
<td></td>
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<tr>
<td></td>
<td>Decentralize innovation processes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduce complexity of internal R&amp;D</td>
<td></td>
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<tr>
<td></td>
<td>Improve internal R&amp;D</td>
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6. **Challenges for organizations**

The present study illustrates that selecting EK sources in an OI context involves several challenges. First, there are many sources from which an organization can acquire EK (cf. Figure 3). This leads to the conclusion that firms must know how to chose the right sources, which are most suitable to generate innovation and what potential influences can be associated with the sources. In general, there is no system of rules that supports such decisions. Depending on, e.g., the length of a project or its focus (e.g., product vs. service, technological vs. process, etc.) the set of suitable sources of EK to support a project may differ.

One aim of OI is experimentation with new ideas and the managing such approaches in order to generate a business value. Hence, firms have to concentrate on those sources that have the biggest positive impact on innovativeness and competitiveness. Nevertheless, potential risks and disadvantages must not be neglected (e.g., Barge-Gil, 2010; Grimpe & Sofka, 2009; Hurmelinna-Laukkanen, 2011). The study showed that although research frequently highlights the benefit of EK (e.g., Ahrweiler et al., 2011; Allee & Taug, 2006; Cantner et al., 2009), the consideration of consequences and negative influences tends to fall short and not uncommonly causes damage (e.g., Frickel, 2011).

Another challenge can be associated with the time and amount of EK. Organizations must define the critical mass of EK and have to decide when a satisfactory level that can lead to a satisfactory decision is reached (Laursen & Salter, 2006).

An issue that is often related to knowledge in general is the fact that it quickly becomes obsolete (Hurmelinna-Laukkanen, 2011). In addition to that, by using social media platforms such knowledge is available to more than just a selected circle of players and organizations (Grimpe & Kaiser, 2010). Opening the innovation process forces firms to actively search for highly potential developments to make sure that competitors cannot draw any advantage from an earlier discovery. Anyhow, there are cases where openness is neither necessary nor reasonable (Ahrweiler et al., 2011). Processes requiring in-depth knowledge are a regular basis for competitive advantages. Therefore, opening up to EK bearers could jeopardize benefits from exclusivity. If openness causes leaks of critical knowledge, firms must calculate such risks (Bergman et al., 2009).
While internal knowledge is a part of the organizational body of knowledge by nature, EK needs special effort to integrate it and to decide about its compatibility to existing knowledge. If an external source of knowledge requires, e.g., internal changes, such as cultural or structural changes (Chen et al., 2011; Chiarioni, Chiesa, & Frattini, 2009), or an investment in transformation (Laursen & Salter, 2006; Sofka & Grimpe, 2010), firms must evaluate whether the potential benefit compensates the additional effort or not.

Organizations that are willing to launch an OI project or to open their innovation process, must define a concise role of internal R&D. They must decide if OI shall act as substitute or complement to existing innovation approaches. If an organization fails to communicate a comprehensible understanding of the role, issues such as the not-invented-here syndrome (Lichtenthaler & Ernst, 2006), an unintended reduction of internal R&D (Teirlinck, Dumont, & Spithoven, 2010) or inertia (Enkel, Perez-Freije, & Gassmann, 2005) can occur.

All in all, organizations must not consider EK as a magic bullet. There are still plenty of risks (Blomqvist, Hara, Koivuniemi, & Aijo, 2004), such as an increasing dependence on external sources (Huggins & Johnston, 2009) or the questionable correctness of EK (Grimpe & Sofka, 2009; Sofka & Grimpe, 2010). Research lacks an analysis of distinct correlations between potential sources/types of EK and their impact on innovativeness. Hence, a forecast of consequences of a knowledge transfer activity is still impossible.

7. Conclusion
This study presented the results of a literature review in the area of tension between OI and management of EK. The aim was to develop an overview on potential sources of EK and their impact on the innovation process. For this purpose, an SCA was conducted. The study revealed that because of the fact that companies are increasingly forced to tap EK and to openly innovate by collaborating with external actors (Kang & Kang, 2009). By sticking to internal sources of knowledge only few organizations can remain competitive or foster innovation (Powell, Koput, & Smith-Doerr, 1996). Therefore, the present research points out that (a) EK in OI is widely discussed in research and considered as critical to success. The literature review illustrates that (b) external sources of knowledge are by no means restricted only to customers, suppliers and academic research institutes. Literature reveals comprehensive scenarios in which, e.g., events such as innovation contests or non-customers/non-suppliers contribute to innovative performance (cf. Sofka & Grimpe, 2010). The sources identified were divided into 7 categories and 20 sub-categories. Each source significantly differs from another regarding the type of knowledge, its contribution to innovation performance and accessibility for companies (Sofka & Grimpe, 2010). Notwithstanding, research lacks a holistic view. Therefore, (c) many positive and negative influences are neglected. Table 1 illustrates positive and negative effects of external sources of knowledge on the innovation process.

The future challenge is to focus on the most valuable categories, to provide the necessary means for knowledge acquisition and to accurately measure if additional EK inflates the complexity of the innovation process. Nevertheless, research lacks a distinct alignment of potential sources/types of EK and their impact on innovativeness, which impedes the process of decision-making in organizations. In order to solve this problem, feasible measuring instruments are required.

References

1 A complete list of the sources of the literature review can be retrieved from http://bit.ly/kmaprefs.


Froslev Christiansen, J. (2005). Withering Core Competency for the Large Corporation in an Open Innovation World? *DRUID.*


Miles, M. B., & Huberman, A. M. (1994). Qualitative data analysis. SAGE.


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