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Abstract

Recent research shows the increasing importance of generating innovative IT solutions within information technology outsourcing (ITO) relationships. This literature review sheds further light on our current body of knowledge with regard to such innovation sourcing engagements. Based on a structured literature review and using citation network analysis methods, we (1) identify key articles and authors covering the topic of innovation sourcing, (2) analyze the development of innovation sourcing in ITO relationships over time, and (3) evaluate relevant concepts for innovation sourcing engagements in practice. Our main finding is the identification, categorization, and relevance ranking of 103 concepts related to innovation sourcing. Additionally, we identify research gaps as well as confirm that citation network analysis is a proper method for the visualization and analysis of literature in the research stream of innovation sourcing. We emphasize further research on innovation sourcing engagements and provide distinctive research directions for the research community.

Keywords: Literature Review, Innovation, Innovation Sourcing Engagement, Information Technology Outsourcing, Social Network Analysis, Citation Network Analysis

1 INTRODUCTION

Information technology outsourcing (ITO), the subcontracting of an organization's information technology-related tasks to an external vendor, is an important part of contemporary organizations' information technology (IT) strategy (Gartner 2015). Traditionally, the reduction of the client's overall IT costs has been the main objective of ITO (Loh & Venkatraman 1992, Hoecht & Trott 2006, Lacity et al. 2009). Recent market analyses, however, indicate a considerable increase in so-called *innovation sourcing* engagements (Gartner 2012). The purpose of these engagements is, at least in parts and in addition to overarching cost reduction goals, the generation of innovative IT solutions to be used in the client organization's products and services. In this study, we define innovation as a new idea, successfully used in an organization's (IT) products, services, or processes, in order to generate additional value for the organization and strengthen its market competitiveness (Loch et al. 2011).

Existing studies have shown the importance of *innovation effects* as one of the key factors for a successful ITO outcome and *innovation* as an important ITO outcome itself (Lacity et al. 2016). For example, Oshri et al. (2015) showed that the quality of the client-vendor relationship has a positive impact on the likelihood of achieving strategic innovations through ITO. Even though a comprehensive body of knowledge exists on how the ITO client-vendor relationship needs to be structured and managed in general (Dibbern et al. 2004, Lacity et al. 2010), our knowledge on how to structure such a relationship to enable innovation sourcing engagements remains scarce (Kotlarsky et al. 2015). Hence, building upon calls for further research on the topic of innovation in ITO relationships (Weeks & Feeny 2008, Lacity et al. 2010, Oshri et al. 2015), and to provide a starting point for further investigations, our research study aims at answering the following research questions:

> RQ1. How did the research on innovation sourcing engagements develop over time?
>
> RQ2. What are the main concepts related to innovation sourcing engagement identified in the literature?

To answer our research questions, we conducted a structured literature review. Specifically, we apply citation network analysis (CNA) and content analysis techniques to identify the development of research over time and the concepts explaining innovation sourcing engagements. In summary, our literature review identified 103 concepts explaining the generation of innovation in ITO relationships based on 57 research studies. In regards of theoretical and practical contribution, our findings reveal the importance of knowledge management and client-vendor compatibility for innovation generation in ITO. Furthermore, our research highlights the need of further analysis of the concept categories as well as on the determination of the relevance of individual concepts for innovation sourcing engagements. The results thus serve as a starting point for further conceptual and empirical research on innovation generation within ITO engagements.

The remainder of the paper is structured as follows. Section 2 offers a brief overview about the theoretical background and related work on ITO and innovation. Section 3 provides details about the SNA and CNA as our research method for data collection and data analysis. In Section 4, we present our findings regarding the development of innovation sourcing engagements as well as relevant concepts of innovation published in the literature. In Section 5, we discuss our results, limitations and future research before concluding our work in Section 6.

2 THEORETICAL BACKGROUND AND RELATED WORK

In the past decade, many literature reviews on ITO summarized its main aspects, concepts, theories, and models. Table 1 compares relevant reviews with a focus on ITO outcome and client-vendor relationships as well as our study based on the criteria for literature reviews from Rowe (2014).

Review	Approach (based on Rowe 2014)	Identified Research Gaps
(Dibbern et al. 2004) - Information systems outsourcing: a survey and analysis of the literature	• **Search Process (SP):** Structured literature review (SLR); Three phases including journal and period and paper selection • **Type of Sources (SO):** Journals and Conferences • **Search Period (PER):** 1988-2000 • **Coverage (COV):** Various IS journals, management journals and IS conferences	• Processes in ITO projects • ITO Outcome • Comparative studies in ITO
Gonzalez et al. (2006) - Information systems outsourcing: A literature analysis	• **SP:** SLR with three steps: (1) search in ABI-Inform database, (2) Keyword search and (3) Individual Paper Selection • **SO:** Academic journals • **PER:** 1988-2005 • **COV:** IS journals, management and business journals	• Client-Vendor Relationship • Vendor-view studies
Lacity et al. (2009) - A review of the IT outsourcing literature: Insights for practice	• **SP:** SLR based on Keyword Search • **SO:** Academic journals • **PER:** 1990-2008 • **COV:** IS journals, management and business journals, operations research journals	• Client-Vendor Relationship • IT sourcing relationship
Lacity et al. (2010) - A review of the IT outsourcing empirical literature and future research directions	• **SP:** SLR based on different keyword searches in various databases (e.g. ABI Inform, EBSCO) • **SO:** Academic journals • **PER:** 1992-2010 • **COV:** IS journals, management science journals, operations research journals	• Political & law ITO topics • Client-Vendor Relationship
Wiener et al. (2010) - Information Systems Offshoring--A Literature Review and Analysis	• **SP:** SLR with three consecutive steps including (1) definition of sources, (2) definition of period and (3) selection of articles • **SO:** Academic journals and conferences • **PER:** 1999-2009 • **COV:** Focus on IS, partly management science	• ITO Decision / Outcome • IT contracts with different sourcing models
Gonzalez et al. (2013) - Information systems offshore outsourcing: managerial conclusions from academic research	• **SP:** SLR including keyword search and selection • **SO:** Academic journals • **PER:** 1993-2010 • **COV:** Journals with focus on IS and management science	• Application of developed theory • Client-Vendor Relationship
Liang et al. (2015) - IT Outsourcing Research from 1992 to 2013: A Literature Review Based on Main Path Analysis	• **SP:** SLR plus CNA and main path analysis • **SO:** Academic journals • **PER:** 1992-2013 • **COV:** Journals from IS and management science	• ITO relationships from new angles including ITO success • New forms of ITO decisions • ITO theory development
This review	• **SP:** SLR plus CNA and content analysis methodologies • **SO:** Academic journals, books and conferences, practice-oriented outlets • **PER:** 1937-2015 • **COV:** No restrictions in terms of research field, broad search (through citation network analysis)	• Focused on concept identification related to innovation generation within ITO engagements
Legend: SP = Search Process; SO = Type of Sources; PER = Search Period; COV = Coverage (in terms of research fields)		

Table 1.   Summary of Literature Reviews on ITO, based on (anonymous for review)

To our surprise – and even though it is increasingly acknowledged as an increasingly important topic (Gartner 2015, Liang et al. 2015) –, innovation sourcing does not appear among the identified research gaps. However, it is mentioned as a relevant topic in the outsourcing research community, but mostly under the umbrella of other topics. For example, Lacity et al. (2010) identified ITO outcome, especially the strategic outcome of an ITO relationship, as a research topic, which includes innovation sourcing engagements (Oshri et al. 2015). Moreover, a current literature review highlights that innovation serves as an enabler for ITO success as well as an ITO outcome itself (Lacity et al. 2016). The client-vendor relationship is another example, which is often-identified as a research gap (Dibbern et al. 2004, Liang et al. 2015), and it allegedly plays an important role for the generation of innovation in the ITO relationships (Oshri et al. 2015). This argument is supported by another literature review, which considers the main path of ITO research and listed ITO success in connection with client-vendor relationship as one of the 12 research streams (Liang et al. 2015). As regards specific research studies, only a few focus explicitly on innovation. One of the few examples is the model of the collaborative innovation process by Whitley and Willcocks (2011), which identifies practices related to the generation of innovation. In sum, none of the existing reviews has focused on innovation in ITO, and innovation-related research is mostly and indirectly subsumed under other topics.

In contrast, we especially focus on concepts contributing to innovation sourcing engagements in the ITO environment. With this approach, we will give an overview about the status quo of innovation sourcing engagement research and present starting points for further research.

3 RESEARCH DESIGN

3.1 Research Method Overview

We used two general research methods for our literature review: (1) selected parts of a structure literature review approach, and (2) CNA as a substitute for the forward / backward research of a structured literature review.

For our first part of the structure literature, we follow the approaches by Levy and Ellis (2006) and Webster and Watson (2002) without conducting the forward / backward search. For the second part of the literature review, we use CNA.

A citation is defined as a connection between a new and an already existing knowledge (Yaru 1997). A citation network is a special form of a social network. Journals, authors, articles, or research concepts can serve as nodes, and the citations between them (edges) connect two or more nodes (Pieters et al. 1999). Citation networks are a valid tool for literature reviews and are able to substitute a forwards and backwards search (Jo et al. 2009). In-depth analysis of the development of research streams, research concepts, and future directions of research are examples of their applicability.

We applied CNA to build our research upon a large set of articles as our baseline. As shown in previous research on ITO (Liang et al. 2015), CNA builds on social network analysis (SNA), and is suitable for reviewing the body of knowledge on a particular subject. In consideration of the fact that citation networks are a special form of social networks, SNA can be used for analyzing such networks (Jo et al. 2009). In general, SNA is a method for analyzing informal communication networks and the relationship between actors in such networks (Marion et al. 2003). According to Polites and Watson (2009), SNA is a valid research method for evaluating scientific journal and article relationships because it offers a "more objective way […] than studies based on individual perceptions, since it avoids biases". The usage of SNA for literature reviews is already an established research approach, and past studies yielded very useful results (Phillips & Phillips 1998, Otte & Rousseau 2002, Jo et al. 2009). We performed our literature review on innovation sourcing including more than 2,400 articles and around 3,000 citations and therefore built a basis for further research in this direction.

In our research, we use graphs as models for our CNA (please see the works of Otte and Rousseau (2002), Knoke and Yang (2008), and Wasserman and Faust (1994) for an in-depth explanation of graph

theory and SNA). Based on graph theory, a graph is defined as a quantity of nodes and edges (Otte & Rousseau 2002). Hereby, nodes are defined as the actors of a network; edges consist of pairs (i, j) describing a connection between the nodes i and j. One can separate between directed and undirected graphs, whereas the direction of a link (edge) between two nodes is important in directed graphs. In our network, articles are represented as nodes and citations are represented as directed edges between the nodes. The sources node of the directed edges is a new article, which cite a previous article, called the target node. Figure 1 provides a simplified example of a citation network graph.

An important indicator within graphs is the graph density, calculating the general level of connectedness of the graph, whereas a graph with connections between all nodes is defined as a complete graph) (Otte & Rousseau 2002). Building upon graph theory, SNA comprises manifold techniques for analyzing network graphs. This includes concepts for analyzing graph structures (e.g., betweenness centrality) as well as determining principal roles and actors within a network (Otte & Rousseau 2002, Jo et al. 2009).
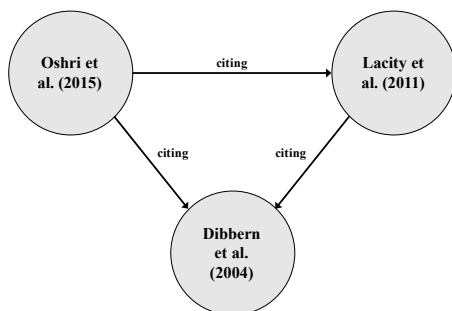

Figure 1.   *Citation Network Graph Example*

3.2   Research Design and Data Collection

Our structured literature review focused on 19 relevant journals for innovation and ITO, including all *IS Senior's Scholar's Basket of Journals, Management Science, Organization Science, Organization Studies, Academy of Management Journal, Academy of Management Review, Research Policy, Journal of Business Venturing, Entrepreneurship: Theory and Practice, Journal of Product Innovation Management, and Strategic Entrepreneurship Journal.* Within these journals, we conducted a keyword search with the search string "('information technology' or 'information systems') AND ('innovation' OR '*sourcing') and selected relevant ones for our further study based on the contextual fit. There were no limitations regarding the published year of the articles.

Based on this approach we identified 40 relevant articles with regard to innovation sourcing. With this set of articles, we used a self-developed crawler software for extracting all citations from the *ISI Web of Knowledge* database to avoid manual extraction of all references. Afterwards, we cleaned the data (typos, duplicates, and so forth) to ensure a high data quality for the further analysis. In our graph, each publication is defined as a node and each citation between our initial set of articles and the citation publications results in a directed edge. Overall, our graph consists of more than 2,400 nodes and approximately 3,000 edges. The citation network analysis substitutes the forward / backward search recommended by Levy and Ellis (2006) and Webster and Watson (2002). We used CNA because of the large amount of identified articles (2,400 nodes) and the need of identifying relevant ones for further analyses.

3.3   Data Analysis

Our data analysis starts with a verification of the initial citation network graph. Based on our identified initial set of articles, we performed a main path analysis (Nooy et al. 2011) as well as a manual content analysis (Neuendorf 2002) for in-depth analysis of the existing body of knowledge on innovation sourcing engagements.

First, based on the initial citation network graph, the *main path analysis* examines the development of the innovation sourcing research stream over time. A main path is defined as a "path from a source vertex to a sink vertex with the highest traversal weights on its arcs" (Nooy et al. 2011, p. 246). In this study, a vertex is one unique article or node. The traversal weight describes the "extend to which a particular citation or article is needed for linking articles" (Nooy et al. 2011, p. 245; please see for details on the mathematics underlyling the traversal weight). In our study, we used the function "search path count (SPC) of the tool 'Pajek' (see http://mrvar.fdv.uni-lj.si/pajek/ for further information) to identify the central articles in our network based on the highest traversal weights, because these articles include knowledge from several previous articles and add substantial new knowledge. The main path analysis results in a graph, which includes the most relevant articles for the research topic and shows the development of research on innovation sourcing engagements over time.

Second, as a starting point for our subsequent content analysis, we developed a 4-core graph consisting of 57 articles in total (one PhD thesis was found to be irrelevant due to missing peer review) by using filters in the tool 'Gephi' (see https://gephi.org/ for further information). This 4-core graph consists of articles, which have at least 4 direct neighbors (citations) based on our initial citation network. A 5-core graph does not exist in the network. The 4-core graph represents the most compressed and connected graph and hence includes the most relevant articles related to innovation sourcing engagements. The 4-core graph enlarges the main path and provides more detailed information about the development of innovation sourcing by presenting also the articles that have a strong influence on the body of knowledge. Afterwards, we conducted a manual *content analysis* (Neuendorf 2002) on all articles in the 4-core graph to identify the main concepts for innovation generation in ITO relationships. The content analysis consists of two steps: (a) identification and categorization of concepts with influence on innovation and (b) allocation of identified concept categories to groups of articles on or close to the main path of innovation sourcing engagements. This resulted in a list of 103 concepts with corresponding definitions. In a focus-group discussion with three ITO researchers, we assigned the resulting 103 concepts to 27 categories to reduce the amount of concepts. The result of this step is a comprehensive overview of concepts relevant for innovation sourcing engagements in ITO based on the most central and therefore important studies on innovation, identified within our literature review.

4   FINDINGS AND RESULTS

4.1   Development of Innovation Sourcing Research over Time

Figure 2 provides the main path of our CNA as well as the traversal weight of the citations and shows the development of innovation sourcing research over time.

Our main path of innovation sourcing starts in the 1980s, about 30 years ago. The starting point consists of a larger amount of articles with the same traversal weight of 0.0021. We focused on four articles, which have the most citations in our citation network. Innovation sourcing engagement is grounded on organization innovation research, including the diffusion of innovation theory (DiMaggio & Powell 1983, Rogers 1983). Based on this, the concept of innovation has been connected to IT in the second half of the 1980s and early 1990s. Until today, the tri-core model of Swanson (1994) serves as a basis for other innovation models, and the well-known case "Kodak effect" showed that innovation can be crucial for organizations, especially in the context of IT (Loh & Venkatraman 1992). In the past 10 years, the main path of innovation sourcing engagements focuses on literature reviews regarding ITO and business process outsourcing (BPO) topics (Jeyaraj et al. 2006, Lacity et al. 2010, Lacity et al. 2011, Lacity & Willcocks 2013). No empirical studies are among them. As mentioned in Section 2, innovation sourcing engagement serves as a relevant topic in the ITO research community, but under the umbrella of other topics such as ITO outcome / success. The main path ends with an article about strategic innovation through outsourcing (Oshri et al. 2015), demonstrating the successful merger of innovation and ITO.

Another finding of our main path analysis is the rising relevance of innovation sourcing. Starting in 2010, the number of published research increased in the past years. A potential explanation for this is the changed demand in the outsourcing practice – from cost reduction to innovation-focused topics (Gartner 2012). The research community reacted and structured the body of knowledge of ITO in several literature reviews. Based on the outcomes, more and more authors focused on the combination of innovation and ITO and developed the research stream of innovation sourcing. Additionally, the relevance of innovation sourcing has been confirmed by Kotlarsky et al. (2015) in a special issue of 'The Journal of Strategic Information Systems'.

Citations (edges)	Traversal weight
Oshri et al. (2015) → Lacity & Willcocks (2013)	0.2216
Lacity & Willcocks (2013) → Lacity et al. (2011)	0.1299
Lacity et al. (2011) → Lacity et al. (2010)	0.1574
Jeyaraj et al. (2006) → Swanson (1994)	0.0021
Swanson (1994) → Rogers (1983)	0.0021
Swanson (1994) → Loh & Venkatraman (1992)	0.0021
Swanson (1994) → Dimaggio & Powell (1983)	0.0021
Swanson (1994) → Kwon & Zmud (1987)	0.0021

Figure 2.   Main Path on Innovation Sourcing Research
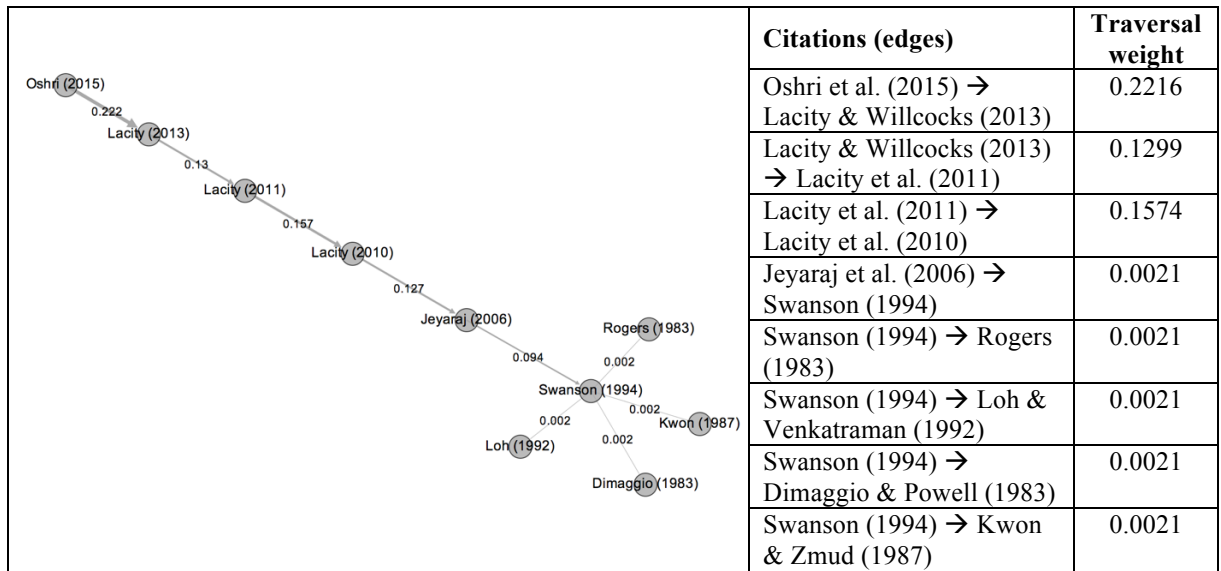
4.2   Main Concepts for Innovation Sourcing

Figure 3 shows the 4-core graph developed as a starting point for our content analysis on concepts related to innovation sourcing.
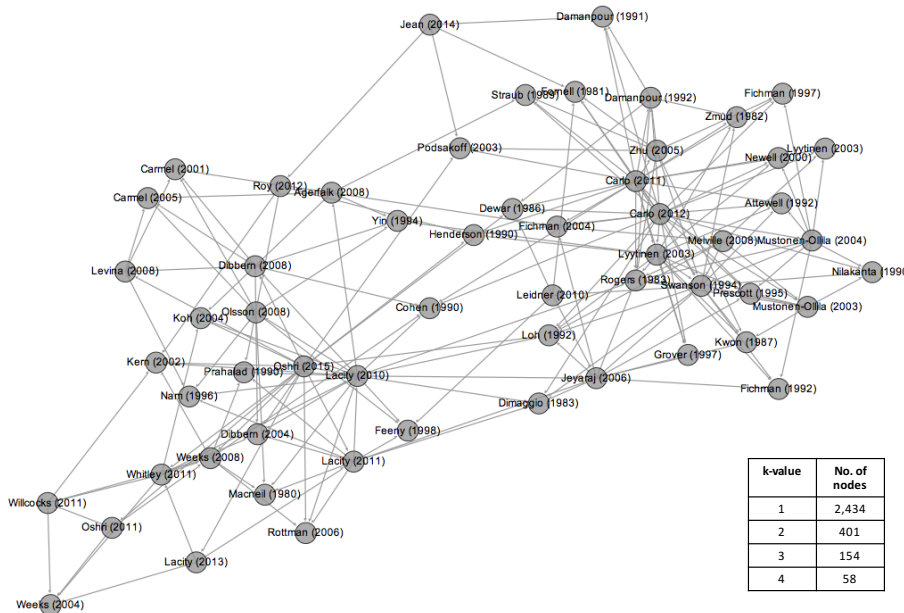

k-value	No. of nodes
1	2,434
2	401
3	154
4	58

Figure 3.   4-core graph of Innovation Sourcing including Graph Sizes for all k-core Graphs

Table 2 presents the list of all categories, including the assignment of categories to practices by Whitley and Willcocks (2011), a short description, exemplary references from articles in the 4-core graph, and a score of research importance for innovation in ITO, based on the betweenness centrality. A complete list of all 103 concepts with the correspondent categories is available in appendix A.

ID	Category & Practice		Description	Exemplary References	Score
1	Knowledge & Knowledge Management	P	Knowledge & Knowledge Management refers to the understanding of and knowledge about work procedures and business processes as well as its organizational management of it.	(Damanpour 1992, Fichman & Kemerer 1997, Dibbern et al. 2008, Carlo et al. 2012, Jean et al. 2014)	439.7
2	Obligation	O	Obligation refers to the responsibilities of the customer or the community in sourcing projects.	(Ågerfalk & Fitzgerald 2008)	321.3
3	Client-Vendor Compatibility	P	Client-vendor compatibility refers to the extent to which each party fits with the other one regarding culture, knowledge, and so forth.	(Henderson 1990, Dibbern et al. 2008, Levina & Vaast 2008, Olsson et al. 2008)	286.6
4	Firm characteristics	L	Firm characteristics refer to external factors of an organization (e.g., structure, size, financial key performance indicators).	(Zmud 1982, Rogers 1983, Damanpour 1992, Cohen 1996, Fichman & Kemerer 1997, Zhu & Kraemer 2005, Leidner et al. 2010, Carlo et al. 2011, Carlo et al. 2012, Jean et al. 2014)	285.7
5	Technology Competence	L	Technology competence consists of the ability of an organization to use technologies and IT human resources to gain advantages towards innovations.	(Nilakanta & Scamell 1990, Damanpour 1992, Lyytinen & Rose 2003, Zhu & Kraemer 2005, Jean et al. 2014)	223.8
6	Communi-cation	P	Communication refers to the proactive formal and informal sharing or exchange of information.	(Nilakanta & Scamell 1990, Damanpour 1992, Loh & Venkatraman 1992, Olsson et al. 2008)	194.6
7	Investment	L	Investment refers to expenses in the organization (e.g., R&D department, hardware, software).	(Zhu & Kraemer 2005)	150.8
8	Organiza-tional Environment	L	Organizational Environment refers to the complexity of the environment of the organization (e.g., market concentration, competitive pressure).	(Cohen 1996, Zhu & Kraemer 2005)	150.8
9	Regulations	L	Regulations refer to government requirements that could affect organizations' activities.	(Zhu & Kraemer 2005, Melville & Ramirez 2008)	150.8
10	Collaboration	P	Collaboration refers to the undertaking of complementary activities to achieve mutual benefits.	(Rogers 1983, Olsson et al. 2008)	148.3
11	Commitment	O	Commitment refers to the willingness of the parties to exert effort and devote resources in order to sustain an on-going relationship.	(Henderson 1990, Olsson et al. 2008)	148.3
12	Conflict Resolution	P	Conflict resolution refers to amicably replacing disagreement with agreement.	(Olsson et al. 2008)	148.3
13	Flexibility	P	Flexibility refers to the willingness of both parties to make adaptations as circumstances change.	(Olsson et al. 2008)	148.3
14	Integration	O	Integration refers to the intertwining processes and attributes into each party's structure and processes.	(Olsson et al. 2008)	148.3

ID	Category & Practice		Description	Exemplary References	Score
15	Interdependence	L	Interdependence refers to the extent to which each party's attainment of goals is dependent on the other party.	(Olsson et al. 2008)	148.3
16	Trust	L	Trust refers to the expectation that a party will act predictably, fulfil its obligations, and behave fairly.	(Olsson et al. 2008)	148.3
17	Change Attitude	P	Attitude of the employees towards changes in the organization	(Damanpour 1992, Willcocks et al. 2011)	139.0
18	Coordination	O	Coordination refers to the management of interdependencies between parties.	(Olsson et al. 2008, Willcocks et al. 2011)	92.7
19	Product / Service / Process Adoption	O	Product / Service / Process Adoption refers to implemented changes in the organization, e.g., changes in the IT platforms or new computing capabilities.	(Mustonen-Ollila & Lyytinen 2004, Carlo et al. 2011)	65.9
20	Contracting	C	Contracting refers to the content and the type of a contract between a client and a vendor.	(Willcocks et al. 2011, Oshri et al. 2015)	37.1
21	Leadership Skills	P	Leadership skills are defined as shaping and mobilizing adaptive work that is engaging people to make progress on the adaptive problems they face.	(Willcocks et al. 2011)	37.1
22	Education	L	Education refers to the educational degree, which the organization's members hold (e.g., Bachelor / Master).	(Rogers 1983, Dewar & Dutton 1986, Fichman & Kemerer 1997)	0.0
23	Product Portfolio	L	Product Portfolio refers to the products diversification of an organization.	(Cohen 1996)	0.0
24	Quality of Client-vendor Relationship	L	Client–vendor relationships represent the connections between a client and a vendor that result in information and knowledge exchanges explain that such relationships between people comprise a more voluntary mode of coordination than hierarchical structure.	(Oshri et al. 2015)	0.0
25	R&D Management	P	R&D management refers to the activities of the R&D department to innovations.	(Cohen 1996)	0.0
26	Supply Chain Structure	L	Structure of the supply chain depends on the industry, and drives the enhanced use of Internet-based innovations	(Melville & Ramirez 2008, Jean et al. 2014)	0.0
27	Training	P	Training refers to the activities of organizational members to gain new knowledge or skills.	(Fichman & Kemerer 1997)	0.0
Legend: Score = Sum of average betweenness centrality of each concept in the category divided by number of unique nodes in the category excluding nodes with value of zero. – Practices by Whitley and Willcocks (2011): L = Leading, P = Performing, O = Organizing, C = Contracting					

Table 2.   Overview of All Concept Categories

We assign the categories to one of the four practices of the collaborative innovation process by Whitley and Willcocks (2011) to determine the focus of our most relevant categories regarding the process. The following four different practices exist: Leading (shape collaborative environment), Contracting (secures collaborative behaviors), Organizing (supports teamwork), and Performing (delivers innovation). Table 3 shows the distribution of categories and articles according to the practices. Interestingly, organizing and contracting do not appear to have as many categories as well as articles.

Practice	Number of Categories in Practice	Number of Articles in Practice
Leading	11	30
Performing	10	23
Organizing	5	8
Contracting	1	2

Table 3. *Distribution of Categories according to the Practices, based on Whitley and Willcocks (2011)*

The category *'Knowledge & Knowledge Management'* has the highest score in our analysis (439.7). There are 9 concepts included in this category in total, but the concepts 'required client-specific knowledge' (Dibbern et al. 2008) and 'professionalism' (Damanpour 1992) have the highest contribution to the score. Both concepts refer to a specific understanding of and knowledge about work procedures and business processes, which are influenced by the experience of the employees. Regarding the generation of innovation, knowledge management is an essential topic, which is well studied (e.g., Van de Ven 2005, López-Nicolás & Meroño-Cerdán 2011). Therefore, it is not surprising that knowledge management is relevant in context of ITO and innovation sourcing. If a client is looking for innovations with its external vendors, the knowledge of both parties support the creation of new ideas, and successful knowledge sharing may be a requisite of innovation. We assign 'Knowledge & Knowledge Management' to the practice 'Performing' of the collaborative innovation process. It is a continuous activity, which have to be done in collaboration with the external vendor.

The category *'Obligations'* consists of the two concepts 'community obligations' and 'company obligations' and has the second highest score (321.3). In the context of opensourcing, for example, Ågerfalk and Fitzgerald (2008) showed that the community as well as the company have to assume responsibilities to foster its success (e.g., a working ecosystem or the control of processes). Transferred to the generation of innovation, responsibilities should be clearly assigned between the client and vendor. For these reasons, we assign 'Obligation' to the practice 'Organizing' of the collaborative innovation process.

The category *'Client-Vendor Compatibility'* consists of 6 concepts and has the third highest score (286.6). The most relevant concepts are 'client-vendor-distance' (Dibbern et al. 2008), 'consensus', and 'cultural compatibility' (Olsson et al. 2008). Client-vendor-distance describes geographical distance as well as cultural distance (e.g., norms, beliefs). Both concepts have been shown to have a negative influence on the generation of innovation. The concepts 'consensus' and 'cultural compatibility' support the relevance of the cultural aspect by referring to the extent to which both parties, client and vendor, can coexist and can agree to common activities and decisions. Several studies support this finding (Beck et al. 2008, Winkler et al. 2008). We assign this category to the practice 'Leading' of the collaborative innovation process, because it refers to general corner stones of the client-vendor relationship, which have influence on all later decisions and activities.

The category *'Firm Characteristics'* consists of 14 concepts and is the largest category in our study regarding the number of included concepts. It has the fourth highest score of 285.7. The concept 'Absorptive Capacity of Vendor / Client' (Dibbern et al. 2008) has the highest impact. It describes the ability of the organization to utilize knowledge from outside the company. The concept 'firm size' (also known as organizational size) is the most often mentioned in our study. A total of 7 studies has determined firm size as an influencing factor of innovation, including Zhu and Kraemer (2005), who has a high betweenness centrality value in our network graph. The high number of investigations shows the relevance of this concept, which is as well supported by the consensus that size has a positive influence on the innovation performance of an organization. We assign this concept also to 'Leading' of the collaborative innovation process, because firm characteristics serve as a basic fundament for the upcoming collaboration with external partners.

The category 'Technology Competence' consists of the 5 concepts 'technology competence', 'technological uncertainty', 'technological capability', 'Internet computing' and 'technical knowledge

resources' and has a score of 223.8. Similar to knowledge management, a main focus of this category is the technical knowledge of the employees as well as the competence of the client and vendor. This finding can be explained by the high complexity of the innovation sourcing engagement with external partners. All involved employees must requisite the required knowledge about the organizations' products, services, etc. to improve them or even develop new ones. They must talk to members of the external vendor on the same level to enable an innovation-promoting working style. This sub-aspect is closely connected to the concept category 'communication', which has also a relative high score of 194.6. We assign 'Technology Competence' to the practice 'Performing' of the collaborative innovation process due to the focus on operational activities. The daily work for the member of an ITO project requires the use of and knowledge about technology.

5 DISCUSSION

5.1 Summary of Findings and Implications

Building upon our research questions, we were able to enhance our knowledge on innovation sourcing.

First, our findings extend *our knowledge about ITO in general and innovation sourcing engagements in particular*. Despite the comprehensive body of knowledge on ITO, our study adds new knowledge about the current state of ITO research and especially about innovation sourcing engagements. Moreover and according to our knowledge, we provided the first dedicated literature review about innovation sourcing engagements. Based on more than 2,000 articles, we were able to present the development of innovation sourcing engagements based on a main path analysis and to identify the most relevant authors and articles regarding this topic. Based on the data set, further analysis about relevant theories could be examined. We used the data set for the identification of 103 relevant innovation-promoting concepts and assigned them to 27 categories. Interesting concepts have been described separately for a deeper insight and their impact on the generation of innovation in ITO relationships. With our analysis, we revealed the need for further research on the prioritization of identified concepts as well as on an in-depth analysis of relevant concept categories in innovation souring engagements. For example, further research is needed on the connection between the most relevant categories and its common impact on the innovation performance of organizations under the umbrella of ITO relationships. Furthermore, we presented interesting findings in the concept categories. We showed that cultural distance as well as geographical distance plays an important role when organizations try to increase their innovation performance with the help of external outsourcing partners. The development of a model, which connects the most relevant concepts and analyzes other influences in innovation sourcing engagements, is now on our agenda.

Second, we identified *research gaps by assigning concepts to the collaborative innovation process*. Most concepts were assigned to the practices 'Leading' and 'Performing', following by the practice 'Organizing'. To our surprise, only one concept with a relative low score has been assigned to the practice 'Contracting', although researchers focused on contract topics in the ITO environment (Yuanyuan & Bharadwaj 2009, Bhattacharya et al. 2014). In previous articles, Lacity et al. (2010) and Liang et al. (2015) also identified contractual governance / formal contract as a current ITO research stream with open research gaps. Due to our few finding regarding contracting, we confirm the need of further research in this area.

Third, we confirm *social / citation network analysis as a practical method in ITO and innovation related research*. Using SNA and CNA techniques for visualization and analysis of ITO and innovation sourcing research is a new approach and has been done only few times (e.g., Liang et al. 2015, anonymus for review). Our results confirm previous statements that SNA is a valid method for research in ITO. It is a feasible technique to analyze a large amount of articles and it substitute a forward / backward search in a structure literature review. Moreover, the visualization of the data helps the reader to perceive the connection between relevant articles in the network. Therefore, we call for other literature reviews using SNA and CNA to gain a holistic overview about the world of literature in a specific research stream. In

a next step of our research, we would like to publish our graph network data for more transparency by making it available online for all interested readers (e.g., via Cytoscape, http://www.cytoscape.org/).

5.2 Limitations and Future Research

Despite the provided answers to our research questions, there are some limitations and corresponding research directions that need to be acknowledged.

First, our literature review based on a relative small set of initial articles. 40 articles in total have been identified in several journals, including the *Senior Scholars' Basket of Journals*. With the social network analysis technique, we identified over 2,000 relevant articles, which we used as a basis for further analyses. An extended initial set of articles could have increased our analysis results. The presentation of the initial network was not our focus, as we followed with a subsequent content analysis. However, we nevertheless emphasize that further studies, especially on the timely development, could use a larger set of articles as a starting point.

Second, we identified concepts from the articles of the 4-core graph by using coding methods. Afterwards, we used results of the citation network analysis (e.g., centrality) for further determination of its relevance. We do not use statistical data (e.g., effect size, R^2) from the examined studies for further relevance ranking. For qualitative studies, we proceeded in the same way and do not include the effect size evaluation of the authors (for more information, Lacity et al. 2010). The use of statistical data would result in more appropriate results regarding the main concept categories of the research stream. Future research should use the articles included in the 4-core graph and repeat the content coding with the mentioned analysis techniques. Futhermore,

6 CONCLUSION

In this paper, we identified relevant articles, authors as well as research concepts on innovation sourcing. We provide an overview about the development of innovation sourcing engagements and the most relevant innovation-promoting concepts. With the SNA and CNA, we were able to work with a large amount of articles and therefore extended the knowledge about innovation sourcing. We are confident that our study results provide an appropriate degree of generalizability and completeness. Nonetheless, we call for further analysis of innovation sourcing concepts using statistical data of the original studies.

7 ACKNOWLEDGEMENTS

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Appendix A

Category	Factor	Category	Factor	Category	Factor	Category	Factor
Change Attitude	Behavior change	Firm characteristics	Absorbed organizational slack	Knowledge & Knowledge Management	Exploratory research performed	Quality of Client-Supplier Relationship	Quality of Client-Supplier Relationship
	Managerial Attitude Toward Change		Absorptive Capacity of Vendor / Client		IT-PACAP (IT-enabled Potential Absorptive Capacity)	R&D Management	R&D intensity
	Client-Vendor-Distance		Decision-making culture		IT-RACAP (IT-enabled Realized Absorptive Capacity)		R&D internationalization
Client-Vendor Compability	Consensus		Employee Sales Efficiency		Knowledge Depth		R&D Permanence
	Cultural Compatibility		Experimentation		Knowledge Diversity		Division of innovative labor
	Differences in County Contexts		Firm size / Organizational size		Knowledge Linkages	Regulations	Regulations
	Differences in Organizational Contexts		International scope of organization		Knowledge Protection		Regulatory support
	Specific Capabilities with respect to needs		Organization / Firm age		Required Client-Specific Knowledge	Supply Chain Structure	location of information requirements
	Partnership		Profit margin		Sensing		Supplier involvement
Collaboration	Boundary object		Status of the target (age, experiences, leadership)		Professionalism		Supply chain structure
	Collaboration history		Centralization		Related Knowledge	Technology Competence	Internet Computing
	Cooperation		Formalization		Diversity of Knowledge and Activities		Internet-based technologies
	External Collaboration		Specialization	Leadership	Leadership		IT-SIC (IT-Enabled Social Integration Capacity)
	Interconnectedness		Functional Differentiation		Strategic Leadership		Participation architecture (crowdsourcing)
Commitment	Commitment		Centralization		Top Management attitude towards IT		Technological capability
Communication	Communication		Administrative Intensity	Obligations	Community obligations		Technological Uncertainty
	Internal-influences		Slack Resources		Company Obligations		Technology competence
	External-influences		Size of the IT function		Competitive pressure		User Communities
	External Communication		Cash Flow		Complexity of the environment		Technical Knowledge Resources
	Internal Communication		Organizational Slack		Dynamism	Training	Training
Conflict Resolution	Conflict Resolution	Flexibility	Flexibility		Munificence		Learning-Related Scale
Contracting	Client Contract type / Portfolio	Integration	Integration	Organizational Environment	Market Concentration	Trust	Trust
	Contracting	Interdependence	Interdependence	Product / Service / Process Adoption	Adoption of innovation		
Coordination	Coordination	Investment	Financial commitment of organization		Base innovation		
	Organizing & teaming		IT Investments		Organizational Innovation		
Education	Depth of Knowledge Resources				Process Innovation		
	IT Staff Educational Level				Service innovation		
	Complexity / employees			Product Portfolio	Degree of Diversification		

Figure 4.   Overview about all 103 identified factors and the 27 corresponding categories