E-Collaboration in Interorganizational Networks: A Literature Review and an Agenda for Future Research

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Abstract

Since the importance of external resources and interfirm collaboration for firms' competitive success continues to grow dramatically, research on interorganizational relationships has become prominent in business and IS research. Over the past two decades, interorganizational networks in particular have been widely recognized by both academics and practitioners as an important form of multi-organizational governance. E-collaboration and the continual progress of the underlying information and communication technologies play a fundamental role in the functioning of those networks. Nevertheless, the understanding of this area remains limited. This systematic literature review provides an overview that structures the efforts in the field of e-collaboration in the context of networks. We analyze the existing literature by using a concept matrix and reveal gaps in research. The results indicate growing interest in the IS community and provide five promising directions for future research.

1. Introduction

Since the importance of external resources and interfirm collaboration for firms’ competitive success continues to grow, research on interorganizational relationships has become prominent in business and information systems (IS) research [46, 50]. Academics have examined the related motives, intentions, and objectives in order to explain the formation of interorganizational relationships through various theoretical paradigms, such as transaction cost economics, resource dependence, and institutional theory [5, 53]. The potential advantages and disadvantages of participation in interorganizational relationships as well as its different forms, which vary by the degree to which participants are linked, or coupled, have been widely discussed. The essence of the majority of these articles is that interorganizational relationships help firms create value by combining resources, sharing information and knowledge, increasing speed to market, and gaining access to foreign markets and competitive advantages [5]. In this context, IS researchers have conducted various studies examining how IS affects and supports collaboration and relationship formation across organizational boundaries.

Despite the existence of various forms of interorganizational relationships in the tension between markets and hierarchies, over the past two decades interorganizational networks in particular have been widely recognized by both academics and practitioners as an important form of multi-organizational governance [43, 44]. Researchers have studied the development and management of networks as well as the associated value-creation process; they revealed that the advantages of network coordination in both public and private sectors are considerable, including flexibility, speed to market, product development, learning, greater competitiveness, and improved services for clients and customers [43]. However, while the advantages of interorganizational networks are manifold and have been unanimously attested in the literature, there are also disadvantages associated with the network form of organizing. Specifically, as the number of firms involved increases, networks become more difficult to organize and manage [5].

E-collaboration as a facilitator of long-term business-to-business interactions plays a fundamental role in the functioning of these networks. The continual progress of the underlying information and communication technologies (ICT) is a catalyst and enabler for collaboration in networks [54]. Recently published research in leading IS journals also reveals that the network perspective is highly relevant for understanding the mechanisms of electronic-facilitated interfirm collaboration [27, 46].

Nevertheless, the understanding of this area remains limited. Thus far, there exists no overview that identifies and structures efforts in this field. In order to close this gap in research, this study provides an overview of the state of the art. Furthermore, directions for future research should be revealed. In particular, we aim to answer the following research questions:

- To what extent has the body of literature already explored e-collaboration in the context of interorganizational networks?
Which areas provide potential directions for future research?

The paper is organized in the following way: Initially, we define interorganizational networks and present an appropriate classification. Subsequently, we examine e-collaboration in the context of networks. We then discuss our methodological approach and present and analyze our results. Finally, direction for future research will be provided and findings and limitations will be discussed.

2. Background

2.1. Framing interorganizational networks

The literature on networks is by now quite extensive, and network research from various disciplines has proposed a wide range of definitions for networks. Despite their differences, nearly all definitions refer to common themes, including interaction, relationships, connectedness, collaboration, collective action, and cooperation [43]. Our understanding follows the definition of Camarinha-Matos et al. [7]: Interorganizational networks consist of a variety of organizations that are largely autonomous and geographically distributed. Furthermore, they are heterogeneous in terms of their operating environment, culture, social capital, and goals. Interorganizational networks collaborate in order to achieve common or compatible goals and are interconnected by computer networks.

When examining interorganizational networks, researchers have focused on various management issues, structural features, and perspectives. Thus, the body of literature provides a large variety of classifications and dimensions of networks [33]. Researchers have derived a number of classifying variables, such as coordination mechanisms [21], object of exchange [48], network orientation and direction [25], and types of relationships and environmental fluctuations [18]. The existing categorizations point to different dimensions and features of networks and help increase the understanding of different types of networks. However, since the majority of classifications do not particularly consider information sharing or IT-related issues, they offer limited assistance for IS research.

Harland et al. [23] provide a conceptual framework of interorganizational networks. Based on the literature from various academic perspectives and empirical data across a variety of industry sectors, they identified four types of interorganizational networks, which are summarized in Table 1.

<table>
<thead>
<tr>
<th>Low Degree of Focal Firm Influence</th>
<th>Dynamic Network</th>
<th>Routinized Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core activities:</td>
<td>Core activities:</td>
<td></td>
</tr>
<tr>
<td>Human Resource Integration, Risk</td>
<td>Partner Selection,</td>
<td>Management</td>
</tr>
<tr>
<td>and Benefit Sharing, Knowledge</td>
<td>Equipment</td>
<td>Information</td>
</tr>
<tr>
<td>Sharing</td>
<td>Integration, Risk and Benefit Sharing, Information Processing</td>
<td></td>
</tr>
<tr>
<td>Competitive Priority:</td>
<td>Competitive Priority:</td>
<td>Process Innovation, Operational Improvement</td>
</tr>
<tr>
<td>Technological Innovation, Demand Management</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The main differentiating factors are the degree of network dynamic and the degree of focal firm influence. The findings of Harland et al. [23] provide insights into network characteristics and different forms of interorganizational networks. They reveal that different types of networks exist and that certain circumstances influence the distinct patterns of networking as well as the primary network themes and activities.

Networks operating under dynamic conditions tend to compete primarily on innovation rather than cost and quality. Thus, particularly within these types of networks, the integration of common resources as well as the sharing of information and knowledge are critical success factors. In contrast, routinized networks typically focus on cost and quality as their competitive priorities. These networks focus on process rather than product innovation. In networks that operate under these stable conditions, the integration of equipment and the efficient processing of information are crucial for achieving cost minimization and quality improvement.

Networks with a low degree of focal firm influence require the encouragement of other players in the network to contribute and invest in innovation. Thus, motivation as well as sharing both risks and benefits is essential. Despite their importance for successful partnerships, motivation and risk/benefit sharing are less critical in networks with a high degree of focal firm influence. In such networks, selection of partners and an efficient decision-making process are the critical factors because the focal firm has substantial influence over the actions of other actors in the network.
Previous research has revealed that the classification of networks should not be viewed as static; networks might move from dynamic to routinized conditions and vice versa. Furthermore, the degree of influence might shift over time [33].

The classification described above has important implications when studying IS-related topics in the context of networks. It states that the different forms of networks have distinct requirements pertaining to their core processes, which differ in terms of network activities, competitive priorities, and the type and amount of shared resources and information [33].

2.2. E-collaboration in the context of interorganizational networks

In recent years, nothing has changed business operations like the emergence of the Internet and its related information and communication technologies have [50]. As a result, conducting business has constantly been evolving from face-to-face human interaction towards a virtual business environment [16]. The various approaches of ICT deployment across organizational boundaries for enhancing collaboration and coordination along the value chain has often been summarized under the loose term e-business, and the body of literature provides a vast number of definitions. Chen and Holsapple [10] provide an integrated definition based on both an extensive review of the relevant literature and the analysis of different elements. Consistent with this research, we define e-business as an approach for achieving business goals in which networked, computer-based technology for information exchange enables or facilitates both the execution of activities as well as the support of the underlying activities in and across supply chains.

However, the examination of ICT-enabled collaborative business activities in interorganizational networks calls for a more differentiated perspective on e-business. Therefore, we refer to Johnson and Whang [29], who classify e-business and related research into three major categories: e-commerce, e-procurement, and e-collaboration.

While e-commerce and e-procurement tend to focus on dyadic and arm’s length transactions between organizations or a single organization and a larger number of individual customers, e-collaboration facilitates long-term business-to-business interactions. These interactions go beyond simple buyer–seller transactions and can be described more accurately as relationships. These relationships include such activities as information sharing and integration, decision sharing, process sharing, and resource sharing [29, 32].

In contrast to e-commerce and e-procurement, the e-collaboration perspective is highly relevant when analyzing interorganizational networks, as it involves cross-company relationships that go beyond simple buy/sell transactions. Thus, although most of the research in this area has focused on e-commerce and e-procurement, the field of e-collaboration is expected to be more promising, particularly in the context of interorganizational networks [29].

The emergence of electronic collaboration has been enabled by interorganizational systems (IOS). Defined as integrated IS shared by two or more organizations [4], these technologies link customers, suppliers, and other network partners. IOS are thus seen as the main driver for electronic collaboration across organizational boundaries [12].

Given the dynamic and often temporary nature of interorganizational networks, it is important to understand their lifecycle [8]. Thus, when examining interorganizational networks, one typically considers the distinct stages of development: creation and formation, operation, evolution, and dissolution or metamorphosis [7, 54, 61]. According to these phases, various interorganizational systems support different tasks within the network. The creation stage deals with the strategic planning and initial incubation of the network as well as with the constitution and start-up. In this phase, IOS facilitate the strengthening of interorganizational relationships and support the creation and formation of networks rather than their operation. The operation stage is the regular phase of the network’s existence. During this stage, small changes in memberships, roles, or operating principles can take place, resulting in the evolution of the network. The stage of dissolution represents the cessation of the network, while during the metamorphosis stage, major changes in objectives, principles, and memberships lead to a new form of network [7].

Figure 1 provides an overview of IOS and their support functions at the different stages of the network lifecycle. These systems rely on both private and public IT infrastructure, such as IT networks, datacenters, and extranets. However, the efficient support of the distinct stages depends both on the extensive and continuous exploitation of collaborative technologies as well as on a stable and capable development infrastructure [12, 54].

Since the unit of analysis in the context of interorganizational networks is no longer a single firm but rather a variety of loosely coupled and largely autonomous organizations, the transfer of findings from research on e-collaboration to the network level poses some challenges. In contrast to organizations, IT related decisions in networks must be governed without the benefits of hierarchy and ownership.
Thus, network members face the challenge of unstable and polycentric power distribution, which results in ambiguous and uncertain conditions [54]. In addition, participants of networks typically have limited formal accountability to network-level goals and the conformity to network IT rules and procedures is purely voluntary [44]. Moreover, the presence of common goals in networks does not necessarily eliminate the existence of conflicting goals [59]. Particularly against the background of different levels of IT infrastructure, networks often struggle with balancing conflicts [42, 54]. Thus, e-collaboration in a network context differs from the single or dyadic perspective for a variety of reasons.

3. Research Methodology

3.1. Data collection

In order to identify to what extent the current literature on e-collaboration has already explored the concepts of interorganizational networks, we conducted an in-depth topic-based literature review following the principles of Webster and Watson [57].

To examine a new research domain, all relevant literature should be discussed. Therefore, although the rigor of conference proceedings might be lower than that of leading journals, we include both as this field of research is still emerging. In this context, the query of scholarly databases is reasonable [6]. In order to adequately explore the literature base, we include the following databases suggested by Levy and Ellis [37]: ProQuest, Elsevier, INFORMS, IEEE, Wilson, Thomson, ACM, JSTOR, Blackwell, LEA Journals, and EBSCOhost. These databases cover all MIS journals in IS research ranked in the top 50. In addition, we add the AIS electronic library in order to access a wider range of leading IS conference proceedings.

Although interorganizational networks are now a commonly understood phenomenon, it is not always clear what academics are talking about when they use the term. In addition, the term network is not always used. Many studies on networks refer instead to partnerships, strategic alliances, interorganizational relationships, coalitions, cooperative arrangements, collaborative agreements, or collaborative networks. Therefore, in order to provide a more comprehensive overview of e-collaboration in the context of networks, we used all keywords mentioned above in addition to the term interorganizational network. To constrain our research to the area of e-collaboration, all keywords were combined with the term e-collaboration as well as with the umbrella term e-business. Furthermore, the analysis was not restricted to a specific time frame.

The collection of data followed a three-stage process. In the first step, a database search was conducted from March to May 2014. The initial search yielded more than 450 articles. However, as we used multiple databases and similar search strings, a large number of results appeared more than once. Identical results were removed. In the next step the titles and abstracts of the remaining 112 articles were scanned and analyzed in order to sort out irrelevant results. This resulted in 73 articles being excluded from further investigation due to two main reasons: First, they focus on dyadic interactions rather than on network relationships and, second, a large number of articles...
do not refer to the underlying understanding of e-collaboration in terms of long-term, business-to-business interactions that go beyond simple buyer–seller transactions. Subsequently, the content of the remaining 39 results was analyzed and again sorted out. In the final step we used the list of references of the remaining 26 articles to conduct a backward search, which follows the same procedure. This backward search led to five more publications. In the end 24 journal and 7 conference contributions were included for further investigation.

3.2. Data analysis

We followed Webster and Watson [57], categorizing the articles into topic-related concepts. In addition, for each concept we distinguish between different units of analysis. We derived five concepts for structuring the literature on e-collaboration in the context of interorganizational networks. These concepts reflect the existing literature on network research, including network type and degree of focal firm influence, level of analysis, perspective, and the methodology used.

The differentiation of interorganizational networks along two dimensions has a long tradition in research. As stated in Section 2.1, we followed the approach of Harland et al. [23] and distinguish between the degree of dynamic and the degree of focal firm influence. The classification of networks along these two dimensions is especially valuable when examining ICT. Various studies on IT adoption and diffusion have revealed that the utilization of ICT is determined both by the external task environment, which reflects the degree of dynamic, as well as by organizational structures and processes that affect the degree to which an organization is able to influence other organizations or might be affected by network members.

Research on networks can further be referred to on three different levels of analysis: micro-level, macro-level, and meta-level analyses. Micro-level analysis examines single business relationships and focuses on a single organization within a network. In comparison, macro-level analysis covers multiple organizations within the same network and concentrates on evaluating these network relationships. Lastly, meta-level analysis deals with the management of a network in relation to other networks, organizations, or customers. These perspectives can be transferred and have previously been used to classify ITC-related research in network contexts [54].

When analyzing interorganizational relationships in networks, it is possible to determine a dichotomy of focuses [40]. First, the management-oriented view deals with the aspects of collaboration and coordination. It focuses on the proactive and ICT-supported development of cross-organizational relationships. Second, the technology-oriented view concentrates on the development of new possibilities for electronic communication. It deals with the technical integration and design of ICT across organizational boundaries as well as with the automation of processes and activities between organizations.

The concepts described above reflect the prevailing research on interorganizational networks and grant the appropriate categorization of literature on e-collaboration in this specific context.

Furthermore, we classified the literature with regard to the applied methodology. For this purpose, we followed the systematization of Palvia et al. [41], who provide an exhaustive scheme of different quantitative and qualitative methods used in IS research.

The literature was initially classified independently by two Ph.D. students. In a second step, inconsistencies were discussed until a common understanding was reached.

4. Findings

The review of the encountered literature (see Table 2) revealed that e-collaboration in networks has already been studied in both dynamic and routinized environments. Thus, e-collaboration seems to be a relevant topic across various sectors and industries. Studies in the context of dynamic networks tend to focus on the IT sector or on highly technology-driven industries, such as telecommunications or electronics suppliers [12, 26]. For example, Hollenbeck et al. [26] examine the adoption of e-collaboration in an international information-technology network. In comparison, in order to study e-collaboration under stable conditions, networks in a low product-complexity industry, such as food [2, 20] or clothing [14, 15], are chosen as the objects of investigation. Various studies do not explicitly differentiate between dynamic and routinized environments. However, the majority of these studies deal with the development of frameworks and conceptual models that may be relevant for both types of networks. For instance, Wang and Yu [56] develop a conceptual framework for the analysis of implementing e-collaboration from the perspective of a business network strategy.

Most articles do not consider the degree of focal firm influence. We found no publication that explicitly examines e-collaboration in a network of equal partners, and only five articles considered the existence of networks where decision making is largely in the hands of a focal firm. For example, Spralls et al. [52]
Table 2. Concept matrix of e-collaboration in a network context

<table>
<thead>
<tr>
<th>Literature</th>
<th>Type</th>
<th>Focal firm influence</th>
<th>Level of analysis</th>
<th>Focus</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1] Adam et al. (2005)</td>
<td>Dynamic</td>
<td>•</td>
<td>High</td>
<td>Management oriented</td>
<td>Case study</td>
</tr>
<tr>
<td>[12] Chi et al. (2007)</td>
<td>Dynamic</td>
<td>• • •</td>
<td>Meta-level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[14] Chituc et al. (2007)</td>
<td>Dynamic</td>
<td>• • •</td>
<td>Technology oriented</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[17] Chung et al. (2004)</td>
<td>Dynamic</td>
<td>• • •</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>[26] Hollenbeck et al. (2009)</td>
<td>Dynamic</td>
<td>• •</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[27] Im and Rai (2014)</td>
<td>Dynamic</td>
<td>• • •</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[31] Kartseva et al. (2005)</td>
<td>Dynamic</td>
<td>• •</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[34] Lee and Ding (2010)</td>
<td>Dynamic</td>
<td>• • •</td>
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<tr>
<td>[35] Lee et al. (2003)</td>
<td>Dynamic</td>
<td>• • •</td>
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<tr>
<td>[36] Léger and Hadaya (2005)</td>
<td>Dynamic</td>
<td>• • •</td>
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<tr>
<td>[38] Lockett and Brown (2006)</td>
<td>Dynamic</td>
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<tr>
<td>[45] Quader and Quader (2008)</td>
<td>Dynamic</td>
<td>• • •</td>
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</tr>
<tr>
<td>[49] Rossignoli (2009)</td>
<td>Dynamic</td>
<td>• • •</td>
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<tr>
<td>[52] Spralis et al. (2010)</td>
<td>Dynamic</td>
<td>• • •</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[53] Straub et al. (2004)</td>
<td>Dynamic</td>
<td>• • •</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[58] Wen and Wen (2006)</td>
<td>Dynamic</td>
<td>• • •</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[60] Xie and Johnston (2004)</td>
<td>Dynamic</td>
<td>• • •</td>
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<tr>
<td>[62] Zhao et al. (2007)</td>
<td>Dynamic</td>
<td>• • •</td>
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<tr>
<td>[63] Zhao et al. (2011)</td>
<td>Dynamic</td>
<td>• • •</td>
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</table>

N=31 10 14 5 0 13 19 0 22 9 9 8 12 1 4

examine the influence of a focal firm on the development of ICT-enabled network relationships.

The literature review revealed that the distinct levels of analysis are explored unequally. None of the articles we reviewed undertakes a meta-level analysis. Most frameworks and theoretical models focus on macro-level analysis, but evidence from qualitative or quantitative research remains scarce. For instance, Straub et al. [53] and Lee and Ding [34] are the only ones to examine the impact of ICT-supported collaboration on network performance. We also found various studies that take the viewpoint of a single organization within a network. Studies on risk- and trust-related topics are predominant within this level of analysis [3, 20, 24, 38].

Most of the publications reviewed have a management-oriented focus. These studies often refer to the formation and improvement of ICT-enabled relationships between organizations and cover both micro- and macro-level analyses. For example, Chi et al. [12] explore the associations between e-collaboration use, network relationships, and structures. From a micro-level viewpoint, Lee et al. [35] assess the benefits of B2B electronic collaboration in networks at the firm level. Nearly all technology-oriented studies reviewed deal with the development of frameworks and models. For example, Zhao et al. [62] propose an integrated model for the standardization of e-collaboration in networks.

Following the classification of Palvia et al. [41], five of the fourteen methodologies have been applied. The development of frameworks and models domi-
nates the literature reviewed, followed by qualitative research methods such as the case-study approach and interviews. Only eight studies applied large-scale surveys. In addition, one research commentary discusses e-collaboration at the interfirm network level [46].

5. Discussion and Research Agenda

Our first research question deals with the extent to which the body of literature has already explored e-collaboration in the context of interorganizational networks. Although our literature review includes an extensive search of various databases and topic-related search strings, only 31 relevant articles were found. Moreover, although our analysis was not restricted to a specific timeframe, the earliest article was published in 2001 [56]. However, our results do indicate a slight increase in publications over the past years. Although a number of articles were published in journals or conference proceedings that do not specifically focus on IS research (e.g., [2, 17, 24, 39]), the majority of the most recently published articles came from leading IS journals, such as Journal of Information Systems [3], Journal of Management Information Systems [63], and Information Systems Research [27, 46]. These findings suggest that the topic is still in a developing stage and is relevant to IS research.

In order to answer our second research question, we identified five gaps in the concepts under study.

First, the literature reviewed indicates that the view from the individual organization (micro level) and the network perspective (macro level) are as relevant as they are in network research [43]. Since network research has already identified meta-level analysis as relevant, this might also be a direction for future IS research on e-collaboration. Meta-level analysis in this context could enhance the understanding of how e-collaboration affects or is affected by relations to other networks or organizations outside the network.

Second, Straub et al. [53] and Chi et al. [12] have already made a first step towards linking the different levels of analysis by examining the influence of interorganizational information sharing and e-collaboration on network performance and structures. However, the correlations have only been empirically tested in dyadic interactions. Accordingly, the question of how e-collaboration at the individual firm level affects collaboration, performance, and structures at the network level and vice versa arises.

Third, the majority of the articles do not consider that networks differ in terms of their degree of complexity, concentration of power balance, and environmental diversity. Findings from previous studies indicate that organizations in networks involving many large and/or evenly balanced power relationships have less control and seemed to be coping in rather than managing their networks [23]. These differences must be taken into account when studying the implementation and design of e-collaboration. For example, and in accordance with Rai and Tang [46], we suggest that future research should examine how a focal firm’s B2B IT capabilities and its interfirm networks coevolve to affect value creation and appropriation from interfirm relationships. Furthermore, various studies from research on IT/IS adoption on the firm level have revealed that the adoption of a technology can be categorized as a stage-based process [22] that is influenced by the maturity level of an organization. Transferring this perspective, the different stages of network development (Figure 1) should be considered when examining the diffusion of e-collaboration in network contexts.

Fourth, few theoretical lenses have been applied for explaining e-collaboration and its role in interorganizational networks. The majority of the articles reviewed do not refer to a specific theory, though there are some exceptions. For example, the transaction-cost perspective and resource-based view have already been used as references [11, 49]. Future research should proceed in this direction in order to strengthen the theoretical foundation. Network research provides a variety of approaches. Overviews that might be valuable for IS research are provided by Straub et al. [53] and Barringer and Harrison [5].

Last, the use of multiple methods increases the robustness of results and helps improve the accuracy of judgments [28]. Since no single approach can provide the richness that IS research needs for further advancement, the combination of different research methods is highly relevant [30]. Therefore, we look forward to seeing a more balanced use of methods.

6. Conclusion and Limitations

In this paper we reviewed the existing literature on e-collaboration in the context of interorganizational networks. The aim was to determine to what extent the body of literature has already explored the role of e-collaboration in the field of networks. Moreover, we wanted to present an agenda for future research. Although our extensive search only yielded a limited number of articles, the results indicate a growing interest in the IS community. We analyzed the literature by using a concept matrix and revealed gaps in existing research. On this basis, we identified promising fields for future research: meta-level analysis and linkages between different levels, the con-
consideration of network characteristics and stages of development, theories for e-collaboration in networks, and, finally, a more balanced use of methods.

While our literature review led to interesting publications and results, there were some limitations that must be addressed. The selection of databases mainly covers IS journals and conference proceedings, which might have resulted in missing relevant sources and publications from adjacent research areas. Furthermore, we did not include a forward search. We also identified various publications dealing with network externalities, especially in literature on IT adoption, such as Cao et al. [9], Riggins et al. [47], Setia et al. [51], and Zhu et al. [64]. However, these articles do not explicitly refer to interorganizational networks as the unit of analysis. Thus, we excluded them from our review.

7. References


[43] Provan, K.G., Fish, a., and Sydow, J. Interorganizational Networks at the Network Level: A


