



Knowledge Sharing and Collaborative Relationships in Business Ecosystems and networks - a definition and a demarcation

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Abstract

Purpose: The sharing of knowledge between partners in collaborative relationships is widely accepted to be fundamental to supporting strategic decision making, particularly in relation to innovation management and business sustainability. This research focuses on how the structure of collaborative relationships in business networks may determine successful knowledge sharing and thus improve decision making and business performance.

Design/methodology/approach: Expert interviews were conducted with participants operating in networks and business ecosystem in four different sectors in Italy and Germany, exploring the process of knowledge sharing, organisational learning and decision making within collaborative relationships. A qualitative textual analysis was used to analyse the experts' responses.

Findings: The research found that an organisation's network position and the network structure, as well as the governance and richness of the business ecosystem in which it operates, influence its ability to share knowledge, to innovate and therefore to compete sustainably.

Research and practical implications: The research demonstrates that innovative strategic decision making, based on access to appropriate knowledge, occurs within the context of social and business network relations operating within a broader more diverse business ecosystem. Closer dyadic or small working group ties best facilitate trust and sharing of the most valuable knowledge. Appropriate participation in and management of such structures is therefore essential to support knowledge-based decision making, and critical to sustained competitive advantage.

Originality and value: The research focuses on how inter-firm relationships are established and maintained, how firms establish trust and facilitate knowledge sharing forming the basis of organisational learning.

Keywords: Networks, business ecosystems, knowledge sharing, decision support, open strategy

Paper type: Research paper

1 Introduction

Collaboration between companies and firms working in a network of interconnections has been of interest to researchers for some time (Lorenzoni and Baden-Fuller, 1995; Chesbrough and Appleyard, 2007). Resource sharing is recognised to be a major reason for collaboration between partners (Ahuja, 2000). Knowledge is considered to be the central resource, enabling firms to build competitive advantage, develop innovative ideas and build sustainable competitive advantage (Lorenzoni and Baden-Fuller, 1995; Barney, 1991). Knowledge sharing between partners is not subject to the same governance mechanisms and processes as knowledge sharing within companies (De Witt and Meyer, 2010). However, between network partners and within organisations, knowledge is shared through both formal and informal relations (Caimo and Lomi, 2014). Formal relations are governed in a different way from informal relations and distinct knowledge sharing mechanisms exist (Caimo and Lomi, 2014). Furthermore, companies network relations depend on the industry structure as well as the position each fulfils within the network (Iansiti and Levien, 2004; Zahra and Nambisan, 2012). There is considerable research exploring how knowledge is shared within networks (Grant, 1996a; Grant and Baden-Fuller, 2004, Zheng et al., 2011) and a recent conceptual

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3 article identified the key structural determinants of knowledge sharing; the formal and
4 informal relations operating in network structures (Wulf and Butel, 2016).

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6 Research into business ecosystems has evolved over the last ten years. Recent research has
7 focused on value creation (Adner and Kapoor, 2010), the evolution of value chains within
8 business ecosystems (Rong et al., 2010), the development of egocentric ecosystems (Isckia,
9 2009), and understanding innovation and technology driven business ecosystems (Li, 2009;
10 Zhang and Liang, 2011) little is known about the structural determinants of successful
11 knowledge sharing within a business ecosystem.

12
13 Business ecosystem structures, similar to business networks, enable firms to exchange
14 knowledge (Ze and Xin, 2014), take decisions and compete in a sustainable way, depending
15 on their position within the system and their ability to influence the ecosystem structures
16 (Albers et al., 2016). This paper first conducts in a detailed literature review, focusing on
17 research on business ecosystem theory and network theory. Network theory is examined in
18 order to understand structural determinants of knowledge sharing within different network
19 structures. The influence of the resource based view of firms and resource exchange between
20 firms is acknowledged and different types of relationships are explored (Pulles and Schiele,
21 2013). The structural and relational embeddedness of the social capital perspective (Burt,
22 1992; Coleman, 1988) is also employed. Business ecosystem theory is reviewed focusing on
23 the underlying concepts based on resource sharing. Finally, the differences between
24 ecosystems and networks, and the determinants of knowledge sharing within business
25 ecosystems, particularly in relation to innovation are identified.

26
27 In order to understand how managers differentiate between network and business
28 ecosystem structures, ten expert interviews were used to explore the underlying structures and
29 dynamics of business ecosystems. The focus is on understanding the determinants of
30 knowledge sharing and innovation within different structures. A qualitative text analysis was
31 conducted to identify how the experts thought business ecosystems and networks are
32 structured and how different structures enable or constrain knowledge sharing, particularly in
33 relation to the sharing of knowledge that is critical.

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35 In the following literature review different network structures will be described and
36 analysed as well as the influence they have on the exchange of knowledge.

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2 Literature review

2.1 Knowledge Sharing in Networks

Collaborative relationships often develop organically in order that organisations might share resources (Pulles and Schiele, 2013; Barney, 1991). Developing innovative ideas to gain competitive advantage (Lorenzoni and Baden-Fuller, 1995) and take strategic decisions for a long term sustainable advantage (Liu and Liang, 2016) is central to this collaborations. Network structures lack the formal coordination function that organizations have (Grant, 1996a). As networks are neither market nor hierarchies (Powell, 1990) they have different governance mechanisms that contrast markedly with normal market and pure hierarchy mechanisms (Jones et al., 1997). Consequently, collaborative relationships can be seen as constructs that are explained by structural and relational factors influenced by organizational theory (Goh, 2012; Powell, 1990; Ahuja and Carley, 1999) as well as social and business network theory (Lorenzoni and Baden-Fuller, 1995; Jarillo, 1988; Pulles and Schiele, 2013; Scott, 2012, Grant and Baden-Fuller, 2004). In order to be innovative and create sustainable competitive advantage (Barney, 1991) knowledge is considered to be the most important resource enabling firms to develop new capabilities and innovative strategies (Lorenzoni and Baden-Fuller, 1995; Grant, 1996a; Grant, 1996b; Grant and Baden-Fuller, 2004). Knowledge sharing therefore plays a vital role in collaborative relationships (Uzzi, 1997) and is seen as a key capability which is essential for building competitive advantage (Quintane et al., 2011) on the long term. Knowledge sharing within networks cannot be done by the same mechanisms as within hierarchical structures. A hierarchy, as for example within a single organisation, typically relies on rules, routines and directives for authoritative execution of processes, whilst at the same time they can also be used for information and knowledge sharing (Grant, 1996b). Networks lack these formal mechanisms completely or partly, depending on their network structure. Instead they are governed by social network mechanisms (Pulles and Schiele, 2013) particularly when no formal mechanisms are present. This means that networks can be structured by formal (Jarillo, 1988) and informal relations (Pulles and Schiele, 2013). Depending on the type of relationships maintained by any single firm within the network, different resource exchange mechanisms may take place (Lorenzoni and Baden-Fuller, 1995; Grant and Baden-Fuller, 2004; McEvily and Marcus, 2005). An individual company is likely to have a strong formal structure of resources and knowledge transfer determined and controlled primarily by formal but also with some informal relations between participants (Grant, 1996a; Grant and Baden-Fuller, 2004). Whereas resource and knowledge exchange in social networks, according to Granovetter, depends upon the social embeddedness of the

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3 individual parties (Granovetter, 1973) and also upon the extent of their social capital (Walker
4 at al., 1997). Networking describes the way relationships are built up (Jarillo, 1988) and the
5 network is the structure that develops as a consequence. Often knowledge sharing and transfer
6 activities across intraorganisational boundaries are shaped by both, formal and informal
7 relations (Caimo and Lomi, 2014) and determined by the types of relationships the company
8 establishes and maintains (Lorenzoni and Baden-Fuller, 1995; Grant and Baden-Fuller, 2004;
9 McEvily and Marcus, 2005).

16 2.2 *Importance of network structures for knowledge sharing*

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18 Networks, depending on their structural characteristics, can be formed by formal
19 contractual relationships (Rong et al., 2010). As explained above, knowledge sharing in more
20 bureaucratic structures is different than in socially determined environments. The less
21 hierarchically a network is structured, the less bureaucracy it contains and the more social
22 mechanisms govern the network (Jones et al., 1997). Hierarchy can be efficient in terms of
23 knowledge transfer as it is not based so much on mutuality and exchange, due to existing
24 authoritative relationships (Grant, 1996b). However, although knowledge is transferred, it
25 may not be immediately recognised as required, and in order to utilise any knowledge gained,
26 the organization needs to learn through the development of new routines (Grant, 1996b).

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28 Informal relations, their type and their structure play a vital role in networks, in order to
29 ease knowledge sharing without the potentially slow movement of hierarchies. Not all
30 networks have same structures. Jarillo used the structural and the relational perspective to
31 explain different structures in strategic networks (Jarillo, 1988). The same structural approach
32 can be taken when looking at different network structures from a social capital perspective
33 (Pulles and Schiele, 2013). This perspective takes a structural and relational embeddedness
34 perspective of social and informal structures, explaining resource exchange and co-creation
35 between firms identifying how structural and social links between firms can enhance the
36 exchange of resources, determined by trust and a shared vision (Nahapiet and Ghoshal, 1998;
37 Tsai and Ghoshal, 1998; Pulles and Schiele, 2013). Inkpen and Tsang introduced the
38 structured - unstructured dimension to explain different types of relationships in a network
39 (Inkpen and Tsang, 2005). Shafique related the type of embeddedness of the firm directly to
40 its ability to access diverse knowledge and establish linkages to the knowledge of other firms,
41 arguing that access to a greater variety of knowledge offers an organisation more possibilities
42 to gain new knowledge with innovative potential (Shafique, 2013).

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3 Structural embeddedness refers to the degree of centrality of any given company within the
4 social network (Nohria and Eccles, 1992, Zheng et al., 2011, Gulati et al., 2011). This is
5 influenced by and influences the number of informal relations and the type of informal
6 relations maintained. Strong ties are determined by strong mutual and frequent interactions
7 (Pulles and Schiele, 2013) which are maintained over time. A strongly embedded organisation
8 is one which has many close ties with which it is in frequent contact, it may be the hub with
9 many spokes. In contrast there are open and sparse networks (Burt, 1992) where participants
10 are loosely tied, in infrequent contact (McEvily and Marcus, 2005; Zheng et al., 2011, Gulati
11 et al., 2011). There are also open networks accessible to all interested parties, and closed
12 networks the structure of relationships in these are described as similarly closed or open (Burt,
13 1992; Coleman, 1988). The structural dimension is important, especially when looking at
14 informal relations being not governed by hierarchical mechanisms of authority and control,
15 but by trust, mutuality and frequency of interaction (Ahuja and Carley, 1999; McEvily and
16 Marcus, 2005; Gulati et al., 2011; Goh, 2012).

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18 For relational embeddedness, the degree of interaction and the amount of trust becomes
19 essential. This is shown in different degrees of strong and weak ties the businesses possess
20 (Larson, 1992; Krackhardt and Hanson, 1993; Uzzi, 1997). The social capital perspective
21 corresponds very strongly to Burt's, Granovetter's and Coleman's concept of strong and
22 weak ties as well as to their closed and sparse network perspective (Granovetter, 1973;
23 Coleman, 1988; Burt, 1992). Strong ties are characterized by a strong interaction, with the
24 facilitated sharing of information and tacit knowledge (Uzzi, 1997) as the partnership is based
25 on a mutual and deeper understanding. Network members are dependent upon each other and
26 develop trust (Larson, 1992). Strong ties are also characterized by strong social control
27 methods (Krackhardt and Hanson, 1993). Weak ties, described by Granovetter as 'local
28 bridges' (Granovetter, 1973) are not that strongly connected but more likely to deliver new
29 information and knowledge. Weak ties relate to Burt's idea of structural holes (Rowley et al.,
30 2000). A sparse structure, observed between weak ties, allows access to new and previously
31 undetected knowledge (Burt, 1992). The same refers to McEvily's and Zaheer's concept of
32 bridging ties (McEvily and Zaheer, 1999). Strongly embedded ties have been found to
33 reinforce existing knowledge. Weaker ties in sparse or open networks provide access to new
34 knowledge, with innovative potential (Granovetter, 1992).

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36 Social mechanisms are important to initiate ties and develop strong informal relations and
37 essential to facilitate knowledge sharing. However, interpersonal ties differ from inter-
38 organisational ties (Rowley et al., 2000; Gulati et al., 2011) as formal structures between
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3 organisations are primarily governed by contracts and strong hierarchical mechanisms (Goh,
4 2012), whereas interpersonal ties are facilitated by mutuality and trust. Therefore networks
5 need to differ in governance mechanisms, depending on their structure.
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8 9 10 2.3 *Network governance and knowledge sharing*

11 The maintenance of formal and informal inter-organisational relationships and the degree of
12 organisational embeddedness within a social network have both been identified as being
13 critical factors influencing the governance of the network and specifically how network
14 members access relevant knowledge. Networks differ in structure, some are more tightly
15 embedded and some more open with structural holes, some determined by informal and
16 formal relations. How this influences the governance of networks remains unclear.
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19 From theory it can be assumed that the number of formal and informal relationships in
20 networks affect the degree of influence among network partners. Formal relations can be
21 regulated more easily by contractual and hierarchical control mechanism (Gulati et al., 2011).
22 In comparison to a bureaucracy the influence and regulation is less, still it is determined by
23 formal requirements (Jarillo, 1988). The influence changes between partners, depending on
24 the degree of formal and informal relations and the ability to access knowledge also differs, as
25 it cannot be accessed in the same way. Explicit knowledge is easy to access, whereas tacit
26 knowledge is nearly impossible to access, but only learnable within its context (Kogut and
27 Zander, 1992; Marabelli and Newell, 2012). Learning its routines and by application in
28 practice (Grant, 1996b) makes tacit knowledge transfer slow, costly and uncertain (Kogut and
29 Zander, 1992). This requires strong and reliable relationships which can be achieved either via
30 a contract and within an internal hierarchy or via a very strong informal relationship (Everett
31 and Krackhardt, 2012). Tacit knowledge is rooted in procedures, norms and rules which can
32 only be shared over time by learning from strongly embedded network members (March,
33 1991). Therefore, specialized and tacit knowledge can be found in learning mechanisms and
34 routines and strong network relations (Grant, 1996b; Winter, 2003) whereas non-specialized
35 knowledge may be accessed in weaker or less authority based relations (Lorenzoni and
36 Baden-Fuller, 1995; Grant, 1996b; Grant and Baden-Fuller, 2004).
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39 In business clusters, proximity facilitates the exchange of tacit based knowledge and
40 experience and can replace formal relations. This corresponds to the embeddedness
41 perspective focusing on the type of informal relations, where direct and strong ties are seen as
42 being closely linked to the organization whereas indirect ties and weaker ties are more remote
43 (Granovetter, 1992; McEvily and Marcus, 2005; Zheng et al., 2011; Gulati et al., 2011). Here
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3 again the amount of influence differs by type of relationship and therefore has an impact on
4 the knowledge shared between partners. Critically, direct ties or dyadic ties (Granovetter,
5 1992) are highly influenced by solidarity, trust and cooperation (McEvily and Marcus, 2005;
6 Gulati and Nickerson, 2008). Trust can be seen as a key factor influencing relational
7 embeddedness fostering collaboration and knowledge sharing (Gulati et al., 2011). Strong and
8 weak ties, as well as direct and indirect ties therefore again describe the degree of influence
9 partners have on each other and in turn affect the type of knowledge shared.
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14 When looking at Burt's and Coleman's concept of structural embeddedness, the degree of
15 influence between partners becomes again important. Densely embedded networks with many
16 connections and well developed social structures are seen as 'closed networks' or 'closed
17 communities' with stronger rules of interaction (Coleman, 1988). Having a better control of
18 the outcome of the network and a more structured communication, the social capital in such
19 closed network is more beneficial and can be better used than in open networks (Coleman,
20 1988; Walker et al., 1997; Ahuja, 2000).
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26 Burt sees more benefits offered by networks that are not densely tied to each other offering
27 a greater variety and a more open approach to networks, being sparse networks (Burt, 1992;
28 Grant, 1996a). The diversity can offer diverse and innovative knowledge (Brass et al. 2004;
29 Zheng et al., 2011). Therefore openness of the network, as well as the type of relationships
30 among partners highly influences the mechanisms of network governance and knowledge
31 sharing (Jones et al., 1997; Rowley et al., 2000; Ahuja, 2000; Pulles and Schiele, 2013). Some
32 researchers have investigated governance mechanisms and the type of knowledge exchanged.
33 Nambisan and Sawhney, for example, differ between a centralised governance structure,
34 determined by formal structures and hierarchical mechanisms and community led structure,
35 influenced by informal structures (Sawhney and Nambisan, 2007). From their view,
36 knowledge space can either be less defined and unstructured, therefore suitable for knowledge
37 exploration (March, 1991) or very well defined and specialized suitable for exploitation
38 (March, 1991; Sawhney and Nambisan, 2007). This knowledge in turn can be access
39 differently depending on the company's relations (March, 1991).
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49 Summarizing the above, structural and relational determinants influence the degree of
50 formal or informal governance mechanisms and therefore the mechanisms of network
51 governance and knowledge sharing (Jones et al., 1997; Rowley et al., 2000; Ahuja, 2000).
52 Networks determined by strong formal structures can act more like bureaucracies (Jones et al.,
53 1997) potentially exchanging different kinds of knowledge but also in a different way from
54 networks determined by more informal relations (Jarillo, 1988; Lorenzoni and Baden-Fuller,
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3 1995; Grant and Baden-Fuller, 2004). The degree of informal and formal relationships also
4 refers to a more open or closed network (Jarillo, 1988; Rong et al., 2010), comparable to
5 Burt's and Coleman's approach to open and closed networks coming from the social network
6 perspective and the degree of relational and structural embeddedness (Coleman, 1988; Burt,
7 1992; Nahapiet and Ghoshal, 1998). Therefore, the degree of social embeddedness and the
8 openness of the network have a strong influence on network governance mechanisms. Figure
9 1 below describes these influencing factors and their impact on network governance
10 mechanisms and knowledge space that influence in turn the strategic decision making in order
11 to gain the knowledge needed to reach sustainable competitive advantage (Rue Yen et al.,
12 2012; Alkhuraiji et al., 2014).

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24 2.4 *Network structure and the environment*

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26 Gulati referred to networks as relational models that do not view organizations as atomistic
27 firms but as participants embedded in closely connected industry structures that influence the
28 nature of competition (Gulati and Nickerson, 2008) and which are highly influenced by their
29 dynamic environment. The influence of the 'environment' can either be the region, the
30 industry or the technology the company employs or its evolutionary stage. This in turn
31 influences the stability of the network, whether it is stable and mature, or unstable and
32 developing (Rong et al., 2010; Shang, 2014). Instability and uncertainty in some industries
33 can hinder innovation, especially in the first stages where it is possible that knowledge
34 diversity is needed. This requires different inter-organisational relationships than those
35 employed in more stable environments, in order to gain access to appropriate knowledge
36 (Shang, 2014).

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45 Depending on the environment the company is in, whether it is 'stable or variable'
46 (Lawrence et al., 1967)², 'low or high velocity' (Eisenhardt, 1989)², with 'smooth or abrupt
47 development' (Suarez and Lanzolla, 2007)² the challenges are different (Adner and Kapoor,
48 2010) as is the knowledge required (McEvily and Marcus, 2005). This requires a more
49 holistic view of strategic decision making by companies acting in networks encompassing
50 how the networks are shaped by the environment and externalities (Alkhuraiji et al., 2016), as
51 well as an understanding of how the knowledge sharing mechanisms are established and
52 maintained by certain actors within the networks (Iansiti and Levien, 2004; Anggraeni et al.,
53 2007). Therefore, the environment of the network can significantly influence the type of
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relationships maintained. This again can be explained by the amount of influence required among network partners within certain industry environments. Adner and Kapoor see the challenges faced by companies in networks relative to the position of the network in industry and the challenges the industry holds for the network (Adner and Kapoor, 2010). Furthermore, network resources are distributed heterogeneously in networks (Pulles and Schiele, 2013), so the access to the resources can be determined by the type of relationship and the structure of the network (Gulati and Gargiulo, 1999).

This means network environment and network structures are determined by environmental dynamics, also influencing network governance mechanisms, and potential—knowledge sharing ultimately influencing strategic decision making at the company level.

3 Business Ecosystem Theory

Business ecosystem theory complements business and social network theory focusing on the different roles different kinds of firms may play within any given network (Adner and Kapoor, 2010). When Business ecosystem theory is related to network theory this could mean that external variety within the ecosystem environment can also lead to diversity of network structure and relations companies have (Peltoniemi et al., 2005). Consequently, business ecosystem theory also refers to the structural and relational dimension described above, seeing organizations as being embedded in a network of ties and social relations (Gulati and Nickerson, 2008; Gulati and Singh, 1998) with different structural properties (Burt, 1992; Coleman, 1988) or tie attributes (Granovetter, 1973) depending on the environmental influences. This connection is built on a theoretical and conceptual approach recently published (Wulf and Butel, 2016).

So far the relation between network and business ecosystem theory has not been researched empirically. But when analysing the literature and findings of network theory and business ecosystem theory many similarities can be extracted such as the role of interaction, relationships, innovation and knowledge (Isckia, 2009; Adner and Kapoor, 2010, Rong et al. 2010).

Researchers define business ecosystems in different ways. Generally business ecosystems are seen as open systems with blurred organisational boundaries, where companies interact with each other (Garnsey and Leong, 2008; Scott, 1987). The terminology comes from biological ecosystems (Moore, 1993; Moore, 1996) and employs the metaphor of interdependent ecosystem actors performing different roles (Li and Garnsey, 2009). “We

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3 found that perhaps more than any other type of network, a biological ecosystem provides a
4 powerful analogy for understanding a business network. Like business networks, biological
5 ecosystems are characterized by a large number of loosely interconnected participants who
6 depend on each other for their mutual effectiveness and survival. And like business network
7 participants, biological species in ecosystems share their fate with each other (Iansiti and
8 Levien, 2004, p. 8).”

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10 Some authors refer business ecosystems directly to network theory, seeing it as an
11 advancement of the loosely connected partners, which no longer build up strategies on their
12 own (Butel 2014; Heikkilä and Kuivaniemi, 2012). “The business ecosystem perspective
13 offers a new way to obtain a holistic view of the business network and the relationships and
14 mechanisms that are shaping it, while including the roles and strategies of the individual
15 actors that are a part of these networks” (Anggraeni et al., p. 11). Overall, the biological
16 metaphor was introduced to describe the idea of firms acting within and being dependent
17 upon their (networked) environment in order to meet challenging competitive conditions
18 (Rong and Yongjiang, 2014). The view of a single isolated firm acting in a market or industry
19 between and against its competitor is complemented by a network approach, seeing firms as
20 being mutually inter-dependent (Brass et al. 2004), co-evolving with each other (Moore,
21 1993; Basole, 2009; Teece, 2007; Mäkinen and Dedehayir, 2012).

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23 Nevertheless, the exact relation and interdependence between business ecosystems and
24 networks has not be defined so far, both approaches have not been demarcated or compared
25 nor have the similarities been shown by empirical research. It remains unclear where the
26 business ecosystem begins and the network ends and if the network is a structural component
27 of a business ecosystem. How experts differentiate between networks and business
28 ecosystems and how this can contribute to the understanding of how knowledge is shared and
29 influences decision making processes will be investigated in the next section.

3 Methodology

3.1 Method and data collection

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33 In this research, deductive methods and inductive methods are combined as coding
34 categories were developed deductively from the comprehensive literature review and
35 inductively supplemented by categories that developed through interviewees input. The
36 deductive approach is important to define network and business ecosystem characteristics
37 from literature.

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3 Qualitative research provides an excellent opportunity to do rich exploratory research on
4 concepts that are not well understood or researched (Stebbins, 2011). Expert interviews are
5 often used to complement other qualitative research methods (Flick, 2009). The expert
6 interviews that were undertaken are part of a larger exploratory multiple case study of several
7 networks within different Business Ecosystems. Within the case studies several exploratory
8 methods are used such as observation, expert interviews, open interviews and document
9 analysis in order to find out about business ecosystem structure, roles played and strategies
10 taken. The expert interviews of this paper were mainly conducted to define the business
11 ecosystem approach and to understand its underlying concepts in front of network theory.
12 (Flick, 2009).

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20 The analysis of the expert interviews was used to explain how business ecosystems are
21 defined in practice. The expert interviews were undertaken between May 2016 and August
22 2016. It was necessary to understand how business ecosystems are structured and how their
23 connections were built up in order to understand how knowledge can be shared within
24 business ecosystems identifying how businesses develop individual innovative strategies and
25 build up their sustainable competitive advantage.

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Experts were recruited by the investigation of the innovation network support programme of
the state of Germany (VDE, VDI, 2016). Here several networks were identified that were
initially established by the state and are now operating independently within their industry or
regions. The regions are listed in the European Union Innovation Scoreboard of innovative
regions (Innovation Union Scoreboard, 2016). Three experts of state governments and seven
experts on innovation networks were interviewed in order to find out how they define
business ecosystems and networks, how they see the concepts overlapping and how they
thought knowledge is shared within these overlapping structural concepts. Altogether, ten
interviews were conducted. This resulted in 44 pages and 20,895 words which were analysed
and coded. The selection of interview partners is shown in Table 1.

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The data saturated at interview number nine of the participants and a tenth interview was
conducted to proof the correctness of the saturation point (Straus and Corbin, 1990). Most of
the participants shared similar views on the topic, which created high coding similarities and
eased the category building. Semi-structured interview protocols were used to ask for business
ecosystem and network definitions in order to get comparable responses across participants.

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3 These questions were developed alongside the literature review and were also the foundation
4 of the deducted coding categories. Additionally, an open interview part was added in order to
5 allow greater interviewer flexibility (Rosenthal and Rosnow, 2008) and to inductively add
6 coding categories to the data analysis (Mayring, 2014).
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10 Each interview lasted approximately 60 minutes, was audio recorded and transcribed
11 manually. A systematic qualitative text analysis was conducted as introduced by Mayring and
12 Kuckartz, who recommend the building of coding categories from literature in a deductive
13 way as well as inductive coding from interview input, depending on the data content
14 (Mayring, 2014; Kuckartz, 2014). Categories were added to those suggested by the literature
15 categories from the themes and statements that recurred most frequently across all interviews.
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17 Four main categories were developed with around 50 coding categories within these main
18 categories.
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24 **3.2 Results**

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26 The most frequently mentioned themes within the main subcategories are displayed in Table 2
27 shown below. It was particularly noticeable that participants defined business ecosystems as
28 comprising of elements observed in networks, such as formal and informal relations, but saw
29 them as a bigger structural entity than networks. One interviewee described these networks as
30 being the platform (bigger or smaller platform) and as an instrument to build up relations;
31 business ecosystems being a bigger platform of network relations. Other interviewees used
32 words such as 'structural entity' or 'governance entity'. Business ecosystems were seen as a
33 network of networks, containing network elements but without the same number of
34 interactions between the business ecosystem partners. In fact business ecosystem partners can
35 be dependent upon each other within the business ecosystem, without interacting directly at
36 all. Interviewees described this phenomenon as an 'economic force field' that creates the
37 fluent and high dynamic borders of the business ecosystem and that draws the partners
38 together. Table 2 shows these main findings in regards to business ecosystems but also to the
39 other three main categories. Due to complexity and space, only the most frequently mentioned
40 categories, the highest level findings can be displayed.
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54 According to expert opinion, networks are on the one hand structural entities within business
55 ecosystems and on the other hand structural elements that describe relations between the
56 partners. Networks are seen as closer entities than business ecosystems. Two network
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3 definitions were mentioned one seeing networks as a governance entity, closer structured than
4 business ecosystems. The other definition seeing 'networks' as meaning network relations,
5 defined by formal and informal relations, leading to a governance entity. Business ecosystems
6 were therefore seen as a looser governance entity, structured by network elements such as
7 formal and informal relations. As shown in Figure 1, knowledge sharing is determined by
8 network structures that exist within the structural entity, which was defined as being a
9 network or business ecosystem entity, characterised by a closer or more open structural entity.
10 The experts confirmed the idea that different network structures in business ecosystems are
11 used for different forms of knowledge exchange. Every business ecosystem consists of
12 different network entities shaped by distinct network structures providing various ways of
13 sharing knowledge, depending on the role or function of the network within the business
14 ecosystem. Experts all agreed that collaboration and cooperation are the basis of all
15 connections.

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17 Table 3 illustrates how business ecosystems and networks were structured by the experts.
18 Using De Witt's and Meyer's four part conceptualisation of strategy analysis, business
19 ecosystems and networks were analysed by their Structure, Context, Content and Process (De
20 Witt and Meyer, 2010). Themes that were frequently mentioned as being typical for networks
21 and business ecosystems were structured with reference to their relevance by the four aspects
22 of strategy. In addition, working groups and cooperation, between two companies in dyadic
23 relations (Gulati and Lavie, 2011) were added to the table as these two structural and strategic
24 entities were mentioned by the experts to be part of an ecosystem as well, showing smaller
25 structural entities which focus on the sharing of know-how and the implementation of
26 innovation, rather than creating new knowledge and innovative ideas.

27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 **3.3 Limitations**

44 The literature review was structured as an overview of network related literature, rather
45 than as a critical review, as the aim was to find similarities to business ecosystem structures.
46 A critical review needs to be conducted in the future in order to discuss the similarities and
47 differences in depth.

48 The experts interviewed were predominantly based in Germany, with one in Italy; thus the
49 findings relate to the perception of participants in these countries. The selection can be
50 assumed to be influenced by some degree of self-selection and the willingness of the
51 interviewees to participate. In order to ensure that the results were robust a variety in different
52 interview partners from different network structures, some more closed, some more open,
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3 some formal some informal networks, were chosen. Whenever possible, information provided
4 was crosschecked against publicly available data, such as reports, surveys and research
5 publications. The experts are not experts in all areas researched and this was addressed by
6 asking them for the main areas they felt familiar with and are expert on, and then
7 concentrating on that area. Having identified their main roles and responsibilities in advance,
8 these were matched to the questions asked, ensuring their contribution was relevant.
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14 PLEASE INSERT TABLE NUMBER THREE ABOUT HERE
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18 **5 Discussion**

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20 In this paper, the concept of the business ecosystem was compared to network theory in order
21 to better understand the ability of companies to share knowledge impacting their strategic
22 decision making. This work addresses the more detailed questions such as how business
23 ecosystem theory and network theory contribute to each other and how this is linked to
24 knowledge sharing. This research was designed in order to gain an in-depth understanding of
25 how the business ecosystems and networks are intertwined and how this facilitates knowledge
26 sharing within business ecosystems. Networks were found to be one structural entity within a
27 broader business ecosystems. Network relations, such as informal and formal relations
28 facilitated knowledge transfer and exchange. Figure 2 shows how knowledge sharing can
29 differ by governance entity depending on the openness of the structure.
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38 INSERT FIGURE NUMBER TWO ABOUT HERE
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41 A business ecosystem consists of several different network structures, each forming different
42 grouping of structural entities which can either be very formal, or informal and may include
43 formal working groups and simple dyadic relations comprising formal or informal
44 cooperation between two firms. Experts confirmed that the knowledge sharing ability differs
45 depending on the ecosystem and network structures and so does the ability to access
46 innovative and creative knowledge. Business ecosystems are perceived as very open systems,
47 their network structures may contain many other structural entities such as interfirm
48 relationships of various kinds. The sharing may need to occur on a lower level, such as at the
49 structural level of a network governance entity or in a working group or dyadic relationship.
50 These findings are shown in Table 3 shown above. Figure 3 summarises the findings,
51 illustrating in simplified form examples of how the different structures contribute to the
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3 overall structure of the Business Ecosystem. The experts reported that innovation takes place
4 at the edge of those structures, so the element that combines or bridges the networks seems to
5 be of particular interest. This relates directly to the concept of bridging ties (Mc Evily and
6 Zaheer, 1999).
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11 INSERT FIGURE NUMBER THREE ABOUT HERE
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15 As described in section 2.3 the business ecosystem structure itself depends upon the
16 environment it operates in. Experts described this environment as an economic force field.
17 Depending on the dynamics within the economic force field, the business ecosystem can
18 evolve from the top down or the bottom up. This confirms the concepts illustrated in Figure 1.
19 Different business ecosystems can contain different governance structures depending upon the
20 dynamics influencing the business ecosystem. Figure 1 also demonstrates that there are
21 certain actors who can influence the dynamics within the business ecosystem. This also
22 corresponds to a result from expert interviews that innovation happens at the edge of the
23 network platforms within the business ecosystem. New networking structural entities,
24 working groups or cooperative relationships are established in order to develop the innovative
25 idea and enable appropriate know-how to be exchanged (Arya and Zhiang, 2007;
26 Galaskiewicz, 1985; Ibarra, 1993; Powell and Kogut; Smith-Doerr, 1996). As discussed
27 above, this relates to the view that controlled and open networks are capable of achieving a
28 more diverse ecosystem with and a greater variety of linkages (Shafique, 2013) facilitating
29 both knowledge exploration and exploitation (March, 1991; Crespo et al., 2014).
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40 Summarising the above, business ecosystem theory offers a broader approach to
41 understanding business network structures and potential innovative strategies. It offers
42 researchers the opportunity to understand how companies may work collaboratively within a
43 broader business environment but also within narrower dyadic relationships, working groups
44 and other network relations. The mechanisms of knowledge sharing in certain network
45 environments and in certain network positions, in addition to the firm's own knowledge
46 sharing capabilities are all necessary to ensure the shared knowledge is transferred
47 appropriately and decisions are made to ensure the development of sustainable competitive
48 advantage. This research demonstrates that within four different industrial sectors, in two
49 countries and therefore within very different business environments, innovative strategic
50 decision making, based on access to appropriate knowledge, occurs within the context of
51 social and business network relations operating within a broader more diverse business
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ecosystem. The results also show that closer dyadic or small working group ties best facilitate trust and sharing of the most valuable knowledge. Appropriate participation in and management of such structures is therefore essential to support knowledge-based decision making, critical to sustained competitive advantage.

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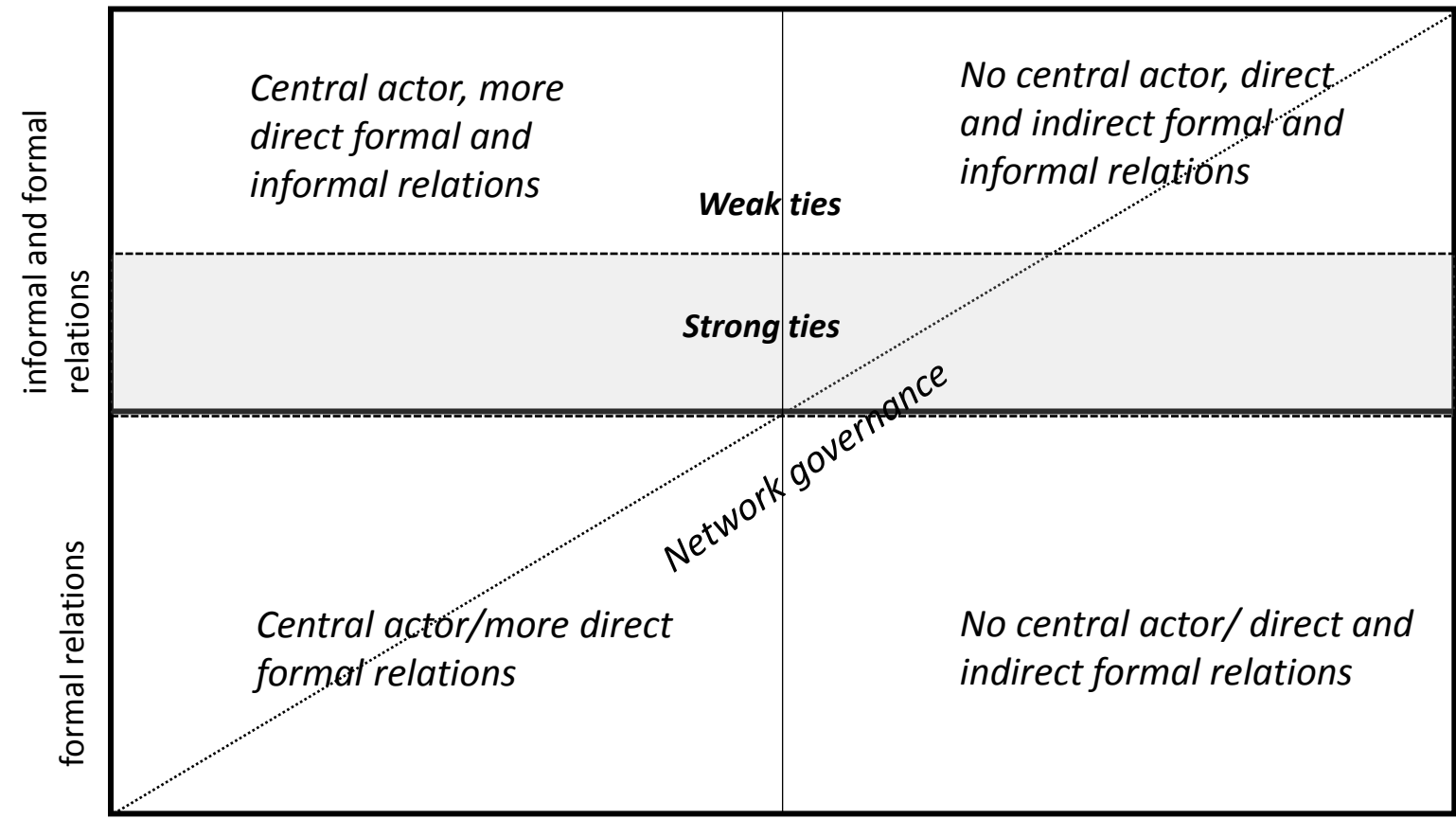
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Knowledge space

Relational and structural determinants



**Small influence/
Informal social
network governance
mechanisms**

Open Network (Burt, 1992)

- sparse network, structural holes)
- Information-rich network
- Open network
- Less network governance and influence

**Strong influence/
network governance
mechanisms**

Centralised
Less embedded-Higher
Influence

Decentralised
Strong embeddedness-
Less Influence

Degree of centralisation

Closed Network
(Colemann, 1988)

Fig. 1. Changes in network governance and knowledge space depending on network structure derived from Wulf and Butel (Wulf, Butel, 2016).

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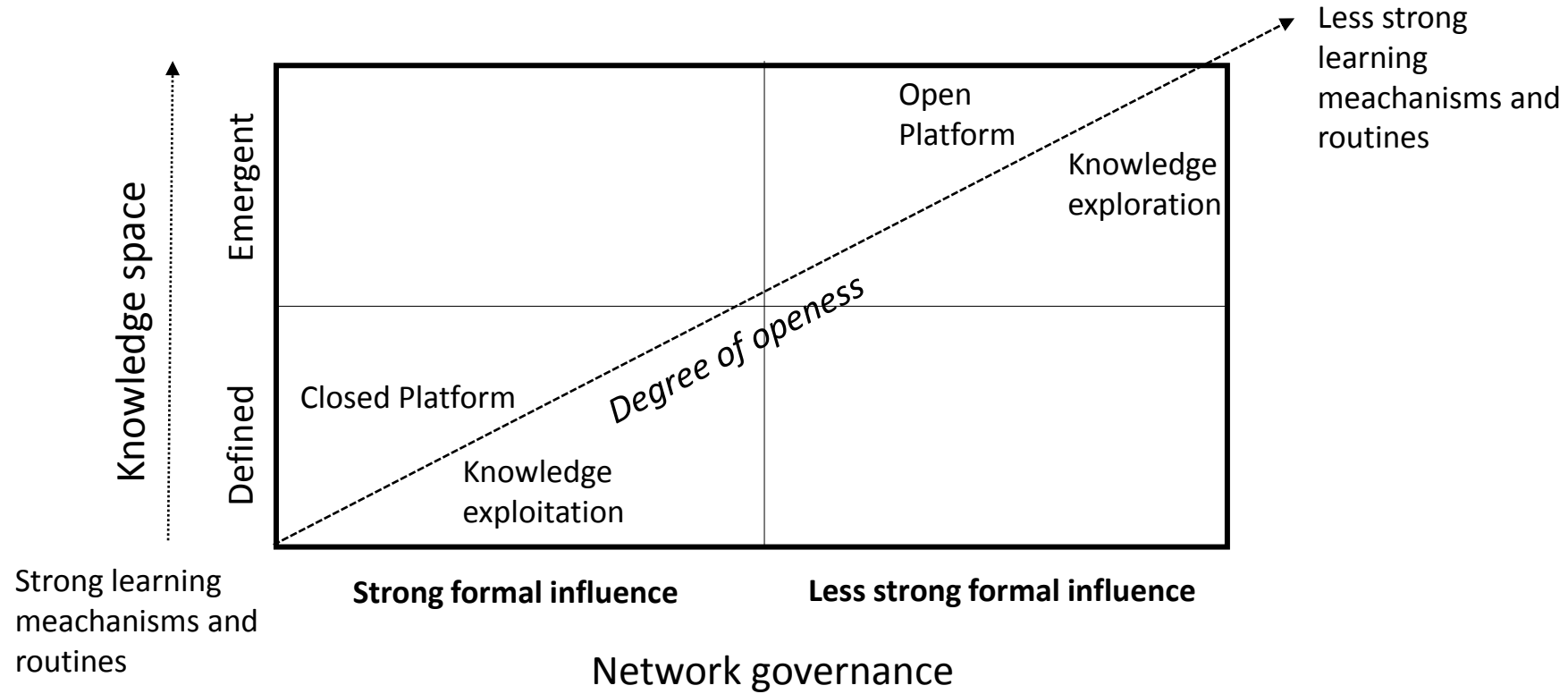
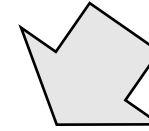


Fig. 2. Business ecosystem structures, platform openness, network governance and knowledge space (own figure)

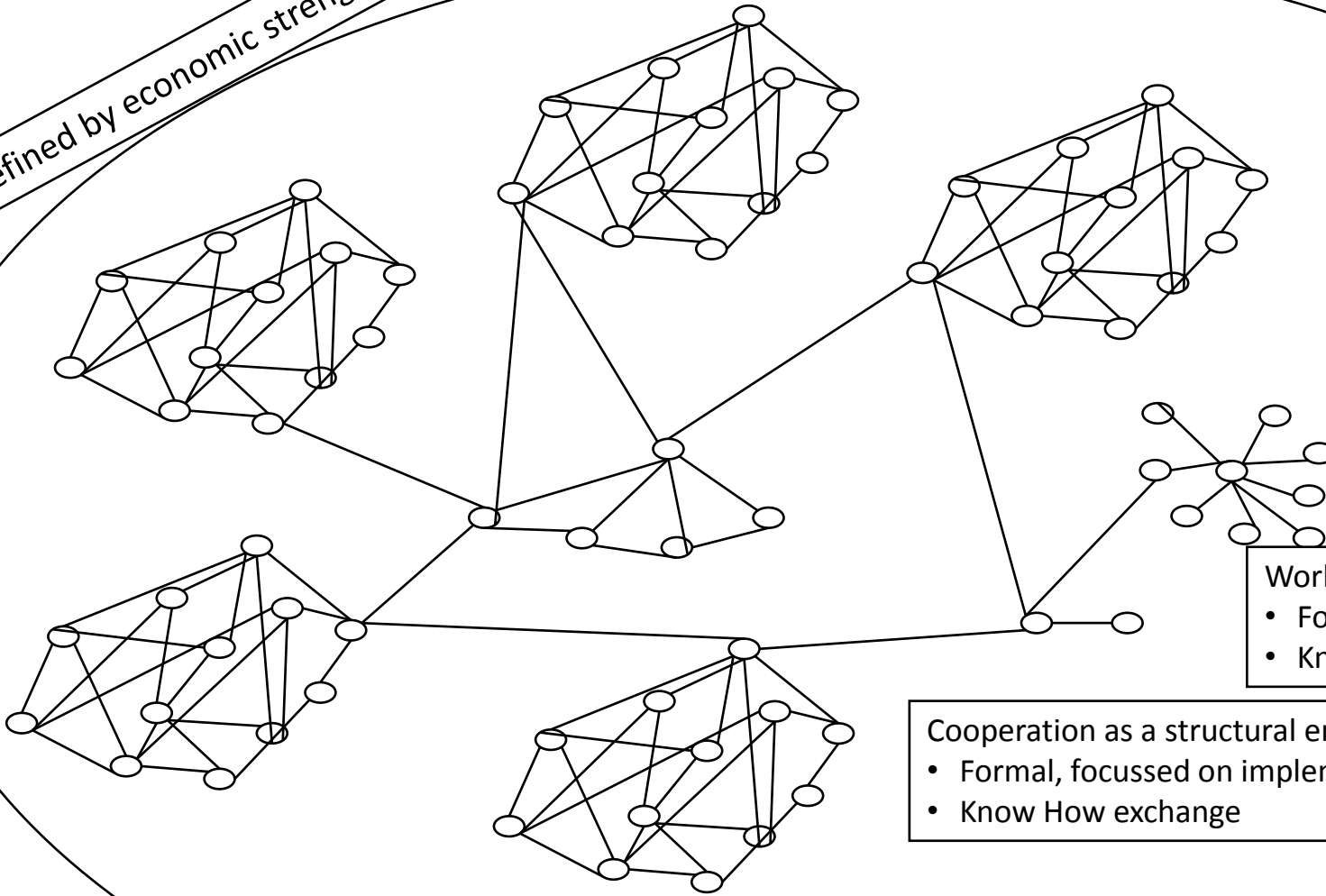


defined by economic strength field

Business ecosystem:

- Is influenced by economic strength field
- Is a structural entity
- Is structured by network structures such as formal and informal relations
- Not all actors need to be in interaction

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Working group platform: defined by certain goal

- Formal, focused on implementation
- Know How exchange

Cooperation as a structural entity: defined by certain goal

- Formal, focussed on implementation
- Know How exchange

Network as a structural entity defined by network relations:
defined by certain goal

- More formal or informal depending on goal
- Knowledge sharing depending on network structure

Numbers and characteristics of network relations and network as a structural entity dominating within the Business ecosystem depend on the strength field and the architecture of the system.

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5 **Fig. 3.** Different structural entities and network relations elements define the business
6 ecosystem architecture (own figure).
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Expert position	Working experience/ network experience (years)	Tasks of expert
Networkmanager/ Plattformmanager	8/3	increase connectivity between partners
Networkmanager/ Plattformmanager	10/5	
Networkmanager/ Plattformmanager	5/2	
Networkmanager/ Plattformmanager	8/2	
Networkmanager/ Plattformmanager	2/2	
Networkmanager/ Plattformmanager	12/2	
Networkmanager/ Plattformmanager	5/2	
Ecosystem manager/ Plattformmanager Germany	16/9	
Ecosystem manager/ Plattformmanager Germany	13/5	
Ecosystem manager/ Plattformmanager Italy	20/8	

Table 1. Selection of expert interview participants, their work experience and the network t

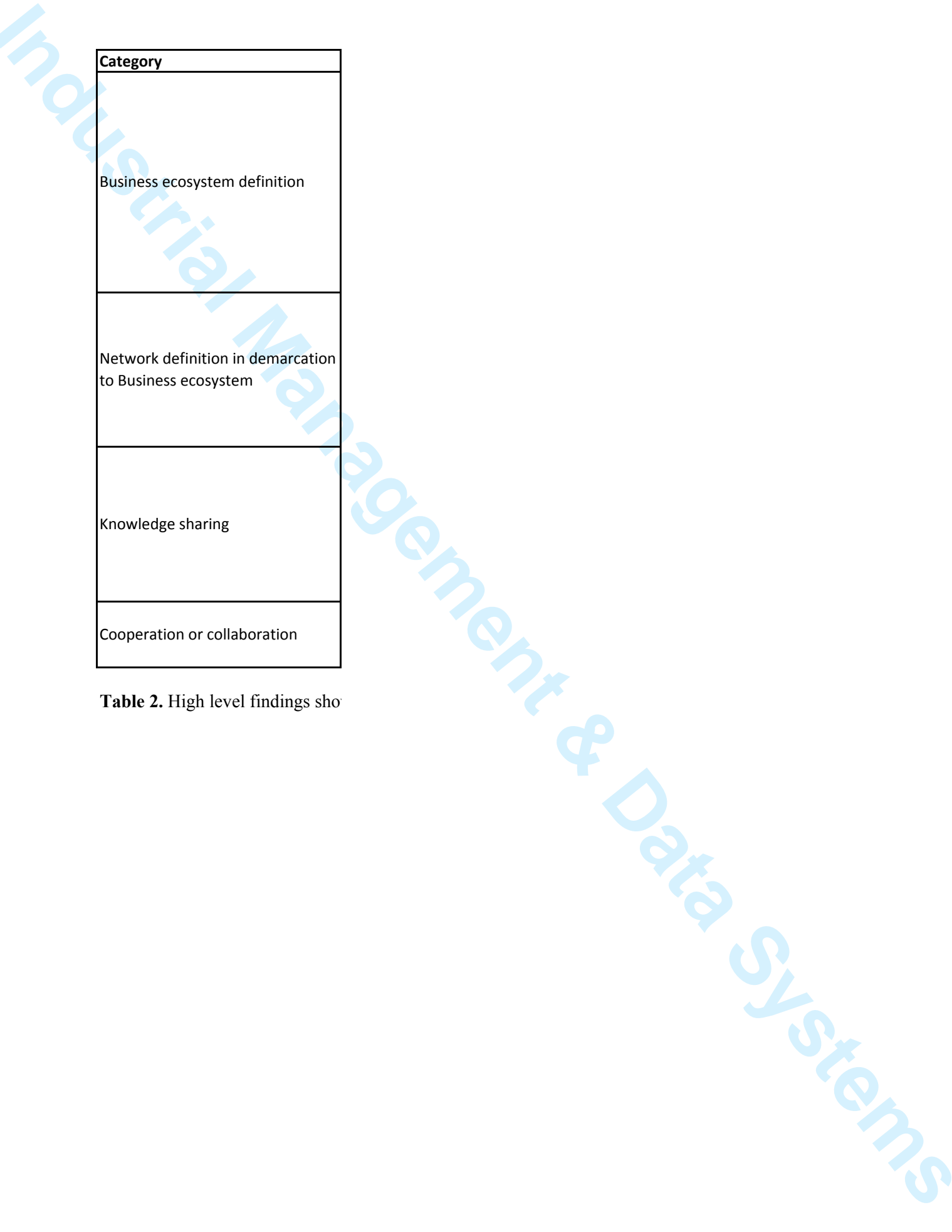
Network relations/ accessability	Industry
formal/partly closed	Automotive
formal/partly closed	Craft business
formal/partly closed	Biotechnology
formal/partly closed	Biotechnology
informal/open	Competitive Sports
formal/partly closed	IT Technology
informal/open	Competitive Sports
loosely connected/ formal and informal relations/Open	EU Business Ecosystem development (Germany)
loosely connected/ formal and informal relations/Open	EU Business Ecosystem development (Germany)
loosely connected/ formal and informal relations/Open	EU Business Ecosystem development (Italy)

hey are working with (own table).

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Category
Business ecosystem definition
Network definition in demarcation to Business ecosystem
Knowledge sharing
Cooperation or collaboration

Table 2. High level findings sho



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3	Main findings
4	Business ecosystem are bigger than networks as a structural entity or platform
5	economic strength field as defining element for the business ecosystem
6	Business ecosystem as top down development possible, such as from political structures and
7	funding and and as botton up development around a grown economic strength field
8	
9	network as structural entity or platform within the Business ecosystem
10	use network elements as structural elements, to build up contacts and connect members of
11	the Business Ecosystem (network elements as a tool or instrument)
12	not all actors in interaction within the business ecosystem
13	Business ecosystem as the environment of the network
14	network as a governance entity
15	Same interest, such as common goals, defines networks
16	Different network structures depend on the goal of the network
17	
18	formal and informal relations as part of network structure as structural elements for
19	connection and interaction
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21	network is a tool within the business ecosystem to exchange resources (such as knowledge)
22	different network structures in Business ecosystems are used for different knowledge
23	exchange
24	distinct knowledge sharing mechanisms in different network structures
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27	Tacit knowledge is shared mainly in closed structures (formal or informal control high)
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29	Innovation happens on the edge of networks or clusters within Business ecosystems
30	characterised by trust and exchange
31	collaboration and cooperation is on the bottom line of all interaction and exchange
32	Driven by having the same goal and interest
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wing the most frequently mentioned themes (own table).

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	<u>Structure</u>		<u>Content</u>			
	structure as governance entity (structure as a platform)	structure as connecting elements (structure as an instrument to connect actors)	Innovation potential	Knowledge exchange	goal orientation	Environment
Business ecosystem	broad platform, big structural governance entity	network structures (formal and informal) as connecting elements	high, combining existent clusters and networks (new combinations possible)	explicit knowledge on Business Ecosystem level, know how on lower levels	broad, economic strength orientated	economic strength field, ever changing environment
Business Network	smaller platform, own structural governance entity, connected to other networks in the business ecosystem	network structures (formal and informal) as connecting elements	depends on the goal of the network	know how easier to exchange in formal networks	strong goal orientation	business ecosystem and other networks in the system, changing environment, networks partly only temporarily existent
Project groups/working groups	smaller platform, often developing out of networks for certain project realisation	network structures (formal and informal) as connecting elements, focus on formal structures	depends on the goal of the working group, implementation potential is high	very formalised, know how exchange easy	strong goal orientation	networks and business ecosystem
Cooperation	dual partner platform, often developing out of networks for certain project realisation	more formal structures	Innovation realisation high	very formalised, know how exchange easy	strong goal orientation	working groups, networks, business ecosystem

Table 3. High level findings showing the most frequently mentioned themes (own table).

<u>Context</u>		<u>Process</u>			
partners involved	accessability	connection	interaction	exchange	governance ability
high variety of actors, loose connections, not all partners connected by network connections (formal, informal)	open	loose connections need to be build up	not all partners in interaction	not all partners in exchange	low, formal and informal mechanisms if connections exist
all partners connected by either formal or informal relations	open/ half open or closed	all partners connected	not all partners in interaction	not all partners in exchange	formal and informal mechanisms if connections exist
most of the partners connected by formal contracts	closed	all partners connected	all partners in interaction	all partners in exchange	high, strong formal connection
all of the partners connected by formal contracts	closed	all partners connected	all partners in interaction	all partners in exchange	high, strong formal connection

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