

INNOVATIONS IN ORGANISATIONS: AN INTEGRATIVE FRAMEWORK

Abstract. Current research on innovations builds extensively on network analysis demonstrating how different characteristics of social networks affect the ability of organisations to secure a continuous flow of innovation. This research, however, is highly fragmented, emphasising different features of social networks having an effect on various types of innovation at different organisational levels. The result is a plethora of research findings that do not systematically inform the subject matter or provide clear guidance for practitioners in organisations. In this paper, we address this gap and propose an integrative framework to help bring the divergent streams of research together and contribute to a better understanding of organisational innovation. We propose to distinguish between two dimensions: innovation type and organisational level. These distinctions robustly describe characteristic organisational contexts in which innovation takes place. We conclude by proposing for each organisational context how specific network characteristics affect innovation.

Key words: *innovations, social networks, organisational context*

Introduction

The ability to innovate is considered one of the key features of modern organisations allowing them to achieve a competitive advantage and ensure their long-term survival. Organisations' ability to innovate is often linked with the ideas of social networks within and between organisations. While social networks are increasingly prominent in innovation research, there is a lack of common frameworks and theories to help integrate the highly fragmented research. The purpose of this paper is to examine the ways in which current research has linked social networks to innovation in organisations

* Helena Kovačič, PhD, Assistant Professor, Faculty of Social Sciences, University of Ljubljana; Andrej Rus, PhD, Professor, Faculty of Social Sciences, University in Ljubljana.

and to offer an integrative framework for bringing the diverse streams of research under a common conceptual umbrella.

While the network perspective may seem natural today, it is a relatively new way to look at organisations. Until recently, economists and organisational theorists used to view organisations as isolated agents interacting with each other through the price mechanism on the market (Williamson, 1975; Teece, 1996). Today, it is commonly recognised that successful organisations are associated with flexibility and specialisation (Piore and Sabel, 1984) because they provide them with the ability to identify market opportunities and respond faster to newly arising customer demand. The search for an organisational form that would allow both specialisation and flexibility to flourish within the same organisation in spite of their implicit contradiction has brought social networks to the centre stage of organisational design. This has happened gradually as the firms' specialisations allowed them to focus on core activities and deepen their specialised knowledge. Innovation that takes place within organisations relies on knowledge that is often tacit (Polanyi, 1966) and hard to articulate (Nelson and Winter, 1982). Communication processes within organisations thus become vital as individuals need to be embedded in dense communication networks in order to easily share knowledge across their specialities, organisational functions, and divisions. On the other hand, organisations' specialisations have also led to a greater division of labour between different organisations, creating higher levels of internal and external interdependence that require the building of relations within and between organisations. For example, organisations focused on developments in technology and with access to the needed innovation development infrastructure may not have the knowledge required for putting new products on the market. Organisations have become compelled to cooperate despite their own hierarchical rigidity in order to access those critical resources they did not possess internally (Todeva and Knoke, 2005) and thus to foster innovation. Technical progress and the dramatic reduction in information and communication costs have broadened possibilities to accelerate innovative activities by engaging in knowledge and innovation networks.

In the last 20 years we have witnessed the accumulation of a vast body of literature looking at the effects of different kinds of network relationships on the innovative performance of organisations. However, this literature remains fragmented. Several strains of literature on innovation seem to exist side by side without much effort at integration. This paper attempts to fill this void and provides an integrative framework for linking innovations with organisational networks and organisational structures.

Theoretical perspectives on innovation

Definition and theories of innovation

To understand the main rationale behind innovations in organisations, we first need to define the concept of innovation as well as discuss and elaborate on the different forms of innovation. Innovation has consistently been defined as the creation or adoption of an idea or behaviour new to the organisation (Daft, 1978: 197). Kanter (1983: 20) further developed this definition and defined innovation as the process of bringing any new problem-solving idea into use. Similarly, Thompson (1967: 2) defined innovation as “the generation, acceptance and implementation of new ideas, processes, products and services”. Here the emphasis is that innovation has only occurred if new knowledge has been implemented or commercialised in some way, which is similar to Schumpeter’s essential feature of innovation as the one being carried out in practice (Schumpeter, 1942). Schumpeter was one of the first to lay out a clear concept of innovation. He considered innovation as an essential driver of competitiveness and economic dynamics.

For Schumpeter (1934), innovations are introduced to the market by entrepreneurs who create and introduce innovations and hence establish “creative destruction” as an essential ingredient of economic development. In his later work, he observed that innovation also requires resources such as R&D and design. He focused on discontinuous (and intentional) changes.

There are several ways to classify innovations. Innovation theorists have distinguished administrative innovations that involve changes in structure and administrative processes from technical innovations that are directly related to the primary work activity of an organisation (Damanpour, 1988). The most widely cited theory is Daft’s (1978) dual-core model of organisational innovation. The model suggests that technical innovation is a bottom-up process that originates deep in the organisation’s technical core while administrative ideas and innovations originate with administrators or upper-level managers who initiate a top-down adoption and implementation process. Following Schumpeter’s theory of innovation, studies of technological innovation have distinguished between incremental and radical innovation (Tushman and Romanelli, 1985), which is the distinction most used in innovation studies. The categories of radical and incremental innovation are intended as ends of a continuum representing the level of new knowledge embedded in an innovation and are commonly used within typologies that attempt to characterise a product’s or process’ degree of innovativeness. Incremental innovation implies a linear, cumulative change in a process or product, representing minor improvements or simple

adjustments in current technology. For organisations, small improvements in existing products and operations deliver ever greater value to customers. On the other hand, radical innovations are nonlinear changes, representing significant departures from existing practice or knowledge. Radical innovation requires a very different culture to sustain it than for incremental innovation.

In response to the increasing complexity of environments and organisations, Teece (1998) argues that different organisational arrangements are suited to various types of competitive environments and differing types of innovation. He distinguishes between autonomous and systemic innovations that are fundamental to the choice of organisational design and to the capabilities needed to produce the innovation. When innovation is autonomous, it can be managed within the decentralised organisational structure. Systemic innovations, on the other hand, require information sharing and coordinated adjustments throughout an entire system and favour integrated organisational structures.

Types of innovation also differ for their targets. Some may be located inside organisations like architectural innovations that apply technological or process advances to fundamentally change some component or element of their business. While some innovations are aimed at current customers, others may be delivered to an existing market that lies beyond a company's current customer base. Still others may be focused on serving an entirely new market that has yet to be clearly defined (Tushman and O'Reilly, 2002). Most product innovations are sustaining, meaning they provide better quality or additional functioning for a higher price to the existing customers. Innovations that target new customers that lie beyond the company's current customer base are called disruptive innovations (Bower and Christensen, 1995). They are distinct from other types of innovations in that they are targeted to a new market by offering simpler, good-enough alternatives and are believed to have a major impact on industry structures.

Network perspective

Theoretical perspectives on innovation have clearly shown that for innovation to occur something more than the acquisition or generation of knowledge is required: the knowledge must be put into action, resulting for example in new or altered business processes within the organisation, or changes in the products and services provided. Because knowledge is directly linked with the individual and its experience, innovation inherently involves the joining of people to produce a coordinated action that leads to innovation. Research shows that the ability to transfer knowledge effectively among individuals is critical to innovation (Nielsen, 2009; Wang,

2010) and a host of other organisational processes and outcomes, including the transfer of best practices (Szulanski, 1996), new product development (Hansen, 1999) and organisational survival (Baum and Ingram, 1998).

The nature of relationships and the assets that are rooted in them have manifested themselves in prior research as strength of relations and trust. Accumulated evidence suggests that strong ties enable firms and units to transfer knowledge (Uzzi, 1996; Hansen, 1999; Reagans and McEvily, 2003). In this line of literature, strength of ties is characterised as a frequency of relations (Hansen, 1999) which indicates that the strength of ties increases with the frequency of interaction and communication. According to this perspective, we can assume that more frequent communication leads to more effective communication.

On the network level, the number of observed ties over all possible ties (i.e. network density) is an important feature of social structure often viewed as the network's cohesiveness. Its positive implications for the network's performance have been presented by several authors, specifically in connection with the building of trust in networks (Granovetter, 1985). Those strongly knit ties are important instruments for avoiding potential strategic advantages accruing to any actor in the network and have, therefore, a positive relationship with collective action. Accordingly, a strong interpersonal connection is expected to have a positive effect on the ease of knowledge transfer. In times of crisis, trust is what leads to cooperation (Krackhardt and Stern, 1988).

In addition, people in different positions within the social network have access to different information and knowledge. This indicates that one's position within an overall pattern of relationships determines whether the knowledge that exists within the network can be used effectively. People holding a central network position have the opportunity to learn from many others in the network and contribute to the diversity of knowledge. The measure of centrality in a communication network has been empirically associated with several important variables that might lead to a superior performance, like influence, cognition, attitudes to technology and involvement in innovation (Ibarra, 1992). Besides centrality, network position from a brokerage point of view can also provide interesting insights into the innovation process since people connecting separate parts of a network have access to diverse sources of information and knowledge (Burt, 2004).

If we look closely at the content of social ties, we see that, like many other organisational processes, the knowledge transfer process is performed in the context of various kinds of relations which may commonly occur in organisations. Although they frequently overlap in organisations (Ibarra, 1992), friendship and advice networks perform distinct functions.

Advice networks are closely related to organisational power (Brass, 1992; Ibarra, 1992), contribute to work-related knowledge (Morrison, 2002) and job performance (Sparrowe et al., 2001) and are in use to solve problems and provide technical information (Krackhardt and Hanson, 1993).

Innovation, organisation and social networks

In this part of the paper, we present the link between social networks and innovations. We examine the nature of this relationship, first by reviewing the recent literature from which the findings in this paper are presented. We perform this review by distinguishing between individual, organisational and interorganisational levels of analysis because the networks at these three levels involve different types of actors and therefore perform differently. This is also the first step in building an integrated framework. The second step follows in the next section where we look at how networks at various organisational levels contribute to different types of innovation and join both aspects within an integrative framework.

Individual level

At the individual level, scholars seek to understand the forces that stimulate innovation in organisations and enhance individuals' ability to come up with novel and useful solutions and to implement them. In the search for the antecedents of innovation on the individual level of analysis, the social network view provides insights into the individual's structural position, which appears to be a determining factor in fostering innovation (Ibarra, 1992; Burt, 2004). By studying a full network in one advertising and public relations agency, Ibarra (1992) extends previous innovation research to both the individual level of analysis and the role of informal networks as a source of behaviourally- rather than reputationally-based power. Individuals' innovation involvement, or the roles they play in technical and administrative innovation processes, was used here as an indicator of the exercise of power. The study findings reveal that network centrality, combining five centrality indexes - communication, advice, support, influence, and friendship - into a single index, mediated the effects of the individual attributes and formal position on innovation involvement (Ibarra, 1992).

The personal networks of top managers also play an important role in the innovation process. They provide access to and control over resources and knowledge (Uzzi, 1997). Research shows that the influence of managerial ties on firm innovation is indirect. Business ties provide access to resources and can exert a significant direct impact on knowledge creation processes, which then impact innovation (Shu et al., 2012). A diverse communication network increases the number of information sources, and diversity in the

expertise of an organisation increases its capacity to innovate (Cohen and Levinthal, 1990). Therefore, roles focusing more on communication with individuals outside of the division seem to be preferable in the early phases of an innovation project (Ancona and Caldwell, 1997). In the later phases of the innovation process, communication should be more internally oriented since in this stage the focus is more on meeting the set goals.

Unlike large firms, small and medium enterprises (SMEs) tend to have limited financial resources and insufficient managerial infrastructure, and therefore rely less on costly research and development (R&D) investment for innovation activities and need to exploit other facilitating factors. Wang et al. (2010) in their study of 49 Taiwanese companies in the bicycle industry investigated the contributions of knowledge acquisition and knowledge absorptive capacity to an SME's product innovation. The study showed that, aside from the R&D investment, the depth and breadth of an owner's prior technical experience contributed significantly to the SME's knowledge absorptive capacity. These results are in line with previous studies which showed that top managers of organisations with a superior performance engaged in more knowledge and information acquisition than the managers of organisations with a mediocre performance (Daft et al., 1998).

Organisational level

Before the 1990s most innovation research was conducted at the organisational level of analysis. A consistent finding of these studies was that those in positions of authority most strongly influence innovation (Van de Ven, 1986) because they have greater access to information and resource flows. Intraorganisational studies that used systematic indicators of network position (Brass, 1992; Krackhardt, 1992; Tushman and Romanelli, 1985) also indicate that network centrality, which may differ from one's formal position, is a significant source of power (Brass, 1992). Exploring the dual-core model, research at the organisational level of analysis indicates that variables pertaining to an organisation's formal hierarchy, such as centralisation, relate more to administrative than to technical innovation (Daft, 1978; Damanpour, 1988).

Dougherty and Hardy (1996) in their research on sustained product innovation regarding 40 cases of new product development in 15 large organisations reveal that the conceptualisation of power must extend beyond the personal and encompass the organisational level. The authors found that when product innovation occurred successfully it was powered by the operational and middle levels of the organisational hierarchies and based mostly on the particular networks, connections and experiences of lower-level managers. They also revealed that primary reliance on such personal power is inherently ineffective for sustained innovation.

At the organisational level, the links between the organisational units also contribute to innovation. A central position in a network provides a unit with important access to new knowledge. Researchers found that its impact on business unit innovation and performance may depend on the extent to which a unit can absorb such new knowledge. Cohen and Levinthal (1990) labelled this ability “absorptive capacity”, which is a unit’s ability to recognise the value of new, external information, assimilate it and apply it for commercial ends (Cohen and Levinthal, 1990: 128).

Tsai (2001) extended prior research and in his study of interunit networks of two large multinational companies found that a unit’s innovative capability significantly increased by its centrality in the intraorganisational network. At the same time, organisational units that received more information and knowledge due to their centrality in information networks performed better in innovation if they had a higher knowledge absorptive capacity. These results suggest that a unit has to invest significantly in its absorptive capacity when expanding its network links.

Evidence gathered hitherto also suggests that the strength of ties affects firms and units in the transfer knowledge (Hansen, 1999; Reagans and McEvily, 2003). Based on Granovetter’s (1973) argument about the strength of weak ties, distant and infrequent relationships (i.e., weak ties) appear well suited for the transfer of novel information, while in contrast strong ties are likely to lead to redundant information because they tend to occur among a small group of actors in which everyone knows what the others know. In his study of the interdivisional network in an electronics company, Hansen (1999) found that weak interunit ties speed up projects when knowledge is not complex but slow them down when knowledge is highly complex. This means that both weak and strong relationships have the potential to contribute to the efficient sharing of knowledge among units.

The notion that firms can improve their innovativeness by establishing relations among employees and with users and customers for knowledge has become prominent in innovation studies. In a study of 169 Danish firms, Foss et al. (2011) studied the effect of interaction with customers on innovation performance. The study shows that the link from customer knowledge to innovation is completely mediated by new organisational practices, notably, intensive vertical and lateral communication, rewarding employees for sharing and acquiring knowledge, and high levels of delegation of decision rights. Partanen et al. (2011) also studied the effect of ties, but with customers and distribution partners. The findings of their study of four innovative SMEs in Finland reveal that, for successful commercialisation, each type of innovation requires a certain type and strength of relationship. Both types of radical innovation need strong collaborative ties with customers, whereas incremental innovations require strong collaborative ties with distribution partners.

Interorganisational level

Innovation is increasingly recognised as being the result of the combination of the various knowledge and expertise that exist within different organisations. Therefore, organisations are trying to survive and seeking a competitive advantage through cooperation and collaboration with different kinds of external sources for innovation. By entering into cooperation linkages, organisations establish relations between each other to access critical resources (Gulati and Gargiulo, 1999) and to join efforts in sharing knowledge within innovation activities. Resources that become available to firms through their interorganisational relationships have been referred to as network resources (Gulati and Gargiulo, 1999). In their literature review, Pettigrew et al. (2004) found that a lack of external ties limits firms' knowledge base in the long term and ultimately reduces their ability to enter into exchange relationships.

The relationship between interfirm collaborative linkages and a firm's innovation output was examined by Ahuja (2000) in a study of 97 firms in the chemicals industry. His study provides interesting results where indirect ties do contribute to innovation output; however, the magnitude of this contribution is significantly smaller than the contribution made by direct ties. This study also reveals that many structural holes are associated with reduced innovation output.

Similarity is found to be one of the most common mechanisms that may lead to more intense and frequent interactions between network members (Baum et al. 2003). Collaboration between similar partners may lead to better knowledge transfer due to their similar routines, still their similarity may be less likely to complement each other's needs and offer new skills and knowledge. Luo and Deng (2009) studied the effects of partner similarity on innovation. Results of an analysis of 176 biotechnology firms show that similar partners in an alliance contribute to the firm's innovation up to a threshold beyond which additional similar partners can lead to a decrease in innovation. They also found that the effect of partner similarity on innovation is positively moderated by organisational ageing and the industry norm of collaboration upon the firm's founding (network density).

The relationship between partner characteristics and alliance outcomes is also mediated by the quality of the relationship. In a study of 120 international strategic alliances, Nielsen and Nielsen (2009) distinguished between two ISA outcomes, learning and innovation. They found that these two outcomes were influenced by a firm's ability and willingness to transfer knowledge, mediated by the knowledge tacitness (the codifiability and transferability of the knowledge to be shared) and trust between the partners (the quality of the relationship). Innovation was measured as an outcome in terms of modification/improvements to products/processes.

In the social networks literature, a consensus remains about the benefits of firms' positions in interorganisational networks for the firms' outcomes. Schilling and Phelps (2007) examined the impact of the structure of industry-level alliance networks on member firm innovation. Using longitudinal data of 169 firms operating in 11 alliance networks, they tested the impact of two network properties – clustering and reach – on the innovative performance and found that firms embedded in alliance networks with both high clustering and high reach exhibited significantly higher firm patenting.

An integrative framework

In the previous section, we reviewed the current literature linking networks and innovations. The literature on innovation in organisations clearly shows that organisations benefit from engaging in relationships over innovation with stakeholders at all three organisational levels. Organisations are more likely to be innovators if they cooperate with others, even in the absence of R&D investment (DePropris, 2002), than if they do not.

The purpose of this section is to build a framework for integrating the highly fragmented research on networks, innovation and organisations. Despite the significant number of studies examining the effect of different aspects of social networks on organisations' innovativeness during the last 20 years, little attempt has been made to systematically translate these findings into a comprehensive review of current knowledge (e.g. Pittaway et al., 2004). A review conducted by Pittaway et al. in 2004 demonstrates the principle benefits of networking on innovation on the interorganisational level. There are also very few attempts to systematically integrate research that examines the relationship between networking and different forms of innovations, although various authors have provided clear implications for how properties of social networks operating at different organisational levels can contribute to different kinds of innovations. Daft (1978), for example, argues that technical and administrative types of innovation require different decision processes and thus may require the mobilisation of different sources of power. This suggests that a particular type of innovation is linked to different power networks involving various organisational levels. Henderson and Clark (1990) propose that technological innovation involving system architecture disrupts existing information and knowledge bases and requires a realignment of information and knowledge streams. Their theory implies that distinct types of technological innovation may require different knowledge and information networks at different organisational levels. Similarly, Markides (2006) argues that while incremental innovations provide short-term revenue, disruptive innovations usually entail a change in a business model, making them harder to implement. Various kinds of

innovations, from business-model innovations to radical technological innovations, create different kinds of markets, pose new challenges for established firms, and require different intra- and inter-organisational networks. While existing theorising holds many implications for linking networks and organisations with innovation, the efforts to do so explicitly remain scarce. The few exceptions are the studies that attempted to link particular network relationships with different kinds of innovations (e.g. DePropriis, 2002; Perntanen et al., 2011) but they focused solely on interorganisational cooperative relations with suppliers and customers.

In order to integrate organisational analysis with network characteristics that drive different types of innovations, we build our framework on two dimensions. First, we distinguish between three different levels of organisational context that require separate levels of analysis: individual, organisational and interorganisational. Second, we evaluate network characteristics in terms of two contrasting dimensions of innovations proposed by Christensen (1997): sustaining and disruptive. Sustaining innovations are innovations that leverage existing technology and service existing customers, while disruptive innovations leverage existing technology to create new revenue streams. The result is a two-by-three table that defines six distinctive contexts of innovation. The fields in Table 1 contain the key network characteristics noted in the literature as contributing to the particular type of innovation in a given type of organisational context.

Table 1: INTEGRATIVE FRAMEWORK OF ORGANISATIONAL INNOVATION NETWORKS (Source: own construction)

	Individual level	Organisational level	Interorganisational level
Sustaining	Centrality Strong ties Closeness Vertical ties	Tightly coupled system Density Concentrated organisational power Centrality	Strategic alliances Highly structured Similarity between partners Division of labour Competence complementarity Goal-driven cooperation
Disruptive	Central position between different networks Weak vertical ties Bridging ties to external groups	Loosely coupled management system Low centralisation of power Units set their own direction Good at spotting changes and opportunities in the marketplace	Ecosystem Loosely coupled Similarity is low Heterogeneity and complementarity Trust Diversity Self-governance Common values

Let us first consider the first row of the table that features sustaining innovation as defined by Christensen above (1997). This type of innovation may include incremental or even radical technological innovation, but its defining characteristics are that it addresses the same market and the same customers. While products and services change and improve due to the innovation, they are intended for the existing customers. Since companies strive to meet and exceed the expectations of existing markets, a sustaining innovation therefore depends on the acquisition, accumulation and mobilisation of knowledge that is directed toward a known customer base. The key challenge for organisations is therefore to mobilise sufficient resources for innovations to occur. The central problem to overcome in any resource mobilisation situation is the problem of collective action (Olson, 1965). While organisations usually employ selective incentives to prevent free riding, they need to go further in order to release the creative energies needed for innovation. They need to apply positive strategies so as to motivate their employees to release their knowledge and creative energy and apply it in the collective effort for the benefit of their organisation. To solve this problem, organisations tend to use various strategies that enhance the cohesion of their teams, reduce the gap between the formal and informal structures and establish strong collaborative links with other organisations.

On the individual level, we thus expect to find individual innovativeness to be associated with centrality, closeness and strong ties. Individuals who occupy a central location in a communication and advice network within a team or a unit would be best informed and exposed to the wider range of diverse ideas that emerge in the group. This gives them an advantage of being aware of ideas being explored on a specific topic. Whereas weak ties appear well suited to the transfer of new knowledge, they impede the transfer of complex knowledge, which tends to require a strong tie between the two parties to a transfer (Hansen, 1999). Closeness and strong relations to many of his/her colleagues can help a centrally located individual mobilise the ideas of several people and bring them together to solve a problem and come up with improvements to old products or services or innovate new ones.

On the organisational level, the cohesiveness of teams can enhance their performance in sustaining innovation because of the density of the communication structure and the fast knowledge transfer, sharing of ideas, and learning. The research which shows that a diversity of teams leads to a better innovation performance is consistent with our argument since it is a high density of diverse teams that helps integrate diverse knowledge into a productive team. Ongoing social ties are believed to shape an actor's expectations and opportunities in a way that differs from the economic logic of market behaviour (Uzzi, 1996) which is reflected in the distinctive

structure and quality of those ties (Powell, 1990). Close relationships are distinctive for their thick information exchange of tacit and proprietary know-how (Helper, 1990). Similarly, research points out that creating teams from among members who come from different organisational units and organisational functions such as R&D, design, marketing and finance can accelerate the innovation process in organisations by improving communication and collaboration among functions that would otherwise approach a new product or service in a sequential manner (Kanter, 1983). Multifunctional projects and teams are integrative strategies that build islands of cohesion within functionally differentiated organisations.

On the interorganisational level, companies work with customers, suppliers and competitors to mobilise knowledge for innovation. Since the focus of sustaining innovation is to meet and exceed customer needs, close relations with customers are perceived as essential. Organisations also work closely with suppliers. The Toyota production system is perhaps the best known example of the close integration of suppliers in the production of vehicles from the design phase to the final assembly (Liker, 2004). The system encourages close collaboration with suppliers in order to capitalise on supplier innovation. The system is based on forging close ties that involve the sharing of information, knowledge and capital. Working with competitors usually takes the form of strategic alliances. Competitors establish joint ventures in order to combine complementary competencies for new product development. The governance of strategic alliances is based on mutual trust that emerges from strong ties and close relationships among executives of the collaborating companies. Sharing capital and resources requires high levels of trust, explaining the finding by Gulati and Gargiulo (1999) that new strategic alliances are best predicted by the number of previous alliances and collaborative ties among competitors. Knowing each other well seems to be a significant factor in the formation of new strategic alliances among competing companies.

The second line in the table refers to disruptive innovation. Disruptive innovation arises when companies offer new goods or services that are cheap, unreliable and poorer in quality but address the needs of customers who were hitherto priced out of the market by the offering of existing companies (Christensen et al., 2015). The new players are in fact opening a new market with their new business models and new ways of bundling the goods and services. Such innovation requires novel thinking regarding the existing industry, its business models, and a skill in detecting the opportunities provided by the weaknesses of the existing market arrangements. The strategy of acquiring, accumulating and mobilising knowledge does not provide the conditions for the creation of disruptive innovation. The existing knowledge often confines the view of the future and limits the perceptions of new

problems, opportunities and solutions. The suitable conditions for disruptive innovation consist of highly heterogeneous knowledge resources that are combined in highly randomised ways. Instead of the accumulation of topical knowledge, there needs to be a large network of seemingly unrelated knowledge pools.

Disruptive innovation on the individual level requires centrality between different networks rather than within an organisation. Business ties provide access to different resources and can exert a significant direct impact on knowledge creation processes, which then impact innovation (Shu et al., 2012). At the same time, bridging ties (Burt, 2004) bring information and control benefits to the managers who can broker structural holes. Individuals who are involved in multiple knowledge networks can be linked with weak ties and can be peripheral in all of them but their betweenness provides them with a unique overview of problems and solutions coming from different professional worlds. They derive their advantage partly by controlling the bridging ties among professional networks yet their key benefit lies not in brokerage but in their ability to spot opportunities, combine diverse knowledge pools, and match problems and solutions from different areas of expertise.

On the organisational level, disruptive innovation requires high degrees of decentralisation and broad leeway for units to set their own direction. Loosely coupled management systems provide autonomy for business units to pursue opportunities as they detect them and act on the feedback of the market. Such arrangements are very difficult to secure in business organisations due to shareholder pressures for cost controls, accountability and performance. For these reasons, most disruptive innovations arise outside of big corporations where the freedom of entrepreneurship is naturally merged with the spontaneity of the structure.

On the interorganisational level, disruptive innovation requires loosely coupled networks of individuals and firms that base their relations on common values, trust, and self-governance. Trust is important for the effective transfer of knowledge between these partners since it increases partners' willingness to commit to helping other partners understand new external knowledge (Lane et al., 2001) and reflects the belief that a partner will fulfil its obligations in the relationship (Inkpen, 2000). Knowledge sharing of the kind promoted by the Open Source Movement provides a common infrastructure for accelerated learning among actors in open-ended networks. These networks exhibit no hierarchy, are replete with weak ties and structural holes and are ever expanding into new knowledge pools and professional communities. Such interorganisational arrangements are best characterised as ecosystems where members are feeding off one another without having to rely on strong ties that might lead to dependencies. Disruptive

innovation arises in such contexts precisely because they bring distant worlds into sufficient proximity to spur the interaction and exchange of diverse information and knowledge, thereby opening up new vistas, new approaches and new combinations that would otherwise be hard to foresee.

Conclusion

Despite the large and diverse body of literature in the area of innovation in organisations, effectively managing this activity provides numerous challenges for companies. Innovation is not only the result of the actions of creative employees, but also the outcome of collaboration among various actors. In this paper, we focused on increasing our understanding of the relevance of the relationships among these actors for the process of innovation.

The research on innovation is highly fragmented and provides many findings that seemingly point in different directions. We tried to make better sense of the innovation research in three related but distinct areas of research: types of innovation, organisations, and social networks. It is important to distinguish the various types of innovation because “different types of innovation require different strategic approaches” (Christensen et al., 2015: 4). It is also important to understand the organisational context of innovation because organisations can concentrate huge amounts of resources whose effects depend on how they are deployed and organised. Finally, it is also very important to understand the ways in which the social networks of individuals and organisations enhance or inhibit the capacity of organisations and individuals to innovate. What is lacking in this research is a systematic attempt to bring these separate research streams together within a unified framework and to ask the question of which networks lead to which type of innovation in different organisational settings.

The framework that we provide is just that. It is not a unified theory of innovation. Instead, it offers a systematic way in which the different streams of research on innovation can be brought together. This constitutes one of the most important limitations of our research. However, we believe this open-ended nature of our framework is also its strongest element since it provides pointers to further research without trying to close this effort.

Our paper offers several important contributions for understanding the link between networks on innovations in organisations. First, we begin by describing different theoretical perspectives on innovation, highlighting the distinction between different types of innovation. Then, we discuss the network literature and explore the causal links between social networks and innovation. We systematically review the research to identify specific characteristics of intra- and inter-organisational networks that have effect

on innovation. Finally, we develop a framework for integrating different aspects and features of networks and mechanisms through which innovation is affected.

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