

KNOWLEDGE TRANSFER, INNOVATION AND SOCIAL NETWORKS APPROACH

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Abstract. *Modern society is dealing with a multitude of data, with predictions that by 2025 the produced data will amount to 160 zettabytes. A generation of useful information and derivation of knowledge from this data is becoming a laborious task, while transfer of relevant knowledge through social networks is becoming even more important. Although there are different definitions of social capital, there is a high level of compliance so that, unlike other concepts related to socio-economic development, social capital is unique because it is relational. It is obvious that the fundamental idea expressed in the concept of social capital is simple: social networks are important, they have value for people and organizations that are involved in this network. The aim of this paper is to analyze the role of social networks in the diffusion of knowledge and information and its contribution to the strengthening of innovative capacities. One of the main reasons for the growing interest in the role of social networks in the creation and transfer of knowledge is that most of the relevant knowledge today has an implicit character and cannot be easily transferred. The compilation method will be used in the paper for the purpose of reviewing existing theoretical and empirical research in this field. The method of description, as a procedure for simple description or reading of facts and processes, will be related to explanations of the notion of more important features of the described facts, their legality and causal connections and relationship.*

Key words: *knowledge diffusion, information, social networks, innovation, new economy.*

1. INTRODUCTION

One of the features of the transition from the 20th to the 21st century has been the emergence of knowledge economy which is directly based on the production, distribution and use of knowledge and information – functions on a completely different value creation logic than the old industrial economy. In the post-industrial debates, knowledge

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is recognised as the new raw material (Pratt 2014, 6) that can be traded, exchanged, and transported, as well as a carrier of productivity and economic growth, leading to a new focus on the role of information, technology and learning in economic performance (OECD 1996, 3). While early knowledge management approaches have focused on capturing, describing and transferring knowledge captured in documents and databases, newer approaches focus on communicative aspects and take a knowledge-in-action perspective (Riemer & Scifleet 2012, 1). „Knowledge-based societies need to manage the intangible assets that create knowledge, such as innovation, relationships, networks, and intellectual and informational capital“ (Parent et al. 2007, 81–82). The central thesis of the social network, as a structural component of social capital, can be summarized in the following words: a matter of attitude. In general terms, the social network can be broadly defined as an „arrangement of differentiated elements, a multitude of interconnected relationships“ (Agapitova 2003, 7).

There is also a relationship between social networks, knowledge and innovative performance. Knowledge becomes a key for successful innovative output. Innovations are based on the knowledge that exists in the firms, and also on the knowledge they acquire from various sources in the form of explicit and tacit knowledge, embedded in new skilled personnel, or subsystems (Saari & Haapasalo 2012, 36–37). Moreover, innovation studies have found that innovation is an interactive process and the central part of the required knowledge is often difficult to codify, so this is why close interaction among actors is important in the innovation process (Lundvall 1992).

These are the general hypothesis of the paper:

H1: Structural properties of networks can be in favor of entrepreneurship, innovation processes, technological change or employment dynamics.

H2: In practice, knowledge transfer has proven a difficult challenge, as information tends to „get stuck“ when it is required to be spread between individuals and professional boundaries.

2. THE IMPORTANCE OF KNOWLEDGE TRANSFER THROUGH SOCIAL NETWORKS

According to Professor Mathieu Weggeman of the Technical University of Eindhoven (Netherlands) *Knowledge is equal to the function of Information, Experience, Skills and Attitude* ($K=f(I*E*V*A)$) (Boersma 2004). It is not a new idea that knowledge plays an important role in the economy. Knowledge has been discussed (at least) since the time of the philosophical debates of Aristotle and Plato. Adam Smith referred to new layers of specialists who are men of speculation and who make important contributions to the production of economically useful knowledge (OECD 1996, 11). The beginning of the 21st century can be described as a time of rapid social change, when knowledge is quickly becoming the prime source of wealth in the world, not only for corporations and individuals but also – and perhaps even more so – for nations and societies (Parent et al. 2007, 81). Knowledge is increasingly recognized by modern organizations as their most important source to gain and sustain a competitive advantage (Jasimuddin 2005). „New knowledge provides new insights, increases efficiency and productivity, and may lead to new business opportunities. On a more aggregated level, these mechanisms have been extensively discussed in the literature on Jacobian (inter-industry) and Marshallian (intra-industry) externalities whereas more micro-oriented studies have examined recruitment

strategies and how mobility enhances learning capacities and learning sharing“ (Braunerhjelm et al. 2017, 5). In knowledge economy, the competitive advantage of organisations relies on the capability to adapt to the changing environment by the continuous generation and application of new knowledge as a valuable intangible asset. This specific capability is described as knowledge productivity (de Jong 2007). „This is the paradox of neo-classical economic studies: knowledge is everywhere, but the skill is in its application (or transfer)” (Pratt 2014, 8).

The diffusion (transfer) of knowledge is a fundamental aspect of economic activity. „Process of knowledge transfer is the dissemination of knowledge from one individual or group to another within the organization or between organizations” (Jasimuddin 2005, 38). Knowledge transfer combines processes, technology, and reinforced behaviors necessary to get the right information and expertise to the right people at the right time so they can act effectively and make good decisions¹. Examples of KT include (Koman & Kundrikova 2016, 609): spin-off companies; incubators and entrepreneur schemes; university-industry contracts and consultancy; licensing of university-originated intellectual property; other modes of knowledge transfer and technology transfer, e.g. work-based learning projects; knowledge transfer, knowledge origination and the knowledge exchange process; innovation, open innovation, and the generation of new ideas.

One of the hallmarks of the knowledge-based economy is the recognition that the diffusion of knowledge is just as significant as its creation, leading to increased attention to „*knowledge distribution networks*” and „*national systems of innovation*” (OECD 1996, 24). A critical factor for implementing successful knowledge transfer relates to the creation of well-connected networks of relationships. According to Social Network Analysis (SNA), social networking is a key factor in understanding knowledge creation processes (Gonzalez et al. 2015). Here, knowledge is understood as a socially constructed and shared resource (Kianto & Waajakoski 2010). With regard to purposes of knowledge management, social network analysis may help to evaluate the availability and distribution of critical knowledge and thus facilitate: (1) the strategic development of organisational knowledge; (2) transfer and sustainable conservation of implicit knowledge; (3) development of core competencies (like leadership development); (4) creation of opportunities to improve communication processes; (5) identification and support of communities of practice; (6) harmonisation of knowledge networks (after mergers and acquisitions) and (7) sustainable management of external relationships.²

Social networks are crucial for the exchange of resources that do not circulate easily through the market, like strategic information, business opportunities, referrals, advice, expertise, tacit knowledge and trust. „Knowledge networks” are a special case of social networks in which the links between the network represent shared or related knowledge. If social networks represent „who knows who”, then knowledge networks represent „who knows what”.³ Within industrial economics and business studies, „knowledge network” concepts have been applied to the theory of the firm, to studies on organizations, and to the analysis of strategic alliances for research, technology transfer, and standard setting

¹ See: Unlocking the Value of Knowledge Transfer: Create Extraordinary Value from What Your Company Already Knows, by Stemke Jeff, Internet, p. 2, available at: www.patinasolutions.com. Accessed March 12, 2018.

² See: Social Network Analysis: A Practical Method to Improve Knowledge Sharing, by Müller-Prothmann, Tobias Internet, p. 222, available at: <https://pdfs.semanticscholar.org/2367/3c3973ea1d7b855289bc374f56ff5d3aa0cd.pdf>

³ See: Collaborative Knowledge Management, Social Networks, and Organizational Learning, by Jones Patricia M., Internet, p. 3, available at: https://humansystems.arc.nasa.gov/publications/collab_know_paper.pdf

(see: Breschi & Lissoni 2004). We can distinguish between two forms of knowledge networks (see: Huggins & Johnston 2010, 460): (1) *contact networks*, through which firms source knowledge; and (2) *alliance networks*, through which firms collaborate to innovate. Networks in the form of alliances usually concern formalised collaboration and joint ventures, and other “contracted” relationships resulting in frequent and repeated interaction. Stenholm et al. (2017, 13–14) make a difference between complementary and synergistic knowledge networks. *Complementary Knowledge Networks* are motivated by the intent to disseminate pre-determined, project-specific knowledge across well-defined boundaries, which is likely to lead to the transfer of existing explicit knowledge rather than the creation of new tacit knowledge or synergies of knowledge. *Synergistic Knowledge Networks*, on the other hand, are motivated by a perception of developing synergies of knowledge through the interaction of most or all of the organizations’ knowledge bases. These types of alliances more likely lead to double-loop learning and spin-off innovations or process improvements, especially as more levels of the organizations get involved and project boundaries are relaxed.

Knowledge transfer related to a variety of mechanisms depends on the nature of knowledge and context. Since Polanyi (1966)⁴ argues that „we can know more than we can tell and we can know nothing without upon those things which we may not be able to tell”, based on epistemological distinctions of knowledge, fundamentally there are two basic types of knowledge: tacit and explicit. *Explicit knowledge* (codified, „knowing what”) is easily transferred because it can be encoded in a widely recognized symbol system, and traditionally it was the backbone of formal structural approaches. On the contrary *tacit knowledge* (uncodified, „knowing how”, „hidden knowledge”) is composed of insights or experiences of an individual that are difficult to articulate (Ghaznavi et al. 2012), and this kind of knowledge can be transferred only under exceptional conditions, it derives its value from being inimitable so it is difficult to leverage because it is difficult to codify (Koman & Kundrikova 2016, 608). Tacit knowledge is difficult to articulate, develops from direct experience, needs face-to-face interaction and shared experience (Forsten-Astikainen 2010, 15). “Focusing on explicit knowledge only, as well as taking a too narrow view of work, learning and innovation areas, involve the danger of erecting barriers of various kinds: functional and hierarchical, for instance; barriers to customers, suppliers and co-operation partners; or mental barriers which impede the generation, transfer and application of new knowledge. These not only hinder the short-term flow of knowledge but in the long term prove detrimental to a company’s innovation - and learning-ability”.⁵ Relationships play an important role in tacit knowledge transfer (Busch & Richards 2005). The companies McKinsey and Bain are using „people-to-people” methods to transfer knowledge within the company. Employees exchange tacit knowledge over telephone, email or video conferences and create realistic solutions (Lobner 2013, 12). For example Daimler-Benz initial collaboration with Swatch was motivated by knowledge transfer of automotive know-how together with precision engineering and micro design to generate value by combining their knowledge. Both companies generated a new product, the „Smart car”, and increased their own company value through the network (Lobner 2013, 23). Fledging enterprises that can mobilize tacit knowledge therefore enjoy a substantial advantage over rivals that cannot. Take the example of the diffusion of knowledge and information in the industry of high

⁴ Polanyi (1966) conceptualizes knowledge as being both explicit (objective and concrete) and tacit (subjective and implicit).

⁵ See: Towards Knowledge Networking, by Seufert Andreas, von Krogh Georg, Back Andrea, Internet, p. 7-8, available at: <https://www.alexandria.unisg.ch/213591/1/KNN.pdf>

technology products and services in the Silicon Valley, where the productivity of the region depends on social capital based on formal and informal networks of interaction and communication at the institutional level. The network of cooperative relationships is created between firms, major research centers, governments, law firms, business associations, stock exchanges and the labor market, creating the basis for a faster flow of knowledge and innovation in the enterprise.

Organizational knowledge is one of the most valuable assets that companies own today and, on the other hand, as shown in Table 1, social capital can „transform” the knowledge resources of a firm into the competencies which are aimed at realizing different goals. The value of the suitable competencies for explicit and tacit knowledge resources is then realized in innovativeness, gradual improvements, and operational effectiveness (Smedlund 2008).

Table 1 Social capital as a value driver in a firm

Tacit (uncodified)	SOCIAL CAPITAL	Competencies aimed at improving current business →	Improvements
Explicit (codified)		Competencies aimed at managing current businesses efficiently →	Operational effectiveness
<i>Intangible assets in the form of knowledge</i>		<i>Competencies</i>	<i>Value</i>

Source: adapted from Smedlund 2008, 67.

Fundamental network challenges that are essential to the contemporary knowledge-based management of innovation systems are: 1. cultural differences; 2. The not-invented-here syndrome (for reasons of prestige, external knowledge or knowledge from other companies is often rejected within a company); 3: strong - weak ties; 4. The free rider problem (companies enjoy the benefits of effective knowledge share without any contribution to them) and 5. intellectual property (Lobner 2013, 22–33).

3. SOCIAL NETWORKS AS INTERACTIVE PRACTICE OF KNOWLEDGE MANAGEMENT AND INNOVATIVENESS

Social networks offer the link and medium in which knowledge travels and transfers among individuals and organizations with different backgrounds, resources, predisposition and insights (Hu & Racherla 2008, 303).

To understand the role of social networks in the transmission of knowledge and information, it is necessary to examine the role of the so-called „strong” and „weak” ties (Granovetter 1973). Each approach offers rather opposite opinions and different options available for the creation and transfer of knowledge and information. Collectively, social ties are indicators of the social capital contained within a given network. The strength of the ties is a reflection of the combination of emotional intensity and reciprocal services that characterize this relationship. As is well known, strong ties (*bonding ties*) are contacts and interactions between individuals within the same (homogeneous, internally oriented) groups, while the weak ties (*bridging ties*) are ties between the groups with different characteristics. *Strong ties* are based on trust and they ensure the flow of information and knowledge transfer, strengthening the existing structure. The argument in favor of strong

ties is offered by Coleman (1988). He believes that „involvement” in a very dense, interconnected and highly cohesive network benefits from the strengthening of trust between individuals and thus promotes joint activities and the exchange of tacit and complex knowledge. Excessively strong solidarity within the group can reduce the inflow and acceptance of new ideas, thus creating inertia and parochialism and limited economic progress as a whole, through the deterrence of the group members from participating in robust social networks. Members of the group can disable outsiders to reach certain positions and opportunities. A good example is the German industry that is characterized by the fact that companies are overly loyal affirmed suppliers and therefore slow in adopting new ideas and possibilities (Adler & Kwon 2000). The groups with strong ties among its members may also adversely affect the economic growth, among other things, by capturing a disproportionate share of the national income.

Weak ties are connections with the outside world and as such allow the emergence of network externalities, most notably the so-called *spillover* of knowledge. Contrary to Coleman's understanding, according to whom closed networks are a better basis for cooperation, Granovetter (1973) and Burt (1992) suggest that as far as individual and business success is concerned, it is much more useful to do with a variety of networks rather than with many ties within a single closed network. New knowledge, new ideas, possibilities and perspectives are spread more easily through weak ties (Granovetter 1973). Granovetter called this process „*the strength of weak ties*”. Sociologists such as R. Burt (1992) analyze social networks in terms of Power Relationships, where one economic actor (who possesses a resource) will have power over another (who desires this resource). Burt (1992) argues that the key in knowledge sharing are networks rich in structural holes. In fact, in structural holes, one gets new ideas and diverse knowledge from different actors. Because of their prevalence, *weak ties* are more successful and attractive in facilitating the flow of knowledge and information diffusion in wider social structures.

In particular, the types of relationship between participants in a network may influence their knowledge transfer. Hansen (1999) analyzed the effects of social tie content on knowledge transfer and centred on the opportunities offered by networks to attain knowledge resources (Table 2). Nevertheless, denser connections limit the flow of new and different ideas and can lead to informational inertia, which hampers innovativeness and renewal capability (Neives & Osorio 2013, 67). Likewise, investigating potentially adequate innovation strategies and social capital dimensions, Rost (2011) believes that the correlation between strength of ties and innovation has an inverted U-shape, indicating that ties should not become excessively strong.

Table 2 Transfer effects associated with four combinations of knowledge complexity and tie strength

KNOWLEDGE	TIE STRENGTH	
	Strong	Weak
Non-codified, Dependent	Moderate transfer problems	Severe transfer problems
Codified, Independent	Few transfer problems	Few transfer problems

Source: adapted from Hansen 1999, 89.

The last two decades of the 21st century were marked by significant structural transformations influenced by the emergence and diffusion of information and communication technology (Skeberdytė 2014). Recently, literature from social physics

(Watts 2004; Christakis & Fowler 2009) has demonstrated that a variety of social networks, such as online social networks, e-mail networks, worldwide web and sex networks exhibit small-world and scale-free characteristics. In the context of inter-organizational cooperation for innovation, the role of online social networks has been highlighted – they may be seen as tools that support the transfer of knowledge (Bebensee et. al. 2011, Faraj et. al. 2011, Von Krogh 2012). In the study of organizations, the term network is used to describe many types of economic arrangement, such as vertical networks that integrate various links in the supply chain, clusters, joint ventures and strategic alliances. We have also witnessed a rapid boost in the development of social networking and online communication. Web 2.0 is the basic structure that enables the use of electronic and communication resources for the formation, maintenance or representation of social relationships, the so-called digital social networks (Mussi et al. 2014). In the context of companies incubated in technological parks, digital social networks may be conceived through planning and may be organized so as to promote the transfer and creation of new knowledge amongst the stakeholders in these parks (Mussi et al. 2014).

Vertical networking solutions can help manufacturing companies to manage the transition to industry 4.0 through IT integration. New, combined solutions need to be developed from a range of components from suppliers of sensors, modules, control systems, communications networks, business applications, and customer-facing applications. Industry 4.0 will generate new insights, support decision-making and create a competitive advantage. The simple networking of cloud-based solutions offers excellent opportunities to host and make efficient use of the big data generated by industry 4.0. This forms the basis for providing over-arching market solutions that seamlessly integrate all stages from suppliers' value chains to end customers, and allow innovation beyond products.⁶

Researchers have also established the connections between organizational learning and innovation development (Chang & Cho 2008; Lynn, Reilly, & Akgün 2000). In this way, social networks, as the main sources of new knowledge, should be related to organizational innovation which is now dependent upon processes of knowledge exchange and complex multi-stakeholder networks. „The situation of slowly changing networks of organisations will be replaced by more fluid, amorphous and transitory structures based on alliances, partnerships and collaborations. These trends have been characterised as a transition towards „open innovation” and „distributed knowledge networks”” (Egeraat & Curran 2010, 2). Sources of innovation do not reside exclusively inside firms; instead, they are commonly found in the interstices between firms, universities, research laboratories, suppliers and customers. More recent developments of regional clusters, such as Silicon Valley, where rapid technological development is combined with a relatively open diffusion of knowledge (Saxenian 1994), and the Italian examples of industrial districts, provide modern examples of collective invention. Innovation networks are generally considered as a means to share increasing R&D costs, gain access to scarce resources and – even more importantly – to manage complex innovation processes, cope with technological uncertainty and create learning opportunities (Buchmann & Pyka 2012, 2). Through communicating with suppliers, customers, and competitors, and through building relationships with universities, research institutes, investment firms, government agencies, and so on, firms develop and

⁶ See: Industry 4.0 Challenges and solutions for the digital transformation and use of exponential technologies, by Deloitte, Internet, p. 22, available at: <https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/manufacturing/ch-en-manufacturing-industry-4-0-24102014.pdf>

exchange various kinds of information and knowledge that are critical to their ability to innovate (Benner 2003).

In business areas, networks includes a wide range of forms, including intracorporate business units, strategic alliances, franchises, R&D consortia, buyer-supplier relationships, business groups, trade associations, government sponsored technology programs, and so on (Inkpen & Tsang 2005). It is believed that effective knowledge transfer through social networks can create extraordinary value in your critical business metrics while helping to ensure that your workforce has the capabilities, expertise, flexibility and resilience to adapt to change and thrive versus your competition (Table 3).

SMEs and start-ups are important participants in interactive learning networks – both exploiting knowledge developed elsewhere and contributing to knowledge development (OECD 2010, 36). Network-based arguments clearly have significant potential to enhance our understanding of two critical tasks comprising the entrepreneurial process: the discovery of new business opportunities and the mobilization of resources.⁷ As Saxenian (2006, p. 95) notes, „as lawyers, venture capitalists, investment bankers, entrepreneurs, managers, and other professionals travel between regions, they transfer technical and institutional knowledge as well as contacts, capital, and information about business opportunities and markets.”

Table 3 Social networking impacts on a company's strategic plans and business goals

Common Business Metrics
Cost reduction
Cycle time reduction
Increased revenue or gross margin
Percent of sales from new products/services
Business growth
Improved quality or safety
Increased customer retention/satisfaction
Increased employee retention/hiring/satisfaction
Accelerated competency/workforce performance

Source: Unlocking the Value of Knowledge Transfer:
Create Extraordinary Value from What Your Company Already Knows,
by Jeff Stemke, Internet, available at: www.patinasolutions.com, p. 6

4. SOCIAL NETWORKS, KNOWLEDGE TRANSFER AND INNOVATIONS – APPLIED ASPECTS

A paradigmatic example of how to create social capital can be a significant support to economic activity represented by Silicon Valley. Total investment in the valley in 2015: \$ 27.7 billion from the 1374 contracts, 4 times more than in the New York metro zone (the second investment hotspot in the US). It is mostly invested in the software industry (\$ 5.1 billion, 376 contracts), biotechnology and medical devices, media and entertainment, and computers⁸. The most famous success story of networking is *Silicon Valley*, as a dynamic and productive region, where dense social networks were found to drive both experimentation and entrepreneurship. In explaining the vibrancy of Silicon Valley (the world's largest

⁷ See: Social Networks and Entrepreneurship, Chapter 10, by Stuart Toby E. and Sorenson Olav, Internet, p. 226, available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.317.8589&rep=rep1&type=pdf>

⁸ See: <http://bacid.rtrs.tv>, p.3

technology park and production of hardware, software, IT technology) and other regional economies many have referred to the concept of social capital. „Silicon Valley should not be understood as simply an accumulation of resources, but as a multitude of social networks that assure an optimal diffusion of information between complementary economic agents” (Ferrary 2003, 121). The importance of networks linking individuals across different companies within Silicon Valley – a learning region and learning communities – is emphasized in Annalee Saxenian's *Regional Advantage* (1994). In her view, the technical expertise of Silicon Valley is spread across hundreds of enterprises tied together by interfirm networks characterized by cooperation as well as competition. Silicon Valley is home to a unique mix of knowledge, skills, and strong, entrepreneur-focused networks. Silicon Valley has both strong horizontal networks between actors undertaking the same activities, such as networks of venture capitalists, entrepreneurs, investment bankers etc. These are important for spreading information through the networks of practice. However, it also has rich vertical networks between, for example, suppliers and customers. Saxenian (1994) stresses how the „job-hopping” culture in Silicon Valley creates tightly coupled social networks through which knowledge flows. At the present time, the United States appears to be the best in the world at innovation. Certainly, a look at the success of Microsoft, Apple, and other companies from Silicon Valley provides a true sense of the United States’ innovative prowess.

Innovation districts (a trend in the United States) are the manifestation of mega-trends altering the location preferences of people and firms and, in the process, re-conceiving the very link between economy shaping, place making and social networking. These districts are geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators. They are also physically compact, transit-accessible, and technically-wired, and offer mixed-use housing, office, and retail (Katz & Wagner 2014, 1). Innovation districts help address three of the main challenges of our time: sluggish growth, national austerity and local fiscal challenges, rising social inequality, and extensive sprawl and continued environmental degradation (Katz & Wagner 2014, 2). Yet all innovation districts contain *economic*, *physical*, and *networking assets*. Networking assets are the relationships between actors – such as between individuals, firms, and institutions – that have the potential to generate, sharpen, and/or accelerate the advancement of ideas. When these three assets combine with a supportive, risk-taking culture they create an innovation ecosystem – a synergistic relationship between people, firms, and place (the physical geography of the district) that facilitates idea generation and accelerates commercialization (Katz & Wagner 2014, 2).

„The transition from a manufacturing-industrial economy to a knowledge economy means a great challenge in a number of policy areas. Traditional production factors such as labor and capital do not seem to be enough in the new global competition. Human capital, social capital and new institutions are amongst the essential factors to promote growth in new, knowledge intense-industries” (Westlund 2005, 3). There is hardly any industry in which there are more strategic alliances and networks already established than in the *Electronics branch*. In Manufacturing Industries, the *automotive industry* is a representative example of the evolution towards networked organization not only in a temporal respect, but also with regard to its macroeconomic and over-all social importance. One example is the automotive industry, where automobiles are developed and manufactured by original equipment manufacturers worldwide. Their network of suppliers often produces more than 70% of the value of the vehicle. In the end, the quality and cost of a vehicle is a function of

the network efficiency of firms working on it (Lobner 2013, 1). Considering electrification as a relatively recent phenomenon in the automotive industry, and given that creating new knowledge networks requires considerable time, effort and resources, automakers prefer to collaborate with established partners rather than seek out new ones based on their knowledge and competence within this field. The alliance is one example of a network strategy designed to help develop and access new and existing knowledge relevant for innovation, which can boost the competitive advantage. The strategic alliance between Renault and Nissan, for instance, aims in part to develop “zero-emission” transportation, their most notable achievement hitherto being the Nissan Leaf battery electric vehicle. In practice the alliance allows Renault access to Nissan’s joint venture activities such as the Automotive Energy Supply Corporation, whose aim is the development and mass-production of lithiumion batteries (Sarasini et al. 2013, 170). Volkswagen’s main partner in terms of electrification publications is the University of Leibniz (19% of 21 publications), with whom Volkswagen has collaborated historically. In terms of electrification patents, Volkswagen’s main partner is its subsidiary Skoda, located in the Czech Republic (8.7% of 263 patents), again reflecting the importance of hierarchical relationships for patented inventions (Sarasini et al. 2013, 181). Innovation in the automotive sector is affected by a powerful supply and network structures, and it seems to be typical for the automotive sector, that innovation activities are interactively spread along the value chain, implementing a decisive role of system (mega) suppliers (EC 2011, 40). CIS 4 data now reflect the interactive, cross-national nature of innovation in the automotive sector. 33% of the innovative firms in the sector confirmed their direct cooperation in the course of innovation activities (20% confirmed cross-national cooperation with partners in Europe, 9% with partners in US-America). 24% of the automotive firms cooperate with suppliers and 19% with customers. A considerable share of automotive firms cooperate with universities (13%), and public research institutions (8%). (EC 2011, 40). The significant and increasing role of innovation along the supply chain seems to be a challenge for future cluster activity in the automotive industry. The potential of proactive cluster promotion innovation depends on the structure of the supply chain and innovation networks (EC 2011, 52). The partnership model is preferred by the Chinese Government in the auto industry. State-owned enterprises (SOEs) and MNEs generally share investment and joint operations through joint ventures. This choice has particularly opened up an effective channel for the transfer of technology and managerial expertise, which have functioned as accelerants to the transformation of the economic system in China (Ding 2013). Knowledge transfer in Chinese business networks is strongly influenced by the Guanxi-based Governance Mechanisms which represents personal connections among individuals in Chinese society, and its functions have strong implications for interpersonal and inter-organizational dynamics (So & Walker 2013). An individual constructs three sets of primary behavioral patterns (collaborative knowledge accessing, reciprocal knowledge exchanging, and hierarchical knowledge sharing) to transfer knowledge in the Chinese business network, given China’s fast-growing economy and huge market potential for both domestic and foreign firms. In *Biotechnology*, as one of the most knowledge-intensive industries and an agent of economic development, the locus of innovation should be thought of as a network of interorganizational relations. In these processes the role of informal interactions among the members of scientific and productive communities has been recognized as a critical vector of information and knowledge and a strategic innovation resource, and as being directly related to the innovation process (Vittoria & Lavadera 2013, 4). Even if the biotechnological industry is still in its infancy,

there are a great number of networked organizations to be found there. Considering that the biotech industry consists of small firms with R&D as their main activity, this smallness makes collaboration with other firms and research institutions a necessity. A large share of the biotech industry deals with products for human health, so the government has motives to interact with the industry, as a financier of R&D and (where healthcare is to some extent a public sector responsibility) and as a demanding customer. Thus, the „golden triangle” of collaboration between companies, research institutions and government seems highly relevant for the success of the biotech industry. This means that the biotech industry has a need to develop a more complex social capital compared with most other industries (Westlund 2005, 7). The collaboration between enterprises and research institutions is supported by one interesting initiative – Bioiniziativa – in the Lombardy region. The aim of this initiative is to promote the economic development and entrepreneurial activities in the biotech field. This initiative supports the commercialization of research results through finding funds or industrial partners for research institutions. This measure is designed to support both enterprises (in 2005, 5 new spin-offs were created) and research institutions (commercialization of research results through support to business plan development and sponsored research) (AFIBIO 2007, 12).

The *technology park* as a network type and environment for cooperation – or the local innovation system – as a milieu, and social capital are two of the factors that enable interorganisational networking. One of the roles of Technology Parks, as innovation promoters, and thus regional developers, is to stimulate and manage the flow of knowledge and technology amongst universities, R&D institutions, companies and markets. In this way, STPs facilitate access for firms to key factors such as R&D, human capital, innovation infrastructures, venture capitalists, technological capital, and social capital (European Commission 2008). According to recent research, Science Parks are most notably presumed to (Grassler & Glinnikov 2008, 28): 1. promote Higher Educational Institution (HEI)/industry linkages and the transfer of technology from HEIs to Science Park firms; 2. promote the formation of new technology-based firms; 3. encourage spin-off firms started by academics; 4. encourage the growth of existing technology-based firms; 5. attract firms involved in leading-edge technologies; 6. create synergy between firms; 7. improve the performance of the local economy and 8. create new jobs directly as well as indirectly. The development of Science and Technology Parks (STPs) is one of the most efficient instruments for boosting local economic development. Since then, STPs have become the centers of entrepreneurship, innovative potential and a place where industry and academia can work side-by-side. Today, there are more than 500 science and technology parks around the world and their number is constantly increasing.⁹ STPs can have different focuses. Recently, areas such as robotics, nanotechnology, environmentally sensitive product design, telecommunications and satellites, biomedicine, etc. have become increasingly popular in the scientific community which has led to the establishment of STPs based on these particular disciplines.¹⁰

The European Commission (2014) proposes that new collaborative *venture capital* models may provide an effective basis for funding innovative firms. As a special form of cooperative arrangements, apart from financing the new company, venture capital firms usually bring their experience to the field, and a network of relations – social capital.

⁹ See: Strategic Development Plan for Business Incubators and Science and Technology Parks in Western Balkan Region, University of Kragujevac, WBCInno project, Kragujevac, February 2014, p. 18

¹⁰ See: Strategic Development Plan for Business Incubators and Science and Technology Parks in Western Balkan Region, University of Kragujevac, WBCInno project, Kragujevac, February 2014, p. 18

Such a network is extremely useful for quickly finding the professional resources and competencies a new venture needs to grow. Additionally, it can provide a start-up with a reputation.¹¹ It is interesting to mention here that among the highest-ranked investors we can not only find traditional venture capital funds, but also „new” types of investors, such as super-angels and corporate venture capital funds (EC 2014, 21). According to a recent report by the European Venture Capital Association (EVCA), micro-venture capital funds (or super angel funds), which first emerged in the United States, are becoming more and more established in the venture capital industry in Europe. The managers of micro venture capital funds typically contribute a significant amount of capital to the fund, making the organization of the fund more of a collaborative nature than a typical „general partner –limited partner” relationship (EC 2014, 22). One of the features of these new models is that corporations have become anchor investors in venture capital funds that invest in both related and unrelated industries (EC 2014).

5. CONCLUSION

One of the hallmarks of the knowledge-based economy is the recognition that the diffusion of knowledge is just as significant as its creation, leading to increased attention to „*knowledge distribution networks*” and „*national systems of innovation*” (OECD 1996, 24).

According to H1, structural properties of networks can be in favor of entrepreneurship, innovation processes, technological change or employment dynamics. The best confirmation of the validity of this hypothesis is Silicon Valley as the world’s preeminent innovation factory, world’s high-tech hub and one of the world’s most important centers of technology disruption, where the productivity of the region depends on social capital based on formal and informal networks of interaction and communication at the institutional level. A representative example of the evolution towards the networked organization are the automotive industry and biotechnology.

In practice, knowledge transfer has proven a difficult challenge, as information tends to „get stuck” when it is required to be spread between individuals and professional boundaries (H2). In other words, knowledge transfer related to a variety of mechanisms depends on the nature of knowledge and context. Relationships play an important role in the transfer of tacit knowledge which is difficult to articulate, develops from direct experience, needs face-to-face interaction and shared experience. Social networks are crucial for the exchange of resources that do not circulate easily through the market, such as strategic information, business opportunities, referrals, advice, expertise, tacit knowledge, and trust. Fledgling enterprises that can mobilize tacit knowledge therefore enjoy a substantial advantage over rivals that cannot. In addition, to understand the role of social networks in the transmission of knowledge and information, it is necessary to examine the role of the so-called „strong” and „weak” ties. New knowledge, new ideas, possibilities and perspectives are spread more easily through weak ties. Because of its prevalence, *weak ties* are more successful and attractive in facilitating the flow of knowledge and information diffusion in wider social structures.

¹¹ See: Inter-organizational knowledge transfer as a source of innovation: the role of absorptive capacity and information management systems, by Cohen Stephen S. and Dal Zotto Cinzia, Internet, p. 4, available at: <https://www.cinziadalzotto.ch/wp-content/uploads/2013/09/Inter-organizational-knowledge-transfer-as-a-source-of-innovation.pdf>

The practical significance of social networks for the transfer of knowledge and strengthening of innovative capacities can be seen through the mechanism of functioning of innovation districts, science and technology parks, and new collaborative *venture capital* models.

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TRANSFER ZNANJA, INOVACIJE I PRISTUP DRUŠTVENIH MREŽA

Savremeno društvo se bavi mnoštvom podataka, sa predviđanjima da će do 2025 proizvedeni podaci iznositi 160 zetabita. Generisanje korisnih informacija i derivacija znanja iz ovih podataka postaje težak zadatak, a prenos relevantnog znanja kroz društvenu mrežu postaje još važniji. Premda postoje razlike u načinu definisanja, postoji visok stepen saglasnosti oko toga da je, za razliku od drugih koncepata vezanih za društveno-ekonomski razvoj, društveni kapital jedinstven jer je relacioni. Očito je da je temeljna zamisao izražena u konceptu društvenog kapitala jednostavna: društvene mreže su važne, one imaju vrednost za ljude i organizacije koji su uključeni u te mreže. Cilj rada je analiza uloge društvenih mreža u difuziji znanja i informacija i njihovog doprinosa u jačanju inovativnih kapaciteta. Jedan od glavnih razloga rastuće zainteresovanosti za ulogu društvenih mreža u stvaranju i prenosu znanja jeste da većina relevantnog znanja danas ima implicitni karakter i ne može se lako prenositi. U radu će biti primenjena metoda kompilacije u svrhu pregleda postojećih teorijskih i empirijskih istraživanja iz ove oblasti. Metoda deskripcije, kao postupak jednostavnog opisivanja ili očitavanja činjenica i procesa biće povezano s objašnjenjima o uočenim važnijim obeležjima opisivanih činjenica, njihovih zakonitosti i uzročnih veza i odnosa.

Ključne reči: difuzija znanja, informacije, društvene mreže, inovacije, nova ekonomija.