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# Lack of knowledge networking? The role of discontinuity in the post socialist countries.

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# **Lack of knowledge networking? The role of discontinuity in post – socialist countries.**

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## **Abstract**

Knowledge generation is considered to be a collective process which requires mobilisation of number of knowledge agents. There is open debate in the literature about the role of spatial proximity for the knowledge interactions. Are proximity or distance interactions crucial for the knowledge generation? At the same time the question of the modes of knowledge governance gains on importance. If the market based knowledge interactions among firms are risky, they will require high level of investments to secure them, transaction costs will be high. In this case, such exchanges take place outside the market in other non-market structures, in principle as hierarchies (e.g. within a firm) or as hybrid contracts (e.g. long-term contracts). Turbulent and uncertain technological, business and regulatory environment in post socialist economies sharply increases the knowledge transaction costs. Due to the discontinuity in the knowledge generation processes, the economic system is characterized by high transaction and interaction costs associated with searching for economically useful knowledge in the region. Collective generation of new technological knowledge based on local intensive network interactions in post-socialist countries is a risky business from this perspective. The lack of trust among people hampers the cooperation activities and indicates potential costs emerging with opportunistic behaviour. According the main principles of transaction cost theory hierarchical organisation dominate in the governance of the knowledge processes as they are more effective to solve potential conflicts. At the same, time closed communities with a certain level of trust engaged in collective knowledge processes, may be expected as well. The empirical part of the paper is based on the case study of territorial knowledge dynamics undertaken in the framework of FP6 EURODITE research project. We are highlighting specific routes of knowledge processes in the IT sector in Bratislava region Slovakia.

**Key words:**

post socialist countries, collective knowledge, transaction costs, territorial knowledge dynamics, Bratislava region

**Introduction**

System approach allows us to consider knowledge as a collective good and the creation of a collective process (ANTONELLI, 2000; PATRUCCO, 2008). This concept emphasizes the importance of structural conditions and time dimension in the analysis of the process in which the knowledge is generated, disseminated, and used. Collective nature of knowledge, therefore, points to the fact that the creation of new knowledge is based on the interaction of different agents. These interactions are influenced by the environment (social, technological, political, etc.). Collective process of creating firms' new knowledge is the result of integration of private investments in education, research and development and absorption of skills and technologies produced by external organizations (other firms, universities, research organizations, etc.). We can formulate a theoretical shift to new paradigm based on multi-local and multiscale knowledge dynamics (CREVOISIER, JEANNERAT, 2009). In the RIS paradigm, learning is mainly cumulative. What economic geographers have added is the view that innovation processes are firmly rooted in region-specific institutions, most of them of an informal nature (e.g. local culture) that are difficult to copy or imitate by actors in other regions. Today the quantity of knowledge has increased and its general access has improved. Sectors split in new "entities" which are made of much more numerous and complex interaction, we observe composite knowledge dynamics. Thus cumulative and composite trajectories will become more and more interweaved. Regarding space and territory, the large opening of access to multiple potential partner and knowledge means that territorial knowledge dynamics are more multi-local and multi-scalar. We argue that cognitive proximity (NOOTEBOOM, 2002), which is considered to be an absorptive capacity open to new ideas, is a prerequisite for interactive learning processes to take place. The diffusion and hence the adoption of technologies and technological knowledge developed elsewhere (e.g., other firms and universities) is now seen as an active process that enters the firm's ability to create new technological knowledge and to introduce technological change. For this being

effective, a minimum amount of internal competencies must be accumulated and available for the firm. Knowledge relationships may cross over regional and national boundaries, as they do over sector boundaries. Network linkages, in general, and non-local linkages in particular, are often found crucial for learning and innovation, in order to avoid cognitive lock-in.

A central insight of the new institutional economics (COASE, 1937; WILLIAMSON, 1975; NORTH, 1990) is that firms organize transactions so as to minimize the costs of governing those transactions over time. Some transactions are most efficiently conducted on the spot market, some through contracts, and some by internalization or vertical integration. During the process of knowledge creation firms combine internal resources (internal learning, formal research and development) with the acquisition of external knowledge resources. The ratio depends on the price, or the respective costs of external knowledge acquisition. If the firms are located in the knowledge favourable environment, the new knowledge has often a contextual character. On the other hand, if the external knowledge is inaccessible or expensive, the internal knowledge processes will prevail. Networks are type of governance mechanisms where the repeated (often routine) transactions minimise transaction costs. The existence of such networks in a region documents former investments in the transaction links. The spatial proximity facilitates the network evolution. In general, the costs associated with the network establishment are lower in the agglomeration.

Emerging literature on network evolution suggests additional network-specific mechanisms. Preferential attachment, embedding and multi-connectivity also induce path dependence in inter-firm relationships. Apart from the endogenous mechanisms of retention and variation, environmental changes may alter crucial conditions (GLUCKLER, 2007). Since institutions such as conventions and routines define the rules of interaction they certainly influence the trajectory of inter-firm networks (MASKELL AND MALMBERG, 2007).

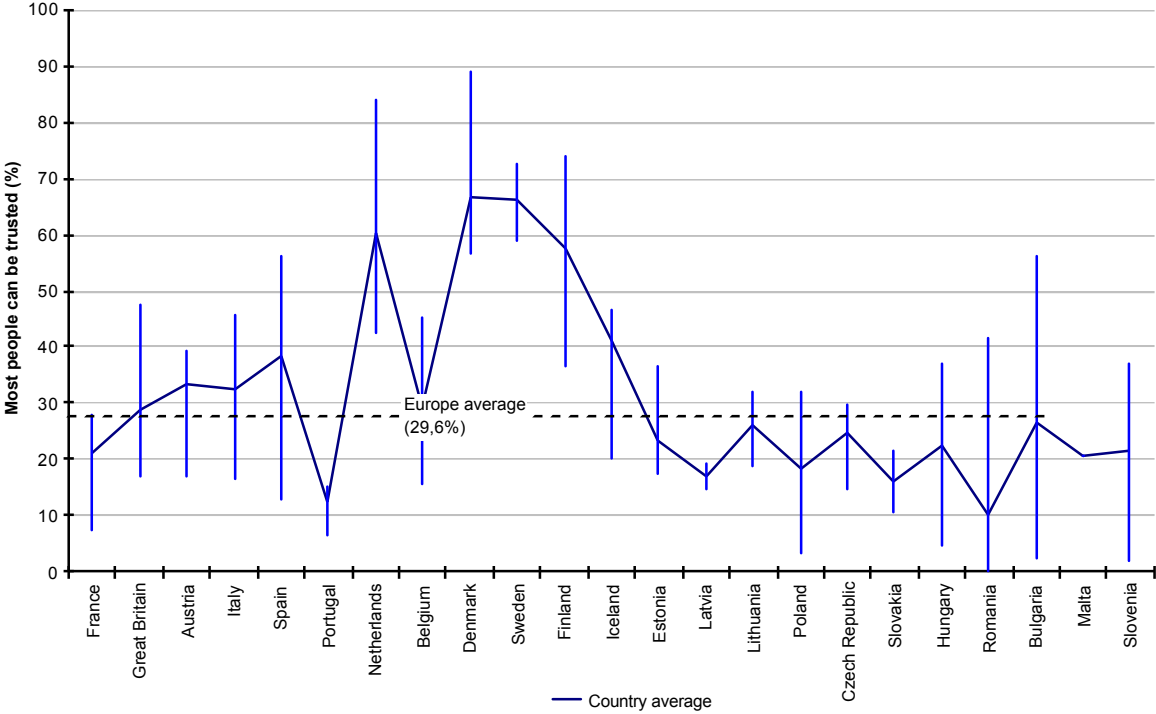
Central and East European countries passed dramatic economic development in recent years; this process was accompanied by the degradation of systemic relations between economic actors and with the creation of new systemic relations (DYKER, 1997; DYKER, RADOSEVIC, 1999; PIECH, 2007; REHAK AND SOKOL, 2007). Such regions are characterized by complex of problems such as weak research activity, lack of specialization in research, lack of excellent laboratories, limited commercialization of research activities, the brain drain, lack of demand for research from the commercial sector, lack of financial and politic support from the government, lack of intermediaries, and so on. In these economies

that have undergone an economic transformation from a planned economy towards market based, regions are often characterized by fragmented innovation systems (OECD, 2003; KOSCHATZKY, 2004). Despite available regional research capacities the knowledge diffusion in the business sector is limited. Regions lack significant knowledge-based clusters and are rather characterised by isolated innovative firms (TODLING, TRIPPL 2005).

If the market based knowledge interactions among firms are risky, they will require high level of investments to secure them, transaction costs will be high. In that case, such exchanges take place outside the market in other non-market structures, in principle as hierarchical (e.g. within a firm) or as hybrid contracts (e.g. long-term contracts) (WILLIAMSON, 1975). Turbulent and uncertain technological, business and regulatory environment in transition economies sharply increased the knowledge transaction costs (MEYER, 2001; HOGSELIUS, 2003). Due to the discontinuity in the knowledge processes, innovation systems are characterized by high transaction and interaction costs associated with searching for economically useful knowledge in the region and with establishing contracts (FRITSH, M., WERKER, C., 1999; DYKER, RADOSEVIC, 2000). Collective generation of new technological knowledge based on intensive network based interactions in post-socialist countries is a risky business from this perspective. The lack of trust among people also hampers the cooperation activities and indicates potential costs emerging with opportunistic behaviour. Trust, norms and social networks, as key components of social capital (PUTNAM, 1993), play a significant role in transactions between people.

The trust between people among post-socialist countries evidently falls behind the level in the rest of the Europe, especially comparing to the Nordic countries. Based on the European Value Survey in 2000 the ratio of trust was approximately 10 percent points lower than the European average, which reached 36.5 % at that time.

**Graph: Interpersonal trust - regional extremes**



*Source: own elaboration based data from the European Values Study (2000)*

According to MEYER (2001) in transition economies, the diffusion of knowledge is of particular concern because the institutional framework does not provide for the efficient protection of intellectual property rights. Hence foreign investors prefer to internalise their knowledge interactions. This includes the transfer of production know-how, assessment of market opportunities for innovative products, as well as the training of sales and service personnel. In line with the main principles of transaction cost theory, hierarchical organisation will be dominating governance mechanism of the knowledge processes as they are more effective to solve potential conflicts. At the same time, closed communities based on of trusted relation may be expected as well.

## **The case of the evolution of the IT security sector in Bratislava region**

### *General overview of the region*

Bratislava region with 2,053 km<sup>2</sup> and population of 603,699 inhabitants (11% of total number of Slovakia's population) is the smallest and most densely populated region in Slovakia. The density of population amounts to 294.1 inhabitants per 1 km<sup>2</sup>, which is 2.7 times more than the average in Slovakia. The level of urbanization in 2005 was 83 %, Bratislava's share being 70.5 %. Region is part of the larger cross border regional initiative Centrope (initiative of eight counties, regions and federal provinces of Austria, Czech Republic, Hungary and Slovakia) with roughly six and a half million people. Bratislava region is economically the most developed region in the SR with the lowest rate of unemployment. With GDP € 11 707 millions (2006) it produce about 26 % of GDP of the SR. GDP per inhabitant is 2.3 times higher than the average of the SR and by 15.9 percentage points more than the EU average. The sector of services has the highest share in creation of gross added value – 72.1 % in 2006. Industry and construction industry contributes by 27 % and agriculture by 0.9 %. Bratislava region highly exceeds Slovakia's average in the volume of investment property per one inhabitant. Within the undergoing structural changes in the region's economy there is evident growth of tertiary sector, especially in trade, services, banking and insurance. Average nominal monthly salary amounts to more than 130 % of the national average. The number of working people in 2006 amounted to 317,400 i.e. 13.8 % from the total number in the SR. For a long time Bratislava region has been the center of education and research in the SR. From population over 25 years of age in Bratislava region there is 25.7 % with secondary and tertiary education which represents double number in comparison with the average in the SR; 29 % have full secondary education with school leaving examination certificate and 8.2 % have secondary education without such certificate. The standard of education in the region is backed up by the presence of 11 schools of tertiary level that comprise 40.7 % of all undergraduates in the SR. Research at universities is limited due to the lack of resources. In Bratislava region there are at present 100 (47.7 %) science and research organizations with the number of research workers being 48.9 %. According the European regional innovation index region reaches 27th place (0.66 of a point). It is mainly due to high level of human resources in science and research (157 % of the EU average), and also thanks to lifelong learning (144 %) and employment in high-tech services (249 %). Bratislava region is a centre of knowledge intensive services. With employment share of 40.53 % (Eurostat, 2007) is above the EU

average (32,94 %). Especially with employment high tech services it belongs to the group of regions with the highest share in EU. In 2007 the Bratislava region ranked eighth in this order.

### *Evolution of the information security services.*

The sector of IT services has been one of the most rapid growing sectors in the region. The employment growth was almost twice that rapid in the KIBS than in the less knowledge-intensive services. Currently (2008) 7 898 employees work in the sector of computer and related services, which comprises approximately 2/3 of the total employment in IT services in Slovakia. The average salary in 2008 is 1.5 times higher than the average in Slovakia. The most significant firms that belong to this sector are the branches of MNEs such as Siemens, IBM, Soitron, Gratex, PosAm, Oracle, HP, Cisco, Datalan, and Ness. The development of the IT sector in Slovakia was, at the beginning of the 90th, linked to the penetration of the ready-made solutions of hardware and software suppliers who tried to saturate the growing demand. The new opportunities of the middle and Eastern Europe markets brought about a flood of foreign companies and supplier chains that were concentrated primarily in the capital city Bratislava. While during the 90's the development of IT sector was based on the sale of ready-use SW and HW solutions, during the end of 90's and the beginning of 2000 there was a rapid growth of services development. This study analyse the territorial knowledge dynamics of services development in the field of information security in Bratislava region. Our objective is to analyze technical, social and territorial processes in this segment and to evaluate the impact of policies on its development.

Information security sector development was closely related with the general development of the information technologies. Due to the slower introduction of information technologies in the SR this process was also delayed. Extensive copying of data and programs at the end of 80's and the beginning of 90's, which brought about spreading of viruses, represented the primary impulses of more significant interest in computer security. VYSKOČ (2005) claims that *“it might not be an exaggeration if we say that it was due to viruses that there was provoked a greater interest in the issue of computer security in ‘civil’ area and that besides ‘enlightenment’ impact, they also supported the foundation of the first larger informal group of specialists beyond power resorts, thus giving assumptions for creation of particular security products, and, later for establishment of specialized firms”*. The first companies that were founded in this period are comprised of the local firms that dealt with specialized fields



of information security, e.g. by antivirus protection (ESET), by security systems and cryptography (INFOTRANS); these firms presently belong to the technological leaders. Another group of firms aiming at information security that originated in the beginning of 90's was formed by firms that distributed foreign antivirus solutions (e.g. Lynx). At that time, information security was in the hands of information scientists; protection of information systems was primarily realized by the sale of ready-made solutions. Also IT companies started to deal with information security; these companies provided services in the field of information systems. Company sector started to grow in the second half of the 90's; new firms with specialized services in information security have emerged. Already before 1989 there were several groups that were predominantly engaged in the research of computer viruses. The first group was composed of computer scientists or computer enthusiasts who gathered in computer clubs. The other group that started to act in the same time was experts who dealt with cryptography or with more widely defined information security. Before the year 1989 a significant part of the information security sector in the region was bound to the protection of secret matters concerning mainly state administration on national level. Specialized institutions were created in the area of home office and Ministry of Defence. Specifically before the year 1989 the security of information was a major task of state protection. The new commercial possibilities on the IT market enabled mobility of such employees who dealt with information security in the state administration. Besides the transfer of employees from the state administration to the commercial sphere, there were also employees with the specific know-how who started to set up their own companies (e.g. in 1995, Alfa VS, Lorenc). On the contrary, in the case of large multinational companies, the important part of clients is formed by firms located outside Slovakia. Consultancy services firms extended their original services by providing consultancy in the field of information security. The market leaders are companies as KPMG, Ernst&Young, Price WaterhouseCoopers, Deloitte&Touch, Accenture and Capgemini. The branches of international firms in Slovakia started their activities in the beginning of the 90's; presently they belong to the largest firms providing consultancy services in Slovakia. In the beginning of the 90's this field was not covered by local capacities, instead, the services were provided by external experts. Later the companies started to create their own local specialized teams. Bratislava has become the centre of international services, branches of companies cover the regions of central and Eastern Europe, as well as those of Middle East.

### *Role of knowledge networks and institutions*

Development of the service sector is to some extent backed up by local academic capacities in mathematics, cryptology, information technology and information management. They represent a substantial prerequisite for adoption capacity of individuals and firms. According to reactions of respondents the local universities do not play a significant role so far. Teaching of subjects that cover the field of information security has started at universities in the year 1995. This issue is not covered by a separate study field but is taught in the framework of separate subjects, e.g. Security and management of information systems (FIIT), Security management of information technologies (Strnád, FIIT), Computer systems security (Hudec, FIIT), Basics of cryptology (FIIT). The Faculty of Law at Comenius University established specialized subjects Legal information technology, Communication law and Computer law. Due to reduced academic capacities the research activity is limited and financially not adequately supported. The research activities are fragmented; institutional cooperation on projects is low. Slovak institutions are engaged only in several specific international research projects. However there are visible university spin-off process of both academics and students. Hiring graduates and research workers from local universities and research centers who work in local specialized companies supports significantly the contextualization of knowledge. It was interesting to find out that the workers from local specialized companies perform simultaneously at local universities where they teach part time subjects close to information security. In the year 1996 was first time published a specialized journal Data Security Management (Czech Republic) and in the year 1999 e-magazine Crypto World. Recently the publisher of DSM magazine opened a Slovak branch in Bratislava, also editorial board now consists of two parts of Slovak and Czech members. There were published also specialized contributions and columns in IT magazines as for example e-Focus (since 1998) and later web portals Security Revue (2006).

Information security belongs to the field where the main actors form so called small world. Predominant majority of the services is performed via intra-company capacities, as it was claimed by one of the respondents of a large consultancy company „*we realize only the projects that can be managed by our own capacities*“. Synthetic character of knowledge in information technologies and a high level of its codification make it easier to obtain necessary knowledge on an individual basis, without inevitable external cooperation. In the 90's, when only several of smaller specialised firms and individuals dealt with information security, these firms represented sub-suppliers of larger IT solutions (e.g. information systems). Inter-

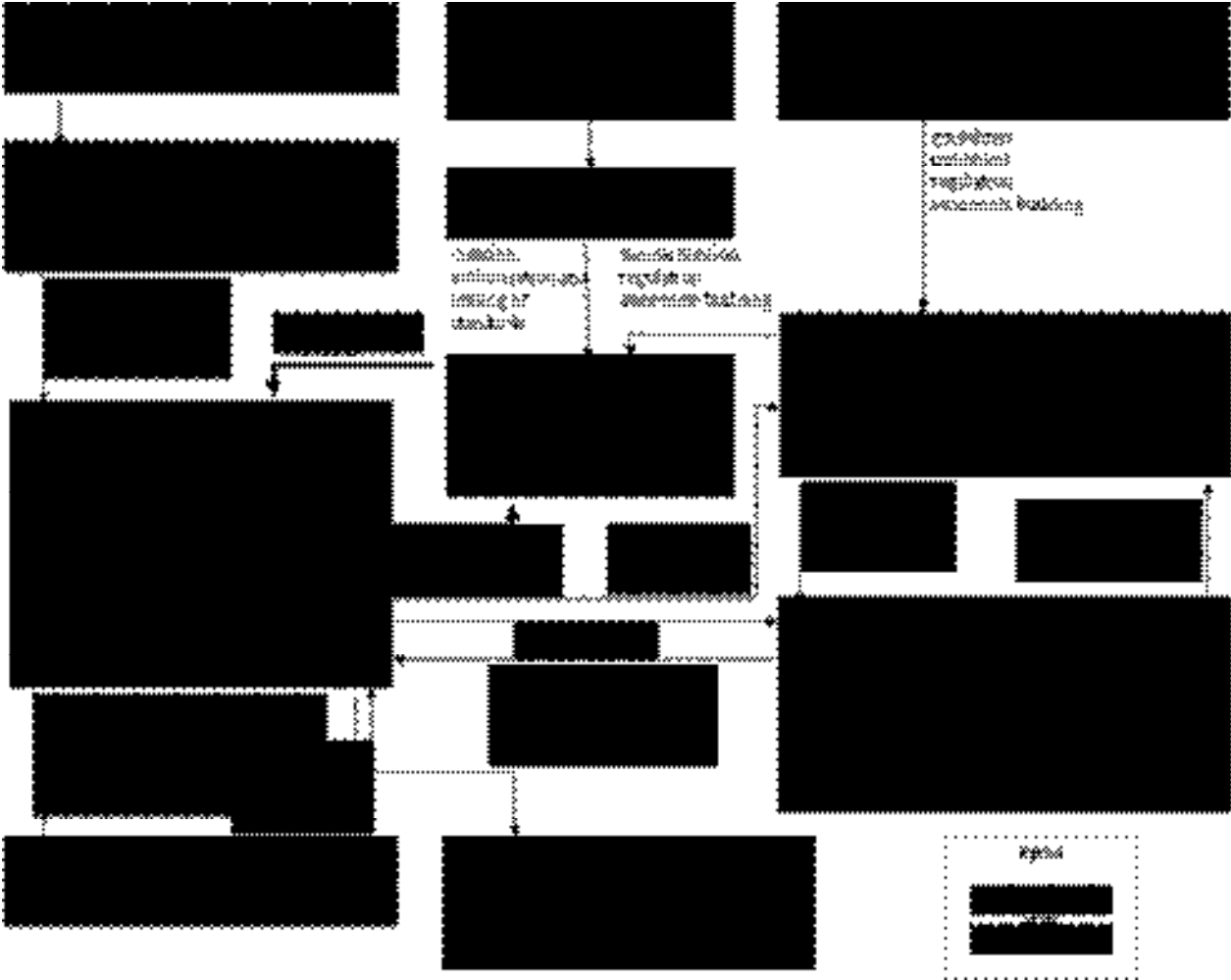
company cooperation is established usually during larger IT projects. On the other hand, very frequent is inter-company mobility of specialised experts, also mergers and acquisitions occur on the sector.

Even though inter-company relations are not very intensive, more frequent are informal relationships; contacts are on friendship basis. Since the beginning, the sector has been characteristic for its intensive networking in the form of occupational associations that were either on commercial basis or had the form of academic associations. During former Czechoslovak Republic there were established specialized institutions, such as Association of firms for information protection (AFOI) in 1993, or, later in 1994 it was GCUCMP (Group of Cryptology Union of Czech Mathematicians and Physicists). The Department of Information Technology at the Comenius University initiated the founding of the academic Slovak Information Technology Society (1993) which gave rise to the specialized department of information security. More intensive gatherings occurred in Slovakia during mid-90s'. In the same year at the Faculty of Information Technologies and Informatics (Comenius University in Bratislava) was established Association for Security of IT (ASIT). Association was transformed from regular seminars on information security that were organized by academicians. The target was to build a selective club of experts in the given field from formerly open seminars. The former members of AFOI founded their own society in the same year under the title of Slovak Association for Information Security (SASIB). The founding members were either academicians or representatives of commercial world. The objective of this association is to support creation of knowledge among founding members (5) and to encourage activities of the state administrative bodies in this field. The association further increased the number of members to present number of 27 members. New members joined the association more or less spontaneously; contacts were made more often on the basis of professional activities (e.g. joint projects) and on the basis of participation in professional events. The association dedicates its activities to organizing scientific seminars; to elaborating expert standpoints to laws and regulations in the field of information security; to working out conceptual materials of national character (e.g. Strategy of Information Security in the SR); to training of information security in the SR, etc. The association is one of the members of AFCEA (Armed Forces Communication and Electronics Association International). In 1999 IT Association of Slovakia (ITAS) was set up. It is a professional body, which associate most significant home and foreign firms and other organisations dealing with information and communication technologies. Almost 75 member companies represent more than 85% of the

Slovak ICT market. ITAS is a member of International association EICTA (European Information & Communications Technology Industry Association). Since 1999 also the Slovak chapter of the international organization ISACA organizes auditors and managers of information systems. At the moment ISACA covers a variety of IT related expertise from variety of industry categories (financial and banking, public accounting, government and the public sector, utilities and manufacturing), which allows mutual composite learning. Its IS auditing and IS control standards (CISA, CISM) became global benchmarks. The initiators of founding ISACA in Slovakia were the employees from KPMG. This firm also supports the association administratively. At present the ISACA Slovakia gathers about 50 professionals from the field of security and auditing of information systems; already 27 of them hold CISA certificate. The last established association in 2005 was the Academic Society for Computer Law and Legal IT which was founded at the Department of Legal IT and Computer Law, Comenius University in Bratislava.

Social contacts, exchange and diffusion of information are performed via organizing of conferences. ISACA in collaboration with the institute of banking training prepared three annual sets of seminar on New Trends in Audit and Security (Bratislava, 2000 – 2002) and two annual sets of seminar Security (Bratislava, 2004 – 2005) organized during the Security exhibition. In 2002, ISACA Slovakia organized the conference ABIT (Audit and security in IT, Bratislava) for the first time and since then, the conference is being held every year. The Slovak association for information security (SASIB) has been organizing Information Security conferences since 2006 (Bratislava). Specialist areas of information security in public administration are being dealt with also within the framework of ITAPA conferences since 2002. Some of the existing associations have not been active for some time; at present time, the most active are ITAS, SASIB, and ISACA. It is necessary to say that the member base of associations overlaps to some extent. At present time, their mutual interests meet in an agreement between SASIB, ITAS, ISACA, and others about coordinated processes in the field of information security. The representatives of academic organizations, associations, firms and state bodies take part in standardization activities via operational boards, e.g. in the Board for information security at the Ministry of finance of the SR.

**Scheme: Institutional environment of knowledge interactions in the INFOSEC sector**



*Source: own elaboration*

Due to the growing complexity of information systems it is possible to observe an intensive process of standardization. This process reflects codification of the best experience in the separate fields of information security; e.g. data encryption, information systems evaluation, information security management system, safety measures and services, private data protection, identification and biometry, etc. This system enables to reduce coordination spending that would occur due to the high complexity of information systems. The major world organizations that deal with the issue of standardization of information security are national ones; as e.g. a British organization the British Standards Institute – BSI (London, UK), National institute of Standards and Technology – NIST (Gaithersburg, Maryland, US and American National Standards Institute – ANSI (Washington, US), further on international

standardization organizations where are represented as well national standardization organizations; the most significant of these are International Organization for Standardization ISO (Geneva, Switzerland), International Electro-technical Commission IEC (Brussels, Belgium), and occupational organizations as e.g. Information Systems Audit and Control Association ISACA (Rolling Meadows, Illinois, USA), The Internet Engineering Task Force IETF (Fremont, California, USA), and RSA Security Inc. (Bedford, Massachusetts, USA).

Standards are formulated very generally, they provide only a framework formulation for solving problems; experience is therefore important for their implementation. Besides, each standard is applied in certain context, which may differ from firm to firm; it is inevitable to adjust it to a definite environment. ISO/IEC standards have impact on equivalent national standards in countries. In Slovakia, the standardization in the field of information security is managed by the Slovak Institute for Technical Standardization (Bratislava, Slovakia). It is the national standardization body responsible for creation, authorization and issuing of technical standards. SITS represents Slovakia in international and European standardization organizations (ISO, IEC, CEN, CENELEC, and ETSI). It issues also generally valid norms in the field of information security. A foreign standard can be accepted in two ways – either as a translation or by adopting a standard in foreign language. In Slovakia the following state bodies, issue standards, or have the right to issue standards concerning information security:

- The National Security Office (protection of secret matters and of electronic signature), (Bratislava, Slovakia),
- The Office for Protection of Personal Data (area of protection of personal data), (Bratislava, Slovakia),
- The Ministry of Finance of the SR (standards for information systems of public administration) (Bratislava, Slovakia),
- The Ministry of Health of the SR (binding standards for medical information technology), (Bratislava, Slovakia).

So far, due to the low research intensity in the SR and due to generally low support by the state, the territorial knowledge dynamics was mostly supported by improvement of entrepreneurial environment. The knowledge implicit type of policy prevailed. Development policy in IT security is aimed more at utilization of new knowledge than on its generation. An important role may be played by a regulation pressure on introducing standards of IT security as in commercial so in private sphere. Application of standards with clients contributes to

regional contextualization of mobile knowledge. The demand of the state via initiatives within e-Government brings about higher demands on installation of information systems and on the relevant IT services. Universities support extra-regional learning and they become a place for anchoring of mobile knowledge. Presently there is more pressure on improvement and more effective research activities at universities as well as on closer link to business sector. This trend could bring a higher level of regional generation of knowledge and intra-regional learning processes.

## **Discussion**

Knowledge dynamics of services in the field of information and communication security is determined by knowledge dynamics in the area of knowledge intensive business services and in the sector of information and communication technologies. ICT sector is characterized by a synthetic knowledge base (COOKE, DE LAURENTIS, 2007). The services and recommendations of information security solution need not necessarily of technical character, nevertheless they often are. From the point of view of information security sector, the knowledge dynamics is primarily determined by the sector development outside the region; it happens largely in the stage of exploration and examination. It concerns mainly creation of security standards and development of security protocols (e.g. PGP, Kerberos, Secure Socket Layer, Transport Layer Security, etc.) which are being developed at universities or in commercial firms and thus they form a part of wider IT solutions. In such a case, the firms that offer providing of information systems use ready-made solutions. A high level of standardization is very typical for the development of sector. New knowledge is created in the region mainly in the stage of exploitation, during the application of IT solutions by a client. Composite character of knowledge dynamics prevails in the service sector. The area of information security is an interdisciplinary one that makes use of knowledge from various scientific fields as e.g. information technology (knowledge about existing ICT systems and solutions), technical sciences (protection of hardware and of technical infrastructure), cryptology (encrypting, electronic signature), economics (economic protection efficiency), law (acts, norms, standards, internal institution legislation), management (information security management), and social sciences (psychology, labour hygiene), and others. Knowledge development in the separate scientific fields contributes to cumulative trajectories and to specialization; on the other hand, utilization of knowledge in the separate scientific fields and

their mutual intersection lead to composite trajectories. Composite character of knowledge dynamics determines also mutual intersection of various fields of services in separate firms. Therefore presently at KIBS sector occur combinations of various types of knowledge domains. More often firms provide comprehensive solutions; moreover technical consultancy and development are combined with consultancy and sale; new delivery models are being created. In the INFOSEC sector an ongoing combination of tacit and codified knowledge basis of horizontal and vertical knowledge domains results into customized solutions for clients.

Although regional research activities are not considered to be important, higher education have serious impact on the development of the specialised KIBS firms. Universities plays a role of gate-openers and catalysts of new global knowledge, thus they contribute to the assimilation, diffusion, absorption and contextualisation of mobile knowledge.

At the firm level crucial know how is being acquired by study of legislation, standards and best practices in the information security area. New knowledge has been obtained at conferences, from methodological documents, discussion forums, international professional education programs etc. High level of codification enables the easy accessibility of new knowledge. Also tacit knowledge plays important role in the FKD, relations with other companies in information security sector are based on personal contacts of firm co-founder from university environment (Comenius University in Bratislava) or later acquired professional contacts with firms associated in various information security associations (ISACA, CSI, ISSA, IEEE, SASIB).

Metropolitan character of the region enables the firm to benefit from the proximity of state administration bodies, institutions form public administration and big or smaller companies from private sphere localized in Bratislava. Awareness building (publication activities, media), formal diffusion of knowledge (conferences, providing specialised education) and non formal diffusion (social ties) are key instruments of anchoring mobile knowledge. There is also close interaction between the policy and private sector, local KIBS participate on formation of legislation in information security in Slovakia (advisory body at the Section of Informatization - Ministry of Finance of Slovak Republic).

Synthetic character of the knowledge and high level of codification of the ICT knowledge enables accessibility, sharing and diffusion in the Internet. While codified knowledge inputs for the services are spatially ubiquitous the tacit knowledge interactions require physical



proximity. Firms are attracting individuals with specific know how (e.g. by head hunting), organising specialised trainings and supports the mobility of experts to diffuse the tacit knowledge. Spatial agglomeration of firms in the Bratislava region supports high level of inter-firm mobility. Spatial proximity of clients in the region is crucial for the consulting activities only small part of the services is exported.

## **Concluding remarks**

Because of existing but fragmented research capacities and the absence of specialized research the region do not belong to intensive producers of new knowledge. The high concentration of educated manpower and the concentration of higher education institutions, however favours the absorption capacity. Substantial part of the new knowledge in INFOSEC sector is generated outside the region and it is transferred to the region within the intra-firm channels in a case of MNEs (trainings, standards). As ANTONELLI (2006) states global corporations are able to generate and disseminate technological knowledge by means of the powerful internal markets, into which the international transfer of technological knowledge can take place with reduced risks of dissipation and opportunistic behaviour. Another governance mechanism for the knowledge diffusion are the international security standards issued by relevant inter / national institutions as ISO (Switzerland), NIST, NSA (in US) or BSI (UK).

On the other hand in a case of services we should highlight that consultancy activities are based on composite knowledge and combinatorial knowledge dynamics. From this perspective new knowledge is generated during the project implementation, it means practical experiences from different knowledge domains are crucial. High level of codification and synthetic character of knowledge in INFOSEC suggest high level of knowledge mobility. Firm develop different strategies to anchor mobile knowledge. Consultancy activities are dominated by tacit / sticky knowledge with level of embodiment, thus co-operation activities, rotation, inviting experts or head hunting are crucial forms of anchoring knowledge.

In case of highly urbanised regions, especially metropolitan regions, distant learning processes could be dominant. Authors as FISCHER, M., M., DIEZ, R., J., SNICKARS. (2001); or DIEZ (2002) specifically focus on the so-called metropolitan innovation systems. Local branches of MNEs and specialized academic networks enable the access to the up-to-

date global knowledge bits. Cumulative knowledge processes could in this case be multilocal and the innovative economic development of these regions could be also based on composite knowledge and distant learning processes. Since it is not always a direct organizational link and there is a geographic mismatch between new knowledge generation and its use, there is space for agents in the system, which seeks for new knowledge and transmits (sell) it to their clients.

The higher the concentration of such firms in the region, the faster diffusion of new knowledge in the region can be expected. Therefore, the regions with fragmented innovation systems can have good access to new knowledge bits. The second major incentive for the development of KIBS is the effort of local organisation (both business and public) to reduce costs and to concentrate on core activities, thus creating demand for the outsourcing of specialized services. The spatial concentration of KIBS can be explained by the advantages of proximity of clients localized collective learning processes and high level of spin-off. Local knowledge interactions are despite the spatial proximity of actors in post socialist countries limited. Fragmented innovation systems are characterized by high costs associated with searching for economically useful knowledge in the region. Obtaining new local knowledge outside their own activities is expensive due to high transaction costs and interaction costs. The existence of these costs allows the creation of knowledge brokering markets in which they KIBS operate (REHÁK, 2009). The emergence of KIBS markets is therefore also response to turbulent and uncertain technical, commercial and regulatory environment (WOOD, 2002). KIBS, as a mediator of knowledge in the region, bring up-to-date technical and managerial experiences from other regions. The higher the concentration of such firms in the region and the higher companies use such services, the faster diffusion of new knowledge in the region can expect. Therefore, even the regions with fragmented innovation systems can have good access to new knowledge. Lack of incentives from the regional research sector can be to some extent replaced by KIBS firms. These companies bring to the region to international standards, which include best practices of technical or managerial experience. An important objective of innovation policy in these regions, according to us is to improve their integration and position in the global economy. The policy should be than focused on the diffusion of new knowledge and increasing the absorption capacity of regional actors. In this environment, knowledge gatekeepers can play decisive role, these gatekeepers are often high-level researchers, senior managers and professionals in companies and public institutions, who have intensive contacts with various actors in the system.

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