

## Knowledge dynamics in regions – new conceptual approaches

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### Abstract

Nowadays there is a theoretical shift in regional studies from a currently-dominating paradigm centred on regional innovation systems to a new paradigm based on multi-local and multi-scalar knowledge dynamics. The regional innovation system is based on the idea that proximity learning can be multifunctional and dialogic and that distant learning is limited to solve mono-functional questions. New paradigm is based on knowledge dynamics, the quantity of knowledge has increased and its general access has improved. This paper combines knowledge dynamics from two territorial and sectors perspective as two major systems where knowledge is created, disseminated and utilised.

**Keywords:** knowledge dynamics, knowledge economy, ICT sector, Bratislava region

### Introduction

In this paper we draw on the theoretical background of knowledge dynamics. By formation the theoretical part of our paper we issued from concept which was formed in theoretical part of EURODITE project.

Knowledge within economic networks is *embodied* (in people, their relationships and their instruments) as a stock, and it is *composed* and *disseminated* (amongst these people, relationships and instruments) as a flow. The ‘stock of knowledge’ includes its embodiment as informal skills and competences as well as more formally articulated knowledge. The ‘flow of knowledge’ includes its composition through ‘learning’ by reflection upon experience, as well as its composition through ‘translation’ from pre-existing knowledge in one format to another, and its ‘dissemination’ in one format or another between users. The ‘learning’, ‘translation’ and ‘dissemination’ processes draw from stocks of knowledge, and in turn they contribute to these stocks through the process of ‘embodiment’.

‘Knowledge dynamics’ occur through interactions amongst knowledge flows and stocks, which arise at different levels of aggregation. We argue here that it is necessary to understand knowledge dynamics within and around firms (the micro-level) in order to make sense of the

knowledge trajectories of aggregates such as sectors, regions, nations or social groups (macro-level).

The significance of knowledge for economic activity has grown exponentially since the 1980s. However, there is as yet little understanding of the nature and composition of the knowledge economy, especially at a regional level. The regional innovation systems (RIS) paradigm was developed during the eighties and nineties in order to explain the crisis and blockades of industrial regions and the rise of prosperity of other spaces (third Italy, high tech regions, etc.). In the RIS paradigm, learning is mainly cumulative (ANTONELLI, 2006), exploring the regional industrial trajectory, but from time to time combining and appropriating knowledge from elsewhere when necessary in order to adapt to global markets and technological changes. But 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. The automotive sector is connected to many fields of knowledge and it is today difficult to identify a “core” of learning dynamics that is specific to it. Growing economic activities such as sports are linked to mass media, to textile and fashion, to large events, to urban large infrastructures, etc. Health (COOKE, 2006) is connected to high tech industries, to biotech, to wellness, to tourism, to mass media, etc. **Knowledge dynamics** are more composite than ever (ANTONELLI, 2006).

Regarding space and territory, the large opening of access to multiple potential partner and knowledge means that **territorial knowledge dynamics** (TKDs) are more multilocal and multi-scalar. They develop within a Europe that is institutionally and economically much more integrated than before and in which mobility is steadily increasing. Medium and long-distance learning has increased and so have the mobility of information, knowledge and competences. These new conditions have changed the role of regions. One can expect that cumulative regional learning still to be the key access to more composite learning. One needs, however, high or specific competence to interact fruitfully with partners located elsewhere. Thus cumulative and composite trajectories will become more and more interweaved. They narrowly link production and use of knowledge. They connect not only technologies, but also socio-cultural changes within learning processes. Long and short distance learning have both increased in significance; anchoring mechanisms of knowledge have changed and are more and more determined by mobile knowledge.

In this wide opening of opportunities due to the abovementioned factors, the main question regarding learning and innovation is no longer the question of technology development, but the question of what to do in order to utilize this improved access to knowledge resources. Two elements seem more important than in the past and affect strongly the **firm knowledge dynamics** (FKDs). First, knowledge value chains have become much more configurational and technology is no longer the driving force of learning and innovation. Technologies are more the result of learning and innovation than its conditions. Second, as the access to knowledge improved, scarcity is no longer the problem. The socio-cultural capacities to imagine and implement business projects or business models (COLLINGE, 2006) which mobilize knowledge developed in the proximity or elsewhere have become central to perform strong economically. Regarding these interactions between different phases of innovation processes and knowledge development, we distinguish between analytical (science based), synthetic (engineering) and symbolic (branding, design, advertising) knowledge. This distinction is of great importance since that knowledge develops from very different fields and sets of players and need some kind of integration in order to innovate.

“KDs” are not “innovations”, even if they are related concepts. Innovation is a change in products, services, or production methods whereas knowledge is rather a resource. Innovation is a typical concept of the industrial society, distinguishing stability and innovation in the evolution of production systems; KDs appears more appropriate for the systematic and

rather permanent changes that occur today in a service economy. If innovation, structural change, patents, spin-offs, etc. are not KDs, they are nevertheless easily observable results of KDs. That is why it is often useful to start from those changes in order to identify where and whom to start the empirical work with.

Here are some illustrative examples (that concerns both regional case studies and firm level case studies) of KDs identified by changes:

- Several firms active in same, similar or complementary activities significantly changed their markets and/or their products, their technologies;
- a research institute produces several spin offs, employs foreign scientists or engineers, participates to international research projects;
- the historical heritage of a former industrial city is progressively becoming a resource for cultural tourism, cultural or international sport events are organized and new flows of tourists arrive.

### **The case study Knowledge dynamics in the ICT sector in Bratislava region**

In the following part of our paper we try to implicate theoretical part at the conditions in Slovakia – specifically at ICT sector in Bratislava region. Bratislava region was also chosen because within the undergoing structural changes in the region's economy there is evident growth of tertiary sector, especially in trade, services, banking, and insurance. The ICT sector gains growing importance. Due to availability of qualified workers, excellent telecommunication infrastructure, presence of universities and easy access via Vienna, most technological investors located their support and development centers in Bratislava. ICT sector is also priority sector of EUROTITE project.

**Bratislava region** is located in the south-west part of Slovakia, part of the dynamically developing so-called gold triangle Vienna-Bratislava-Győr/Budapest. In terms of territorial-administration arrangement it is concurrently NUTS 2 and 3 region with 8 districts at NUTS 4 level. It is governed by Bratislava Self-Governing Region. In 2005 603.7 thousand of inhabitants lived in the region, density of the population reaches 294 inhabitants per km<sup>2</sup>. The region is characteristic with the high level of urbanization, exceeding significantly the SR average, up to 83,4 % of population lives in urban areas. It is situated at the junction or it lies in the proximity of several multimodal corridors of European importance. Per capita GDP reached 129,3% of the EU27 in 2004. The economic base is characterized by multi-sectoral structure with fast growth of entrepreneurial activities of both domestic and foreign entities (60 percent of all direct foreign investments in Slovakia are located in the region). The economy is dominated by the services (banking, ICT, trade, tourism...), which accounts for 64,1% of the added value of the region. It is a centre of R&D in Slovakia hosting 44% of research capacities. Even though Bratislava region is the centre of higher education and research in the SR, the quality of regional research sector is still debatable. With the view of international comparison, there is shortage of sufficient research specialization, financial provision, sufficient critical mass of research activities and top quality research in some field. Lately, there has been increasing pressure on involvement in international programs and research networks, especially in the field of technical sciences. Transfer of knowledge from academic sector to regional economy is limited; there is lack of institutional prerequisites and, on the other hand, there is a demand of entrepreneurial world, though still limited but growing. Education and research sector is represented by several centers that deal with information security from the point of view of technical sciences (Faculty of information science and information technologies, Faculty of electrical engineering and information science STU Bratislava), of economic sciences (Faculty of economic information science EU

Bratislava), and of natural sciences (Faculty of mathematics, physics and information science CU Bratislava, Institute of information science SAS).

**The ICT sector in Slovakia** has been a source of growth in recent years, notably due to foreign investments. Bratislava region attracted a number of international ICT firms, which are looking for the right balance between the level of costs and quality of services that means between the level of wages and qualification of people. In this case study we will primarily focus on two segments: on firms operating in IT security sector (Silentel, Eset, Seetrust) and on impact of the MNEs on the ICT sector in Bratislava region. There is a large part of innovative fast growing ICT small and medium sized firms in Bratislava region that are either new start-ups or spin-offs from university or academy of science. Some of them are already successful on a global market. On the other hand there are 3 types of IT centers operating in Bratislava: call centers, international operation centers and software houses (e.g. HP, AT&T, IBM, Accenture, Soitron etc.).

## 1. Security technologies in the ICT

The sector of information security involves firms, the main products of which are concentrated on some of the fields of information system security in public administration, firms and for individual users. The main segments of this market comprise protecting information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction (anti-virus protection, electronic signature, cryptography, web application security, security IT audits, etc.)

Market with enterprise information security has now in Slovakia a growing tendency. After a significant penetration of IT into administration of firms, the field of information security has become an important and inevitable part of (information) management of organizations. Another important accelerator of the development of this market is the initiative of building IT society in the EU as well as in the SR, mainly in the field of public administration (eGovernment). With developing market, several firms, that dealt with introduction and processing of information systems, increased or complemented their activities by providing information security services (EMM, Tempest). These firms utilize standard processes aimed at a complex audit of customer information security.

Besides entire development of the information and communication security sector, there is an independent segment of firms that specialize in a specific aspect of security – the most successful being that of coding of mobile communication (Silentel), anti-virus protection (ESET) and biometrics (Innovatics). These firms offer very specific products that result from active creative activities of those firms (often in collaboration with public research sector). These firms have a decisive role on foreign markets and an intensive growth is expected in near future.

Further targets of research could be other potential firms that offer complex services in the field of information system security, in the field of consultancy (audits, systems), in the field of training and certificate (L&D Consulting, VaF., REI, EMM, Gordias). Another group of potential firms are those dealing with information security whilst this activity is not their core business (Soitron, Tronet, Lynx, Varias, S&T Slovakia, APP Slovakia, Bank Pro Team, Columbex International, Netlab).

Bratislava region can be included among regions that extensively utilize knowledge generated outside the region (international security standards ISO 17799, ISO 20000, ISO 27001, CISA and CISM). In order to have access to such knowledge, firms become members of various international associations dealing with security, e.g. ISACA, ISSA, IEEE Computer Society. According to the KPMG survey, in Slovakia an important role in creation of security standards is played by parent companies, utilization of the so-called British Standard represents 15 %. It is, of course, inevitable to adapt international standards to local

ones; firms modify a system in compliance with the concrete situation, for a client, for his specific needs and requirements. There are also other ways that can be characterized by a cumulative knowledge process, where proximity learning plays an important role. In this case, intensively used knowledge based on local research institutions (universities, academy of sciences) in the field of cryptography and mathematics. A number of firms in this sector originate as spin-offs from academic organizations or their owners (or key managers) act as lecturers at universities in the region.

## 2. Impact of the MNEs on Bratislava region

Slovakia and especially Bratislava region have become an important investment destination for IT sector. Global IT players as Accenture, Dell, HP, IBM, Lenovo and others created in their service centers more than 1,500 work places within the period of one year. Operation centers employ highly qualified IT specialists, such as software engineers, project managers and consultants. Despite the fact that they often employ fresh university graduates without experience, they highly value the skills and qualification of such labour force. The research target firms belong to the major employers in the region in the IT sector.

At the beginning of the 90<sup>th</sup> large first IT investors in the region were using knowledge developed in their parent companies and did not contribute to the regional knowledge dynamic. Firms had been usually intensively seeking for local IT skills and not for the specific local knowledge. However, they are slowly becoming embedded in the region by capital mergers and acquisitions (Siemens), business co-operation with regional IT firms and co-operation with regional universities within the process of new standards in IT education.

Slovak companies start to establish professional and close relationships with its local MNE partners and suppliers. Companies reached remarkable level of authorized partnerships and specialist certificates by big foreign companies. Implementation of customer's projects involves intense cooperation with companies and requires perfect knowledge of their products and methods of tailor-adjusting them to the clients. Local IT skills and knowledge have adapted to the newly one coming from Western Europe. This creates new knowledge trajectories and we expect that local knowledge processes of generating specific knowledge will occur. At the same time intensive in-firm training of large pool of new workforce (usually new graduates) may facilitate knowledge contextualization in the future.

Several international ICT firms started to cooperate with universities and secondary schools, in order to prepare students for their future career in ICT. For example Cisco Systems signed the special agreement with Slovak Ministry of Education to train network specialist at the Slovak schools. In 2005 approx. 3 600 students graduated at "Cisco Network Academy". At present the certificate of the network knowledge from Cisco Academy is in demand in the recruitment process in local international ICT firms. Similar as Cisco also Microsoft started the MS Academy - a programme running on the base of agreement with Slovak Ministry of Education. There are initiatives of local MNEs (e.g. IBM and Sun Microsystems) to enter to the education system with similar project in close future.

## Conclusions

Bratislava region enjoys the status of the region hosting capital city with high concentration of governmental R&D capacities. Institutions as Academy of Science and existing universities are providing mainly fundamental research with emerging albeit still limited transfers and knowledge spill-over to the business sector. Meanwhile, recent major regional initiatives are associated with development of joint training programmes and innovation strategies, establishing necessary innovation infrastructure, and marketing activities of R&D results. Bilateral co-operation among key regional players within innovation system (mainly university – business) is slowly developing. Currently the main

incentive is to initiate reconstruction of training programs at the university with will correspond with requirements of (mainly) large foreign investors. The technology based and most dynamically growing segment of the economy - larger foreign-based companies - has still marginal impact on domestic research, even if its technology potential may soon contribute to more intensive interchanges between domestic research community and industry. Joint bilateral, especially long-term R&D activities, are still lacking.

The current ICT sector has evolved by the ongoing merger of information technology and telecom technologies; consequently a range of new products, services, applications, markets, policy and regulatory domains have emerged. The IT sector development in Bratislava region is characterized by two parallel trends. The first trend is the development of local firms and their opening positions on new markets (as for instance segment of information security). Substantive share of firms, however, operate on local and national markets, as they take advantage of better knowledge of those markets. Competition pressure of big foreign firms is reflected in higher number of acquisitions and mergers of smaller local firms. More significant success on foreign markets can be observed with the firms that developed very specific product (service).

Another dominant trend is the entry and development of big IT centres of global firms that employ considerable part of labor force. Knowledge dynamism of such firms is often strictly internal (intra-company) with very limited interaction with local knowledge base. Even though firms penetrate into the region for the sake of obtaining cheap labour force with good IT qualification, saturation of labour market starts to be a serious problem. Fluctuation of IT workers in existing development and service centers is still low but recruitment of new workers, in case of extension of capacities, is not simple. Therefore firms show a considerable interest in closer collaboration with universities in the field of defining and providing supplementary learning activities. Contribution and structure of IT specialists on labour market still cannot cover the growing demand.

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