Knowledge-based ECONOMY

as factor of competitiveness and economic growth

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Edited by Małgorzata Runiewicz-Wardyn

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PREFACE

The book describes the emerging phenomenon of Knowledge-Based Economy (KBE) by looking closely at the processes of its development, its key factors and their interactions. A KBE is characterized by technological, economic, social and cultural innovation. The key drivers of KBE are: investments into research and development (R&D), education and training; development of information and communication infrastructure (ICT) as well as the institutional environment that provides incentives for entrepreneurship and efficient use of existing and new knowledge.

The aim of the book is to investigate what was the impact of KBE (its direction, structure and character) on competitiveness and economic growth of firms, sectors and regions. The subject is very important for the future economic and competitiveness related policies. Particular emphasis is placed on the following subject-related topics:

- Knowledge as a new paradigm and factor of competitiveness and economic development;
- Position of Poland in terms of knowledge-based economy in comparison to other EU countries;
- Impact of new technologies and knowledge management on economic growth and employment in regions;
- Policy implications for R&D, technology transfer and knowledge implementation for country's and regional competitiveness.

The book contains five parts. The first part of the book includes theoretical background and study results on the relations between knowledge economy and competitiveness of firms, sectors and national economies. The authors explore the evolutionary nature of competitive advantage theory and present the latest study results on the applicability of new growth theories in explaining the economic performance of firms, sectors and nations.

The second part of the book presents authors' approaches to measuring the impact of KBE and its main pillars, e.g. economic incentives and institutional environment, labour skills and education, and advancement in information and communication (ICT) infrastructure and innovation system, on economic growth and competitiveness.

The central question of the third part of the book focuses on the knowledge-based growth capabilities of regions, and how can they be improved through regional policy. Knowledge spillovers also happen in particular places having the implications for the regional growth capacities and competitive advantages of local economies. The authors draw attention to the two groups of subject-related problems. First group of problems deals with the general aspects of regional competitiveness and growth, e.g. regional innovation policies, R&D expenditure, etc. The second group discusses the results of selected case studies on the implementation of the knowledge-based regional development programmes, and their possible impact on regional growth and competitiveness.

The fourth part of the book discusses briefly the ICT and Internet impact on the economic efficiency of companies and sectors, including e-commerce enhancing the overall business and value-adding activities of organizations.

Finally, the last part of the book discusses challenges and opportunities related to the knowledge-based growth in developing and post--socialist countries. The opportunities arise from high level of education and long-term traditions of knowledge-intensive sectors in many transition economies; the challenges are associated with the poor institutional environment, notably labor market institutions as well as inadequate property rights legislation.

PART I

THE ROLE OF KNOWLEDGE IN MODERN THEORIES AND PRACTICE OF COMPETITIVENESS AND ECONOMIC GROWTH

Itzhak Goldberg
Gabriel Goddard
Smita Kuriakose

BUILDING KNOWLEDGE-BASED ECONOMY AND ABSORPTIVE CAPACITY TO ENHANCE GROWTH: THE ROLE OF CROSS-BORDER KNOWLEDGE FLOWS IN EUROPE AND CENTRAL ASIA (ECA)

1. INTRODUCTION

Improving the absorptive capability of countries – their ability to tap into the global technology pool – is an important mechanism for accelerating industrial development and increasing economic growth. Trade flows, foreign direct investment (FDI), labor mobility and training, are among the key mechanisms for knowledge absorption. But such transfers are not automatic. They also require a good investment climate as well as a national education and research and development (R&D) systems. This study provides an analysis of the extent of knowledge and technology absorption by firms in Europe and Central Asia (ECA) based on statistical analyses of various data sources, including the World Bank Enterprise Surveys and patent databases maintained by the United States (USPTO) and European Patent Offices (EPO), and case study evidences.

The study addresses the following issues:

- How does openness to trade, participation in global supply networks, and investment in human capital via on-the-job training enhance knowledge and technology absorption in manufacturing firms in the ex-socialist ECA countries?

- How does FDI stimulate acquisition of managerial and technical skills, new machinery and equipment and market development?
- What can we learn from patents and patent citations about international knowledge flows and about cross-national technological cooperation in ECA?
- What are the policy implications of the above issues and what is the role of government interventions to facilitate knowledge absorption in ECA?

2. DEFINITION AND FRAMEWORK

Absorption is a costly learning activity that a firm can employ to integrate and commercialize knowledge and technology that is new to the firm, but not new to the world – for simplicity development of new to the world knowledge can be considered innovation. In other words, innovation shifts a notional technological frontier outwards while absorption moves the firm closer to the frontier. Examples of absorption include: adopting new products and manufacturing processes developed elsewhere, upgrading old products and processes, licensing technology, improving organizational efficiency, and achieving quality certification.The ECA Knowledge Economy Part II (ECAKE II) is a follow up to "Public Financial Support of Commercial Innovation" (ECAKE I), which focused on innovation. ECAKE II provides a more detailed analysis of the complementarities between innovation and absorption, with a focus on absorption. As will be shown in our empirical findings, R&D, which is a key input into innovation, is an input into absorption as well. Indeed, there are important complementarities between innovation and absorptive capacity. Innovation promotes absorptive capacity because the generation of human capital and new ideas and the associated knowledge spillover effects help build absorptive capacity. Conversely, the absorption of cutting edge technology inspires new ideas and innovations.

The **conceptual framework** that shapes our analysis follows the endogenous production-function approach. Its premise is that innovation and absorption of knowledge, which are central forces behind economic growth, are in turn determined by economic conditions and policies. We consider trade, FDI, R&D, and patent citations as "channels of absorption", that is, conduits for diffusion of knowledge between countries and absorption within firms. These channels constitute the central focus of the study. Our analysis investigates how the presence of these channels (i.e., the fact that a given firm has received FDI, or invests a certain amount on R&D) affects absorption outcomes. A second line of inquiry asks about the conditions and policies that induce firms to activate these channels as part of their overall growth strategy.

Properly designed economic policies can significantly influence the degree of a country's absorption and the decisions by firms to undertake investment decisions to absorb new technology. The channels of technology absorption – trade, FDI, R&D – need a stable and conducive policy framework and a business-friendly investment climate, and a firm's ability to absorb this technology and knowledge depends on its organization and the skills of the workforce.

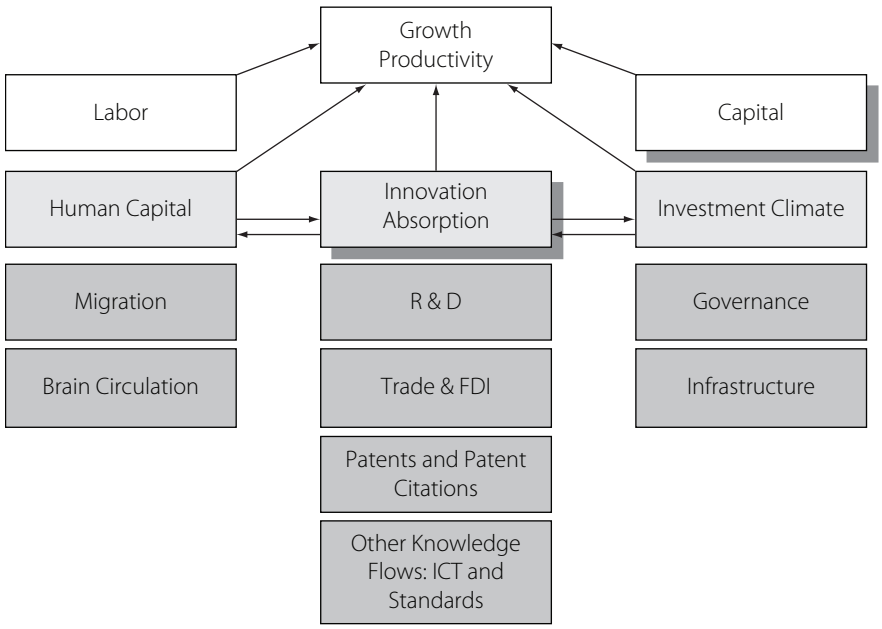

Figure 1. Innovation and Absorption as Inputs into Growth and Productivity

Figure 1 describes the important channels of absorption at the country as well as the firm level. While in and out migrations of workforce and brain circulation are important channels of innovation and absorption, they are beyond the scope of the analysis in this study. The channels highlighted in the middle column of Figure 1 will constitute the central focus of the study.

3. THE LINKS OF KNOWLEDGE ABSORPTION TO TRADE AND FDI

Openness to foreign trade and investment is critical to the process of technological absorption and diffusion, not only for the competitive pressure it exerts on management and corporate governance but also for the exposure to global best practice technology and management techniques that such openness provides to local firms. We address two questions: Is there "learning by exporting"?; How does FDI affect absorption?

Is there "learning by exporting"? The concept of "learning by exporting" has been seen in the literature as a process by which exporting increases productivity by exposing producers to new technologies or through product quality upgrading. Exporting is another channel through which firms based in open economies can acquire foreign knowledge about technologies and products. However, the apparent absence of statistically significant learning-by-exporting effects documented in many contexts has led many economists to question its importance and has, to some extent, undermined the productivity case for pro-trade reform.It may be that a decade of applied research has systematically underestimated the effects of FDI and openness on the technology absorption of local indigenous firms. Our study strongly suggests that the conventional methodology employed by virtually all previous researchers to estimate learning-by-exporting effects may be biased against finding a linkage between exports and increased technology absorption, even when such a relationship exists. This bias exists, in part, because the conventional methodology uses changes in TFP as a proxy for technology absorption and diffusion instead of considering concrete instances of efficiency-enhancing technological investment.

How does FDI affect absorption? There is an ongoing debate in the literature about the impact of FDI: some have suggested that positive **technology spillovers from FDI** are largely limited to "vertical" FDI transactions, in which there is a direct purchasing relationship between the foreign firm and the local supplier. Using more direct proxies of the firm's relationships with multinationals, we find evidence that both vertical and horizontal FDI promote learning by local firms, and our case study identifies some explicit channels through which the learning occurs.

Econometric Analysis: The BEEPS datasets are cross-sectional surveys, and the most complete of these surveys is the most recent one, conducted in 2005. In these surveys, firm managers are asked specifically whether their firm recently introduced a new (to the firm) product, upgraded an existing product, acquired a new production technology, signed a new product licensing agreements, or acquired a new quality certification. Each of these potentially represents a dimension of the kind of technology absorption process we believe is fostered through exposure to international best practice. Our contribution lies in establishing a direct connection between the exposure to international technical best practice through trade and supply networks and specific, discrete processes of technical improvement at the firm level.

The indicator variables mentioned above are more direct measures of technology transfer or technology absorption than changes in productivity. While the measures have the disadvantage of reflecting the self-assessment of a firm representative, they have the important advantage of not being obscured by changes in the firm's market environment

that are coincident with the absorption of the new technology. All but one of our measures of international connectedness (as seen in Table 1) are positively associated with technology upgrading, and the coefficients on the export and multinational JV dummy variables are particularly large. Another empirical regularity that merits comment is the robustly positive relationship that exists between measures of human capital at the firm level and technology absorption.

Table 1. Correlations of Technology Upgrading with Firm Characteristics ([+] positive correlation, [−] negative correlation)

Dependent variable: Upgrade						
Exporter Dummy	[+][4]					[+][4]
Export %		[+][4]				
Majority Foreign Owned			[−][2]			[−][4]
% Sales to MNCs				[+][4]		[+][4]
JV with MNC					[+][4]	[+][4]
Size	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]
Age	[−][4]	[−][3]	[−][3]	[−][3]	[−][3]	[−][3]
State Owned	[−][4]	[−][3]	[−][3]	[−][3]	[−][3]	[−][3]
R & D Expenditure	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]
Foreign Ownership	[−][3]	[−][2]			[−][2]	
Web Use	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]
Training	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]
Skilled Workforce	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]
University Graduates	[+][2]	[+][3]	[+][3]	[+][3]	[+][2]	
Governance Index	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]
Use of loan	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]	[+][4]
Observations	7901	7897	7920	7754	7920	7736
R-squared	0.26	0.25	0.25	0.26	0.28	0.29
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes

[1] Significant at 10%.
[2] Significant at 5%.
[3] Significant at 1%.

In our panel data, *transition* to exporting is positively and significantly correlated with *increases* in measured technology upgrading. We find this to be true even when we control for firm size, firm age, state ownership, foreign ownership, human capital, and environmental factors affecting export climate. This is consistent with the hypothesis that exposure to foreign markets fosters learning, and our results suggest that this learning effect is not limited to foreign-owned firms. It is, of course, not inconsistent with the view that firms, as they seek to transition to exporting, will invest in upgrading their technology to make themselves more competitive in foreign markets. In other words, technology upgrading could also increase exports – but, to the extent that the technology upgrading was motivated in the first instance by the desire to compete in a foreign market, it still reinforces the policy implications we stress.

Policy implications

Reduction of the remaining barriers to FDI in ECA could increase FDI and, given the positive association of absorption and FDI, facilitate absorption. For example, Russia fares worse than other countries in the region, attracting one of the lowest levels of FDI inflows. World Bank research has pointed to key shortcomings in the Russian business environment; many of these shortcomings are a function of government policies that limit FDI inflows and foreign firm operations, especially in the service sector. Another example of the remaining reform agenda in ECA is Kazakhstan, which has done more to lower its tariffs on goods than it has to liberalize its barriers to FDI in the services sectors. In view of the importance of exports and FDI to learning and knowledge absorption in the private sector, the "behind the border" reform agenda in ECA continues to play a crucial role in enlarging the available channels for technology absorption from the rest of the world. The reform agenda includes[4]:

- Reduction of **entry barriers** which have been shown to dampen investment, calling for trade reforms.
- Reforms of the regulatory regimes for **business services**, such as in telecommunications, financial services and transportation, are important, as it has been shown that these reforms are highly correlated with inward FDI in business services in ECA;
- **Trade facilitation**, which includes improved and simplified customs procedures, enhanced port efficiency, and improved conditions for transportation including reduction of bureaucratic and governance problems for transportation services. As the new WB study "Connecting to Compete: Trade Logistics in the Global Economy" shows,

[4] Source: authors' calculations using BEEPS data for 2002, 2005.

many ECA countries can do a great deal to improve their trade facilitation.

- Reduction of non-tariff, **technical barriers to trade**, technical standards or regulations that unfairly favor home production over imports, hamper entry of firms into export markets, reduce trade in some cases, and increase firm start up and production costs.

4. HOW DOES FDI STIMULATE KNOWLEDGE ABSORPTION? – A CASE STUDY OF SERBIAN ENTERPRISES

The objective of this case study is to complement and better understand the findings from the econometric analysis of the BEEPS surveys presented in the previous chapters. The econometric analysis provides evidence in favor of the view that multinationals contribute to *indigenous* technological improvement, but survey analysis can provide only a limited perspective on the causality relations between FDI and absorption. Focusing on the dimensions of product mix, production technology, management and skills, the case study sheds light on the firm-level absorption process following FDI acquisition in the context of a transition and post-conflict country, Serbia. The case study illustrates the critical role played by the foreign strategic investor to help a company to cope with the challenges of absorbing knowledge embedded in capital goods, from exports, from "knowledge brokers" and codified in intellectual property. The following key questions guide the research and discussion in this chapter:

- What is the effect of foreign ownership on technology absorption: i.e. is there a difference in the absorption process followed by firms acquired by a local *vis-à-vis* foreign investor, e.g. MNE?
- How does ownership affect corporate governance and how does the latter, in turn, affect absorption?
- Was management and organizational change a pre-requisite for the implementation of new investments and technology?
- What were the effects of the investment climate on M&A FDI and what are the corollary effects for greenfield FDI.
- What determined the foreign investors' relocation of R&D to and from Serbia?

Eight large companies operating in the metal processing, household chemicals, pharmaceuticals, and cement industries were included in the case study. In brief, the guiding selection criteria were that: industries as well as company characteristics (esp. size of the firm) helped for the *comparability* of results; company characteristics and the type of acquisition (esp. type of buyer) provided some *controls to test counterfactuals*; companies were privatized early on to ensure the availability of archival information (due diligence, post-acquisition monitoring) and sufficient

time for key restructuring and investment decisions to have been implemented. The chapter presents the main results about absorption via acquisition FDI in different industries; comparing the pairs of companies in as far as it is possible.

Experience in ECA shows that concentrated ownership is important for productivity growth and for corporate governance. We know from the literature that risk–taking incentives – which are necessary for innovation – depend on good corporate governance; managers in state or dispersed ownership enterprises have little incentives to take risk as they have a lot to lose from the downside, and little to gain from the upside, of innovation. The Serbian case studies provide insights into the relevance of post-transition corporate governance for the willingness of managers to innovate and absorb; i.e., to take risk and carry out the needed reorganization. The dispersed ownership resulting from mass privatization (or from the pre-reform 1997 Law in Serbia) have proved particularly problematic in post conflict-countries, plagued by ethnic and social divisions, such as Bosnia, Moldova, Armenia, Macedonia and Tajikistan. In such circumstances, a strategic owner, local or foreign, is a sine qua non condition for improving corporate governance and consequently for technology absorption.

Our case studies suggest that the speed and scale in re-establishing a presence of the pre-sanctions Serbian exports on foreign markets differs between those enterprises privatized to a foreign strategic and those sold to a local investor. In general, the companies sold to domestic investors were not able to increase exports in such a significant way while comparators receiving FDI are doing much better. Moreover, the really big changes in product mix and manufacturing were in companies bought by foreign investors. We found that, among the recipients of foreign investment, all but one company had replaced their top management. New directors were brought in from the MNE or also the domestic investor's holding, from rival companies, and promoted from within.

In companies acquired by foreign investors, the comparative advantage for R&D lies in the adaptation of products and machinery to local conditions. For example, advanced formulae or product designs are transferred from the MNE and adapted locally so that they can be manufactured efficiently in the acquired plant.

Policy implications

To solve the enduring problems of dispersed ownership in insider-dominated companies that nonetheless have the potential to attract FDI through M&A, the government could facilitate consolidation of its stake with that of other minority shareholders, of packages of more than 51% of the shares, which could be interesting enough to attract a strategic investor. In addition, in M&A involving companies with partial or full

state-ownership, the government could facilitate: (i) hiring of high-quality financial advisors for transaction, (ii) attracting a core (strategic) investor by accepting lower revenue for the sale of government shares.

The Serbia case studies describe intensive training efforts conducted by foreign acquirers to bring the acquired firms to the technical frontier. In some cases, this included bringing assembly line workers and a shop foreman into established plants in other countries, so that front-line workers could receive direct advice and instruction from their peers in the parent company. Training manuals and training procedures used in contexts like this can often be considered strategic assets of a foreign firm; there may be a natural reluctance to share such knowledge with unaffiliated indigenous firms.

5. PATENT CITATIONS, INTERNATIONAL CO-INVENTION, AND MULTINATIONAL SPONSORSHIP OF LOCAL INVENTION

We analyze international flows of disembodied knowledge by analyzing three of their many channels: patent citations, international co-invention, and multinational sponsorship of local inventions**.** While patents are viewed as a form of intellectual property right over some of the economy's innovative output, patent citations provide us with a convenient metric of how various existing pieces of patented knowledge have contributed to the creation of a new piece of patented knowledge. Innovators aim to invent new products but inadvertently they also create knowledge that is not retained as a trade secret. This disembodied knowledge becomes available to other innovators and reduces future R&D cost to all. A company that takes a patent on an invention is *legally required* to disclose important information about the new technology, and this information becomes public. There is extensive literature that shows that patents serve as an important channel of technological diffusion and that patent citations are a good proxy for the actual flows of technological knowledge.

The USPTO and EPO patents data suggest that there is a disproportionate concentration of patents in the relatively more advanced ECA economies. Hungary and the Czech Republic are clear standouts in terms of inventive performance. Using another new source, the technology absorption study of the Global Economic Prospects 2008 reports that among middle-income countries catch up is particularly strong in the Czech Republic, Hungary, and Poland, where the level of technological achievement increased by more than 70% during the 1990s.

For most countries, the pace of convergence was much slower. Russia is a large patent generator in aggregate terms, but it is less significant than one might expect given its size and Cold War era scientific

strength. Importantly, the patent data shows that from 1993 through the end of 2006 (Figure 2), seven countries, Russia, Hungary, Poland, Slovenia, the Czech Republic, Bulgaria, and Ukraine (ECA 7), obtained 5,489 patents, whereas India-based inventors obtained only 3,331 and China-based inventors obtained 4,063. The performance of the ECA 7 countries has been much better on a per capita basis. In recent years, ECA patenting in the United States has not grown significantly, while India and China have surged ahead.

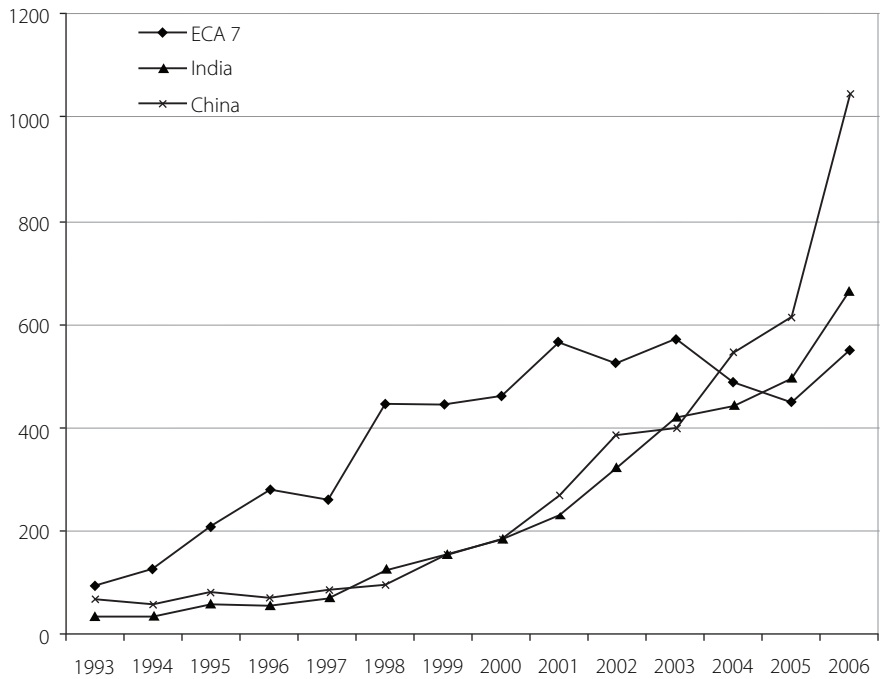

Figure 2. US Patent Grants for the ECA 7 vs. India and China

Source: authors' calculations based on the US Patent and Trademark Office CASSIS CD-ROM, December 2006 version. The graph compares counts of patents in which at least one inventor is based in one of seven ECA countries, India, or the People's Republic of China. The ECA 7 are Russia, Hungary, Poland, Slovenia, the Czech Republic, Bulgaria, and the Ukraine.

Our analysis finds statistical evidence of the relative isolation of the R&D community in many ECA countries based on international technological trends: indigenous patents generally make fewer citations to the existing state of the art than comparable patents filed in other parts of the world, and they cite "narrower" inventions. Traditional scientific institutions are characterized by the poor impact of their patents. Moreover, the numbers of indigenous patents are low relative to the level of R&D investment.

Figure 3 disaggregates ECA patent grants into those generated by international teams of inventors and those generated solely through the efforts of inventors based within a particular ECA country.

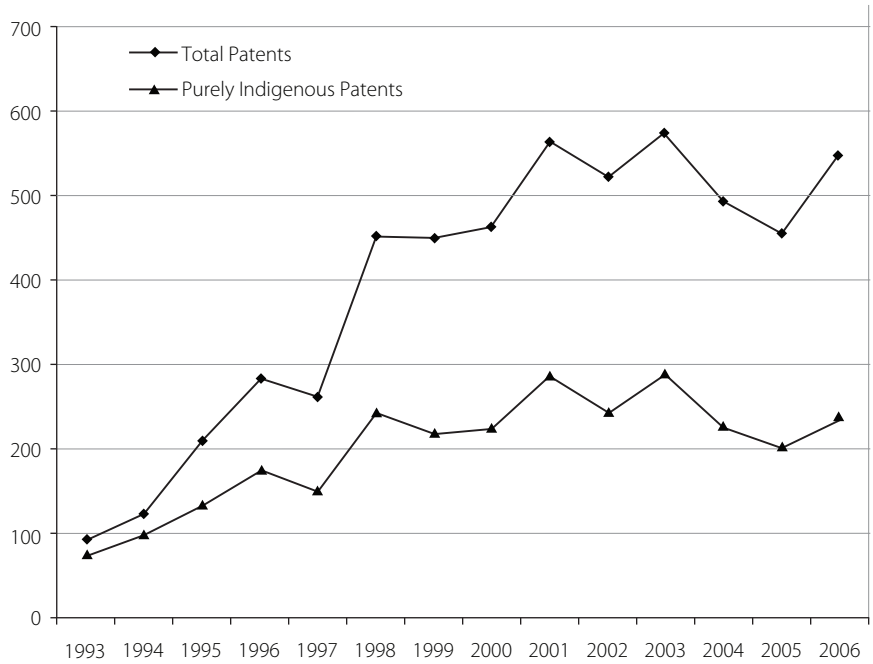

Figure 3. The Expanding Role of International Co invention in the ECA 7

Source: authors' calculations based on the US Patent and Trademark Office CASSIS CD-ROM, December 2006 version. The graph tracks total counts of patents in which at least one inventor is based in one of seven ECA countries: Russia, Hungary, Poland, Slovenia, the Czech Republic, Bulgaria, and the Ukraine. "Purely indigenous patents" are those generated by a team whose members are all based in a single ECA country.

On the positive side, we observe that international R&D collaboration, of various forms, has allowed the ECA region to partially sidestep the handicap of its own R&D productivity imposed by its insufficient grounding in the recent advances in the state of the art. Various forms of international R&D cooperation appear to be quite important in ECA inventive activity. A large fraction of ECA patents taken out in the EPO are "co-invented" with inventors in Western economies, of which Germany plays a particularly important role. Co-invention is a patent in which at least one named inventor is located in the ECA region and at least one inventor is located outside the region. Co-inventions are quite common. Most regional specialists would not be surprised to see the revealed prominence of German inventors in these co-inventions.

Policy implications

All of the findings reaffirm the need for continued efforts to reform ECA R&D systems and complete the transition from the socialist-era science and technology architecture to a system modeled on global best practice that is more internationally integrated and more market-driven. In the CIS, the persisting effects of the legacy of Soviet R&D policies account for a bureaucratically rigid, hierarchical system that is detached from the needs of the business community and relatively isolated from the international scientific community. We find statistical evidence of this relative isolation in the citation patterns. We see evidence of the limitations of indigenous invention in the relatively small number of citations these patents receive from subsequently granted patents.

Foreign firms appear to be making a significant contribution to ECA-region inventive activity. The research described above documented the significant contribution foreign firms have made and are making to the ECA-region inventive activity. Foreign firms' local R&D operations and their sponsorship of local inventors collectively generate a large fraction of the total patents emerging from ECA countries. Not only does this process of international co-invention contribute to the quantity of ECA patenting, but it also raises the quality of ECA inventive effort. Whereas indigenous ECA patents lag behind other regions in terms of the degree to which they build on prior invention and extend it, the ECA patents created through multinational sponsorship are more effectively connected to global R&D trends and generally represent inventions of higher quality.

We argue that governments should encourage foreign R&D investment and international R&D collaboration. However, as shown in ECAKE1, measures to support R&D are ineffective when the key prerequisites, human capital and investment climate are insufficient as discussed below.

6. LOOKING FORWARD

This study provides new and persuasive evidence of the importance of trade openness, FDI, human capital, R&D and knowledge flows for innovation and absorption in ECA. The countries in the region differ in their remaining reform agendas, both in general terms and in these areas in particular, as well as in the relevant resource endowments needed to affect the transition towards a more dynamic and globally competitive knowledge economy.

The fast technological catch-up experienced in the more reformed economies is indicative of the fact that within-firm productivity improvements, rather than reallocation of resources, are growing in importance

as a source of growth in ECA. The countries that are now member states of the European Union increasingly participate in FDI-driven intra-industry trade, which is conducive to technology absorption. But many of the CIS and SEE countries still face a remaining agenda of enterprise restructuring, easing entry and exit of firms, improving access to credit and accelerating the "behind the border" reforms to benefit from trade openness.

As was stressed in ECAKE1, the pre-requisites for the success of innovation and technology absorption are adequate (i) skills and human capital and (ii) investment climate and governance. ECAKE1 presented the Knowledge Economy Index (KEI) for human capital and investment climate. Eight ECA countries' (Estonia, Slovenia, Czech Republic, Latvia, Lithuania, Hungary, Poland, and the Slovak Republic) score clearly higher than others. Some countries have a lower score due to one or more bottleneck in the mentioned pre-requisites: for example Russia has a low score on the investment climate and Turkey has a low score on education.

Even as knowledge, commercial innovation, and R&D become a priority for ECA's advanced reformers, the Industrial R&D institutes (IRDIs) inherited from the centrally planned system remain un-restructured in many ECA countries. Scarce resources spent on subsidizing the subsistence of IRDIs could have been used more efficiently to encourage innovation. Restructuring of IRDIs is needed to stimulate the transition of applied R&D to projects that are relevant for private enterprises, and ideally there should be a migration of laboratory workers to the private sector. A movement of qualified resources to the private sector is a key step in rectifying the imbalance between public and private R&D spending. Restructuring would also resolve some of the current intellectual property conflicts of interest created by the systemic moonlighting of RDI workers in private enterprises. ECAKE III will study restructuring or closure of the old IRDIs to build a sector of public and/or private research institutes and national laboratories based on best practice models, and available transition instruments to facilitate the restructuring effort (e.g., technology business incubators, science parks, etc.).

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Małgorzata Runiewicz-Wardyn

EVOLUTION OF FACTORS AND MEASURES OF INTERNATIONAL COMPETITIVENESS. THE INCREASING ROLE OF KNOWLEDGE

1. INTRODUCTION

The economy is an evolutionary system. The nature of competition and competitive advantage has been transforming throughout the decades under many factors, from globalization to the rapid diffusion of new technology. The evolutionary nature of competitive advantage required firms, sectors and regions to act differently in order to survive and prosper. In particular, they must look to new sources of competitive advantage and engage in new forms of competition (see also DeNisi, Hitt and Jackson 2003).

Knowledge, and its application, is now acknowledged to be one of the key sources of growth in the global economy. The increasing importance of knowledge has created both a challenge and an opportunity for developing countries. If properly adapted to circumstance and effectively deployed, knowledge can be a key driver of development.

The first part of the paper aims at presenting the evolutionary approach to economic theories in explaining the nature of competitive advantage and competitiveness. The second part of the paper demonstrates the empirical evidence of relative competitive advantages of European Union and Poland in knowledge and skill factor intensity.

2. FROM CLASSICAL TO "NEW GROWTH" THEORY

Theory helps us make sense of the ongoing shift from a resource-based economy to a knowledge-based economy (Cortright 2001). An early attempt to understand how nations compete and what determines the growth was expressed in Ricardo's theory on comparative advantage. Assuming that countries differ in their production technologies, the author argues that each country enjoys a comparative advantage in the production of at least one type of goods. In early twentieth century, Heckscher and Ohlin postulated that patterns of trade and comparative advantage depend on the relative abundance of factor endowments or production factor availability. Countries would benefit from trade by exporting the goods that are intensive in its abundant factor (DeNisi et al. 2003). Thus, in a resource-based view, the competitive advantages of firms were explained by the distribution of resources in competing firms.

Two other well-known economists contributed to a better understanding of competitiveness. Schumpeter argued that the innovation and technological change comes from the entrepreneurs, who are by carrying out "new combinations of resources" improve competitive advantage and economic growth of nations. More importantly, Schumpeter argued that certain changes in the economy are caused endogenously and that actual economic development consists of a sequence of historical states enhanced by "internal dynamics" (Witt 2002, p. 7–22).

Important conclusions of Solow studies over the growth factors of United States economy between 1948 and 1982 demonstrated the fundamental role of technological innovation and increased know-how in an economy (DeNisi et al. 2003). In the 1950s, Robert Solow built a model that added a third factor, after capital and labor, technical knowledge to spur economic productivity and growth. Solow viewed technology as a continuous set of knowledge that became evident over time and not created by economic forces. Solow's model is often referred to as an "exogenous" model of growth (Cortright 2001).

Thus, the analysis of competitiveness must consider different dimensions interacting with one another. Porter (1990) illustrates the systemic relationship between factors of competitiveness in so called "diamond approach". The four areas that make up the diamond are: factor conditions, demand conditions, context for firm strategy and rivalry, and supporting industries.

New Growth Theory, developed by Paul Romer, departs from the traditional emphasis on the accumulation of capital and underlines that knowledge drives productivity and economic growth. Since ideas can be shared and reused indefinitely, they cannot be a subject of "diminishing

returns". This way, the increasing returns to knowledge drive economic growth. For example, the cost of developing a programming for Software or Internet website is initially very high, but costs of serving an additional user is almost equal to zero. The production capacities of information and communication technologies (ICT), particularly the Internet, give evidence to the view that information and ideas can be moved costless from place to place ("death of distance", see Cairncross 1997).

Recent studies conducted by Peteraf (1993) or Schoenecker and Cooper (1998) emphasize that a sustained competitive advantage of firms is achieved thanks to the resources that are rare, valuable, and difficult to imitate (Schoenecker, Cooper 1998). If firms successfully employ these intangible resources, they gain an advantage over the competitors, which, if sustained, may lead to higher performance and long-term competitive ability of firms and sectors. Human capital is the most valuable intangible asset of a firm, along with the other firm's resources such as brand, reputation, etc. (Peteraf 1993). The term knowledge-based resources usually refers to skills, abilities and learning capacities, which can be developed through experience and formal training as well as through the ability of human capital to adapt and acquire new information. Once a firm acquires knowledge resources through selection or training, it must find a way to diffuse that expertise throughout the entire organization. Otherwise, the impact of these knowledge-based resources on competitive advantage and long-term competitiveness will be limited. Thus, in order to exploit the intangible resources and gain competitive advantage the adequate firms strategies, structures, and systems are crucial[1].

The summary of the newest theories of competitive advantage doesn't exhaust the rich literature describing competitive advantage phenomenon, but rather synthesizes different theory approaches to the problem of competitiveness. The above mentioned theory approaches draw several conclusions. Firstly, evolutionary nature of competitive advantage theories implies the dynamic approach to competitiveness measures. Secondly, competitive advantage of firms and nations is driven and sustained by endogenous factors and firm's intangible resources such as human capital, eg. knowledge and skills. Thirdly, the institutions provide incentives for the efficient use of existing and new knowledge as well as development of entrepreneurship.

[1] Human capital refers to all of the resources that individuals directly contribute to an organization: physical, knowledge, social, and reputational (Hitt, Keats, DeMarie 1998).

3. SPECIAL CHARACTERISTICS OF KNOWLEDGE-BASED GROWTH ENVIRONMENT

Institutional framework

Douglass North argues that neoclassical theory fails to explain the success of modern economies, mainly as it underestimates the role of governments in economic development (North 1995). North points out that the ability of economies and various institutions to respond to new economic environment is critical in shaping economic development. Markets alone cannot create necessary conditions for the efficient function of a market economy (see North 1990; Olson 1996)

A successful transfer of knowledge into competitive advantage critically depends on the efficiency of economic policy to create an institutional environment. These common efforts or "collective action" of firms, education and public sectors have been ignored in classical theories of competitive advantage (Romer 1993, p. 388; Romer 1994, p. 21). New Growth Theory brought in a new view of the role of institutions in setting the necessary conditions for economic growth driven by knowledge (Cortright 2001)[2]. The key institutions dealing with the creation and diffusion of knowledge include education and training, patents and copyright offices.

Research and development

The primary source of knowledge is research and development activities (R&D) conducted by firms or public institutions. Two important types of knowledge are tacit knowledge and explicit knowledge. Tacit knowledge is grounded in experience and is difficult to express in a codify way, it is embedded in the minds of individuals and the routines of organizations and passed along to others through direct experience (Polanyi 1973; Reed, DeFillippi 1990). Explicit knowledge, in contrast, can be formalized, codified and communicated, e.g. put on the Internet and be made freely available to the world.

New knowledge, tacit knowledge, and ideas generated by R&D lead to new processes and products that are used as inputs in the production of final goods. As inputs improve their quality, or as intermediate or capital goods become more specialized, they contribute to the productivity growth. The traditional inputs (capital and labour) are characterized by diminishing returns, whereas knowledge is subject to increasing returns because, among other reasons, ideas can be shared and reused at zero

[2] Institutions make the rules of the game and the processes by which rules are determined and enforced.

cost, whereas physical capital goods and services can be used by only one person at a given time and cost (Romer 1986). Thus, R&D activity is a key driver of the competitive advantage for firms pursuing innovation.

The impact of R&D on productivity growth takes place through three channels. First, access to a larger pool of knowledge increases the productivity of R&D activities in the countries involved, thereby enhancing future productivity growth. Moreover, the cyclical character of spending in R&D and business expectations about growth are likely to be self-fulfilling, e.g. if businesses expect growth, they spend more on R&D and invest more, which triggers and sustains growth; the increasing returns associated with new technology can help make this process self-sustaining. On the other hand, if businesses are pessimistic, they may cut R&D spending and invest less, contributing to or aggravating an economic slowdown (Evans et al. 1996).

Romer (1986) postulated that R&D activities are associated with externalities, which affect the stock of knowledge available to all firms. The externalities or "knowledge spillovers" take place if new knowledge generated by the R&D activities of one agent stimulates the development of new knowledge by others or enhances their technological capabilities. Thus, R&D-based innovation doesn't affect solely the performance of those actually undertaking these activities but gives rise to important external effects ("R&D spillovers"). Careful econometric studies have repeatedly shown that the social rate of return to research (the value of all of the economic benefits received by society) is typically two to five times higher than that private rate of return (the profits accruing to the individual or the company that pioneered the innovation; Jarboe and Atkinson 1998)[3].

As a consequence, a country's productivity growth is positively correlated with the degree of its openness to flows of information and to its capability to absorb and utilize knowledge generated abroad. Both international trade and foreign direct investment are vehicles for cross-border learning about products, production processes, market conditions, etc. (see also Romer 1992).

Space dimension

Idea creation, new business development and economic change all happen in specific places. Globally competitive firms in any given industry are not only found in particular nations, but are frequently concentrated in particular regions within those nations (Porter 1990). Knowledge spillovers from the human capital in cities provide higher productivity.

[3] Property rights for an invention may influence negatively the knowledge-driven growth, e.g. patent on a specific element of a computer program may slow down the development of technology.

One leading study found that cited predecessor patents were about five to ten times more likely to come from the same metropolitan area (Jaffe et al. 1993). New industries invariably arise from nearby scientific research (Goldberg 1999). Thus, knowledge spillovers happen in particular places having the implications for the geography of economic activity and local economic development.

Empirical data support the notion that knowledge creation tends to be quite localized. Studies of the patterns of patent activity in Europe, for example, find that innovative activity, measured by new patents issued, is considerably more concentrated (Caniels 1997). Audretsch and Feldman, who examined data on new product innovations in the United States, found that the highest regional concentration occurred in those industries, in which new knowledge plays an important role (Audretsch 1998). Keller's cross-national study of the diffusion of innovations found that technological knowledge is to a substantial degree local, not global. The benefits from foreign knowledge spillovers declined with distance, on average a 10% higher distance to a major technology-producing country such as the United States was associated with a 0.15% lower level of productivity (Keller 2000).

Falling communication and transportation costs and the reduction in barriers for trade and international competition make locational advantages of industry innovation even more significant, because firms with true competitive advantages are more able to penetrate other markets. Competitive advantage in advanced industries is increasingly determined by knowledge, skills and rates of innovation, which are embodied in skilled people and organizational routines. Yet, the process of creating skills and the important influences on the rate of improvement and innovation are intensely local (Poter 1990, p. 158).

Network readiness

The role of linkages and interactions in improving competitiveness of regions and nations is assessed according to the "network readiness" indicators, which defines the capacity to exploit the opportunities offered by ICTs, e.g. Internet users per hundred inhabitants, cellular subscribers per hundred inhabitants, Internet users per host, percentage of computers connected to the Internet, availability of public access to the Internet, etc.

An important objective of ICT is storing and distributing the explicit knowledge that employees gain through their experience on the job. Designing and effectively implementing an electronic information system is one approach to develop a capability for managing knowledge. Other approaches focus more on knowledge creation (for example, through research and development) and continuous change that reflects new knowledge (for example, organizational learning).

Even though, ICT and particularly Internet increases the economic efficiency of companies and sectors via intensification of rivalry between competitors, lowering barriers to market entry and an increased access to information of buyers. Yet, a historical founder of competitive advantage (Porter 2001) regards Internet as an element of infrastructure rather than new source of value or competitive advantage.

Summing up, knowledge spillovers shape patterns of development. The existing subject literature points out to the following framework, enabling the development of knowledge-based economy: economic and institutional regime that provides incentives for the efficient use of existing and new knowledge and the flourishing of entrepreneurship; skilled population, R&D framework and "knowledge spillovers"; a dynamic information infrastructure that can facilitate the effective communication, dissemination, and processing of information; and local innovation capacities that can assimilate and adapt firms, universities and business centers to local needs, and create new technology.

4. KNOWLEDGE-BASED APPROACH TO COMPETITIVE ADVANTAGE

The key concept when using knowledge-based approach to competitive advantage is a gradual transition from price-based to quality-based sources of competitiveness as a condition for achieving sustainable long-term growth performance. Porter[4] assumes that every country follows the path of evolutionary development, consisting of the three stages related to development of competitive advantage. Every country begins from the stage of utilizing simple work and resources producing the resource-consuming and/or labour-intensive goods, then develops and moves towards production of more capital-intensive goods and finally focuses on production of goods requiring qualified work and technology. At the innovation-driven stage, ability to create new products and processes using the latest knowledge on technologies appears when a country possesses highly qualified human capital and supports active policy in R&D field.

The key elements of the Porter's system of competitive advantage have clear parallels with the mentioned characteristics of knowledge-based growth environment linkages. The author identified four basic categories of determinants. First category include *factor conditions* – basic factors of competitive advantage such as simple natural resources, climate, location, skilled labor, or advanced factors such as communications

[4] The Michael Porter's theory of competitive advantage was selected because it has already long tradition in analyzing competitiveness; it is easily accessible (by its complex, yet easy to read "diamond model) and last but not least, because it includes both micro- and macroeconomic perspective on competitiveness.

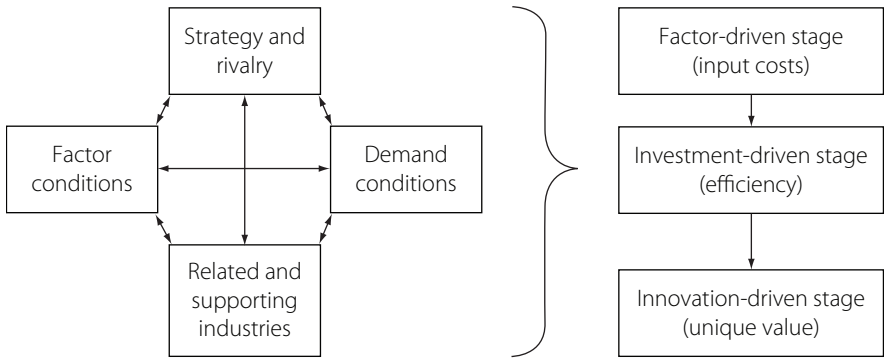

Figure 1. System of competitive advantage

Source: M. Porter, *Competitive Advantage of Nations*, 1990.

infrastructure, educated personnel, university research institutes, or creating technological know-how (Figure 1).

Secondly, *demand conditions* include availability of channels for internationalizing local demand (multinationals), the nature of the market, a degree of sophistication of local buyers demand; innovative pressure on local suppliers resulting from global trends and markets (pressure is bigger in case of qualitative not quantitative factors). Third category, *related and supportive industries*, refers to the "presence in the nation" of suppliers who are internationally competitive (Porter 1990) contributing to new ideas and stimulating innovation (usually via *clusters*). Finally, the last category – *firm strategy, structure, and rivalry* – constitute the national environment, such as institutions, governmental policy and network of suppliers, buyers, and competitors stimulating each other through rivalry. It is being evaluated on basis of qualitative characteristics of business operations and decision-making, including their social context. Porter places geographical industrialization and innovation at the centre of the process of development and competition. Thus, innovation performance is supported by the factor of local environment and institutions.

5. KNOWLEDGE-BASED ECONOMY IN NEW AND OLD EU MEMBER STATES

The comparison of the EU countries position in terms of knowledge economy index (KE) considers the development in time since 1995. The KE index considers the quality of knowledge use-supportive environment, and is calculated as the average of normalized values of indicators presented as knowledge economy pillars (Table 1). In general, New

Table 1. Knowledge Economy Index of EU countries

Country	KEI		Economic Incentive and Institutional Regime		Innovation		Education		ICT	
	2007	1995	2007	1995	2007	1995	2007	1995	2007	1995
Sweden	9.26	9.15	8.59	8.22	9.72	9.65	8.98	9.06	9.76	9.65
Finland	9.07	9.36	8.95	9.36	9.60	9.21	9.20	9.19	8.52	9.67
Netherlands	9.02	9.32	8.69	9.50	9.41	9.43	8.74	9.16	9.25	9.19
United Kingdom	8.80	9.01	8.54	8.60	9.21	9.26	8.50	9.16	8.93	9.00
Austria	8.58	8.78	8.69	8.86	8.82	8.77	8.08	8.82	8.75	8.68
Ireland	8.56	8.57	8.54	8.39	8.92	8.87	8.62	8.68	8.16	8.35
Germany	8.54	8.75	8.38	8.41	8.93	9.08	8.08	8.74	8.79	8.75
Belgium	8.46	8.85	8.19	8.68	8.93	9.04	8.72	9.33	8.01	8.37
Luxembourg	8.39	8.39	8.99	9.25	8.82	8.79	6.18	6.29	9.58	9.24
France	8.36	8.61	8.02	7.91	8.59	8.83	8.52	9.02	8.31	8.70
Spain	8.09	8.21	8.09	8.66	8.09	8.11	8.42	8.45	7.74	7.63
Italy	7.98	7.85	7.30	7.37	8.05	8.19	7.86	7.88	8.72	7.97
Portugal	7.44	7.66	8.02	8.01	7.40	7.30	6.93	7.38	7.43	7.93
Greece	7.29	7.50	7.38	7.39	7.62	7.28	7.56	7.64	6.60	7.67
Slovenia	8.16	7.65	7.57	6.71	8.18	7.79	8.54	7.75	8.34	8.33
Estonia	8.07	7.76	8.07	8.20	7.42	6.59	8.29	8.07	8.49	8.18
Hungary	7.64	6.99	7.64	5.73	8.18	7.57	7.68	7.47	7.08	7.18
Czech Republic	7.64	7.53	7.59	8.23	7.67	7.01	7.59	7.32	7.69	7.57
Cyprus	7.63	7.11	8.04	7.46	7.64	7.33	6.61	5.96	8.22	7.69
Lithuania	7.49	5.89	7.45	5.21	6.43	5.25	8.30	7.26	7.79	5.83
Latvia	7.37	5.55	7.26	6.21	6.44	2.28	8.35	7.32	7.45	6.39
Poland	7.24	6.48	7.07	5.02	6.89	6.14	8.11	8.09	6.87	6.64
Slovak Republic	7.22	6.95	7.38	6.84	6.95	6.96	6.92	6.97	7.63	7.04
Bulgaria	6.18	5.81	4.84	5.11	6.56	4.66	7.34	7.12	5.99	6.36
Romania	5.86	5.33	5.77	5.25	5.69	4.89	5.91	6.01	6.09	5.17

Source: Knowledge Economy Index, World Bank 2007, www.worldbank.org

EU member states economies enjoy factor endowments characterized by a high level of education, particularly high in the Baltic States and Poland. However, the knowledge-supporting environment is still relatively insufficient in terms of innovation system development (Baltic States, Poland, Slovakia) and quality of institutions (this is true mostly to most recent EU members – Bulgaria and Romania).

In the ICT pillar (assessment based on the telephones, computers and Internet usage) NMS still lag behind. Yet, it should be noted that some smaller NMS such as Estonia, Malta and Cyprus evidenced extremely good performance in terms of ICT, overtaking some of the Old Member states, e.g. Portugal and Greece.

In general, in comparison to 1995, all New Members states have shown significant progress in all KE index pillars. Yet, despite of the overall progress, in comparison to the best performers, Scandinavian countries, their knowledge-based competitive standing is still moderate, especially in innovation performance.

One should remember that competitive advantage is improved not only by country's investments into R&D and new technologies but mostly by a possibility of new knowledge implementation and commercialization. Table 1 and Figure 2 present a qualitative structure of economic activities of EU-10 and EU-15 divided by intensiveness of utilized factors. The structure, created on basis of cluster-analysis techniques, names five industrial groups: raw materials-intensive, labour-intensive, capital-intensive, easy to imitate and difficult to imitate.

The EU-10 appears to have stronger comparative advantage in low-tech and medium low-tech goods, with a significant proportion of its internal resources being directed towards labour and capital intensive sectors.

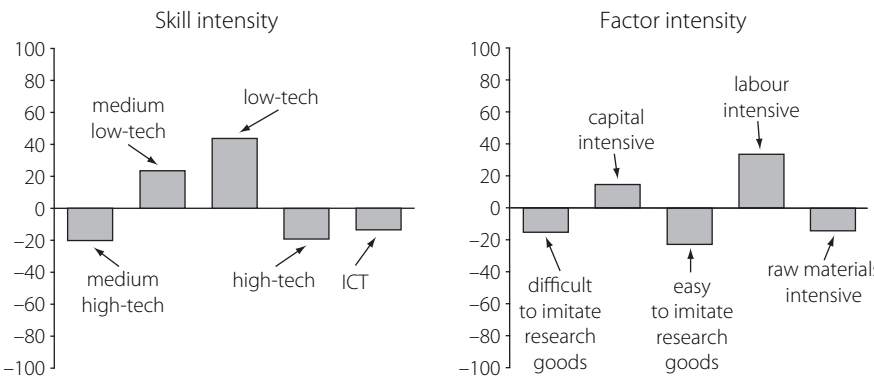

Figure 2. Qualitative structure of economic activities of EU-10 (2005)

Note: weighted trade balance of product cluster relative to overall trade balance.
Source: *EU Competitiveness and Industrial Location*, Bureau of European Policy Advisers, European Commission (2006b), http://europa.eu.int/comm/dgs/policy_advisers/index_en.htm

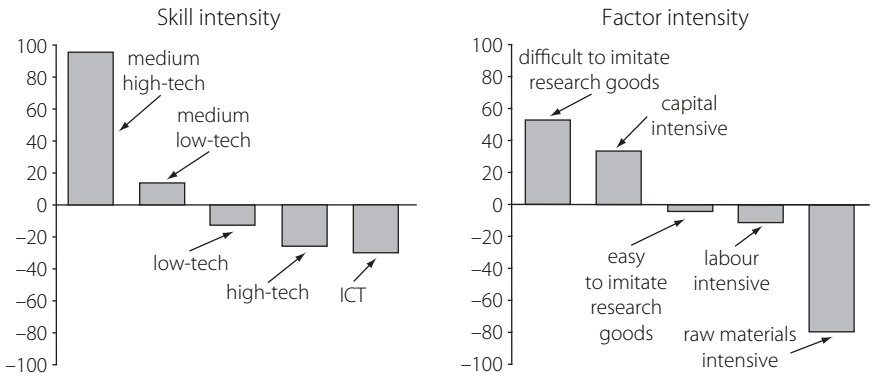

Figure 3. Qualitative structure of economic activities of EU-15 (2005)

Note: weighted trade balance of product cluster relative to overall trade balance. Source: *EU Competitiveness and Industrial Location*, Bureau of European Policy Advisers, European Commission (2006b), http://europa.eu.int/comm/dgs/policy_advisers/index_en.htm

Figure 3 shows the comparative advantages of the EU-15, which is in particularly strong in the medium-high technology category and to a lesser extent the medium-low technology area where the EU-10 is also strong. As it concerns the factor intensity breakdown, the EU-15 does extremely well in the medium high-tech and difficult-to-imitate research goods as well as in capital-intensive goods. It does very poorly in raw material intensive industries.

Concluding the presented data in Table 1 and Figure 2, one could notice the complementarity between the trade structures of the EU-10 and EU-15. The low tech, labour intensive, specialization patterns exhibited by the EU-10 grouping in contrary with the medium high-tech industrial specialization of the EU-15. These specialization patterns suggest that EU-10 has to intensify the support for R&D as well as physical capital investments and commercialization.

6. POLAND – A SUCCESS AND FAILURE IN "CATCHING UP"

Poland has substantial potential for knowledge economy development, especially in terms of its education and human resources. This relative improvement of Poland's position in Knowledge Economy Index hasn't been so far reflected in the advancement of Polish competitive advantage towards quality-based or innovation driven specialization. Figure 4 presents the structure of the competitive advantage diamond based on World Economic Forum (WEF) survey for 2006–2007. Three development stages of competitive advantage sources can be identified on a scale from 1 (the worst result) to 7 (the best result): factor-driven

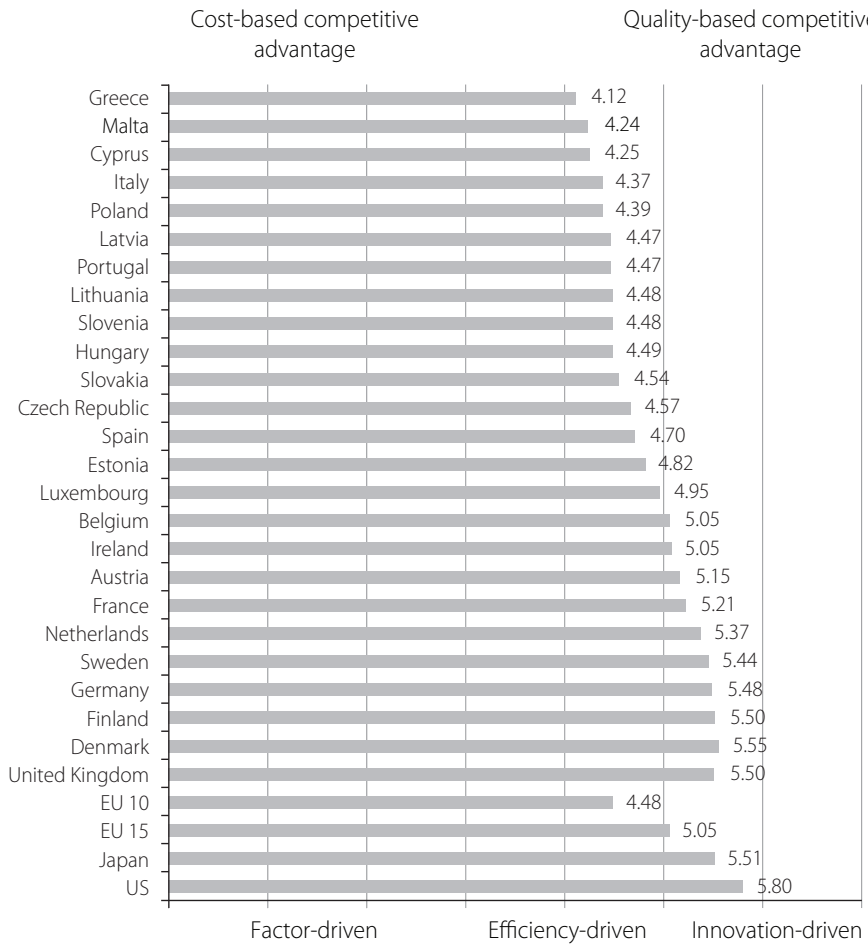

Figure 4. Sources of competitive advantage in selected countries in 2006–2007

Note: 7 – the best result, 1 – the worst result.
Source: World Economic Forum 2007, www.wef.org

(interval 1–3), efficiency-driven (interval 3–5) and innovation-driven (interval 5–7).

The key characteristics of competitive advantage sources concept of global competitiveness index presented by WEF (2007), with reference to Porter's model of competitive advantage system. This concept considers three development stages: factor-driven, where companies compete mainly with cheap inputs using adopted technology; efficiency-driven stage, which is characterized by the better quality of products and relatively higher productivity of firms (eg. access to the best technology available, availability of developed human capital and external openness); and innovation-driven stage at which firms are able to create

new products and processes using the latest production and organisation procedures, sophisticated operations characterised increasingly by (qualitative) development of clusters (their internal and external linkages). This stage is achieved by the active interactions between the key elements of Porter's competitive advantage model.

Based on the analysis of sources of competitive advantage, Poland, like most of the New Member states, seems to enjoy the efficiency-driven competitive advantage, showing relative progress towards the quality-based specialisation. Differences between EU members are significant. In terms of the characteristics of WEF 2007, Poland's relative advantage is due to technological openness (companies are open to and active in absorption of new technology) – 4.88 points relative to 4.04 for EU10 and 4.70 for EU15.

The relative disadvantage is the institutional environment, e.g. framework, in which private individuals, firms, and governments interact; property rights; legal framework; corporate governance as well as government attitudes toward markets and freedoms. An overall score of Poland in the institution pillar was 3.65 points, relative to 4.2 for EU10. Insufficient investments into R&D, especially by private sector, and a low level of collaboration between universities and industry is reflected in the below average score for the EU10 and EU15 groups – 3.73 relative to 3.9 for EU10 and 4.8 for EU15 (World Economic Forum 2007). The latter major disadvantages of Poland's competitiveness index contributed to the deteriorating position of the country in an overall Global Competitiveness Index 2006–2007 ranking – from 45th in 2006 down to 51st in 2007.

6. CONCLUSIONS AND POLICY IMPLICATIONS

If the country wants to enjoy the knowledge-based growth and competitiveness, it needs to follow the evolutionary path of economic growth, from factor-based to quality-based competitive advantages/competitiveness. Generation and development of quality-based competitive advantage requires improvement in technology knowledge and innovation capacity. The quality of ICT infrastructure, increasing R&D activities and effective governance, especially on the regional level, are the key factors enabling knowledge-based competitive advantage and a convergence process between new and old EU member states. The degree of their contribution for future growth and competitiveness will, however, depend on the degree of interlinkages between main competitiveness categories, e.g. factor conditions – physical, technological and administrative infrastructure; external environment and sophistication of the domestic demand; level of national innovation systems and cluster development.

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COMPETITION AND ENTRY OF FIRMS AS HYPOTHETICAL FACTORS OF INNOVATION. THE CASE OF POLISH SME AGAINST THE THEORIES

1. INTRODUCTION

Textbook of economics assumes the following:

- competition boosts innovation,
- entry enhances competition,
- deregulation removes entry barriers.

Thus, a comfortably straight line could be drawn starting from deregulation as an essential condition and ending at innovation as its final outcome.

Since the beginning of transition to a market economy, Polish business has undeniably been deregulated, entry and exit of firms is intense and degree of competition certainly increased. All this has nevertheless not been followed by progress in innovation.

In the following, I will try to confront more specific findings of economic research on the subject of the relationship between entry, competition and innovation with the process of change of Polish industrial structures, in particular with respect to SME.

The text is organized as follows. Section 2 summarizes the principal research outcomes on interrelation between entry, competition and innovation. Section 3 confronts some of the findings with the realities of SME development in Poland. Section 4 concludes, which of the hypotheses are confirmed or refuted and for which reasons.

2. HYPOTHESES ON THE IMPACT OF ENTRY AND COMPETITION ON INNOVATION

Entry is a part of process of creative destruction described by Schumpeter as the one assuring development of the market economy. Destruction, represented by exit of firms of low performance from the market, obviously statistically enhances productivity and degree of innovativeness. It is less obvious why entry (and which entry) may enhance competition and innovation. It is because the entering firms are heterogeneous and the most efficient of them survive. The possibility of survival depends on a number of conditions (as for example entry deterring strategies of incumbent firms, technical barriers as efficient scale of business, existing patents, reputation of existing providers) but also, to a substantial degree, on the entrant itself. The size of the firm entering the market and its endowments (in particular financial and technological) is important, thus the chances for survival of a subsidiary of a multinational are much higher than those of the small firm. But also the strategy of the firm counts (Cincera, Galgau 2005). It may be one of passive learning, but those actively learning and investing to enlarge their capacities have much greater chance. Besides the fact that survivors present usually more active attitude, they upgrade the standing of the sector by the fact that their equipment is more recent (and thus they are better endowed to adopt new technologies). Nevertheless, the fact of persistence of firms of different productivities proves that parallel processes of creation and destruction have only partial leveling effect.

The new entry numerically upgrades competition (by increasing the number of firms and, together with exit of less performing firms, by leveling their productivity). Nevertheless, the relation between entry, competition and innovation is far from being straightforward. Aghion et al. (2002) indicate that entry of new firms, implying increase in competition, may have two effects of quite opposite direction depending on the difference of technology levels between the firms in the sector. Stronger competition may generate an escape-competition drive to innovate but, conversely, may hamper innovation if stronger competition reduces rents on innovation (so-called Schumpeterian effect). The first, escape-competition effect, dominates when differences between entrants and incumbents are low (they are competing neck-to-neck"), the other, Schumpeterian effect – when difference increase. As stronger competition implies differentiation between providers, it comes out indirectly that increase of competition at its lower levels stimulates innovation, conversely to increase of degree of competition when it is already strong. The result may be also interpreted in another way. Entry of firms of similar technology level stimulates innovation both of entrants and of incumbents, but when the difference of levels is too big, innovation is de-stimulated (Cincera, Galgau 2005).

The first set of above indicated hypotheses has been successfully verified on the data of British listed companies. The interrelations between entering and incumbent firms of different size have not been studied. There is no convincing evidence that the hypotheses of Aghion et al. (2002) hold for all the layers of the market (especially for the firms of different size).

De-regulation of product, labour and capital markets enables entry of a bigger number of firms and thus reduces domination of the few of them on the market. Out of empirical research on OECD countries (Scarpetta et al. 2002) it stems that de-regulation has even stronger impact on entry of small firms. Indirectly entry implies reduction of mark-ups and, by enhanced competition and reduced adjustment costs, leads to cost reduction and higher investment (Alesina et al., 2003). Nevertheless, different shape of de-regulatory reform may lead to different outcomes in terms of efficiency (Griffith, Harrison 2004; Nicoletti, Scarpetta 2003). In particular, reduced mark-ups may hamper R&D expenditure. The same may be the outcome of privatization if those were public firms that invested the most in R&D. According to Brand (2004), the underpinning of high productivity growth is not the same in different industries: in young ones (especially ICT related) it depends more on entry of new firms while in mature industries rather R&D expenditures of incumbents matter.

This very brief summary of some research findings proves that many factors influence the relationship between deregulation, entry, competition, and innovation. The most interesting findings are those of Aghion et al., first, because it focuses on the process of competition, and next, because it points at differences in the possibilities of firms to compete (the concept of "neck-to-neckness").

The research referred to above does not specifically focus on SME, who contribute the most to entry. The empirical layer of the research of Aghion et al. even deliberately cuts it out.

In the following I will try to look for the relevance of particular hypotheses on the interrelation between deregulation, entry, competition, and innovation for the case of Polish SME. The rationale for choosing this kind of business is not only its role in Polish transition, but also its potential chances in Knowledge Economy, requiring smaller size and higher flexibility (Coyle, Quah 2002).

3. ENTRY OF SME IN POLAND AND ITS IMPACT ON INNOVATION

A. Problem: radical entry, but limited innovation

Since 1990 Polish economy is subject to intensive entry of new firms, especially small enterprises. As reported in 1990 (Sachs, Lipton 1990), only 982 State-owned enterprises (out of approximately 7.000) employed

less than 100 persons and average employment per firm amounted to 1.132. This picture of domination by big firms quickly become obsolete due to the destruction of the public sector by privatization (often meaning selling out parts of enterprises) and creation of new units.

Nowadays, the structure of Polish economy is radically different. It may be qualified as bi-polar with "missing middle". While small units (up to 49 employees) constitute 64.6% of all the economic agents of more than 10 employees, the medium ones (50–249 employees) represent 29.2% and the big ones (of more than 249 employees) amount to 6.1% (GUS, 2006).

If nobody can deny the dynamics of the Polish economy (GDP growth exceeding 5% in the recent years), it is certainly not due to technology advantage. According to data by Poland's Central Statistical Office (GUS, 2005), in 1995–2004 the GDP share of R&D expenditure in Poland decreased from 0.65% to 0.58% and is now below the figures for European economies (2.55% in Germany and in Denmark, 2.19% in France, 4.27% in Sweden, 3.49% in Finland, 1.26% in Czech Republic, 0.95% in Hungary). Contrary to other European economies, the majority of expenditures come from State budget and not from industry sources. The share of innovative firms in 2004 was 39.0%, compared with the EU average of about 53%. Interestingly, the public sector revealed a higher share of innovative firms (47.6%) than the private sector (37.8%; GUS 2005). Thus the technological level of Polish economy rather deteriorated instead of ameliorateing and was still substantially lagging after other European economies.

As to the outcomes of the application of new technologies, it is interesting to review the structure of sales by technology level (OECD classification). The share of low-technology sectors is still the highest, at 38.6%, while medium-low technology sectors account for 31.3%, medium-high for 25.6% and high technology for 4.5%. The shares for technologies at different levels are not the same in the public and private sectors. The private sector is the most (41.2%) dominated by low technologies, though in foreign-owned companies the proportion of medium-low technology is the highest (42.5%). The public sector reveals a higher technology level than the private sector: medium-low technology sectors account for 56.8% of overall sales (GUS 2005).

B. Who matters for competition and innovation: entry and "neck-to-neckness"

The other statistical source, taking also into account survey results for the micro-enterprises (up to 9 employees) gives obviously the different results in terms of number of units (small enterprises constitute 99.0% of the population, out of which 96.3% are the smallest) but the

performance problem revealed is similar (GUS 2007a). In 2005 the ratio of costs to revenues amounted, similarly as indicated in the previously quoted source, to 90.6% for the small (thus being the most profitable), to 95.8% for the medium and to 94.6% for the big ones. Thus, the medium sized firms are the less performing. The investment effort was nevertheless biased in opposite direction. Only 1 over 8 small enterprises invested in 2005 and investment expenditures amounted to 2.6% of revenues of this group. On the contrary, out of medium sized enterprises only 1 over 10 did not invest and their expenditures amounted to 4.3% of revenues. The highest was investment effort as compared to revenues in the biggest enterprises (6.3%) and almost all of them invested. The other data of interest is the degree of depreciation of machinery, this time the lowest in small enterprises(52.1%) compared to medium (60.5%) and big ones (62.2%). Thus the data reveal weak propensity to growth in the small firms and their younger age (which may be the outcome of their shorter survival time).

While frequency of the biggest firms is identical both in Poland and in EU-27 (0.2%), in Poland both medium and small but not micro (10–49) firms are scarcer (0.9% and 2.7% against 1.1% and 6.9% in the EU-27). On the opposite, the smallest firms (up to 9 employees) represent in Poland 96.3% and in the EU-27 92.1%. Labour productivity in EU-27 firms is systematically increasing with the size of firm, from the smallest to the biggest, contrary to the relative weaker results of medium companies revealed for Poland.

The data reveal that there are problems in selection process of newly created Polish small enterprises. The best fitted of the micro ones should grow and enrich the layer of first small and then medium enterprises. As to now, the structure of Polish firms is overcrowded by the smallest agents.The outcome of such a situation is that thread of entry of new firms to the group of medium and big enterprises is reduced as compared to the cope of entry to the group of small units. Thus the pressure due to entry of sufficiently "neck-to-neck" partners is too weak to imply innovation. On the other hand, small enterprises are unable to stand "neck-to-neck" competition with bigger incumbents. It comes out that the concept of "neck-to-neckness" implies a necessity to distinguish the layers of comparable firms and to enquire about relationship between entry to these particular layers and innovation.

C. What matters for survival?

The other publication of Polish Statistical Office provides the outcome of the survey covering 5 years of the process of growth of small (mainly micro-size) enterprises (GUS 2007b). 2/3 of units created survived the first year of activity, and the bigger ones (legal persons and not belonging to physical persons, unit employing labour force) had better chances. The

starting of business was mainly out of own financial assets (for 83.9% of enterprises), rarely out of credit. Only 1 out of 3 units invested during the first year of activity. After 5 years this factor was nevertheless found decisive: 60.4% of firms investing during the first year survived against 38.2% of non-investing.

The general ratio of survival after 5 years was 28.1% and was higher for legal persons and those employing labour force. The surviving firms increased in terms of employment, but their average size did not exceed 5 employees. Thus, their growth was extremely limited. It comes out of the data that two factors were decisive for survival of the firm: initial conditions (size and endowment) and strategy. The distinction between passive and active learning is particularly relevant to this problem. Most of the firms were applying passive survival strategy. Their objective was just short-term survival, thanks to exploiting market opportunities of the moment (the smallest firms were frequently changing sector of operations and periodically suspending activity) and the easiest factors (cheap labour force). But only active long-term strategy (investment and innovation) was really promising success. As principal barriers to growth the firms indicated insufficient demand and high competitive pressure (33%). Frequency of supply-side barriers was relatively weak (18%) and shortage of financial resources was a principal one. The smallest firms were the least involved in innovation (Wojnicka, Klimczak 2006). In the years 2002–2004 it was the case of 17% of small Polish firms, of 40% of medium and of 67% of big. The percentages were growing but still lagged behind the figures for EU-15, where in 1994–96 44% of small firms introduced innovation, 58% of medium and 79% of big. Innovation consisted, in small as in majority of Polish firms, in process innovation connected to purchase of new equipment.

Other studies among small "success firms" (Sosnowska 2005) prove that this success is often based on innovation. These companies, deprived of the possibility of pursuing their own research, apply generally known technologies and solutions, but thanks to the skills and imagination of their staff, they are capable of meeting the individual needs of their customers. Small innovative firms in Poland show features typical of the New Economy: concern for meeting the needs of individual customers, attention to high product quality, telecommunications infrastructure, and the proper selection of employees and their creativity.

D. What conditions for innovation are lacking?

The small enterprises probably realized that innovation is a key factor of success but encountered substantial barriers. Three of them may be indicated as principal: financial constraints, institutional rigidities and managerial deficiencies.

Table 1. The sources of finance of innovation in firms of different size in Poland, 2000 and 2004 (%)

Company size	Year	Own sources	Bank credits	Other
Total	2000	75.2	15.4	9.4
	2004	78.0	16.3	5.7
Small enterprises	2000	60.7	29.9	9.4
	2004	65.0	27.3	7.7
Medium enterprises	2000	68.7	16.3	15.0
	2004	71.2	18.9	9.9
Big enterprises	2000	78.1	13.0	8.9
	2004	81.1	11.5	7.4

Source: E. Wojnicka, P. Klimczak (2006), *Stan sektora MSP w 2000 r. Tendencje rozwojowe w latach 1994–2004*, p. 87.

Table 1 exhibits how innovation was financed in Polish firms of different size.

The data reveal that while internal sources were prevailing in all the firms, credits were much more important in the smaller ones than in big ones. This observation apparently contradicts our previous research on crediting companies, the conclusion of which was that banks ration lending to smaller firms (Akiba, Lissowska 2006a; 2006b). In fact, there is no contradiction. The table should be read in parallel with the other proportion: that of general lower frequency of innovation in small firms. Quite obviously, the financial barrier exists for them. Having both difficult access to credit and limited internal sources they have to adjust their innovation projects to accessible external finance and thus limit them.

Distrust to creativity and change on the side of finance providers creates a barrier to growth for small business, common to Poland and to some degree to the other European countries and distinguishing them from the situation in the US (Scarpetta et al. 2002). As revealed by inquiries carried out in Polish banks, small business, new or undertaking something new, is, especially in the eyes of finance providers, less worthy than a big firm, the strength of which is not its adaptive capacity but market force and support it may eventually obtain from the State or from the network of the mother firm.

But also venture capital in Poland is reticent to finance projects of small firms. One reason why they avoid smaller firms is high monitoring costs in the case of dispersed projects. Another problem is that most funds do not wish to expose their owners to excessive risk and

their staff lacks the necessary technical skills to assess new technologies. Other reasons why venture capital funds in Poland "fear" small technology-oriented firms include financial market regulations that discourage smaller firms from floating their shares and bonds on the stock exchange. This deprives them of cheaper funds and makes it difficult for venture capital funds to sell the shares of the companies at any time. As a result, venture capital funds in Poland are unable to invest all their resources (Goldberg 2004).

Recently, a new trading platform (New Contact) has been opened by the Warsaw Stock Exchange to enable small firms to access financial markets. Nevertheless, broader financing of small firms by financial markets needs venture capital providers to develop more specific competences (monitoring of small, technology-oriented firms) and small firms to accept control sharing (e.g. admit venture capital representatives in the board).

The characteristics of business environment seem related to weak innovation in Polish firms especially of small and medium size. For technology development and innovation, which are both complicated and costly, they need cooperation. Thus, easy contract enforcement is a crucial condition. In the period 2002–2004, about 6.4% of Polish small and 20% of all medium firms had cooperation agreements. For the small firms it was less than for EU-15 small firms over the period 1994–1996 (8.4%) and only slightly more for medium-sized firms (16%). The proportion of big firms having cooperation agreements was substantially higher both for Poland (45%) and for EU-15 (50%). It seems that reticence to cooperate is a common feature of small firms both in Poland and in EU. It may be one of the factors disabling innovation. The fact that proportion of cooperating firms was substantially higher for firms doing innovation proves that it was important for this process.

The other factor of underdevelopment of Polish firms with respect to innovation is insufficiency of partners from research sector – some entities were shut down, other were unable to supply solution to industry. It was to some degree a result of privatization. The new owners of companies closed research centres or they were transformed into public units evaluated as units doing basic research. Thus, they lost interest in cooperation with the firms. As a substitute, the firms cooperated with consultancies (Wojnicka, Klimczak 2006). The difficulty to deal with licenses in Poland as revealed by the World Bank study on *Doing Business* is undeniably an additional obstacle to produce and apply innovation.

E. Regulation or deregulation? What kind of regulation matters?

One of the other factors of reticence of the firms to innovate is undeniably the quality of regulation. Absence of the clear project with this respect, initial de-regulation ("the best industrial policy is its absence"

used to declare one of the first ministers of industry after transition), further centralization and tendency to broaden regulation, frequent and incoherent changes, created a wild and hostile environment for business. If it may suit big firms able to navigate in this legislative jungle (and even to manipulate it), the small ones need a reduced set of clear and stable rules. A delay to install "one shop" to register a new business, both in Poland and elsewhere in Europe, confirms a reticence of the States with this respect.

According to the report of the World Bank (Doing Business 2007) Poland takes 75th place among 175 countries as for the indicator of ease of doing business. As to different areas, in starting a business its ranks 114th, in dealing with licenses 146th (!), in employing workers 49th, in registering property 86th, in getting credit 65th, in protecting investors 33rd, in paying taxes 71st, in trading across borders 102nd, in enforcing contracts 112th, in closing business 85th. This profile is similar in other new EU Member States (except Estonia and Lithuania) and diverges considerably from EU-15 countries, ranking usually below 40 (with notable exceptions of Greece and Italy). In developed European economies, both dealing with licenses and enforcing contracts is easier than in EU-10, but employing workers is more difficult. It thus contradicts a sometimes quoted thesis that post-transition economies are more liberal than established market economies and thus more welcoming technology-oriented firms (Kapas, Czegledi 2006). Not only Poland has weak advantage as to liberalization, but its broadening regulation is rather a barrier and not help for the companies. In particular, this is the case of administrative rules concerning licenses and effectiveness in enforcing contracts. Those features weaken even more the propensity of companies to cooperate and to introduce innovation.

4. CONCLUSIONS

The analysis of relationship between the entry and innovativeness of Polish SME addresses the theoretical hypotheses of section 2 in the following way:

- what matters for competition in industry is the type of entrants (their size and endowment) and also quality of their strategies (if they are active); innovation is not only an outcome but also a factor determining success of entry,
- competition visibly takes place within "layers" of "neck-to-neck" (with respect to some competencies) firms; it is why small firms may find their place on the market,
- if active strategy enables growth of a firm and its switch to a "higher layer" of competitors, difficult financing (and risk aversion of providers), unreliable cooperation and lack of research partners hamper it

and weaken competition; this was the reason of overrepresentation of the smallest firms and weakness of middle-sized,

- de-regulation of entry is highly insufficient for firms' performance; besides, de-regulation of innovation care for the rules of cooperation is needed.

The above observations indicate the areas open to enhancement of real situation by policy measures.

On the other hand, they suggest also some enrichment of the model of "neck-to-neckness". It should be developed to cover different layers of coexisting firms competing mostly among themselves at aiming at joining the layer of competitors of the higher "neck-to-neckness" standard.

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KNOWLEDGE ORIENTATION AND PERFORMANCE PARADOX

1. PROBLEM

The literature on economics and management is searching for the answer to the question concerning the relationship between different factors and enterprises performance. One of the factors arousing significant interest is knowledge. However, the answer to the question about the relationship between knowledge and performance is not clear. On the one hand, there are opinions that the knowledge and information are of crucial importance for economic performance of enterprises (Pfeffer, Sutton 2002). Such opinions are not rare. On the other hand, the performance paradox and productivity paradox are discussed and described as well. The first paradox indicates the lack of relationship between managers' knowledge and their activities in the enterprise. The second concerns the lack of evident influence of information technology (knowledge management) on productivity at the macro and micro level.

As far as the performance paradox is concerned, Pfeffer and Sutton indicate that the discrepancy between knowledge and its application in the enterprises is an important and general problem. They stated that the economic results of enterprises depend more on how managers transfer knowledge to their activity than on their knowledge of a proper solution. The observations of the practice prove that there is a divergence of what firms know and what they are doing. The reasons for this problem are not clear (Pfeffer, Sutton 2002).

As far as the productivity paradox is concerned, discussion about it has gone on for many years (Papp 1999/8). Productivity paradox indicates

the lack of evidence that there is a link between the application of IT and economic results in enterprises and in the whole economy. Although this paradox is applied to the IT, it is also applied to the knowledge management (KM). The reason for this is that the "knowledge management" concept during the 1990s was often used to describe computer applications for information storage and retrieval. Now, KM is rather seen as a perspective on management of the firm as a whole, encompassing activities in all relevant managerial areas (Salojarvi, Furu, Sveiby 2005). Nevertheless, the management of IT processes is still an important part of knowledge management.

The literature has seen a boom in the number of publications dealing with the management of knowledge. Success is said to depend on the organizations' ability to gather, develop and utilize its knowledge. But there are only a few studies on the relationship between KM and company performance. There is a lack of empirical research proving that KM activities create value (Salojarvi, Furu, Sveiby 2005). Furthermore, most research on KM focuses on large business so there is not enough information about SMEs (Matlay 2000).

In the period of 2005–2007, authors from WSE carried out research devoted to the relations between knowledge of medium enterprises and their performance (Mazur, Rószkiewicz, Strzyżewska). The following paper contains comment on this research from the point of view of the two above-mentioned paradoxes.

2. DEFINITIONS OF VARIABLES

To examine empirically relations between knowledge and performance of enterprise, authors of related research introduced new constructs – manager's knowledge orientation (MKO) and enterprise knowledge orientation (EKO) (Kohli 1990). It was assumed that relationship between knowledge and performance can be divided into two components:

- relation between manager's knowledge orientation and enterprise's knowledge orientation,
- relation between enterprise's knowledge orientation and performance.

From the logical point of view, these two components are two sequent stages of the process of achieving economic results due to knowledge. To be more precise, the first stage consists of the influence of manager's orientation on the enterprise orientation, the second consists of the influence of enterprise orientation on its performance.

Manager's knowledge orientation (MKO) was defined as an attitude of managers toward knowledge. This attitude consists of three components:

- rational component concerning the manager's evaluation of the knowledge importance for the enterprise development,
- emotional component concerning manager's emotion linked with the knowledge as a base for success in business,
- behavioral component concerning the intention of the manager to operate in areas of acquiring data and information, their creation and using of new knowledge.

Enterprise's knowledge orientation (EKO) is understood as a synthetic category encompassing the levels of intensification of the processes concerning knowledge in three areas:

- acquiring data and information, including their actualization and dissemination,
- creating new knowledge and its dissemination,
- using knowledge, including transfer of knowledge outside the enterprise.

Besides the definitions of those two constructs, operational definition of performance was provided. Performance was understood as economic results of activity of the whole enterprise and characterized by:

- the position of the enterprise in the sector, described by the level of profitability, market share, dynamics of sales *vis à vis* analogous average indicators for the sector,
- changes in economic situation of the enterprise in relation to the previous year described by the changes in economic results and sale,
- realization of the market and financial plans in the last five years.

How to relate the above definition to both paradoxes? Performance in the presented research is measured by many indicators, not by productivity. Nevertheless, in the literature relations between knowledge or IT investment and performance were extended to various performance ratios, which concern macro level, e.g. GDP, and firm level, e.g. profit (Rei 2002). So the presented research is situated in the area of the co-relations between knowledge and performance in a broad sense. To be more precise I distinguish two aspects of performance paradox. The first aspect embraces the relation between MKO and EKO, the second aspect embraces the relation between EKO and economic performance.

3. METHOD OF DATA COLLECTING

Data were obtained from a questionnaire survey. The survey was carried out using telephone (CATI) by a research agency. The questionnaire consisted of parts devoted to:

- attitude of managers
- managers' assessment of processes in enterprises,
- managers' assessment of performance.

The problem with self-assessment as data collecting is its reliability. But in this case when attitudes were researched, this method is the appropriate one. As for the situation in enterprises, it was assumed that respondents are experts and they do not have any motive to overestimate it. The anonymity rule was respected. To limit misunderstanding of the question the questionnaire was protested by authors and by agency.

The respondents were higher managers from 852 medium sized enterprises operating in Poland. Randomly selected sample of enterprises includes those from the service and industry sectors (excluding mining and high tech companies), which employ 50 to 250 workers. The sample was representative. The collected data were examined using logit regression, Person correlation coefficient and segmentation analyses. The membership function within the framework of the fuzzy set theory was used to measure the levels of EKO and MKO.

4. PROPOSITIONS

Three propositions concerning performance paradox were formulated.

- P.1. There is a relationship between manager's knowledge orientation and enterprise knowledge orientation.
- P.2. There is a relationship between enterprise knowledge orientation and its performance.
- P.3. The impact of enterprise knowledge orientation on its performance depends on the structure of enterprise knowledge orientation.

The third proposition needs some explanation. According to the definition of enterprise's knowledge orientation (EKO) it encompasses partial knowledge orientation in three areas of processes concerning knowledge:

- acquiring data and information, including their actualization and dissemination (area A),
- creation of new knowledge and its dissemination (area B),
- using knowledge, including transfer of knowledge outside the enterprise (area C).

Partial orientations are assumed to have different levels of intensification. These levels form the structure of enterprise knowledge orientation. E.g. one structure can be characterized by high level of orientation in area A and low levels in area B and C. The second structure can be characterized by low levels in areas A and B and high level in area C.

5. EMPIRICAL RESULTS

P.1. There is a relationship between manager's knowledge orientation and enterprise knowledge orientation.

To verify this proposition the level of MKO and EKO were measured.

The results of the research reveal that there is quite a high average level of MKO in the whole sample which is 0.81 on a scale from 0 to 1, measured by membership function. Furthermore, the level of MKO is very homogeneous. This result seems surprising, but literature study shows that there are some social processes, which cause the homogenization of managers' attitudes. Koźmiński underlines group self-identification (Wawrzyniak 2003), Antczak (2005) writes about globalization of managers mentality, Obłój (2003) shows isomorphism forced by environment, Sztomka noticed demonstration and imitation effects (Koźmiński, Sztompka 2004). There are also other Polish studies in which authors (Szaban 2000) noticed similarity of managers' behavior and attitudes. A similar phenomenon is described by Finnish researchers. They found a high level of awareness of KM in the sample of 108 Finnish small and medium sized enterprises (Salojarvi, Furu, Sveiby 2005).

The average level of the enterprise knowledge orientation in the whole sample is lower than MKO and reaches – 0,68 measured on a scale from 0 to 1 using membership function. This result is to some extent convergent with performance paradox. It means that MKO is not fully transferred to the knowledge processes in enterprises. The hypothetical reasons may be:

- the sociological phenomenon of the gap between declaration and behavior,
- lack of possibility to change the knowledge processes because of the scarcity of financial and know how resources,
- difficulties connected with necessity of changes in the whole mechanism of enterprises when introducing KM, especially changes in the mentality of employees,
- the time needed to introduce changes following the managers orientation.

In spite of the differences in the levels between MKO and EKO, MKO has a statistically significant positive correlation ($r = 0.37$; $p < 0.001$) with EKO. It means that there is coincidence between these two categories. However, other studies and general knowledge on management allow the interpretation of these results as the evidence of the impact of managers' knowledge orientation on knowledge processes in the enterprise. This influence does not seem to be very strong, so the relation between MKO and EKO categories was examined using segmentation analysis. The whole sample was divided into four segments with the two dimensions – MKO and EKO. The results are shown in the Table 1 and illustrated by the matrix in the Table 2.

That matrix shows that in these four segments of enterprises the impact of MKO is different depending on quadrants (Q).

In QI high MKO correspond with low EKO. It means that managers are not able or do not want to change the enterprise processes. The

Table 1. Segmentation analysis according to average levels of MKO and EKO

	Identified segments of enterprises			
	1	2	3	4
MKO	0.77	0.87	0.85	0.73
EKO	0.51	0.81	0.66	0.69
Share of segment in the whole sample of analyzed enterprises (in %) and its size	19.9 n=170	29.6 n=252	28.4 n=242	22.1 n=188

Source: J. Mazur, M. Rószkiewicz, M. Strzyżewska, *Orientacja na wiedzę a wyniki ekonomiczne przedsiębiorstwa* (the book is in the process of being published by Oficyna Wydawnicza SGH).

Table 2. Four segments of researched enterprises

	EKO low	EKO high
MKO high	QI/ S 3 Knowledge-oriented but non-effective	QII/ S 2 Knowledge-oriented and effective
MKO low	QIII/ S 1 and S 4 Traditionalists	QIV No segment of enterprises was identified in this quadrant

Source: J. Mazur, M. Rószkiewicz, M. Strzyżewska, *Orientacja na wiedzę a wyniki ekonomiczne przedsiębiorstwa with some changes* (the book is in the process of being published by Oficyna Wydawnicza SGH).

possible situation is also that there is a time lag between actions undertaken by managers and the situation in enterprises. It is possible that benefits of MKO increases with time. MKO like ICT would not have a measurable impact on EKO until it reaches a critical mass of diffusion and experience (Rei 2002).

In QII the knowledge-oriented managers do influence knowledge processes in the enterprises.

In QIII, two segments of relatively little knowledge-oriented managers correspond with low EKO.

QIV indicates that without high MKO there is no highly knowledge-oriented enterprise. This result underlines the importance of managers' knowledge attitudes for knowledge processes in enterprises. MKO is condition sine qua non of highly knowledge-oriented enterprises. There

is no substitute for MKO as a factor of EKO. So quadrant II, III and IV confirm the dependence of MKO and EKO but quadrant I confirms the performance paradox. This QI result is valid for 28% of the whole sample. It means that the performance paradox understood as the transmission the MKO to EKO (the first aspect of performance paradox) is true only in some enterprises, but generally is not confirmed.

P.2. There is a relationship between enterprise knowledge orientation and its performance.

EKO has a statistically significant positive correlation ($r = 0.33$ $p < 0.01$) with performance.

It does not confirm the performance paradox understood as the lack of evidence of influence of knowledge processes in enterprises on their economic indicators.

This result is moderate. Not very high correlation hypothetically can be due to many reasons. Researchers underline that enterprises invest in IT to a much higher degree than in the education of employees. Yet computers without well-educated and motivated workers can not be efficient (Salojarvi, Furu, Sveiby 2005).

P.3. The influence of enterprise knowledge orientation on its performance depends on the structure of enterprise knowledge orientation.

In the presented research, one reason for that moderate (not high) correlation was revealed. It is the structure of EKO. As it was mentioned above, the level of intensity or maturity of the knowledge processes in

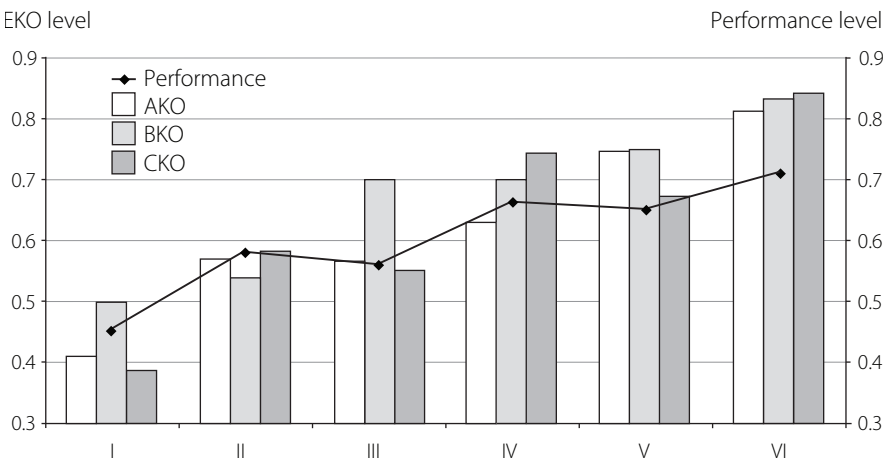

Figure 1. The structure of EKO and enterprises performance

Source: J. Mazur, M. Rószkiewicz, M. Strzyżewska, *Orientacja na wiedzę a wyniki ekonomiczne przedsiębiorstwa with some changes* (the book is in the process of being published by Oficyna Wydawnicza SGH).

the three areas – A, B, C can be different. Indeed the segmentation analysis identifies six segments of enterprises having different levels of partial EKO.

AKO, BKO, CKO means partial orientations of three areas of knowledge processes in enterprises. Comparison of S II and S III shows that the increase of the level of KO in one area does not help to increase enterprise performance. In this case the increase of the knowledge orientation in area B does not increase performance. The parallel conclusion follows from comparison of S IV and S V. The increasing AKO but decreasing CKO does not improve performance because the structure is still unbalanced. The best performance is in segment VI, which has the highest level of orientation and the most balanced structure. Thus, from the performance point of view, the best structure can be defined as a balanced structure on the high level of knowledge orientation.

Results received from Polish research are similar to those received by Finnish scientists. They conclude: "Companies with more comprehensive and strategic approach to knowledge and intangible assets are growing more than those with a less balanced approach. It raises a question mark about the effectiveness of piecemeal "KM implementation", which is the most common approach (Salojarvi, Furu, Sveiby 2005).

Some additional conclusions arise from observations of Figure 1. The S III shows that it is useless from a performance point of view to develop an area of new knowledge (innovation) creation unless it is not based on the information from outside the enterprise and when it is not used. There are some enterprises, which create innovation relying on their own engineers' expertise. In the literature they are called scientific-oriented. This group of enterprises does not appear responsive to knowledge about the market (Darroch, McNaughton 2003). "The evidence suggests that firms with a strong knowledge management orientation perform best across all measures while the scientific-oriented and non-adopters perform worst"[1]. (Non-adopters mean the group of enterprises that is not knowledge management oriented.) So, the innovation should be created in close understanding of what is going on in the market or in the broader environment. The S V shows that the knowledge gathering and creation of new knowledge is not efficient if the enterprise is not capable of using this knowledge and if this sometimes very advanced knowledge remains unused. To sum up, it can be noticed that enterprise can achieve the best performance when it introduces the knowledge orientation evenly to all three knowledge area processes.

[1] The research do not define the analyzed categories in the same way as it was done in the Polish research, but there is in the same broad problem of relation between knowledge and performance. The research examines organizations with 50 or more employees in the New Zealand.

6. CONCLUSIONS

Theoretical implications

The research results confirm neither the first nor the second aspect of performance paradox. On the contrary, they prove that there is a relation between knowledge orientation and performance. Of course, the correlation analysis indicates only the coincidence. It does not confirm the causal relations of variables. However, the statement about dependence of examined categories can be accepted on the basis of many other studies showing the logic mechanism of the impact of knowledge orientation on performance. It can be stated that there is no basis to accept performance paradox concerning the knowledge orientation, although there are some groups of enterprises in which the connection between MKO and EKO is not observed. Taking into account big expectations of managers and researchers on the role of knowledge, we can only speak about relative paradox of performance. It means that the research results concerning the knowledge impact are below the expectations.

Managerial implications

The first implication is that knowledge orientation positively influences enterprise performance.

The second implication is that the knowledge orientation should be implemented evenly, it means in all three areas of knowledge processes.

7. FUTURE RESEARCH

The limitations of the research issue from the sample excluding high-tech and big companies. So it is advisable to conduct further research on a representative sample of all enterprises in Poland. It would be interesting also to analyze the reasons for the lack of transfer of the MKO into EKO in some enterprises.

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PART II

THE STATE AND PERSPECTIVES OF KNOWLEDGE-BASED ECONOMY

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Agnieszka Rosolińska

NEW CHALLENGES FOR FINANCING BUSINESS IN THE KNOWLEDGE-BASED ECONOMY

1. INTRODUCTION

At the threshold of the 21st century the knowledge-based economy is a reality. Intellectual capital (IC) in various forms is implicated in the recent economic, managerial, technological and sociological advancements in a manner previously unknown and largely unforeseen, even by the greatest thinkers of the previous century.

Specifically, the importance of intellectual capital is emphasized in:

- revolution in information technology and the information society,
- the rising importance of knowledge and the knowledge-based economy,
- the emergence of innovation as the principal determinant of competitiveness.

Managers, consultants and researchers agree that the intellectual capital is essential in the creation of a company's value and national economic performance. Over last two decades, we have witnessed an active debate on the nature of IC and the impact on the firm's value. The review of related literature allows for identification of the four main approaches towards research in this area which basically depend on disciplines (Dobija 2003):

- economic view on intellectual capital (the role of human capital and knowledge as a source of economic development),

- sociological view on intellectual capital (social capital allows for creation of intellectual capital, intellectual capital is rooted in social relations and its structure),
- managerial view on intellectual capital (processes and activities aimed at development of intellectual capital of a firm), and
- accounting and finance view on intellectual capital (measurement and reporting of intellectual capital).

Managers and consultants tend to use the term "intellectual capital" interchangeably with "human capital", although human capital may be but a part of intellectual capital in an organization. Perhaps this exchangeability of terms may be explained by the fact that they consider the human capital of an enterprise to be the most significant element of its intellectual capital. We often encounter the slogan *the human capital is the most important asset of the company*, which captures the essence of the matter, notwithstanding the lack of terminological precision. In his work entitled *Brain Power. How Intellectual Capital is becoming America's Most Valuable Asset* (1991), Steward lists the elements of which the intellectual capital is composed:

> *...Operation of each enterprise is dependent on patents, processes, managerial skills, technology, information on consumers and suppliers, as well as experience. This sum of knowledge equals the intellectual capital.*
>
> *...It is the grand total of all knowledge of all individuals in the organisation, which gives the company its competitive advantage.*

However, the increased importance of knowledge assets has generated some frustration over accounting and its reporting system. Financial statements suffer from a lack of timelines, inaccuracy, and a limited ability to convey prospective data and risks facing the firm. Only some intellectual resources, so called intangible assets, can be reported in the financial statements of an organization (IAS, 38). International standards specify criteria, which intangibles have to be met in order to be included in the financial statement. The reason for such a treatment is clear: intangibles are too uncertain to be included in the financial statement. The standard setters want to preserve a more conservative approach so potential users of accounting information are not misled and can make better decisions. Of course, one can agree with such an approach, given that there is a chance that management would like to use intangible to "color" their performance. On the other hand, one have to be aware that not including information on intellectual assets can also seriously hinder decision making of potential investors.

The use of IC information by capital market participants in guiding financial decision has been already researched on the supply and

demand side. On the supply side, there are many suggestions of additional disclosures, also in a form of a report on IC to guide investors' decisions better (Sveiby 1997; Mouritsen et al. 2001; Edvinsson, Malone 2001). On the demand side, we already know that users of accounting information are increasingly aware of the importance of IC information, which is not directly reflected in financial statements (Eccles et al. 2001). However, there are also suggestions that IC disclosures are not appreciated enough by the market participants as they may not understand the IC concept and the value of IC resources to the company (Bukh 2003; Mouristen 2003; Johanson 2003).

Johanson (2003) states five reasons, why the capital markets resist using IC information and at the same time points out that one of the major difficulties connected with use (disuse) of IC by the capital market is the mentality of the market participants:

- Problem of knowledge (awareness), connected with lack of understanding of importance of immaterial assets,
- Problem of uncertainty, understood as a lack of trust towards various ratios, including concerns about their reliability and usefulness,
- Problem of ownership rights,
- Problem of management,
- Mentality problem of market participants.

Our knowledge and understanding how the IC information is used in private companies as well as of smaller sizes is not as broad as it is in a case of public private companies. This does not mean that smaller businesses do not consider intellectual assets to be important. Quite to the contrary, for many of them intellectual resources are the only important assets. This high reliance on IC resources creates however different challenges. There is less need to inform the owners about how those resources are utilized as entrepreneurs have often first-hand knowledge of it and, more importantly, the most important IC resources are often embedded in them. The challenge lies in signaling the use and the importance of intellectual resources to the external finance providers. The following chapters will discuss those challenges and provide some recommendations.

2. CHALLENGES FOR ENTREPRENEURS IN THE KNOWLEDGE ECONOMY

Obviously, information concerning intellectual capital gained importance because it is perceived as an integral part of a firm's value-creating process (Bukh 2003). That is why the managers are searching for answers, which intellectual resources help to gain competitive advantage and to win in the market place. This is however very difficult as such resources can not be easily and unambiguously defined, classified

and measured. Therefore, the effective management of intellectual capital is very difficult. Additionally, the accounting system does not support managers in that process as intellectual capital is not reflected sufficiently in financial statements. And what is very important, the external users of accounting information also do not get all necessary information about important resources influencing corporate value. The inability of financial statements to provide prospective information concerning the company's future may be especially problematic in case of innovative, entrepreneurial firms.

The problem lies in convincing the external finance providers to invest in the particular innovative business. And that is why some entrepreneurial firms face problems with raising funds from banks. In case of small innovative companies, the standard creditworthiness and credit risk assessment procedures cannot be directly applied and that is why banks regard applications from such firms as more costly and more time consuming. Banks perceive such firms (that is the ones with higher asymmetry of information, short credit history and short period since being founded) as the ones lacking basic input data. Additionally, as the amount of borrowing is usually much lower, banks see the credit risk assessment procedure as more costly when compared with bigger companies. Young entrepreneurial firms lack tangible assets, do not have well-established reputation and often show initial low profitability. It is difficult for outside investors to ascertain the quality and the potential value of technological innovations. Banks regard such firms as riskier (higher technological and market risk), because the growth of the market is difficult to assess. And this is connected with bigger collateral requirements that are hard to meet for knowledge-based firms.

There are two types of collateral. It may be either an existing asset of the firm that is pledged to a bank in the event of financial distress (equipment, real estate, or inventories) or an additional asset that would normally not be legally attachable to the firm, like the private property of its owner. The first type of collateral is often difficult to meet for knowledge-based firms, whereas the second one is more common in case of such enterprises. The problem appears when the company has little collateral to pledge to the bank and is unable to provide "hard" evidence of its profitability in the past as well. In such a case, the entrepreneur will be compelled to turn to the other financial intermediaries, such as venture capitalists and business angels. It is worth to take a closer look, why and how they do it.

Below, the introduction to venture capital financing is presented, as well as the scope of such investments on the Polish market, together with a short discussion concerning the barriers and the potential of VC financing development.

3. FINANCING KNOWLEDGE AND INNOVATION USING ALTERNATIVE SOURCE OF CAPITAL

Private equity and venture capital – what is so interesting about it?

There is no one agreed definition of a term *venture capital*. Generally speaking, venture capital refers to a mid- and long-term financing of projects characterized by high risk and the above average rate of return on the investment. It is understood differently in Great Britain, continental Europe and most countries in the world, and differently in the United States. As Kornasiewicz (2004) states, the main difference is that in the European understanding, venture capital means investing capital in early stages of company's development as well as financing large replacement and buyout projects, whereas in the USA it is strictly limited to early stages, and in this case, the meaning of venture capital is much narrower.

Venture capital is very often used alternatively with a term *private equity*, however these terms do not mean the same. According to Kornasiewicz (2004), venture capital has a narrower meaning, as it is just a segment of capital investments called private equity. Such an approach is consistent with the definition presented by the European Private Equity and Venture Capital Association (EVCA).

> *Private equity provides equity capital to enterprises not quoted on a stock market. Private equity can be used to develop new products and technologies, to expand working capital, to make acquisitions, or to strengthen a company's balance sheet. It can also resolve ownership and management issues. A succession in family-owned companies, or the buyout and buying of a business by experienced managers may be achieved using private equity funding. Venture capital is, strictly speaking, a subset of private equity and refers to equity investments made for the launch, early development, or expansion of a business.*
>
> EVCA, http://www.evca.com

Despite the fact that there are many different definitions of and approaches to the term venture capital in the worldwide literature, an unquestionable feature of this form of business financing is a simultaneous support in the company's management process that the investor brings in when starting to get involved in a particular project. For the purposes of this study, especially referring to the section in which the market statistics are presented, the broad category of private equity/venture capital (PE/VC) will be taken into consideration to ensure the comparability of data. The usage of the narrow definition of venture capital might lead to wrong conclusions.

What does the process of PE/VC investment look like?

Venture capital can be brought into the company in different stages of its maturity and that is why it can be either seed, start-up, expansion, replacement or a buyout capital[1]. Although VC is very often identified with early stages, it is invested rather into mature companies, as the below statistics confirm. The investment process, typical for the most PE/VC funds, can be characterized as follows (Węcławski 1997): 1) the accumulation of capital, 2) searching for projects to be financed, 3) investing capital, 4) participation in management, and 5) divestment. The first phase lasts for several months and during that period the PE/VC fund accumulates capital from private and institutional investors and sets the rules of investing the gathered funds. After that, the fund searches for interesting projects to allocate capital, using different, complex procedures of projects' selection. The choice of projects can last for even 2–4 years. The process of projects' analysis covers a general assessment that is used for a quick, initial selection of the best projects out of many submitted applications and then a detailed assessment of approximately 1/3 of all applications. Venture capital funds make an extremely detailed assessment of projects, so called *due diligence*, which is a procedure of a comprehensive and thorough analysis of a company (Węcławski 1997; Sobańska, Sieradzan 2004). Generally speaking, the investors assess the quality of management, products' features, market potential and the company's value growth potential. As Tamowicz (2004) states, first of all the quality and the experience of management is analyzed as these are the most important criteria of investment projects' selection. The management potential is top-ranked. An earlier experience, a completeness of a management team and an experience in the sector are also ranked very high. It means that PE/VC investors assess above all the knowledge resources, and that is why venture capital can be an interesting alternative source of capital for

[1] EVCA presents the following definitions:For early stages: 1) seed capital – financing provided to research, assess and develop an initial concept before a business has reached the start-up phase, 2) start-up capital – financing provided to companies for product development and initial marketing. Companies may be in the process of being set up or may have been in business for a short time, but have not sold their product commercially.
For later stages: 3) expansion capital – also called development capital. Financing provided for the growth and expansion of a company, which may or may not break even or trade profitably. Capital may be used to: finance increased production capacity; market or product development; provide additional working capital, 4) replacement capital – purchase of existing shares in a company from another private equity investment organization or from another shareholder or shareholders, and 5) buyout – a transaction in which a business, business unit or company is acquired from the current shareholders (the vendor), management buyout (MBO), management buying (MBI), institutional buyout (IBO), leveraged buyout (LBO).

innovative companies. Normally, PE/VC investors have a better technological expertise, obtained through the specialization in a particular industry, and they are therefore better equipped and prepared to assess the profitability of the project. And they do it more accurately than a bank can. Venture capitalists can also develop closer relationship with an entrepreneur, and base their decision on "soft" qualitative information gathered through contacts with the firm and often with its owner. Simultaneously to this phase, the negotiations of cooperation terms, signing a contract and as a result, investing capital takes place. After engaging the capital, the fund joins the company's management, that is starts its consultancy and supervisory activity. The scope and intensity of such an activity depend on the company's development stage. This phase lasts on average from 3 to 6 years. The last phase is called a divestment or an exit, during which a fund withdraws from the investment. This can be carried out in many different forms (e.g. a trade sale, a public offering, a sale to management, a write-off; Tamowicz, Rot 2002) and it lasts for several months.

Business Angels – who are they and do they differ from PE/VC investors?

It is worth noticing that in case of small and medium enterprises (SMEs), sometimes some mysterious investors appear, so-called *Business Angels*. They are private investors who use a venture capital mechanism to invest their own capital in businesses, which are characterized by high risk and the above average rate of return. However, a high rate of return on the investment is not the most important issue for business angels. Their investment motives and patterns are quite different that in case of venture capitalists.

Business angels are mostly interested in smaller projects and they prefer to invest in a seed or start-up stages rather than expansion or a buyout. And that is why they become a supplement of PE/VC funds and at the same time an interesting alternative for entrepreneurs[2].

There are many differences between business angels and venture capitalists, which make them mutually complementary at the same time. It should be stressed that these two types of investors declare a wide cooperation, and very often co-invest in the same businesses (Mikołajczyk, Krawczyk 2007). First of all, it is important to notice that business angels are informal investors. In contrast to venture capitalists, they invest their own capital, and the invested sources are

[2] A broad, interesting discussion concerning business angels' activity in SME sector was presented by Mikołajczyk and Krawczyk (2007).

in general much lower than in case of PE/VC funds. Business angels are interested to entrust a seed and start-up capital, becoming at the same time a part of a growing company. At last, these are investment motives that make business angels different from venture capitalists. They are rather non-financial or at least a rate of return is not the most important impulse for investment. The benefits that most business angels are searching for when getting involved in the particular business, are first of all pleasure (they treat it as a hobby) and personal satisfaction of being a part of a company's success (Mikołajczyk, Krawczyk 2007).

According to the European Business Angel Network's (EBAN's) surveys,[3] the general social, professional and personal profile of a business angel is the following: a male, aged between 35–65, having a successful experience as an entrepreneur or a manager, available at least one day a week to advise trustworthy entrepreneurs, prepared to invest the equivalent of at least 15% of his own funds in a single deal, and ready to contribute his network of personal contacts in a business. It is essential to remember that the presented characteristic is just a framework, as the business angels are a heterogeneous group, and this diversity is visible when analyzing the situation in different countries.

In Poland, there are currently four business angels networks: 1) the Business Angels Network Poland (PolBAN), a member of the EBAN, founded in 2003, 2) the Polish Confederation of Private Employers Lewiatan Business Angels (LBA), founded in January 2005, 3) the Silesian Business Angels Network (SilBAN), established in September 2006 and 4) the Lublin Business Angels Network, founded in 2007. There are several hundred Polish business angels acting actively on the market, waiting for interesting projects. As one of them said: "The effective investing means finding the areas that the others are afraid of"[4].

A brief historical view – PE/VC in the USA and Western Europe

PE/VC market was first formed at the beginning of the previous century in the United States of America, thanks to the wealthy private investors' capital engagement in the development of newly established companies. Although the roots of venture capital financing can be found earlier (Dąbkowski 2002; Wytwer 2005), most sources provide the above mentioned period as the beginning of venture capital's era. It is commonly accepted that a turning point for the development of

[3] The results of the survey are presented in: *Introduction to Business Angels and Business Angels Network Activities in Europe* (01.09.2006), EBAN.
[4] http://www.polban.pl/

this type of capital investments was a year 1946 when the first venture capital fund, American Research and Development Corp. (ARD) was established (Sobańska, Sieradzan 2004). The United States of America are not only the cradle of PE/VC market but they also remain the world leader in this type of investments. Węcławski (1997) notices, that in the European countries, the tax and administrative barriers blocked for many years the development of PE/VC sector. The dynamic development of West European PE/VC market that started in the nineties of the twentieth century still did not manage to liquidate the gap between the Europe and the USA. There are still significant organizational, legal and tax differences between the countries in the European region (Wytwer 2005). The best developed European PE/VC sectors are in the following countries: United Kingdom, France, Germany, Sweden, Italy, Netherlands and Spain. In other countries the PE/VC market is much less developed.

In 2005[5], the largest market in terms of investment value was United Kingdom, with PE/VC investment value on the level of USD 27.92 billion (an increase of 25% on the 2004 level of USD 22.36 billion). The second largest market was France (USD 8.55 billion – an increase of almost 40% on the 2004 level of USD 6.12 billion), followed by Sweden (USD 3.52 billion – an increase of 85% on the 2004 level of USD 1.90 billion), Germany (USD 3.16 billion – a decrease of 28% on the 2004 level of USD 4.41 billion), Spain (USD 3.12 billion – an increase of almost 36% on the 2004 level of USD 2.30 billion), Netherlands (USD 2.74 billion – an increase of 41% on the 2004 level of USD 1.94 billion) and Italy (USD 2.56 billion – an increase of almost 48% on the 2004 level of USD 1.73 billion). In the nineties of the twentieth century, the three largest West European PE/VC markets: United Kingdom, France and Germany raised together over 60% of the total value of funds raised in Europe.

In 2005, the total value of PE/VC capital invested globally was approximately USD 136 billion, which is up over 23% from USD 110 billion in 2004. In North America, the value of investment amounted to USD 47.65 billion (USD 46.41 billion in USA and USD 1.24 billion in Canada), whereas USD 55.1 billion was invested in Europe (a 27% increase on 2004). The Figure 1 presents the global value of funds raised and investments in the period between 1998 and 2005.

In 2005, the share of particular regions in the global PE/VC investment value was the following: Europe: 40% (in 2004: 39%), North America: 35% (in 2004: 41%), Asia Pacific: 22% (in 2004: 16%), Middle East & Africa: 2% (in 2004: 3%) and Central & South America: 1% (in 2004: 1%).

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[5] The data presented in this section comes from *The Global Private Equity Report 2006* (published in 2007) that is being prepared by PricewaterhouseCoopers on a yearly basis.

The Figure 2 presents the regions' share in the global PE/VC market in terms of investment value (cumulative value between 1998–2005).

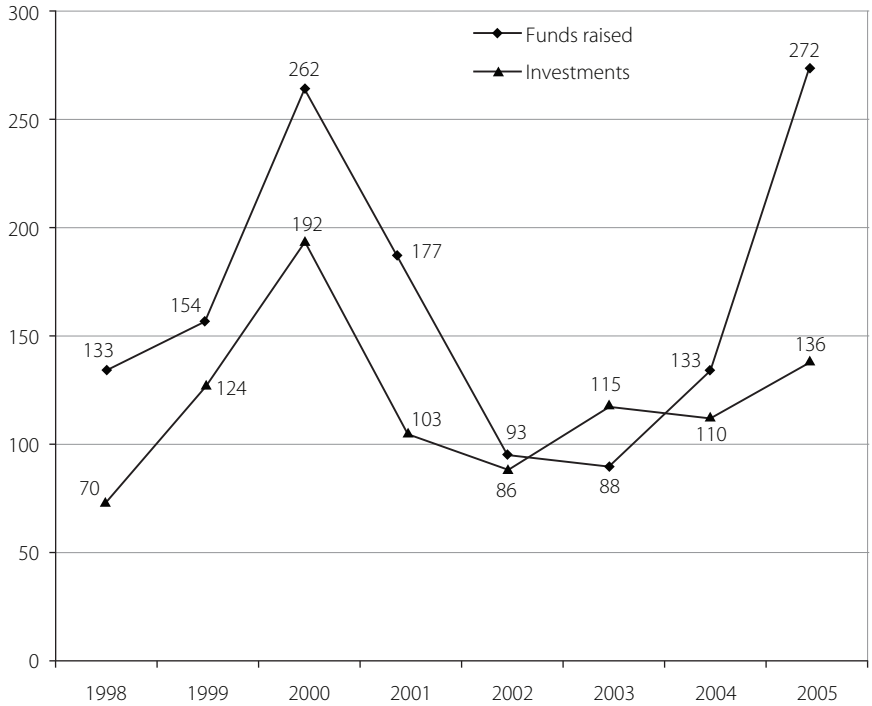

Figure 1. Global investment and fund raising trends in the years 1998–2005

Source: *Global Private Equity Report 2006*, PricewaterhouseCoopers, URL: http://www.pwc.com/extweb/pwcpublications.nsf/docid/A0777B94B3CC3741852572FA0071AEC9/$File/global_pe_report.pdf

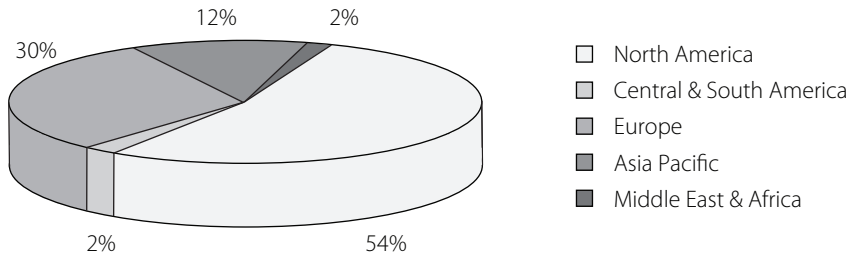

Figure 2. Cumulative investment share in the global PE/VC market per region, 1998–2005

Source: *Global Private Equity Report 2006*, PricewaterhouseCoopers, URL: http://www.pwc.com/extweb/pwcpublications.nsf/docid/A0777B94B3CC3741852572FA0071AEC9/$File/global_pe_report.pdf

Polish PE/VC market in comparison to Central and East European countries – the scope of investment and the barriers of development

In the Central and Eastern Europe, the private equity and venture capital market started to develop at the beginning of nineties of the twentieth century, which was directly linked to the economic transformation that took place at that time. Significant structural changes that were made in the particular countries created favourable conditions for the development of this type of capital investments. At the beginning, such investments had primarily a privatization and restructuring character, what was a natural reaction for the needs of economies in transformation (Wytwer 2005). In Poland, the biggest PE/VC investors in the first years of transformation were the European Bank for Reconstruction and Development (EBRD) and the International Finance Corporation (IFC) (Kornasiewicz 2004)[6].

The first PE/VC fund in Poland, Polish-American Enterprise Fund, was founded in 1990 by the USA Congress as a part of a broad USA aid programme directed toward post-communist countries in the East Europe. A company Enterprise Investors (EI) was established to manage the fund. While setting up the Polish-American Enterprise Fund, the same funds were established in Hungary, Czech Republic and Romania. In 1992–1993, many commercial PE/VC companies arrived in Poland, out of which there are two that are worth mentioning: the New Europe East Investment Fund and the Schooner fund. The extremely important period for the further development of the PE/VC market in Poland was a year 1994 as many new funds appeared then at the same time. The growth of competition and the emergence of new alternatives for the entrepreneurs caused the business transactions more complex. Currently, in Poland, there are approximately 30 entities that obtain PE/VC fund's features. In the Polish Private Equity Association (PPEA) there are 32 full members[7], who are the representatives of companies that manage PE/VC funds.

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[6] The EBRD invested about USD 250 million in such businesses as the Banking Centre in Warsaw, The Sandomierz Glassworks, The Wielkopolski Bank Kredytowy and FIAT Auto Poland factory. The EBRD also supported the development of PE/VC funds established in the region in the nineties of the twentieth century, acting as a partner-founder of most of those funds. The IFC, together with other strategic investors, invested over USD 277 million in such businesses as the Lucchini foundry, the International Bank of Poland and the Sandomierz Glassworks.

[7] In the PPEA, next to the full members, there are also many (approx. 50) associate members who support PE/VC fund managers, e.g. consulting firms, legal offices and banks.

Poland's accession to the European Union in May 2004 marked a milestone and contributed to a rapid growth of a Polish private equity and venture capital sector. Its effects were noticeable in the previous years. Total funds raised in 2004 amounted to EUR 303.9 million[8]. Although fundraising activity was much lower in 2005 (EUR 59.1 million), in a year 2006 the total value of funds raised reached a spectacular record level of over EUR 936 million. This is consistent with the latest fundraising trends in Europe, where the boom on PE/VC market is visible. In 2006, funds raised in Europe amounted to EUR 117 billion, whereas the investment value reached EUR 71 billion.

Private equity houses based in Poland invested EUR 294 million in 2006, which is an increase of almost 91% over 2005 (EUR 154 million). The vast majority of investments were made into mature companies, as it used to be in previous years. The number of investments increased from 32 in a year 2005 to 46 in a year 2006 and the average value of each transaction grew by EUR 1.6 million to the level of EUR 6.4 million.

The Figure 3 presents the structure of investment stages in Poland. The tendency to invest capital in mature companies is the same as in the whole Europe. Seed and start-up investments are still marginal.

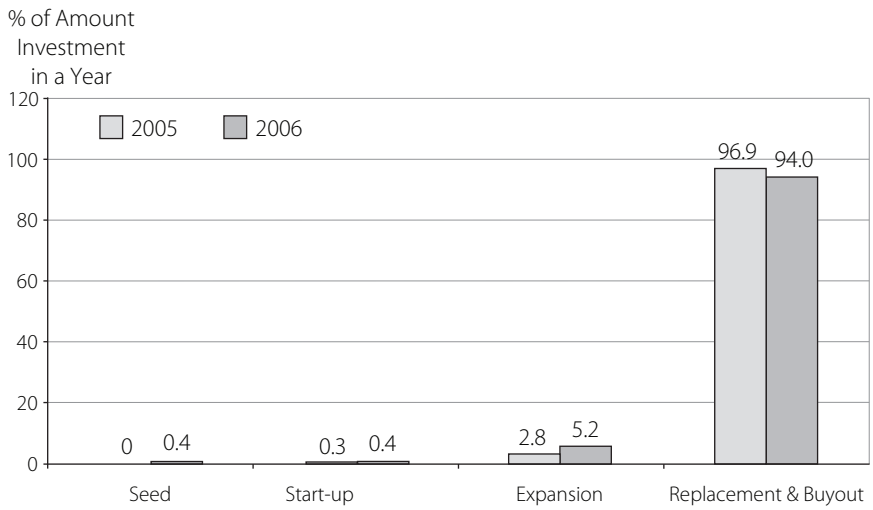

Figure 3. Stage distribution by percentage of amount invested by Polish-based PE/VC fund managers, 2005–2006

Source: *EVCA Yearbook 2007*, www.psik.org.pl

[8] The data presented in this section comes from the EVCA Yearbook 2007, www.psik.org.pl, and *Central and Eastern Europe Statistics 2006. An EVCA Special Paper*, October 2007.

Sector distribution of investments was varied, as it used to be in previous years. Polish-based PE/VC fund managers focused on communication companies where they invested EUR 165 million, over half of the total investment value. This sector was the most popular also in 2003 and 2004 as in a year 2005 investors focused strongly on consumer-related companies. Manufacturing companies received EUR 61 million in 2006 and the financial services sector EUR 41 million.

Divestment[9] ("exits") value in 2006 amounted to EUR 140 million, which means an increase of 21% according to EUR 116 million reached in 2005. However, the number of exits fell from 40 in 2005 to 37 in 2006, which resulted in an increase of the average value of divestments from EUR 2.9 million (2005) to EUR 3.8 million (2006). Most exits, 53%, took the form of public offering (19% in 2005). Divestments by sale to another private equity house ranked second with 15% (0.9% in 2005). Only few divestments were conducted by a trade sale (14%), which is a surprisingly low result comparing to the situation in 2005 (64%). Repayment of principal loans constituted 12.5% of the total value of exits. Other forms of exits represented marginal shares in the total value of divestments in a year 2006.

Comparing the situation of Polish PE/VC market to other Central and East European (CEE) countries[10], Poland is one of the largest PE/VC markets in the CEE region.

In 2006, fundraising for CEE region reached a new record level of EUR 2.25 billion, an increase of 74% over the prior record level achieved in a year 2005 (EUR 1.29 billion). In 2004 (EUR 496 million) and 2003 (EUR 312 million) the value of funds raised was much lower. Such an achievement in fundraising in the past two years shows the growing interest of institutional investors to participate in the CEE region. Capital raised was primarily directed toward PE/VC fund managers focused on buyouts. Over 80% of funds raised came from outside the CEE region, primarily from Western Europe and North America.

In 2006, the investment activity in CEE region increased significantly, achieving a level of EUR 1.67 billion, over three times as much as in a year 2005 (EUR 506 million), and reaching an absolute at-time record level. About 90% of investment activity in the CEE region was concentrated in four countries: Czech Republic, Hungary, Poland and Romania. A dramatic increase in investment activity was noticeable in

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[9] According to the EVCA reporting methodology, divestment value is calculated on the basis of the historical cost of the investment in a company that was sold (which stocks were sold) in a particular year and it is not the sum of actual proceeds from the sale of a company.

[10] For the purposes of the EVCA reports on PE/VC markets, Central and East European Countries comprises the following countries: Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Serbia and Montenegro, the Slovak Republic and Slovenia.

Hungary, Czech Republic and Poland. Such a high level of investment registered in Hungary and Czech Republic was driven by single large transactions in these countries.

The Figure 4 presents investment activity in CEE countries in 2005 and 2006.

Comparing PE/VC investment activity in the region to the GDP, there is still a significant gap between CEE region and other Europe as a whole, although this gap is getting smaller. Investment value as a percentage of GDP in CEE in 2006 was 0.218%, which is just a 39% of a European average indicator of 0.552%. The Table 1 and Figure 5 present the ratio of PE/VC investments and GDP.

As in the whole Europe, also in CEE region most investments were made into mature companies. In 2006, 91% of total transaction value was represented by buyouts, which is six times as much as in 2005. Expansion investment value decreased compared to 2005, and represented

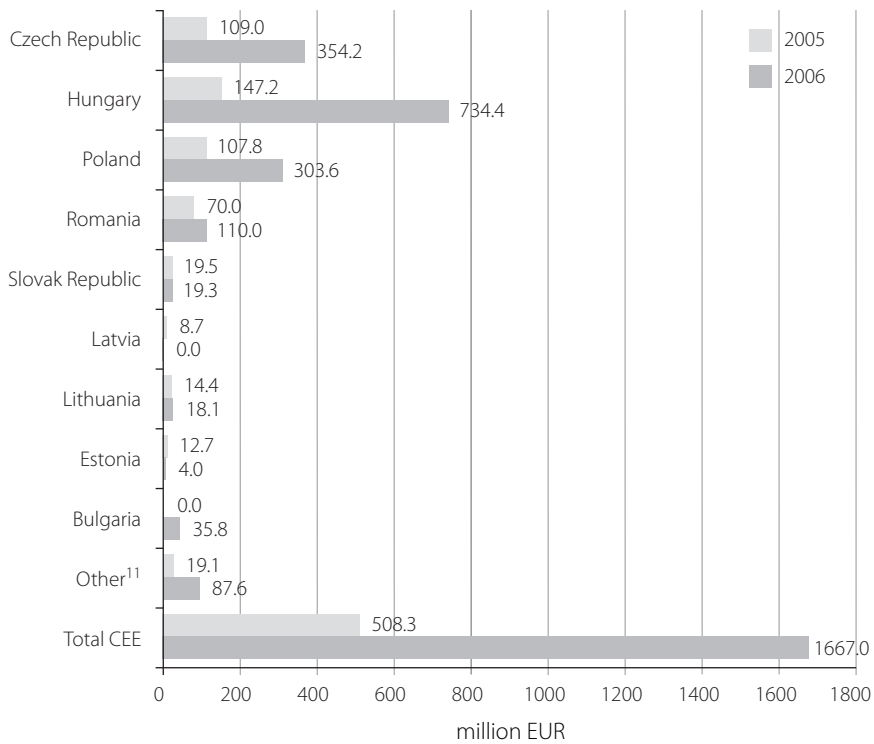

Figure 4. Annual investment value in CEE, 2005–2006

Source: *Central and Eastern Europe Statistics 2006. An EVCA Special Paper*, October 2007, p. 4.

[11] Croatia, Slovenia, Bosnia and Herzegovina, Serbia and Montenegro.

only 5.7%. Other types of investments were marginal (start-up: 2.7%, replacement: 0.5% and seed: 0.1%). However, the above data does not allow to conclude that CEE investment targets lack growth perspectives. On the contrary, as most buyout targets were actually growth companies.

Divestment activity in the CEE region in 2006 increased slightly comparing to the level achieved in 2005. Most exits were conducted by a trade sale (47%). 18% of total divestments were made by public offering, whereas sale to other private equity firms comprised 12.7%. Other ways of exits took much smaller shares in the total value of divestments (repayment of principal loan: 8.2%, sale to management: 8.2%, divestment by other means: 5.4%). Till 2006, Poland became the largest CEE market in terms of divestment activity (31%).

Table 1. PE/VC investments as a percentage of GDP in CEE (in thousands EUR)

Country	Total investment		Investment as a % of GDP	
	2005	2006	2005	2006
Bosnia and Herzegovina	9,974	5,328	0.123%	0.055%
Bulgaria	0	35,812	0.000%	0.143%
Croatia	756	12,033	0.002%	0.035%
Czech Republic	108,952	354,208	0.112%	0.315%
Estonia	12,652	4,031	0.120%	0.031%
Hungary	147,247	734,360	0.167%	0.883%
Latvia	8,719	0	0.068%	0.000%
Lithuania	14,359	18,103	0.070%	0.076%
Poland	107,818	303,621	0.045%	0.118%
Romania	70,000	109,956	0.088%	0.115%
Serbia and Montenegro	6,367	31,501	0.030%	0.150%[12]
Slovak Republic	19,467	19,348	0.052%	0.045%
Slovenia	2,009	38,712	0.007%	0.130%
Total CEE	508,320	1,667,013	0.073%	0.218%

Source: *Central and Eastern Europe Statistics 2006. An EVCA Special Paper*, October 2007, p. 5.

[12] Based on 2005 GDP.

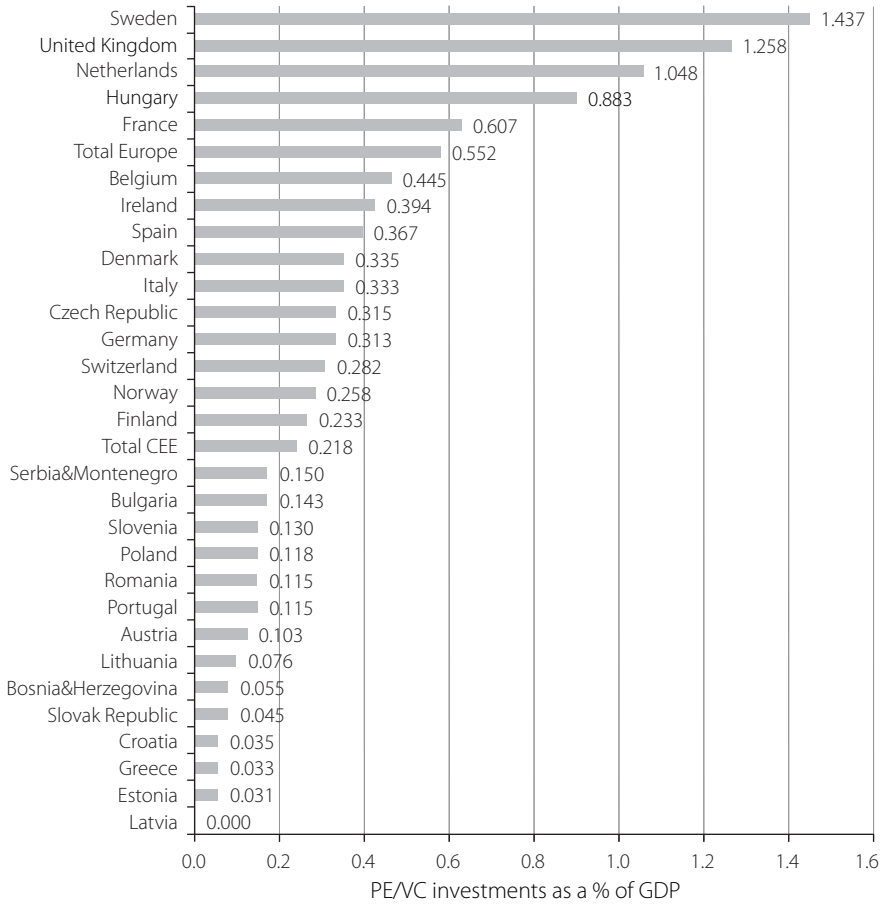

Figure 5. PE/VC investments as a percentage of GDP for Europe, CEE and selected European countries in 2006

Source: *Central and Eastern Europe Statistics 2006. An EVCA Special Paper*, October 2007, p. 5.

As the above statistics show, the CEE region has a significant growth potential. It means that there is a space for innovative projects to be financed. However, there are many different barriers of the PE/VC market development, both on the supply and the demand side of the economy. One of the most commonly stressed barriers is the weakness of domestic sources of financing, as their share in the total venture capital investments is marginal (in 2004, it was only 1%). To improve this situation, the sources of domestic investors, such as OFE, banks and insurance companies' need to be activated (Grzywacz, Okońska 2005; Rogoziński 2003). Another barrier connected with the development of PE/VC sector is an inefficient state and local government administration as well as jurisdiction (protracted administrative procedures: beginning with the

registration of a company, through receiving all the necessary administrative permits concerning a foreign investment in Poland, and ending with many local permits) (Grzywacz, Okońska 2005). Also tax barriers are very important. There are no specific regulations concerning a one-time taxation of income, which, if existed, would make the PE/VC fund's investment profitable for the final investor. An extremely important barrier is at last a problem with financing the development of small and medium enterprises. Worldwide, SMEs' financing is a domain of local investors and in Poland this situation should not be different. And if the funds raised for the investment purposes come mainly from other countries than Poland, the capital is directed toward large projects, and that is why it passes by SMEs. Moreover, it is clearly visible that there is a lack of seed, start-up and early expansion capital in Poland, and SMEs are searching just for such a capital[13].

The barriers occurring on the supply side are not the only ones that hinder the development of PE/VC market in Poland. There are many significant barriers on the companies' side as well. And those demand-side barriers may be even more important. Most entrepreneurs are not familiar with the principles of venture capital funds' activity. According to the results of the research conducted in November 2001 (Dzierżanowski, Tokaj-Krzewska 2002), only 24% of entrepreneurs from the SME sector were acquainted with the term venture capital. Three quarters of entrepreneurs stated that they had never heard about it. In the group of respondents who met with the term earlier, only 20% entrepreneurs could define it correctly. Most entrepreneurs who were familiar with the VC concept perceived it as an inaccessible and unattractive source of capital. In the past few years the knowledge concerning a venture capital financing and the approach to it might have improved, but it is probably still unsatisfactory.

The interesting issue concerns the way venture capital investors perceive the Polish managers' activity. Unfortunately, according to the survey conducted in a year 2003 (Kornasiewicz 2004), PE/VC fund managers assess the quality of Polish managers as being on a very low level. First of all, Polish managers lack necessary knowledge and experience in management, but at the same time they are too emotionally linked with their businesses to let some external specialists get involved in the management process of their firms. And they are simply afraid to start cooperation with a PE/VC fund. What is also important, the expenditure on R&D in Polish companies is limited (Grzywacz, Okońska 2005). Another significant problem concerns a lack of well-prepared, interesting innovative projects that could be financed by venture capital investors. As many investors, especially business angels, stress, there is

[13] The problem of venture capital in the SME sector, especially concerning barriers in that field, is widely discussed in Grzywacz, Okońska (2005) and Rogoziński (2003).

a capital to be invested, but there are still very few interesting projects prepared.

Despite many barriers discussed above, the prospects for growth of the PE/VC market in Poland are big, what is lately confirmed by many experts and practitioners (Wytwer 2005; Grzywacz, Okońska 2005). Basing on the experience of the world leaders in PE/VC investments (United States, United Kingdom, France, Germany), first of all the legal and tax barriers should be liquidated. Not only experts stress a need to develop venture financing in Poland. According to the survey conducted by EVCA in 2003, the entrepreneurs who received the venture capital assessed this type of financing very high (Grzywacz, Okońska 2005). EVCA directed the survey toward the entrepreneurs from the European countries (including Poland) who got either seed, start-up or expansion capital between 1995–2001. 95% of respondents admitted that without a venture capital support, their companies would develop much slower or even would not exist at all.

The above discussion shows, that there is a space for venture capital financing on the Polish market, and that this type of capital investments in Poland has a growth potential. There is however a great challenge facing the entrepreneurs who need to learn how to use it. And while building a competitive advantage of a company in the knowledge era, the venture capital may occur a very useful tool, especially in case of small and innovative enterprises.

4. CONCLUSIONS

In the knowledge-based economy these are intellectual resources that play a dominant role in a company's value creation process. That is why the managers are trying to find out, which intellectual resources contribute to gaining the competitive advantage and to achieving a market success. However, this is very difficult as immaterial assets can not be easily and unambiguously defined, classified and measured, which causes problems with effective IC management. Additionally, the managers are not supported by the accounting system, as IC is not sufficiently reflected in the financial statements. Therefore, there are new challenges emerging that the today's entrepreneurs need to face. They are connected with signaling the use and the importance of intellectual resources to the external finance providers.

Raising capital from banks to finance innovative, entrepreneurial projects is very difficult as banks are not willing to take high risk connected with financing such firms. The entrepreneurs are compelled to search for some other sources of capital, and they more often turn to private equity and venture capital financing, which seems to be a very interesting alternative. Normally, thanks to the specialization in a given

industry, VC has a better technological expertise and is better equipped to assess the profitability of the project, more accurately than a bank can. Generally speaking, venture capital financing can be characterized as low-collateral, high-growth and high-profitability.

When analyzing the situation of Polish PE/VC market in comparison to other European markets, it seems that it has a real growth potential. Although there are some barriers concerning legal, administrative and tax issues, they seem to be not the most important factors that hinder the development of PE/VC investments. The important barriers appear also on the demand-side of the economy.

The research shows that there is a space for innovative projects to be financed by PE/VC fund managers and business angels, but Polish market still lacks well-prepared innovative projects, that could encourage investors and convince them to finance the particular idea. This might be connected with the fact that most entrepreneurs are simply not familiar with the principles of venture capital financing. However, a very important issue concerns the awareness of IC importance and the ability to manage intellectual resources effectively to create company's value.

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Izabela Koładkiewicz

THE TRANSFER OF KNOWLEDGE AND TECHNOLOGY BETWEEN THE RESEARCH AND DEVELOPMENT SPHERE AND INDUSTRY IN POLAND: PERSPECTIVES OF THE REPRESENTATIVES OF SCIENCE AND TRANSFER INTERMEDIARIES[1]

1. SCIENCE — INDUSTRY COLLABORATION: THE CONTEMPORARY CHALLENGE

Efficient mechanisms for the transfer of knowledge and technology between the research and development sphere and industry are increasingly seen as a factor prerequisite to growth in innovation/innovativeness. At the same time, they define the competitiveness and development dynamics of national economies and entire regions[2]. In the case of the European Union, this trend is visible in the assumptions behind the

[1] This article was developed within the framework of the KBN research project *Research and Development Unit as a Creating Knowledge Organization Functioning Models*. The project leader is professor R. Rządca.

[2] The United States, Europe and Japan continue to lead in world science. Emerging economies are playing an increasingly important role. This is especially true of sectors based on advanced technology – e.g. China is ranked sixth in the number of scientific publications. Their share in the number of triadic patents is also growing (*OECD Science, Technology and Industry: Scoreboard 2007*).

Lisbon Strategy as well as in the objectives of the Seventh Framework Program – the basic instrument for implementing the strategic aim of the Strategy, which is to transform the European Union's economy into the most competitive and dynamic knowledge-based economy in the world capable of guarantying continuous economic growth, the creation of new and better jobs, and the guarantying of greater social cohesion. The triad of knowledge made up of education, research, and innovation is vital to achieve this target (http://www.kpk.gov.pl/7pr/podstawy/cele_i_budzet.html).

Advise and assistance in reorganizing research activities and innovation policy on a European scale, intended to guaranty an economic and competitive future to the member states of the European Union, is the objective of the European Research Area (ERA). The ERA forms a platform that allows the regrouping and intensification of research activities on a European Union level, including coordination with domestic and international initiatives. Among the major tasks facing the ERA is the growth of efficiency in utilization of resources and scientific institutes on a European level, greater growth private investment in research and development, increased mobility of human resources and researchers, and the guarantying of conditions conducive to the "common value" research space.

The matter of collaboration between science and industry is also taken up by the *Lisbon Declaration – Europe's Universities beyond 2010: Diversity with a Common Purpose*, prepared by the European University Association (EUA). Item 19 of the EUA declaration defines cooperation among universities and businesses as a "co-innovative" process in which the universities play the role of knowledge supplier. It also points to the need to strengthen dialogue among the spheres, where a useful instrument for achieving this target is seen by the EUA in programs for educating PhD students as well as actions aimed at creating a European Institute of Technology (EIT), a European Union proposal.

Questions of cooperation of the research and development sphere with industry was also examined in the most recent annual OECD report – *Science, Technology, and Industry: Scoreboard 2007* – as an important component of innovation policy. The authors of the report demonstrate that one of the instruments applied by the government of many countries to stimulate the transfer of technology from university centers to industry is urging colleges to acquire patent rights covering their inventions as well as the application of appropriate tax incentives[3].

The problem of effective mechanisms for the transfer of knowledge and technology between the research and development (R&D) sphere and the economy is also seen in Poland. The need to implement new mechanisms as well as to effectively improve the efficiency of existing

[3] Australia, Canada and the United States are pioneers in such practices (OECD).

ones is becoming more and more pressing with each successive year. R&D intensity indicators (the ratio of expenditures on research and development to the GDP) are not only low (Figure 1), but also demonstrate poor growth (see Table 1), which is a much greater cause for concern[4].

Table 1. Main Indicators in Research and Development Activities (R&D) over the Years 1995 and 2000–2005 in Poland

Specification	1995	2000	2001	2002	2003	2004	2005
Gross domestic expenditure on research and development in PLN million (current prices)[5]	2,132.8	4,796.1	4,858.1	4,522.1	4,558.3	5,155.4	5,574.6
Ratio to gross domestic product (GERD/GDP) in %	0.63	0.64	0.64	0.58	0.56	0.56	0.57
Per capita in PLN	55	125	126	118	119	135	146
Employment in research and development per 1,000 economically active persons[6]	4.9	4.6	4.5	4.5	4.5	4.6	4.4
Including research staff	2.9	3.2	3.3	3.3	3.4	3.6	3.6

Source: GUS Central Statistical Office, *Science and Technology in 2005* [in Polish], p. 35.

[4] Compared with R&D intensity indicators (the ratio of expenditures on research and development to GDP) for 2005, European Union countries saw a growth of up to 1.7% with a value of up to 3.3% for Japan (OECD).

[5] Excluding depreciation of fixed assets.

[6] Employment – in fulltime equivalent job positions, economically active persons (encompassing employed and unemployed persons) as based on the Labor Force Survey (LFS).

A R&D intensity indicator on a level of 0.5% means that Poland will have major problems with implementing the Barcelona Target of 3% – a component of the Lisbon Strategy put before the member states of the European Union. Achieving a threshold of expenditures for research and development activities on a level of 3% by the year 2010 is intended to foster a bridging of the distance separating the European Union from its main rivals – Japan and the United States (see Figure 1)[7].

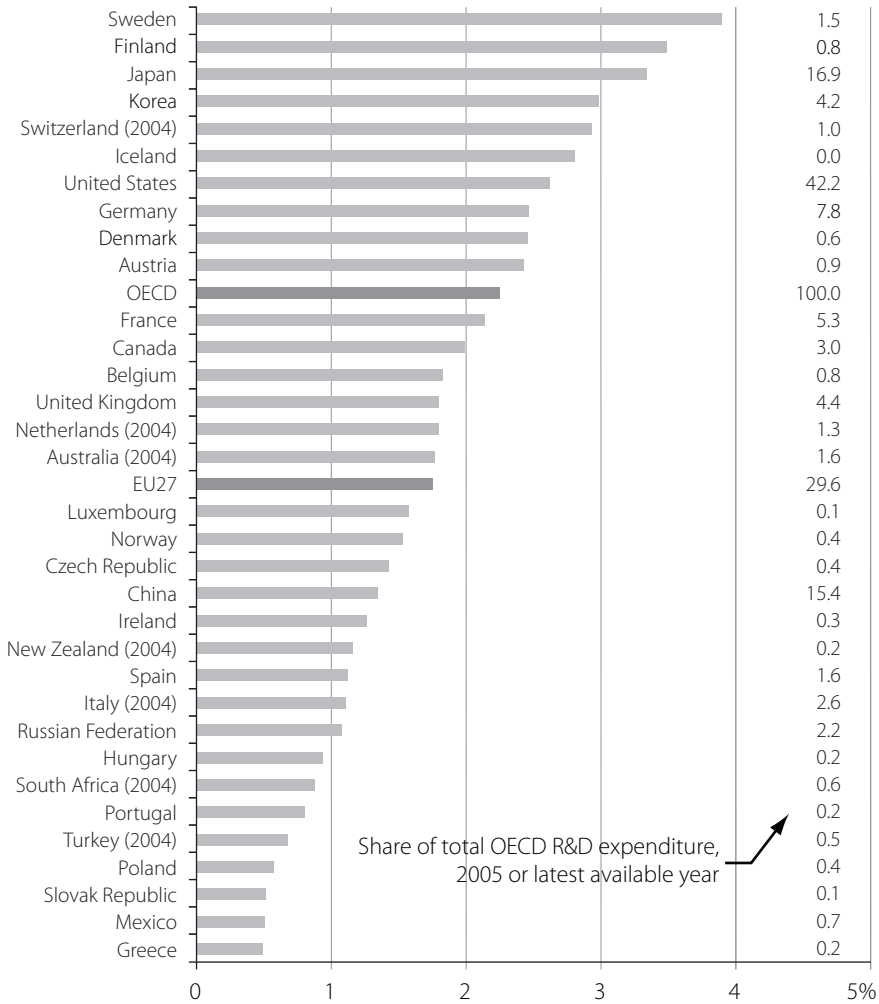

Figure 1. R&D intensity,[7] 2005 – trends in domestic R&D expenditure in 2005

Source: *OECD Science, Technology and Industry: Scoreboard 2007*, http://oberon.sourceoecd.org/vl=448947/cl=14/nw=1/rpsv/sti2007/ga2-1.htm (visited November 18, 2007)

[7] Gross domestic expenditure on R&D as a percentage of GDP. Data are adjusted up to 1995. USD from 2000 in purchasing power parity (PPP).

The low level of financing for the Polish R&D sphere is not an isolated deficiency. Another weakness is the low dynamics in transformation aimed at shedding the inertia of the prior system that was in effect for forty-five years (the longevity and slowness of the process). Also insufficient is the level of structural changes. R&D continues to be industry-oriented as well as strongly dependent on its consumers for research

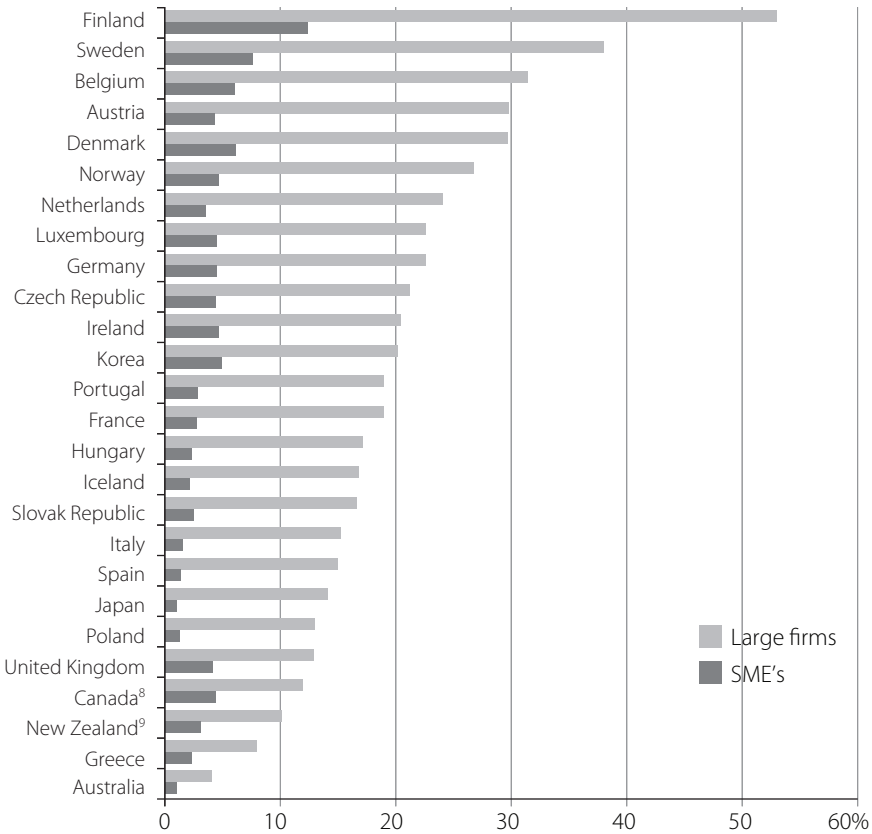

Figure 2. Collaboration with public research organizations by innovative firms – firms collaborating in innovation with government institutions in 2002–2004[10] by size[11] as a percentage of all firms

Source: *OECD Science, Technology, and Industry: Scoreboard 2007*, http://masetto.sourceoecd.org/vl=1558665/cl=12/nw=1/rpsv/sti2007/gc5-2.htm, (visited November 18, 2007)

[8] Manufacturing sector only.
[9] Refers to firms that cooperate with Crown Research Institutes, other research institutes or research institutions.
[10] Or nearest available years.
[11] SMEs: 10–249 employees for European countries, Australia, and Japan (employed persons); 10–99 for New Zealand, 10–299 for Korea, 20–249 for Canada.

and development results. However, an increase in activity on the part of R&D representatives, aimed at decreasing the distance to the business sector, has been observed recently (Szerenos, Sobczak 2006, p. 23, Jasiński 2006, p. 203). Nevertheless, as seen in the data in Figures 2 and 3 illustrating collaboration between science and industry, the road remains long.

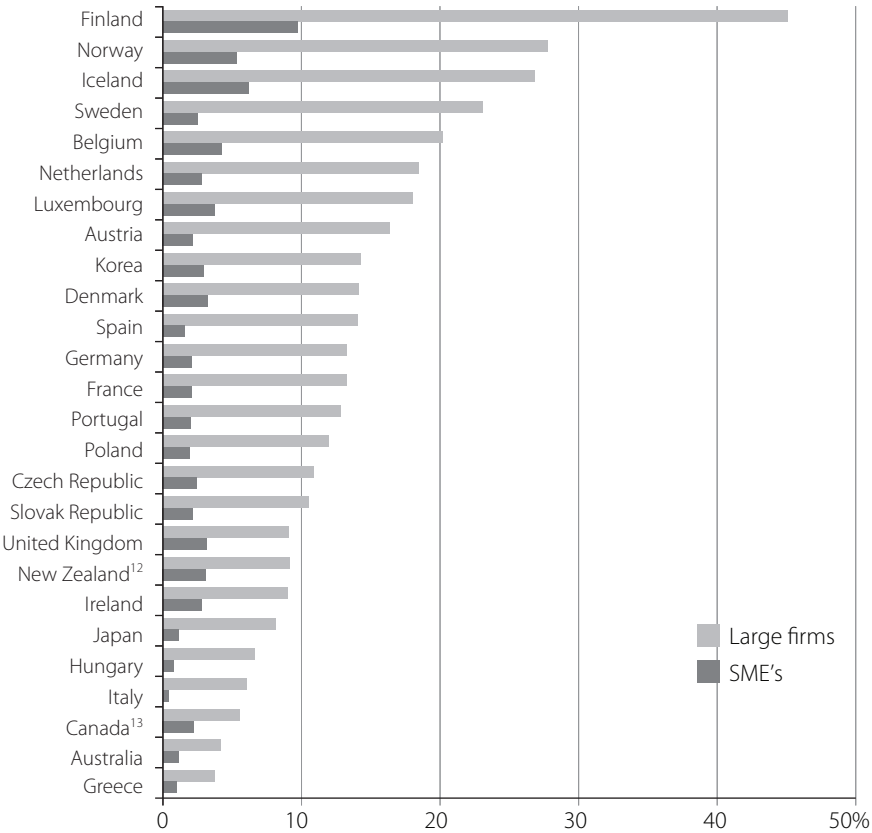

Figure 3. Collaboration with public research organizations by innovative firms – firms collaborating in innovation with higher education institutions in 2002–2004[14] by size[15] as a percentage of all firms

Source: *OECD Science, Technology, and Industry: Scoreboard 2007*, http://masetto.sourceoecd.org/vl=1558665/cl=12/nw=1/rpsv/sti2007/gc5-2.htm, (visited November 18, 2007)

[12] Refers to firms that cooperate with Crown Research Institutes, other research institutes or research institutions.
[13] Manufacturing sector only.
[14] Or nearest available years.
[15] SMEs: 10–249 employees for European countries, Australia and Japan (employed persons); 10–99 for New Zealand, 10–299 for Korea, 20–249 for Canada.

2. TRANSFER OF KNOWLEDGE AND TECHNOLOGY IN POLAND: SELECTED RESEARCH PROBLEMS

Problems relating to the transfer of knowledge and technology between the research and development sphere and industry are attracting the interest of Polish researchers with increasing frequency. Research achievements expressed as the quantity of studies devoted to this subject matter is growing, albeit it is dominated by an identification of needs and expectations on the part of businesses, which is determined by a growth in their innovativeness. Relatively little space is occupied by questions linked with the expectations of representatives of the research and development sector that they introduce when engaging in relations with business partners. No one needs to be convinced that the efficiency of undertaken cooperation is determined by familiarity with the entry motives of the partners in their mutual interactions as well as knowledge regarding the objectives that they intend to achieve within the framework of such collaboration. It is for this reason that among the goals of this study is a demonstration of the needs and expectations of representatives of the scientific community with respect to collaboration with industry. The center of attention will primarily be filled by matters of identifying barriers seen by R&D representatives that determine the effectiveness of such interactions.

Successive matters that will be discussed in this study will relate to the role of entities involved in technology transfer – intermediaries in the process of knowledge and technology transfer between entities concerned with education and science and those involved in the economy and labor market – i.e. technology parks, research and development centers, technology transfer centers, technology platforms, academic business incubators.[16] The popularity of the application of such solutions in Poland is growing, so an overview of their experience to date in serving as a bridge between science and the economy is worthwhile.

Prior to any presentation of an overview of research findings, the kind of institutions forming the research and development sphere in Poland should be kept in mind. According to Baruk (2004, p. 34), they include:

- Scientific units of the Polish Academy of Sciences,
- Research and development units such as research and development institutes, research and development centers, laboratory centers, and other organizations whose main task is the conducting of research and development activities,

[16] In topical literature these institutions are referred to as bridging institutions or intermediary institutions (Szerenos, Sobczak 2006).

- Colleges and universities,
- Entities providing services for science, such as scientific libraries, archives, associations, foundations, etc., and
- Development entities, which are economic entities involved in R&D in addition to their primary operations (industrial companies with their own research and development laboratories, research and development divisions and centers, research and development departments, engineering and technology offices, technology development units, study and design bureaus, etc.).

This analysis primarily encompasses the first three types of entities named above as well as entities involved in technology transfer (intermediary institutions such as innovation and entrepreneurship centers, etc.).

3. BARRIERS TO THE TRANSFER OF KNOWLEDGE AND TECHNOLOGY BETWEEN THE RESEARCH AND DEVELOPMENT SPHERE AND INDUSTRY: THE SCIENTIFIC COMMUNITY'S PERSPECTIVE

An analysis of topical literature primarily provides information relating to barriers impeding the transfer of knowledge and technology between partners from the research and development sector and the economy. Relatively little data depict the real, tangible benefits stemming from established relations. Such an observation should not be a surprise. It is always easier to complain and seek the causes of an inability to act, especially when the analyzed type of cooperation is encumbered by unique specifics from its very onset. It stems from the "inbred" differences relating to the mission and objectives of representatives of the world of science and of the economy, differentiation in organizational structure and entertained policy, and variation derived from individual orientation, philosophy, and interests on the part of researchers (see more broadly, Table 2; Geisler, Rubenstein 1989, p. 45).

In addition to the above factors that may be ranked as the "genetic code" of the organizations, of no small significance is the importance of external conditions on the undertaking of common action, including government policy regulating conditions and possible forms of mutual interaction.

The summary listing of barriers impeding collaboration between entities from the research and development sphere and industry in Poland was compiled by Krasowski (2003, p. 98–100), on the basis of selected as well as own research results. Among the main sources of organizational difficulties in science–industry cooperation, as seen by entities from the world of science, are:

Table 2. Sources of "Differences" between Entities of the Research and Development Sphere and Industry

I.	**"Inbred" Differences in Mission and Objectives**
I.1.	Research orientation (fundamental research / applied research), time horizon (long-term / short-term), and methods of interaction (cooperation vs. competition and confrontation)
I.2.	Research results – Free access vs. confidentiality
I.3.	Exclusivity in use of research results
II.	**Differences in Organizational Structure and Policies**
II.1.	Conflicting and conflicted structures – rigid company decision–making structures vs. amorphous structures in universities that are a barrier to quick decision–making
II.2.	Remuneration for university researchers
II.3.	Advisory relations
II.4.	Financing of research costs
II.5.	Diverse interests and values – Universities, like all organizations, are not monoliths and can be subject to internal tensions in defining policy guidelines for the future
III.	**Differences in Researcher Orientation, Philosophy, and Interests: The Individual Level**
III.1.	Conflict between commitment and interest: The primary task of the university staff is to conduct research and publish findings, which is important in evaluating the university; lack of time for involvement in other activities, concentration on fundamental research
III.2.	Promotion and restriction policy
III.3.	Own abilities and external assistance
III.4.	Perception and undertaking

Source: E. Geisler, A.H. Rubenstein (1989), *University – Industry Relations: A Review of Major Issues*, in: A.N. Link, G. Tassey (ed.) *Co-operative Research and Development: The Industry – University – Government Relationships*, Kluwer Academic Publishers, p. 45 (modified by IK).

- Overall weakness of the research and development sphere in Poland caused by a lack of appropriate development base, a lack of proper information flow regarding new technologies for the economy, poor institutional collaboration among partners where the primary complaint involves a lack of knowledge about partners from the industry sector, poor formal ties between companies from the SME sector and research and development units, colleges and universities, and Polish Academy of Sciences institutions;
- Staffing problems stemming from the generation gap, the aging of the scientific staff, a lack of selectivity in choosing staff, and a small share of employed foreigners;
- Modest financial resources as well as a lack of proper financial, organizational, and logistic support, a shortage of systemic preferences

(grants, loans, investment allowances), and a lack of venture capital supporting the execution of successive phases of work on new technologies;
- Low efficiency of action on the part of bridging institutions created to facilitate the transfer of technology to companies and an insufficient level of information on the functioning and offers of such entities as well as costs related to using their services.

Simultaneously important and a cause for concern is the unchanging nature of factors halting the development of collaboration between science and industry observed in research conducted by Krasowski over the years 1997, 1999 and 2001, which involved research and development units and companies from the SME sector. In spite of the fact that they have been known for years and it may seem that the next step should be their neutralization or elimination, practice shows that they continue to be an unsolved problem.

The results of Krasowski's research also shed more light on the needs of research and development units in terms of improving conditions for their collaboration with the economy. They see the lack of financial resources for innovative projects in companies, the low level of funding for research on the part of the government, and the low level of interest in innovation among the businessmen themselves as being the main impediments to the transfer of their knowledge to the economy. Successive positions, as defined by research and development units on the list of barriers hampering the transfer of knowledge, include organizational and technical difficulties in creating the transfer and implementing R&D studies, as well as greater appeal of foreign technology to businessmen. However, Krasowski's research shows that that last factor is losing its importance.

The above-specified factors inhibiting effective collaboration between the scientific sphere and industry also found themselves on lists of barriers as seen by twenty-two research and development units from the Voivodeship [Province] of Greater Poland that took part in research conducted by Stryjakiewicz and Wajda in September of 2006. Their lists were also opened by questions tied to a shortage of sufficient financial resources and capital in the science and economy as well as a lack of interest in scientific research on the part of the economy. Moreover, the research and development units of Greater Poland also pointed to factors limiting cooperation, such as (presented by decreasing gravity; Stryjakiewicz, Wajda 2006, p. 25–26):
- Discrepancies in time-related perspectives of the partners from the two sectors,
- Mismatch of offers – A lack of correspondence between the supply of R&D work and demand for it on the part of companies,
- Lack of mutual information regarding R&D work and the needs of the economy,

- Differences in the objectives of activity in the R&D sector and the economy,
- Uncertainty of results in joint operations of the R&D sector and the economy,
- Dearth of potential and technical resources,
- Fear of divulging know-how to the competition,
- Fear of losing scientific independence,
- A deficit of qualified personnel employed in the economy,
- A deficit of qualified personnel employed in the scientific sector, and
- Differences in organizational structure and methods of communicating.

To a significant extent, the above list of sources of difficulties in building relations with industry as seen by the research and development units of Greater Poland match those found in the table of "inbred" differences between entities of the worlds of science and industry. Thus, what is seen is a certain cohesiveness of Polish and American experience on the part of institutions from the research and development sphere because Table 1 mainly encompasses the practice of American universities. Moreover, yet another dimension worth noting is that in spite of the fact that twenty years have elapsed since the date of publication of the table, the knowledge it contains is still current in the case of Polish organizations, which functioned and function subject to completely different conditions.

4. TECHNOLOGY TRANSFER INFRASTRUCTURE UNITS IN POLAND: DASHED HOPES?

In the view of experts, an important role in improving the efficiency of flow of knowledge and technology between the worlds of science and industry should be played by "go-betweens" acting at the tangent point of the two while simultaneously creating the infrastructure for technology transfer (see e.g. Jasiński 2006). The importance of such institutions is also demonstrated in the draft National Development Plan 2007–2013 (NPR, item 210). According to its authors, a solution allowing for the elimination of presently existing structural weaknesses in this field is the creation of commercial forms of institutionalized brokerage between entities involved in education and science, the economy, and the labor market that can take on the form of research and development centers, technology parks and platforms, and academic business incubators.

In addition to the above-mentioned institutions, Jasiński (2006) also demonstrated the need for creating two other types of institutional structures functioning on the perimeter of science and industry – i.e.

bridging institutions or technology transfer brokers as well as spin-off companies.

According to data from the SOOIIP Report, there were twenty-nine technology transfer centers, fifty-three business incubators, and twelve technology parks in Poland involved in training and advisory services, financial aid, technology transfer, and offers of premises for SMEs, at the end of 2004 (SOOIIP 2004).

There can be no doubt that the activities of such institutions form an interesting research area, although the Author has found that publications devoted to such questions show that the process of learning by Polish researchers about technology transfer infrastructure units is proceeding relatively slowly, which is borne out by the small number of studies devoted to them. In spite of such a humble pool of Polish research findings, it is possible to define the real role of technology transfer infrastructure units in the process of transferring knowledge and technology in Poland. Among studies identifying the objectives of such units, the methods of operation they apply for transferring technology, and the main sources of financing for their activities, is provided by the findings of the Poznańska team and Jasiński. (Poznańska 2001; Jasiński 2006).

The results of these studies are not optimistic, however. They demonstrate that activities in the realm of facilitating the transfer of knowledge and technology are not priority operations in the examined entities, but merely one of their aims. The analysis of objectives conducted by the Poznańska team in business incubators and technological centers and parks disclosed that the main aim of their activities at the turn of the 20th and 21st century was the offering of assistance to newly established companies and the creation of jobs. Targets such as the transfer of technology from scientific centers to the companies were not a priority. The observed hierarchy of objectives at that time was determined by industrial and innovation policy of that time that, in the view of the researchers, placed stress on fighting unemployment and solving social problems. The weak links of innovation and entrepreneurship centers with representatives of the research and development were extremely characteristic, especially of the first half of the nineteen–nineties. Interest in questions of improving the innovativeness of domestic entrepreneurship and of the economy did not emerge until the second half of the nineteen–nineties (Kłopotek 2001).

A similar breakdown of priorities was observed by Jasiński (2006), who conducted studies on a sample of fifteen technology transfer infrastructure units in 2005. His findings also show that activities relating to facilitating knowledge and technology transfer are not among priority activities in the examined entities, but only one of their targets. The technology transfer infrastructure units were primarily involved in organizational–technical consulting, technology audits for SMEs,

the organizing of meetings among partners (bringing companies together), and in assistance for SMEs in preparing applications for projects financed using government or European Union funds[17] (Jasiński 2006).

Thus, Polish technology transfer infrastructure units are professional intermediaries in the flow of knowledge and technology to a minimal extent as opposed to their counterparts from advanced countries. The efficient realization of this task continues to be a major challenge that Polish technology transfer infrastructure units must ultimately face.

In conclusion, it is worth adding that the popularity of utilizing such institutional solutions around the world also varies, although analyses of experience to date also demonstrate only a partial meeting of hopes. For example, studies by the Siegel's team show that there is a broad range of factors limiting the efficiency of university technology training center programs. They include information and cultural barriers cropping up between the three key parties involved in the project – university administration, researchers, and companies-businessmen, the level of the staff working in the technology transfer organization and compensation practice applied there, and inadequate rewards for scientists and researchers involved in the university technology training centers. (Siegel et al. 2004)

The activities of such intermediaries continue to remain a relatively poorly investigated area.

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[17] Fifteen technology transfer infrastructure units took part in the study, they replied to three questions in an Internet questionnaire (all entities to which an invitation was forwarded).

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Jakub J. Brdulak

COOPERATION BETWEEN THE ENTERPRISE AND STAKEHOLDERS[1]

1. INTRODUCTION

Conceptions of the management based on cooperation, are now becoming more and more popular. Importance of the conceptions of such kind as clusters, network economy, and synergy is steadily increasing. The conviction, which forms a basis for this trend is, that within the global economy, only the teamwork can guarantee a market success. The conception of building the relations with Stakeholders, to which this paper is devoted, is neatly inscribing itself into this trend.

The main purpose of this paper is to present the model of cooperation between the scientific sector – the Warsaw School of Economics (WSE) – and the private sector – the Deloitte and Schenker Companies – established within the scope of teaching methods.

Cooperation between the Warsaw School of Economics on one hand, and Deloitte and Schenker Companies on the other hand, is of synergetic character. Model of this cooperation is characterized by practically bringing only the benefits to the participating in it organizations. In Poland, building of such relations is still far from being widespread; on the

[1] Illustrated by the case of instructive projects, created jointly between the Warsaw School of Economics on one hand, and Deloitte and Schenker Companies on the other (Brdulak 2007).

other hand, in the countries of Western Europe and in the United States it is prevailing, and even demanded by the environment.

This paper is divided into two main parts. The first one defines the conception of Stakeholder, whilst the second presents the model of cooperation between WSE and the Companies.

2. ASSUMPTIONS FOR THE STAKEHOLDERS THEORY

The brief, and complete enough, definition of the "Stakeholder" conception was presented by the Polish Forum Corporate Governance:

> *The conception, as introduced by the Stanford Research Institute in 1963, and standing for the person or entity interested in the activity of a Company, and also incurring various kinds of risk connected with its functioning. In contrary to the shareholder, first of all interested in the profit on the Company activity, the Stakeholders make up a much more wide group, including, among others, the employees, customers, grantors of credit, suppliers, and in a wider context the local public as well.*

One can distinguish the four basic assumptions for the Stakeholders theory:

- The enterprise has relations with various groups, which are called the Stakeholders of the organization. The stakeholders are exerting their influence on the organization's activity, and remain under the influence of this activity.
- This theory is analyzing these relations from the point of view of benefits, which they can bring to both, the organization as well as to its Stakeholders.
- Every Stockholder presents and strives for the internal value, that is cherishes a specific expectations. Simultaneously, he is making his best, to ensure that his expectations are predominating over the expectations of other Stakeholders, and that his interest has a priority over the interests of others.
- This theory is focusing on the process of taking strategic decisions.

Expectations of the individual groups of Stakeholders are presented in the Table 1.

The Stakeholders connected with the sector of science are not shown in the above Table. However, one can assume that the cooperation with this sector is included in the Stakeholders group: governmental and public institutions as well as national and regional communities.

The role of Stakeholders in managing of enterprise shall rise. As determined in the Handbook 2130-1: Role of the internal audit and internal

Table 1. Expectations of Stakeholders

Stakeholder	Expectations
stakeholders and owners	growth in the Company value
	maximization of the value of shares
	complete and reliable information
	public obeying of Company behavior
	competent managing organs
	enhancement of Company image
employees	satisfying salary
	meeting the obligations
	complete and reliable information
	satisfaction from work, opportunity for development
	efficient Company management
cooperating partners and suppliers	financial credibility of partner
	meeting the obligations
	economic profitability
	ethics in the activity
	culture and professionalism in the activity
	cooperation
	quality of communication process
customers	economical features of the product/services
	functionality of the product/services
	quality of the product/services
	clear, readable and available information
	attractive pattern of the product project and service
	satisfactory process of the purchase/customer servicing
	personification of the relation with customer
	positive image of the Company
competition	honest competition
	transparency and readability of competition activity
	culture in the business activity

financial institutions	profit on the capital loaned
	credible financial result
	meeting the obligations
	publicness, reliability and comprehensiveness of information
	competent managing organs
governmental and public institutions	observing the legal norms within the scope of public obligations towards the self-government and state
	payments made in favor of earmarked funds
	cooperation within the scope of the national and local development stimulation
	supporting of the institutions engaged in a charity and social activity
nationwide and regional communities	safe, non-hazardous to the public activity
	natural environment protection
	patronage and sponsoring of the cultural, sport and scientific events
	civic attitude of the Company towards the public environment
	undertaking of actions supporting the structural transformations
	co-financing of actions aimed at the local development

Source: on the basis of Paliwowa-Matiolańska (2005).

auditor in the ethical culture of organization[2], *the enterprise is using a numerous legal forms, structures, strategies and procedures in order to ensure, that (Gleim 2006)*:

1) *It observes the legal norms and regulations.*
2) *It meets commonly binding norms for carrying out the activity, ethical orders, as well as public expectations.*
3) *Brings about the benefits to the public and adds a value to the specific Stakeholders within the long- and short-term outlook.*
4) *Since it bears the responsibility for decisions taken, actions, behavior, and results, this ensures providing of the exhaustive and reliable reports to its owners, supervising organs, other Stakeholders, and to the public.*

[2] The Handbook, number 2130-1, belongs to the group of handbooks pertaining to the Governance, rated among the Standards of Activity within the International Standards of Professional Practice of Internal Audit, which are a part of the Framework Principles of the Professional Practice of Internal Auditor. The Standards are established by the Institute of Internal Auditors, and are applied within different scope by the majority of developed countries including Poland as well (see e.g. The Law on Public Finances dated 30th June 2005, Art. 58).

The here-above listed items are presenting the process of governance, which in accordance with the international standards of internal audit is a part of the ethics of organization.

An attention should be drawn to the fact that the conception of "Stakeholder" appears in the two above items: the third and fourth. The Organization has to add the benefits to Stakeholders, and has to provide them with the reliable reports.

In connection with the above, also the establishments operating in Poland are attaching higher and higher weight to building their relations with the Stakeholders. The exemplary Schenker Company, in its public report for 2004 and 2005, titled *The Economy, Ethics, Ecology*, identifies 7 groups of its Stakeholders, which are presented on Figure 1.

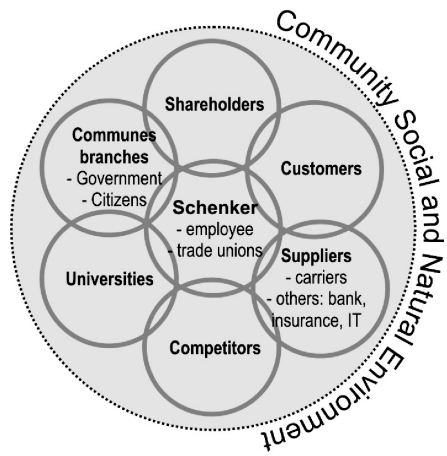

Figure 1. Groups of Schenker Company Stakeholders

Source: The Public Report for 2004/2005: The Economy, ethics, ecology, Schenker, http://www.schenker.pl/upload/attachments/314/31487/ob_raport.pdf

An attention should be drawn to the fact that within the Stakeholders' groups, the academies and scientific circles were distinguished. In this connection, one can state that this Stakeholder is significant for the Schenker Company.

3. COOPERATION BETWEEN THE SCHENKER AND DELOITTE COMPANIES AND WSE

Presently, within the confines of Warsaw School of Economics, the author of this paper is developing cooperation with the Schenker and Deloitte Companies within the scope of teaching: by taking the patronage over the subjects run by WSE, by the Companies. The Schenker

Schenker	Deloitte
Schenker is currently the largest logistic operator in Poland (the status as on January 2007), the leader in a flow logistics. Schenker Ltd. employs 1,500 workers, owns 17 – integrated by informatics – logistic terminals, 64 thousand sq. m. of warehouse area in a few warehouses, 4 bonded warehouses, approximately 300 daily domestic and over 40 international regular road connections. The Company income in 2006 amounted to PLN 863 million and the profit PLN 36 million. The Company is a part of Schenker Group, with the annual sales amounting to the tune of € 13 billion, employing 55,000 workers, and owning 1,100 branch offices worldwide. It is one of the leading suppliers of integrated logistic services worldwide. Basing on the overland, air and maritime transport, as well as the warehousing, Schenker is offering comprehensive logistic solutions as well as managing of the global chain of supplies. The Company is operating within the confines of Deutsche Bahn AG.	The name of Deloitte Company refers to the Deloitte Touche Tohmatsu, the entity operating under the laws of Switzerland, which applies also to its member companies, and also to their relevant subsidiaries and associate companies. Earlier, the Company was known as Deloitte & Touche or Deloitte Touche Tohmatsu, but in 2003, a uniform brand of "Deloitte" was introduced. Based on the intellectual capital of more than 150,000 employees worldwide, Deloitte renders the professional services within five domains: consulting, audit, risk management, financial consultancy and tax advisory services. The Company is operating in more than 140 countries. The global income in financial year 2007 amounted to USD 23.1 billion (growth by 15.5% in relation to the previous year). Deloitte is present on Polish market since 1990. The merger with Andersen Business Consulting took place in 2006, what resulted in formation of the largest group of business consultancy in the Central Europe. In Poland, Deloitte employs almost 1,000 workers including the Polish and expatriate specialists.

Figure 2. Presentation of Schenker and Deloitte.

Source: company based data.

Company took patronage over the subject run since the winter semester of academic year 2007/2008, **Knowledge Management** (number of signature: 3143-01), while the Deloitte Company, since the summer semester of academic year 2007/2008, of the subject **Getting Knowledge for Strategic Management** (number of signature: 7779-01). Both subjects shall be run in English language, which enables participation of the foreign students.

Cooperation Chart, based on the example of Schenker Company, is presented in the Figure 3.

The groundwork of collaboration is a cooperation of Schenker and Deloitte Companies with WSE lecturer. In the cases of both, the Deloitte as

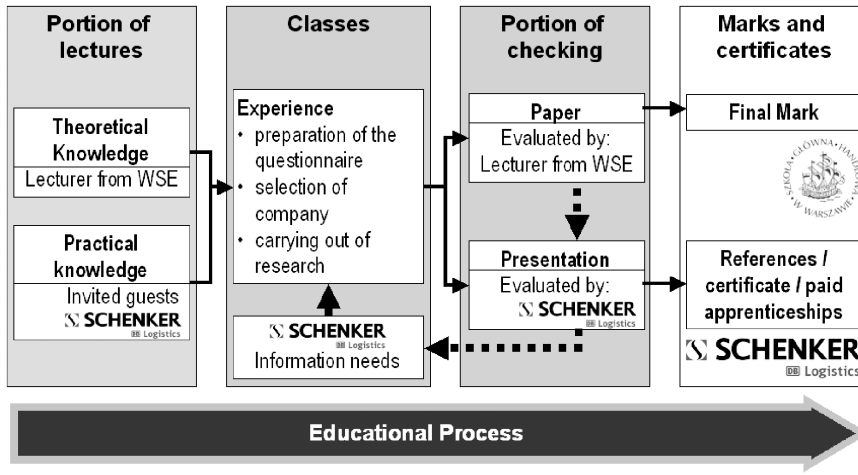

Figure 3. Cooperation between Schenker Company and Warsaw School of Economics, within the scope of taking a patronage over the teaching lessons.

Source: own elaboration.

well as Schenker Companies, this cooperation is accomplished by means of the meetings of the lecturer with the representatives of Companies responsible for cooperation with WSE, as well as by sending lecturer's reports on the progress of teaching lessons, as realized within the confines of the Project. In the case of already under-way cooperation with Schenker Company, the Company informs the lecturer (e.g. by brief consultations or training sessions) about its expectations with regard to lessons carried on. The purpose of these actions is the accurate conveying of the Schenker Company needs so that the lecturer, when carrying out the subject of study, represents the Company and implements its objectives. Owing to the above, the Schenker does not need to engage its employees in the execution of this Project to large extent. This is a key element of this model, since it helps to greatly reduce the cost of cooperation between the Company and academy.

The main commitment of Schenker Company is its participation and carrying on two lessons (2 times, 90 minutes each). During the first lessons, the Project coordinator, acting on behalf of the Company, makes presentation of the Company, presents the expectations of Schenker Company within the scope of its needs for information, and conveys basic information pertaining to the methodology. During the next lessons (these are the last lessons for students), the representatives of Schenker Company Managing Board are evaluating the effects of students' work. All students that complete the project execution shall receive certificates issued by Schenker Company, and the best ones are invited for the paid apprenticeship in the Company. The time spent during the two lessons is practically the only physical encumbrance to the Company,

the academy lecturer carries on the remainder of work and coordination duties.

In the case of Deloitte Company, the model of cooperation shall be more developed with respect to the Deloitte Company engagement into the project:

- the Project coordinator acting on behalf of Deloitte Company shall participate in 7 lessons with students,
- the students shall receive a book devoted to the strategic management and published by Deloitte,
- some lessons shall take place in the quarters of Deloitte Company where the students will have the opportunity to use (within certain, limited scope) the knowledge base of Deloitte Company,
- the final works of students – reports on the sector analysis – shall be published on the main page of Deloitte, with the full names of works' authors given.

The project functional structure itself shall be analogous to the Project with Schenker Company – students are selecting the subject, as covered by the Deloitte Company patronage, and within the confines of this subject are executing a program jointly established between the WSE lecturer and the Project coordinator acting on behalf of Deloitte Company. At the end of their work on the subject, students shall also receive the certificates bearing testimony of their participation in the Project and issued by Deloitte Company, whereas the best of them shall be invited for the paid apprenticeships.

Cooperation between the Company and the scientific entity as based on this model is generating the benefits for all the parties involved in the Project.

Benefits for the Company:

- building of the image of an enterprise that is socially trustworthy,
- possibility of acquiring the students that are adapted to the needs of Company as far as the human resources are concerned,
- possibility of increasing the knowledge base of the Company,

Benefits for the student:

- verification of theoretical knowledge acquired at the academy in the context of market needs,
- work for the enterprise under "laboratory" conditions, i.e. without bearing the sanctions for wrong decisions and actions,
- obtaining of the certificate of completion the subject of study, issued by the Company,
- possibility of being invited for the paid apprenticeship.

Benefits for the lecturer:

- enhanced attractiveness of the lessons,
- possibility of acquiring new knowledge from the partners in subject,
- possibility to verify the lecturer's theoretical knowledge in the context of market needs.

4. CONCLUSIONS

At the very end of this paper, it is worth to mention the assumption made, which claims that the economy of European Union needs approximately 50 years to catch up with the American economy in respect of the effectiveness and competitiveness (Dominik 2006). Cooperation between the academies and enterprises in the United States is something that is obvious and widely applied. The research workers in the USA have to possess the managerial competences, i.e. to be good salespersons. A good salesperson is a person that is creating the value for all participants within given transaction. The model described in this paper is of such character. Therefore, it is worth to duplicate it in other schools, academies and teaching units, with the active participation of enterprises as well.

The projects of this type are designed for building of so-called "learning regions", where the academy becomes a center of the local growth of knowledge. As an instance, it is recognized that thanks to, among other things, a very strong scientific center at Stanford University, the Silicone Valley came into being in the United States (Saperstein, Rouach 2002).

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Jan A. Fazlagić

PRIMARY EDUCATION – THE POOR NEIGHBOUR ON THE KBA AGENDA

1. INTRODUCTION

Education, along with research & development (R&D), is unanimously considered the main building block of the Knowledge Economy. Education is, however, a lengthy process, which begins with the birth of a child and continues throughout its lifetime. To emphasize this phenomenon, the concept of Life-long learning has been introduced in order to focus the attention of policymakers and businesses on "after graduation" learning. Unfortunately, far too little attention has been given to the most important period of creating human competences: the primary education stage, which starts at the age of 0–5 and continues until the age of 15. Teachers get the more status (and pay) the older the children they teach, but their impact is lower (*sic*!). This paper's aim is to awaken the attention of policymakers and KBA researchers to the fact that the best returns on education can be achieved not in supporting universities but in supporting kindergartens and primary schools. It is there and then that the key KBA competencies such as creative thinking, mathematical skills and most of all the zeal for learning are created or strengthened.

The overarching goal of this paper is to highlight the importance of pre-school education from the point of view of economics. The importance of pre-school education for child development is well documented in pedagogical literature but almost absent in debates on KBA. It seems that investments in information and communication technologies (ICT)

2. THE ECONOMICS OF INVESTMENT IN KNOWLEDGE

and tertiary education attract too much attention considering their input/output relationships.

It is assumed that the main investments in knowledge are the expenditures on R&D, ICT spending and tertiary education spending. Little attention is given to calculating the risk of such investments. Obviously, neither ALL spending on ICT nor all spending on education produce equal positive returns. In poor countries, simple stationary items may produce better results even than the famed $100 laptop.

Investments in knowledge are co-related with risk (like any other investments). Financial investments bear the risk of financial loss, e.g. due to market fluctuations. In case of investments in knowledge, the risks are mainly lost opportunities for alternative forms of learning, e.g. an employee who attends a training course chooses an option. Usually this choice excludes the participation in other forms of training. A good example to illustrate the importance of option analysis is provided in the report prepared by a Dutch consulting company Walgemoed. Test wells drilled by an oil company can serve as an example. Only some of the wells produce results; most are "dry". Should the costs of dry wells be included in the total costs of finding oil? Only the costs of successful test wells are qualified for capitalisation according to the present accounting standards. Similarly, in case of education, every hour of teacher-student interaction is both an opportunity to gain new knowledge and a threat of a lost opportunity of learning (if the teaching process is inefficient). Like kindergarten before it, preschool education is a concept whose time has come. One who has studied preschool education in the context of global competitiveness is Nobel Prize-winning economist James Heckman. When it comes to investing in early childhood education, he says it best: "We can't afford not to" (Barnett 2005).

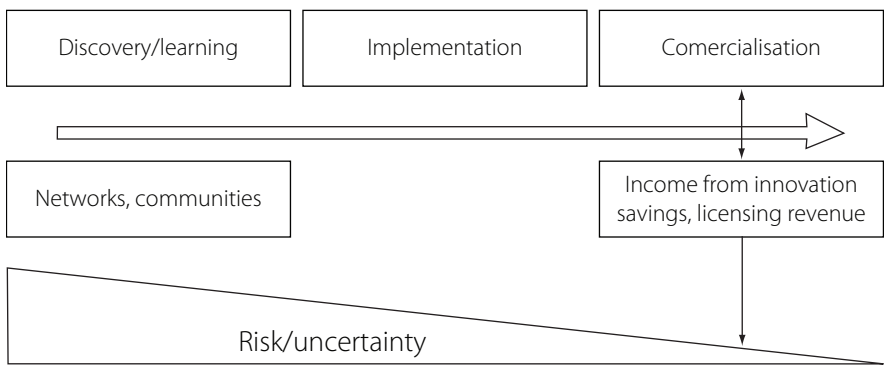

Figure 1. Risk in the process of commercialisation of knowledge

Source: developed from B. Lev, *New Accounting For The New Economy*, May 2000.

Figure 1 shows the relationship between risk and income for knowledge-intensive investments. Corporations may choose whether they take up high-risk/high return activities (e.g. conducting expensive basic research in undiscovered areas) or decide to invest in well commercialised/low-margin knowledge-intensive activities. Similarly governments, when making investments decisions face a similar dilemma. Tertiary education can be thought as low-risk/low return knowledge investment since most of the social and analytical skills are developed before a student reached the university. US universities are a good example of how inefficient primary and secondary education may be compensated for by the inflow of foreign talent.

Thus, investments in pre-school education can be compared to investments in knowledge in corporations. The more mature the knowledge the clearer the input-output relationship.

- The first phase ("the fuzzy front end") is highly informal, chaotic. It acts as a filter for more mature ideas. It is experimental and chaotic, marked by a high tolerance for ambiguity and uncertainty and a willingness to consider the unreasonable.
- In the second phase of innovation there are targets; time and costs are important. There are numerous quantitative goals, a sense of urgency, schedules, teamwork in contrast to individual activity, and commitment to the goal. There is also low receptivity to new ideas compared with the first phase.
- In the third phase, operations, predictability and strong financial orientation become predominant. Commitment to the established values and businesses and reluctance to change help maintain the cost and time-to-market effectiveness.

Investment in education is usually measured by spending per student (Figure 2)[1]. Poland has one of the largest populations of pupils as a share of total population among EU countries.

Pre-school education is the first phase of educational process, which, according to the Bologna Process, should continue up to tertiary education with Ph.D. degree. Pre-school education is provided to children aged 3–6. In Poland, pre-school education is provided in kindergartens and in "kindergarten units" located within primary schools. In the school year 2004/2005 children in Poland were for the first time obliged to attend a one-year pre school preparation. In the same year, there were 17,200 pre-school education units in Poland, including 7,700 kindergartens and 9,500

[1] Generally the public sector funds education either by bearing directly the current and capital expenses of educational institutions (direct expenditure for educational institutions) or by supporting students and their families with scholarships and public loans as well as by transferring public subsidies for educational activities to private firms or non-profit organisations (transfers to private households and firms), both types of transactions together are reported as total public expenditure on education.

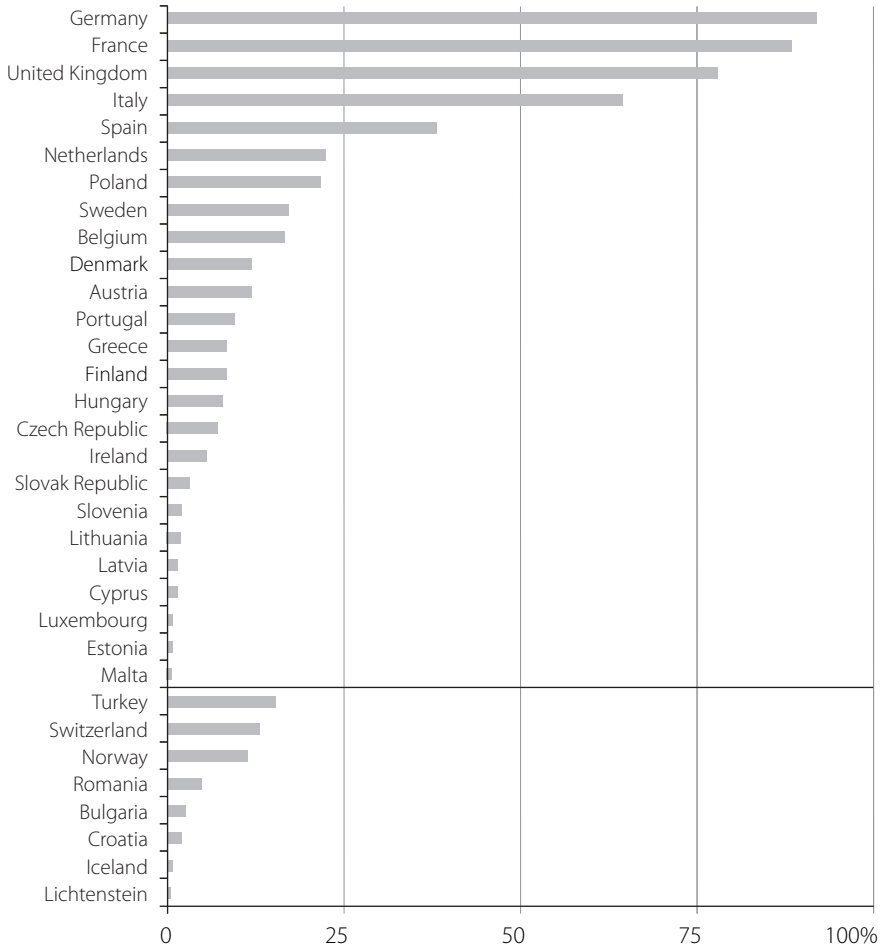

Figure 2. Public spending per pupil/student in PPS (purchasing power standard)[2]

Source: *Europe in figures. Eurostat yearbook 2006–07*, p. 94.

"kindergarten units" in primary schools. A total of 840,000 children were in the system, an increase of 8,100 compared with the previous year.

Early childhood is defined as the period between birth and the 8th year. Psychologists agree that these years play a vital role in the later stages of development of a human being. The early works of Lev Vygotsky and Maria Montessori paved way for the development of knowledge on early-child development providing plenty of evidence that these early years are a great opportunity for an education system to form

[2] EU 25, EUR/PPS 515 647 million total public expenditure on education; EU 15, EUR/PPS 470 525 million total public expenditure on education; euro area, EUR/PPS 364 090 million total public expenditure on education; refer to the Internet metadata file http://europa.eu/estatref/info/sdds/en/educ/educ – list of indic.htm).

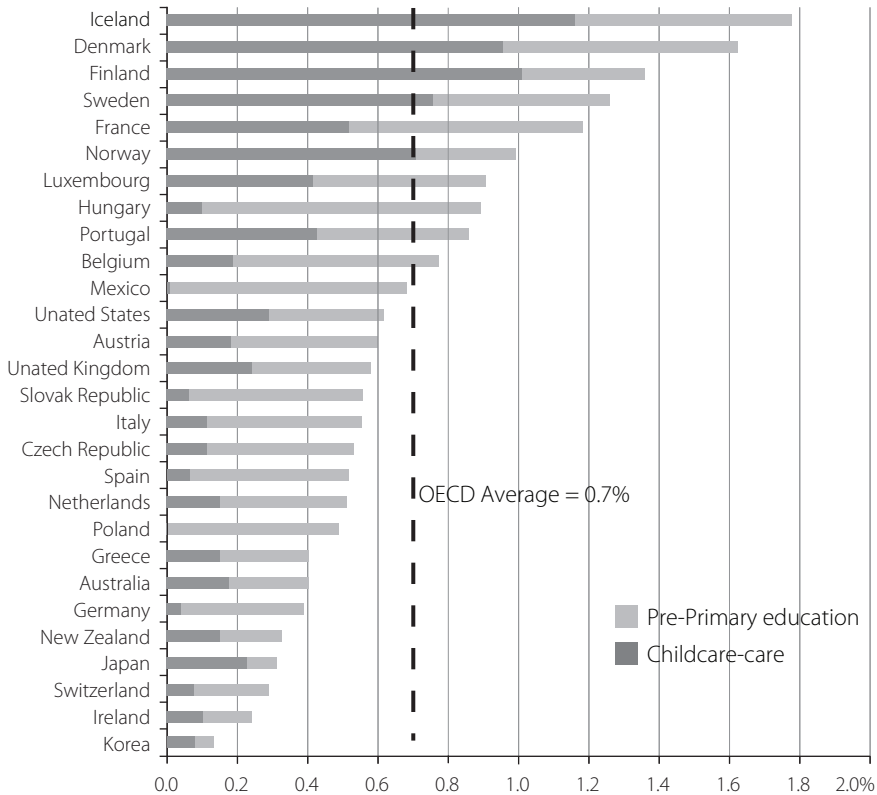

Figure 3. Public spending on children care and education for children aged 5 and less (% GDP)

Source: OECD Family Datebase.

intelligent and creative citizens. A child is exceptionally prone to stimuli from its environment. Kindergarten provides a number of opportunities for creating social skills, which cannot otherwise be formed in its home environment. Kindergartens provide an opportunity for children to learn cooperation and communication skills within social groups. Children who have participated in pre-school education generally perform better in primary schools. They are more open, independent, bold and persistent in school. Kindergarten education is effective in helping underprivileged children to gain necessary social skills.

Children who have participated in well designed educational programmes score better at school and tend to be more intelligent than those children who have not taken part in such programmes.

Access to pre-school education in Poland is substantially lower than in many other countries. In the year 2003 60% of children aged 2–5 did not participate in pre school education. Currently, only six-year-olds are obliged to participate in the education system.

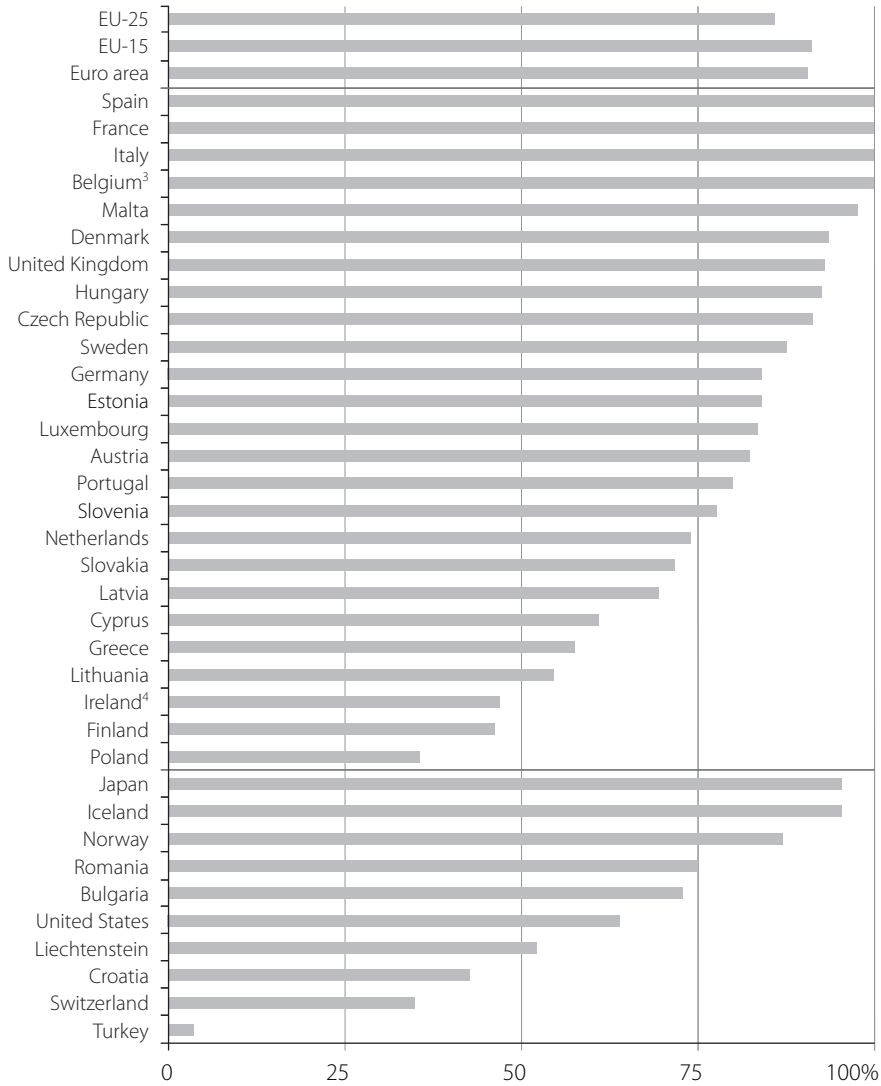

Figure 4. Four-year olds in education[5]

Source: *Europe in figures. Eurostat yearbook 2006–07*, p. 86.

[3] Excluding independent private institutions, excluding enrolments in the German speaking community.

[4] There is no official provision of ISCED level 0 education; many children attend some form of ISCED level 0 education but data are for the most part missing.

[5] This indicator presents the percentage of the four-year-olds who are enrolled in education-oriented pre-primary institutions; these institutions provide education-oriented care for young children; they can either be schools or non-school settings, which generally come under authorities or ministries other than those responsible for education; they must recruit staff with specialised qualifications in education; day nurseries, playgroups and day care centres, where the staff are not required to hold a qualification in education, are not included.

The Polish Strategy for education development 2007–2013 aims at introducing new forms of organization in pre-school education such as:

- sub-units of kindergartens,
- Kindergarten groups counselled by one teacher, individual classes for children who are not able to attend kindergarten.

Its goals include:

- increasing the number of children in pre-school education,
- providing quality education, preparing for primary school

The introduction of compulsory education for five-year-olds is planned.

Pre school education deserves greater public awareness. In Poland, the majority of children aged 4 and less in rural areas stay at home (Figure 3) and for the whole 3–5 age group it only slightly exceeds 50% (Figure 4). The awareness of pre-school education should be promoted similarly as better healthcare practices and habits are promoted.

3. CONCLUSIONS

If education is a pillar of the Knowledge-based Economy then pre-school education is a building block of the education sector. Pre-school education, contrary to tertiary education, is not a subject of political debates. The strategic goals of social and economic policies do not collide in the area of pre-school education. Economic and social outcomes are equally important in this sphere. Investments in pre-school education in the global economy are relatively safe. There is no threat of "brain drain". Kindergartens unlike universities and R&D centres are generally local. Their importance is viewed mainly through the satisfaction of parents who take pride in the faster educational progress of their children. The macroeconomic effects of pre-school education can be estimated with a 20+ year time lag. Exactly the same dilemma (i.e. whether to invest in processes with quick returns) is faced by corporations. They can either purchase expensive technologies on the market or invest in "blue sky" research in hope of achieving break-through results in a decade or two. As the quality of pre-school education depends on the personal traits and professionalism of teachers, there is no need for the costly bureaucratic structure characteristics of primary and secondary education. Thus in the case of pre-school education, more money can reach the "end-user".

Pre-school education is not intended to increase the general understanding of the world among children. Its goal is to create a greater intellectual potential, which can be used in later stages of education. In the global economy, the investments in knowledge should cover all aspects of life-long learning. Kindergarten education seems to be gradually "discovered" by decision makers. Countries such as Spain or the UK

place more and more emphasis on the education of 3–5 year-olds. National education systems in developing countries seem to copy the strategies of corporations.

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PART III

THE ROLE OF KNOWLEDGE AS SOURCE OF COMPETITIVENESS AND ECONOMIC DEVELOPMENT OF REGIONS. EMPIRICAL EVIDENCE

Nicola Bellini

REGIONAL POLICIES IN THE KNOWLEDGE-ECONOMY SCENARIO: THE ROLE OF EUROPE'S CONNECTED PERIPHERIES

1. INTRODUCTION: THE SCENARIO

This paper discusses the present trends in regional innovation policies, with special reference to the European Union. Critical views and policy approaches are analyzed. The paper suggests that "connected peripheries" may have a chance to be the new hot spots of economic development, if this ambition is supported by appropriate policies including some relevant update of the innovation policy toolbox.

The scenario designed by the new globalized knowledge economy is characterized by a number of threats and opportunities. Knowledge creates value for products and services, knowledge creates wealth and competitiveness, knowledge feeds growth. With variations, the "laws" of the globalized knowledge economy apply to all countries and regions, both developed and developing. For the first time in recent history, both research and policy practice are suggesting a new, possible linkage between innovation and technology, on the one side, and development, on the other. India, China, Korea, Morocco and other "less developed countries", but also some of the countries and regions of Eastern Europe provide evidence of this linkage. New "powerhouses" are emerging with a significant role played by universities, research, high technology companies and waves of young generations of "knowledge workers".

At the same time, new approaches to innovation have evolved from the traditional "linear model" to systemic views, emphasizing the interactive, social and geographically-specific nature of innovation processes. The systemic, territorial-based approach has become increasingly dominant in the way that most regions and countries look at their innovation potential and at the constraints they have in meeting the challenges of the globalized knowledge economy.

Apparently this would suggest that a new era of innovation policies should start (or should have already begun) with a significant role played by those policies that are most able to build and maintain (and renew) the kind of complex learning systems that are required to produce and absorb innovation in an effective way. Policies that allow for greater and more effective "institutional thickness" in regional innovation systems are bound to be the core of development strategies[1].

2. THE CRITIQUE

And yet doubts and skepticism seem to have undermined the intellectual and practical credibility of regional innovation policies for the past ten years. Powerful and converging critical arguments are put forward.

First, regional innovation policies appear to be often too narrow in scope and too small in terms of resources to tackle the macro-dimensions of innovation in highly industrialized Europe. It is suggested as an "imperative" strategy of concentrating investment on research & development (R&D) excellence, scaling up resources to pursue major technological advances, with the implication of an almost monopolistic role of national governments. Regional innovation policies are left with only marginal tasks as "too small". It must be emphasized that this criticism hides at least one serious misunderstanding and conceptual confusion, namely that regional means territorial in nature, not (only) sub-national and "narrow". In other words, today also "grand policies" face the challenge of "being regional" and territory-specific.

Undoubtedly some regional innovation policies have proved to be too ambitious and vague also in their peculiar tasks. The objective of "re-creating Silicon Valley", which has been so influential in shaping regional priorities in the past, now only belongs to the dream book of the regional policy-makers. Wide evidence supports now a sound skepticism about the ability to originate high-tech clusters by decree. Policies have suffered from insufficient realism, from approximate and stereotypical design and, moreover, from a "best practice" syndrome, i.e. a tendency to be passively and uncritically subject to rapidly changing policy

[1] Policy arguments that are presented in this paper were originally developed in Bellini and Landabaso (2007).

fashions, with too little thinking devoted to the careful adaptation of "good practices" to each region's peculiar situation. Undoubtedly policies often would need objectives that are more realistic and more precisely defined.

Third, regional innovation policies appear too difficult to manage, in relation to planning as well as in policy delivery, both requiring strong public-private partnership and inter-institutional cooperation. They are subject to many constraints, both in terms of legal powers of the regional governments (especially in non-federal countries) and in terms of financial resources available to them.

Regional policies imply complex governance systems. Being for several reasons at the forefront of a new idea of "State" and "public-private cooperation", they need to rely heavily on the subsidiary role of private actors and to depend on the smooth working of inter-governmental relations both upwards (national governments, European Union) and downwards (municipalities and provincial governments). Furthermore, regional policies on the European scale involve too many actors with substantial quality variations in their ability to manage programs and design policies. This problem is of course dramatized by the enlargement of the Union to new countries and to many new regions where a bottom-up strategic planning method rather than top-down dirigisme is a radically new approach.

3. POLICY APPROACHES

In all regions, innovation is critically important but there is no "One best way" regional innovation policy adapted to all sorts of regional environments. Regional characteristics linked to, among others, sectoral specialization, firm size and "isolation", do matter when addressing the need to formulate appropriate regional innovation policies.

Sectoral specialization determines different ways of innovating. Traditional sectors (e.g. textiles, wood, leather, agro-food, ceramics, metalworking, shoemaking, etc.) populated by small and medium size enterprises (SMEs) represent the highest industrial value added in most regions, especially in southern countries and less favored regions. These sectors are comparatively more dependent on the regional environment to innovate. Proximity plays a more important role and innovation is more incremental and less dependent on R&D efforts and technological breakthroughs. More technologically advanced sectors (e.g. chemistry, aeronautics, electronics, information and communications technologies, informatics, etc.) better represented in more advanced regions are more directly dependent on R&D efforts as such and are based on relatively bigger and more internationally connected and innovative firms, which often have the necessary internal R&D capacities.

In advanced regions where international R&D activities are already developed, regional innovation policies may be understood and interpreted essentially as the spatial implications of traditional (national) innovation and technology policies, responding to issues such as the adequacy of physical research infrastructures, the creation of critical masses of R&D potential in high-tech sectors, the supply of well trained human capital and R&D teams, the entrepreneurial exploitation of innovative results etc. In these regions, availability of R&D capacities in big firms and "excellence" R&D facilities in public laboratories allow for a bigger policy emphasis on technology generation and diffusion along a more traditional "R&D linear model". There is aclear correlation between the regional density of large enterprises and R&D business expenditure, and regions with a high concentration of SMEs tend to show low rates of R&D business expenditure.

In less advanced regions and in those regions that are undergoing industrial decline, regional innovation policies cannot be just about preconditions and implications. They deal directly with the issue of the relationship between innovation (and technological R&D) and economic development. In these regions, in particular small firms make up most of their economic tissue. Unlike large firms with internal R&TDI capabilities located in advanced regions, the SMEs depend largely on their capacity to access technology and knowledge inputs from its regional environment, be it as inputs from the region itself (e.g. co-operation with other regional firms and suppliers/customers, skilled manpower, R&D capabilities, technology transfer from Technology centers and Universities…) or as relays (proximity gates) to sources of technologically advanced equipment and R&TD excellence networks internationally. Most often SMEs access advanced technologies through the acquisition of advanced equipment and networking between innovators (i.e. combined development of new products, sharing knowledge among companies – suppliers and customers, etc.). In this respect we may certainly expect that innovation statistics based on R&D expenditures or personnel tend to underestimate innovation capacities in less favored regions.

Does evidence support the claim of these regions to base their development on innovation? Is the geographical concentration of R&D activities an inescapable rule of European development? Several studies seem to suggest that it is dangerously confusing to interpret the distribution of R&D activities as the same as a distribution of innovation capacities. Of course, no one can deny the existence of a high degree of geographical concentration of European R&D and of very significant regional gaps, also within countries, not only in terms of R&D expenditures but also with reference to some other key indicators, like the rate of employment in knowledge-intensive activities.

At the same time, however, other indicators suggest that the innovation potential is more widely diffused. The peripheries of Europe show

remarkable "vitality indicators". If we look at the level of participation in European programs, at the number of students in high education or at the number of science parks and innovation-minded initiatives we can hardly make this consistent with the core – periphery relationship that the old geography of innovation was proposing. The emergence of peripheral cores, often specialized in specific areas, suggests that the "knowledge factory" is and can be more spatially dispersed.

As a consequence, in EU policy terms, it would be wrong to infer from the concentration of R&D activities that such concentration must be maintained and even strengthened, so that a diffusion of innovation activities could be even detrimental to the overall innovative performance of the EU. On the contrary, excessive geographic concentration of innovative activities may lead to under-utilization of the actual potential which lies in Europe's regions.

Within this scenario, the analysis of practice gives us good and bad news. Good news are that in fact innovation is not just a luxury item for rich regions but can be a most powerful engine for catching-up for most regions. Important opportunities seem to be linked to the new geography of innovation. Well-targeted investments in public research and high education can originate stocks of qualified human capital, including entrepreneurs and scientists, that may be less mobile than standard economics would suggest. Even without or before conscious policy strategies to promote spin-off companies, there is evidence that new businesses are started by entrepreneurs preferably in the same place where they have received their degrees and completed their education. Case studies (e.g. the "Arno Valley" in Tuscany, Italy) show that high-tech concentration is not the result of some planning exercise but the overall outcome of the sum of individual choices to establish professional activities where personal linkages have developed most strongly, normally during university years. At the same time other case studies (e.g. the ICT district in Cagliari, Italy) report about the importance of the spillover of human capital from some major research establishment into new entrepreneurial activities.

4. CONNECTED PERIPHERIES

The concept of marginality itself, which used to "condemn" certain regions to the periphery of development, must be revised. "Connected peripheries" are good candidates to be new hot spots of economic development.

As it is suggested by recent trends in place marketing, new priorities emerge in the knowledge economy, showing a shift from traditional approaches that prioritize the co-localization of economic activities in "special places", where work and business conditions are optimized, to the co-localization of "special people" (the so-called creative class) in

"ordinary places" where life is made more enjoyable and safer. Within certain limits, the physical marginality of regions may be attractive when it supplies "talented people" with a greater quality of life than the one offered by overcrowded, congested and polluted metropolitan areas. Nature, health and education facilities, security or local culture as well as leisure facilities (sun and sea or snow) also count.

Small and medium-sized cities may provide the kind of lifestyle amenities that are key in attracting knowledge workers. Also rural areas, rather than being only identified as agricultural and "declining", offer unparalleled amenities and quality of life. Increased mobility makes rural regions attractive residential locations and in fact stronger rural – urban links makes this distinction increasingly opaque. In several European areas it is not easy to say where "rural" starts and "urban" ends. Rurality is also not just a return to a nostalgic past. It may well be the place of and for technology: a place to use high-tech (services!), a place to produce high-tech. Physical marginality itself (like in the extreme case of "insularity") may push regions to invest heavily on ICT and to exploit the irrelevance of distance in some ICT businesses.

Peripheries however need to be connected. In the knowledge economy the new ICT infrastructures are vital. Fast broadband communications are a basic pre-requisite that is still insufficiently developed in Europe's peripheries.

But also physical infrastructures are important, as they guarantee fast transportation of goods and people and accessibility. Especially one type of infrastructure may make the difference – an efficient, well-served airport may transform remote areas into the backyard of metropolitan cores. The possibility to reach international hubs and to travel to and return from the main cities of Europe within one or two days puts an area on the map of possible locations of the new, highly internationalized knowledge workers and companies.

Connections are not just about physical or IT accessibility. Crucial connections are virtual, intangible linkages to international high-value added networks and especially to the R&D and Technology "excellence" networks. Institutions and often just individuals can play the role of local "gates to the world": a good university, an outstanding research institute, a famous theatre, an internationally-renowned company, but also just a famous scientist, orchestra conductor, artist, entrepreneur… They make the place recognizable on a larger scale and provide local systems with relationship assets that may prove invaluable in supplying development strategies with opportunities and world-class resources.

Finally, connections are also of a more general social and cultural character[2]. To the knowledge workers periphery is acceptable, isolation

[2] I owe some of the following reflections to a joint research project with my colleague Alberto Bramanti of Bocconi University.

is not. Isolation is avoided by "being on the map" of tourist destinations, cultural events, sports etc. of the highest visibility. Isolation is avoided by the openness of the local society and its readiness to accept incomers (inhabitants. students, investors, tourists…) from different countries and to facilitate their integration as well as by other factors such as internationally-oriented institutions (including non-profit organizations concerned with humanitarian issues), the existence of liaison organizations with communities abroad (e.g. with migrants communities), the diffusion of certain personal attitudes of local people (knowledge and practice of foreign languages, propensity to travel and to personal mobility, diffusion of internet and international media), the diffusion of a variety of culture-specific activities (cultural centers, ethnic restaurants), the propensity to cultural contamination and modernity (e.g. in architecture and urban planning, by accepting additions and insertions into the traditional fabric of the local cities) etc. On the negative side, isolation is – in a sense – first in the mind of the people, in their hostility to the difference coming from outside, in the parochialism of culture and personal attitudes and – last but not least – in the general attitude of accepting peripherality as a structural handicap without remedy, to be compensated by the generous policies of some central authority.

Good news also come from the realization that some of these factors, including appropriate institutions and policies, can be produced in a relatively short period of time and that therefore territorial hierarchies are not totally fixed. Innovation-based strategies have a political return that is concrete and visible quite soon.

Good practices show, however, that less advanced or declining regions aiming at rebuilding their economic future on innovation must comply with some "rules of the game". Bad news are that the rules of the game are quite strict and demanding. The world-class quality of resources and outcomes is a requirement that cannot be bypassed or underestimated. Good government as well as good governance is also necessary. Policy-makers do not need to be visionaries but technology forecasting helps and they *do* need to be ready to catch windows of opportunities that are unplanned and unexpected, to support new initiatives and new actors even against established constituencies (the lock-in problem!) and to provide world-class services and manage global relations.

To sum up, European experiences seem to converge in confirming the (hard too some, but golden) rule that regional innovation systems are not generated by policy. They are too complex a construction to be designed by the enlightened hand of a policy-maker. Yet policy cannot be hands-off because it is likely to be heavily determining the outcomes. This may happen in at least five ways.

First, policy can create pre-conditions for cluster development, especially by investing in an excess availability of knowledge resources and

human capital. Second, policy can provide, mostly through support services, greater "intelligence" of technological and market developments and new relations. Third, policy is responsible of the timely recognition of those "spontaneous" phenomena that may evolve into clusters. As a matter of fact, policy makers are often astonishingly late in recognizing the potential for cluster development and the opportunities and needs of these "proto-clusters" for linkages and resources. Fourth, policy can substantially ease evolutionary trends (e.g. the emergence of leaders within the clusters) by avoiding lock-ins (of different kinds: functional, political, cognitive…). Fifth, by an appropriate management of "foreign relations", policy can contribute to widen the horizons of cluster development, whenever territorial proximity is a constraint and some of the cluster functions (e.g. manufacturing) must take place in different, even far-away areas.

5. ADDITIONS TO THE TOOLBOX: THE MANAGEMENT OF REGIONAL IMAGE

The necessary reappraisal concerns not only the general approach to policy making but also the contents of the innovation policy toolbox. Indeed, the intensive exchange of good practices for the last two decades has consolidated a standard toolbox that is shared by most regions in Europe. It includes traditional subsidies, public procurement and more "fashionable" items such as business support services, human capital formation and technology transfer and the promotion of industry–university linkages.

The toolbox of regional innovation policy is however complemented by new sets of instruments that respond to apparently different policy objectives and in fact act upon dimensions of innovation that are often overlooked in policy discourses, like cognitive dimensions. An example is provided by place branding and the management of regional / city image.

Discussions about image and branding policies is usually placed in the framework of "place marketing" and marketing literature helps in defining the features, components and main characters of image and of its relationship with local identity. Place branding has been defined as the practice of applying brand strategy and other marketing techniques and disciplines to the economic, social, political and cultural development of cities, regions and countries. Place branding has attempted to transfer into local economic development not only some communication techniques but also the identity-building power and the linking value that "post-modern" scholars attach to brands.

Marketing lessons are fundamental also from a policy perspective. Image:

- reflects and synthesizes the experience of individuals from which it derives;
- communicates and shapes expectations with respect to what the area can or should give to individuals;
- is a filter which influences the perception of the area, the quality of life and services, the level of development and the (individual and collective) expectations about the future;
- is self-reinforcing through the activities of actors, conforming to the expectations and through their subjective evaluations based on the relationship between perception and expectations. When an image has been consolidated, it is likely to be self-fulfilling.

Marketing, however, is no substitute for policy. Still marketing can be functional to policy. This statement requires some explanation.

Local and regional policies of innovation, which form an essential part of modern policies of local development, are less and less an expression of government and increasingly an exercise of governance, adopting its philosophy and instruments. By the term "governance" we mean a variety of guidance mechanisms, not necessarily restricted to public actors, whereby social processes are consciously directed in situations of interdependence. The concept that allows best to describe and understand the practical meaning and implications of governance is "policy network". Policy networks are alternative to traditional ways of government (and, to a large extent, also to contemporary approaches of "new" public management).

The management of policy networks can take place at two different levels, using substantially different sets of tools. On the one hand, the structure of the network can be influenced, for example, through the composition, the number of actors, its openness, the internal rules, the introduction of new actors and the exclusion of some of the present actors, etc. On the other hand, at the cognitive level, it is possible to influence the perception, the views and expectations, to anticipate the exclusion of diverging ideas and views, to facilitate interaction and to promote a common language, to induce collective reflection and to prevent cognitive lock-in, etc. Therefore, the toolbox of industrial and innovation policies also includes a set of "second generation" policy instruments, which impact on the cognitive dimensions of local networks in the attempt to govern their evolution through the formation of perceptions and expectations and which incorporate the management of regional / city images through branding.

This is especially true when policies deal with complex processes like innovation and economic development that are characterized by risk, uncertainty and information asymmetries. Making sense of the place where we live and work, as well as of its present reality and future perspectives, is then essential: "managing the place brand becomes an attempt to influence and treat those mental maps in a way that is deemed

favourable to the present circumstances and future needs of the place" (Karavatzis, Ashworth 2005).

The political relevance of place branding is twofold.

Firstly, the image of an area (region, city) reflects its identity. As such, we are not dealing with objective, technical data, but with a social, historical and highly subjective (and sometimes even artificial) construct, which consists of the total of affective and rational images produced by individual actors or by groups of actors. These images show the values which the various groups connect to the area, to its characteristics and its identity, synthesizing their view of the area in stereotypes and "labels" and creating "myths" through the selective narration of the social, economic and historic characteristics of the area.

However "different people, at different times, for different reasons, create different narratives of belonging. Place images are thus user determined, polysemic and unstable through time" (Ashowrth, Graham 2005). When different images coexist at a certain time, there may then be a competition between images in order to control the representation of the past / present / future of a territory and therefore the policy agenda.

The case of Tuscany reflects this kind of situation. The touristic image of Tuscany is intimately consistent with a popular vision of the future development of the Tuscan economy that assumes the exit from the manufacturing sector as unavoidable and – in fact – desirable. According to this post-industrial vision, tourism, services, agri-food industries and other environmentally sustainable activities should substitute manufactures in creating value and sustaining income levels.

This vision has been increasingly influential, although never made it to "get hold" of the political agenda. Regional and local governments have mostly confirmed their allegiance to "industrialist" visions, even in front of the crisis of the few large corporations present in the Region. This has happened with two variations: the belief in the alternative model of development provided by smaller companies in the "industrial districts" *vs.* the belief in the evolution towards a neo-industrial scenario, characterized by service-manufacturing integration, high levels of R&D activity and an increasing role of high-tech companies.

Both industrialist visions had images of Tuscany that could be conveyed to the general public. On the one hand, the industrial district vision built a powerful intellectual myth of an alternative economic model, mixing cooperation and competition, capitalist growth and social stability. Only in one case, i.e. the city of Prato, one has openly made reference to and emphasized the role of manufacturing tradition as a constituent part of the image of the city. More recently, due to the ups and downs of the economy, the general perception of industrial districts has been more frequently linked to crisis and de-industrialization rather than to

success and growth. On the other hand, the neo-industrial vision has developed its own brand, "Arnovalley"[3], that enjoyed some success in the national press, had some modest attempts to gain wider audience also through Internet, but eventually was delegitimized by the "new economy" crisis. Also due to the weak perception of the need to "brand" industrial Tuscany and to the inability to sustain a "dissonant" discourse on regional heritage, the strength of the traditional image succeeded in preventing the emergence of new ones that could reflect the vision of more dynamic industries and social groups.

The role of cultural heritage here comes into play, showing how different images and visions are build upon (very) selective narration of the region's history and shared values. The emphasis on a romantic, anti-modern, "natural" image of Tuscany, the obsession with "preserving the past" and the stubborn reluctance to modern additions has been clearly instrumental to the post-industrial vision of regional economic development.

The interpretation of culture as "entertainment for tourists" (Sacco 2005) is based on forgetting. When nature is indicated as the strategic resource of future Tuscany it is easily forgotten how little of the Tuscan landscape is "natural" and how often it is, on the contrary, a classical case of *Kulturlandschaft*, with man-shaped hills, lines of cypresses and pine forests along the coast. When authenticity is based on history (i.e. the longer its history, the greater the authenticity), it is easily forgotten the huge amount of process and product innovations that are supporting the quality and competitiveness of the local "authentic" food industry.

As one scholar of high-tech development problems in Tuscany once reminded his readers, "Galileo used to live here" (Bianchi 1996). Yet it is surprising to notice how rarely the brand "Galileo" is used, even in his hometown, Pisa. Leonardo da Vinci, another icon of modern science, is much more frequently remembered (and reminded to tourists) as an artist than as a scientist.

Also forgotten are some fundamental characters of Tuscan history, such as the intimate link between modernity and beauty and between culture and economic development that was the essence of the golden centuries of the Medici's. Beauty is communicated as a mostly esthetic fact and visitors often are left in total ignorance about the tremendous technical challenges and outstanding skills behind some of the greatest works of art. In Pisa, only the dramatic events concerning the stability of the Leaning Tower have drawn attention to the fascinating technical complexity of that building.

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[3] The obvious reference to Silicon Valley is here combined with the fact of the geographic concentration of high-tech activities in the area between Florence and Pisa, along the river Arno.

The strength of this collective mood is reflected in Florence, a "high culture district" with a dramatic inability to express and communicate innovation. As one inhabitant once put it in a private conversation, "we should expect to be ordered to go out dressed up in Medieval costume". The most modern landmark in the city is the Santa Maria Novella railroad station, a masterwork of modernist architecture, built in the 1930s and actually "imposed on" the city by the Fascist regime. With the exception of some occasional linkages to modern creativity, mostly in the field of fashion, Florence is today a frozen city. The recent debate about the new entrance to the Uffizi Museum and the innovative proposal by Arata Isozaki (finally cancelled in 2004) has led the distinguished art historian Irving Lavin to comment about "the bitter irony that is behind the conservative mood that dominates in Florence – right in Florence! – and suffocates the spirit of adventure and innovation that created the city we all love and admire, where the notion itself of modernity was born. The Cathedral itself, and especially Brunelleschi's dome, would be surely prohibited today (…) Florence has become a stone-made Disneyland"[4].

Secondly, there may be coherence or incoherence between "image" and "product". In some cases, the conscious generation of this gap can be justified by the willingness to anticipate a development which has not yet been realized. In other words, image is not used to define a "visible" reality, but to create an ideal situation in a reasonably nearby future, which more or less large social groups want to strive for: a "better" area (city or region), more livable and/or wealthier and/or more modern than it effectively is. The imagery therefore overlaps the vision that society and local politics envisage and to which they commit.

A gap between image and reality can also emerge because a place is going through a phase of change which has not yet been completed and, therefore, its significance cannot yet be fully perceived. As a consequence the area's evolution is misunderstood. In other words, situations of political and cognitive lock-in in "post-paradigmatic" areas (for example in several Italian industrial districts) can generate stereotypical images referring to historic production structures which are outdated and – which is worse – can hamper innovative dynamics which are taking place. The latter will not be recognized or will be dismissed as "other", transitional, non credible and non reliable phenomena. To sum up, by manipulating the possible gaps between image and identity, the expectations, perceptions and eventually performance of economic actors can be influenced.

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[4] Speech in the occasion of the awarding of the Galileo Prize 2005 in Pisa (author's translation from the official Italian text, downloadable from http://www3.humnet.unipi.it/galileo/fondazione/Home/home.htm

6. CONCLUSIONS

Present trends in regional innovation policies show a mixed picture of great potential and also clear constraints for the action of governments. Two main topics are proposed for further discussion and research:

- it is argued that peripheries are likely to play an important role in innovation, provided that they are connected to the traditional cores of economic power and knowledge production. Connections are of course related to accessibility and infrastructures (old and new), but also refer to more intangible (and crucial) aspects, i.e. the openness of society and local culture;
- it is argued that greater attention should be paid to non-conventional innovation policy tools, especially those that impact on the cognitive dimensions of innovative processes. In this respect we emphasized the relevance of image management and place branding, not only in terms of place marketing but also to support perceptions and expectations that are in tune with innovation policy objectives.

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THE STRATEGY OF BUILDING KNOWLEDGE-BASED ECONOMY IN LOWER SILESIA

1. INTRODUCTION

Knowledge-intensive jobs are the key to realize the Lisbon strategy for Europe on global and especially regional scale. Allocating resources, particularly structural funds, for the knowledge triangle sectors (education, research and innovation) may provide the necessary leverage to achieve the target and to assure viability of solutions. The City of Wrocław, Poland, prepared a comprehensive regional development strategy EIT Plus (European Institute of Technology), the goal of which is to stimulate knowledge-intensive growth of Wrocław and the Lower Silesia region by concerted effort of the knowledge triangle stakeholders. This should lead to a positive economic and social transformation of the Wrocław region and, due to direct cooperation, of other regions in Poland. The cooperation with the neighbouring regions (including trans-border cooperation) will contribute to establishing a significant knowledge-based economy region in this part of Central Europe. Consequently, the implementation of the Programme should also help in strengthening the economic position of Poland.

The core financing for EIT Plus comes from the EU structural funds for 2007–2013. Other sources are: national schemes, EU initiatives, public-private partnership and a key commitment from business. The name of the programme purposely refers to the goals of the visionary initiative of the EC and its President to establish the European Institute of Technology, the mission of which would be to contribute to Europe's economic growth and competitiveness by creating a model for synergetic development of education, research and innovation.

2. THE EIT PLUS PROGRAMME – CONTEXT

On 14 February 2006, the Government of the Republic of Poland adopted an allocation strategy for the EU cohesion funds available for Poland in the years 2007–13. The EU funds are expected to strengthen significantly the pro-innovative nature of Polish economy. For this to happen, the development strategy of Poland has to be closely linked to the regional development strategy. The EIT Plus programme is a concrete implementation proposal of the national development strategy on both the metropolitan and regional level.

An important part of the programme is to develop Wrocław infrastructure to potentially host the EIT's head office as well as at least one of the nodes of the European Institute of Technology. This has been reflected in the proposed name of the programme – "EIT Plus". It should be stressed, however, that hosting the EIT by Wrocław is not a precondition for the implementation of the EIT Plus programme, while the reverse may likely be true. The key objective of the programme is to optimise the use of the city's and the region's social and financial resources in accordance with the Lisbon Strategy, i.e. adapting development strategies to knowledge-based economy and knowledge society goals.

3. THE EIT PLUS PROGRAMME AND THE INITIATIVE OF SETTING UP THE EUROPEAN INSTITUTE OF TECHNOLOGY

Poland was one of the first Member States of the EU that have actively supported the idea of setting up the European Institute of Technology as early as in April 2005. Wrocław on its part was the first to declare its interest in hosting the EIT (and it still strives to achieve this goal). The main reason behind the European Commission's initiative was the awareness that Europe can become an "innovation backwater" if the development of higher education system, scientific research and innovation are neglected. Poland also faces this threat, which is the reason why successive governments have been favouring the European Commission's initiative.

Soon after the initial proposal was formulated, the Wrocław community embedded the EIT bid with a broader context of a development programme integrating scientific, education and innovation sectors – the EIT Plus programme. The interdependence of the Wrocław EIT bid (i.e. the headquarters and one of the EIT "knowledge and innovation communities" – KIC) and the city's development strategy is worth stressing. The regional strategy provides for using the EIT principles as a basis for its own operations (the three elements of the knowledge triangle). At the

same time, the development of research institutions, higher education system and business sector under EIT Plus can be a key argument for locating the EIT in Wrocław.

The EIT Plus Programme consists of several projects aimed at developing a knowledge-based economy in Wrocław and Region. The projects are addressed to different social groups playing an important role in the education-research-innovation triangle: pupils and teachers, engineers, students, academic crises, business and innovative enterprises. Below, some of the flagship projects being prepared or even implemented in frames of the EIT Plus Programme are listed:

- Wrocław Research Centre EIT+,
- Wrocław Biotechnology,
- Advanced Materials and Nanotechnologies,
- Wroclaw Information Technologies,
- Support for innovative enterprises,
- Fellowship "Talent",
- Internet Portal "Mathematics",
- Lower Silesian Science Festival,
- Wrocław Centre "Science Today".

For Wrocław to become home to one of the EIT knowledge and innovation communities, it is necessary to ensure state-of-the-art research and education infrastructure. This can be achieved by building a modern research and education campus as well as securing land and the necessary infrastructure for the innovative businesses. The campus should not only meet the education and research standards, but it should also accommodate students and staff that will be employed there or that will participate in the EIT's activities. This will be an element of an investment planned in the city within the framework of the EIT Plus programme (construction of a modern academic campus). The campus is aimed to integrate higher education institutions in Wrocław, now largely dispersed.

However, the EIT Plus programme is much more than just the support offered to the applied sciences. The idea here is to assure the development of everything that is best at our universities in terms of basic research and economic and social studies. The experiences of various countries, including Poland, have shown that not only do those fields of studies guarantee the influx of qualified graduates willing to undertake the most difficult tasks outside their specialisation, but they also build the entrepreneurship culture targeted at commercialisation of research activities. The Wrocław community wants the new academic curriculum to be a result of the dialogue with business partners. Also, measures will be taken for full implementation of the Bologna Process provisions in Wrocław (especially free transfer of students from one university to another and multi-institutional interdisciplinary studies).

4. IMPLEMENTATION OF THE EIT PLUS PROGRAMME

The field of advanced innovation research

The key for economic success of the EIT Plus programme is advanced applied research. We want major investors in the region to join, on the long-term basis, their science and research bases with those of the institutions of higher education and scientific institutes of Wrocław. Many companies (including Siemens, Fagor, Electricite de France, Volvo, Macopharma, Philips Lighting, HP, Master Foods, Whirlpool, KGHM) have already signed long-term agreements with the local institutions of higher education guaranteeing them access to world class specialists. In return, the most active companies in this partnership may count on better access to best students starting their career.

Other companies are planning to undertake complex research activities. Another scheme focuses on science and research in business involving local staff (this is seen as an important condition for investments located in Wrocław and the region). The city will provide the necessary infrastructure.

Particular care will be taken in the EIT Plus programme for the creation of good financial and logistic conditions for small and medium innovative enterprises (especially originating from the local academic community). The companies led by young Wrocław citizens operating on the market of financial services and internet technologies are already in the lead in Poland. They soon will be joined by bio-tech start-ups.

Research specialisation

Apart from general strategic objective of the EIT Plus programme, i.e. channelling future development of the agglomeration in accordance with the renewed Lisbon Strategy, the programme defines the following subject fields as priorities:

- Information technologies and the ICT sector (software, hardware and system solutions for the service sector, especially the sector of financial services).
- Biotechnology and advanced medical technologies (BioMed).
- State-of-the-art materials and nanotechnologies (NanoMat).
- Basic research in the selected sciences (maths, physics and chemistry).

Moreover, the experts groups proposed several high priority tasks in BioMed and NanoMat areas, which were derived from existing and potential regional science and technology specialization:

NanoMat:
- nanotechnology for photonics, micro- and nanoelectronics and sensors,
- functional polymers and polymer composites,
- lanthanides for nanotechnologies,
- materials for the energy storage.

BioMed:
- design, manufacturing and preclinic testing of new drugs,
- transportation and delivering systems for drugs,
- molecular diagnostics,
- bio molecular modelling.

In all the fields the research and academic community represents a good European level and in some of them it is at the European forefront. At the same time, our experience has shown that these are precisely the areas where research results can be quickly implemented, where new companies may be established and where there are prospects for cooperation with large businesses located in Wrocław and Wrocław metropolitan area. It should be noted that the objectives set above are fully compliant with the recommendations included in the Aho report *Creating an Innovative Europe*.

School education

Strengthening the academic and innovation dimension of Wrocław is a focal element of the EIT Plus programme. However, high standards have to be achieved already at the schooling level. This entails a return to education allowing for student's interest in preferred areas (interests in IT and natural sciences, economics and engineering). Thanks to this measure, universities and innovative business in the region of Wrocław will be supplied with highly motivated and well-educated young workforce.

Major financial, infrastructure and organisational effort will be undertaken to assure long-term development and support of the best secondary schools (lyceum) developing specialist programmes by funding advanced laboratory equipment and necessary teaching aids. Broadband internet access and necessary IT equipment will be provided at every Wrocław school. Also, qualifications improvement system for teaching staff will be launched in cooperation with Wrocław higher education institutions.

Moreover, a system of financial and material assistance (e.g. dormitories and scholarships) to assist young talents, particularly those from poorer families, will be created. Implementation of a dedicated support has already been put in place for pupils who pick sciences.

Academic field: new Wrocław Research and Education Campus Pracze

Wrocław is already a major academic community in Poland with almost 140 thousand students and several autonomous higher education institutions. The latter results, however, in weakening of the community due to its dispersion. To provide incentive for joining forces in preferred areas a new metropolitan innovation and technology campus will be created in Pracze, 12 km from a city centre. Along with dormitories for a few thousand students a new business, research and innovation centre will be set up. The centre will serve all Wrocław institutions of higher education and it will be modelled on the German Fraunhofer Institutes. The preference will be given to modern industrial technologies (nanotechnologies), life sciences and medical sciences (including biotechnology), and, most prominently, to the speciality of Wrocław – information technologies.

The goal of the research investment in Campus Pracze (of 140 million EUR) is building the new integrated research centre for materials, biomaterials and nanotechnology investigations (see Annex). The project will enable to concentrate research activities in fields which constitute strengths of Wrocław as an academic and technological centre and will increase the competitiveness of The Lower Silesian Region and its position in EU as a Region of knowledge-based economy. Research centre will support the development of basic research in the field of advanced materials, modern biotechnology branches and advanced medical technologies. It will constitute a basis of EIT+ Program creating strong foundations for innovations and application and technological research.

The mission of research centre and Campus Pracze as all is to undertake initiatives and to create favourable conditions for a close co-operation between partners from research, economy and business sectors in the field of advanced materials, nanotechnologies and biomaterials. The Centre's research potential is based on three virtual Centres already existing in Wrocław: Centre for Advanced Materials and Nanotechnology**,** Biomedical Engineering Centre and The Centre for Bio monitoring, Biotechnology and Protection of Lower Silesian Ecosystems. Integration of research and economical potential and creation of technological and regional specialisations will result from the project.

Preliminary assumptions of the research centre are as follows:

- the Centre will be a scientific and high-lever educational institution (graduate school) providing research and education in the interdisciplinary fields of its competence,
- priority competence fields of the Centre are: BioMed (biochemistry, biophysics, biotechnology), NanoMat (functional and advanced materials and structures, nanotechnology), Info (applicative informatics),

- the Centre will integrate the local potential of scientific institutions and innovative enterprises enhancing its role in European Research Area,
- Scientific Committee and Consultation Committee consisting of invited persons from science, business and industry (from Poland and other EU countries) will elaborate strategy of Centre and control its activities,
- Research groups of Centre will be organized for 3–5 years in order to realize research and technological projects,
- Laboratories will be a core-structure of Centre, independent on research groups,
- English will be the education language in Centre,
- Scientist from other countries will be invited to the Centre in order to join research groups or give lectures in the priority fields of the Centre.

Campus Pracze with a total area of 27 ha possesses a great potential for farther development in near future. Industrial research centres, Business and Innovation Park, Centre e-Health, technology parks, incubators and other innovative institutions are hoped to be constructed in the direct neighbourhood to the Research Centre EIT+.

5. FINANCING THE EIT PLUS PROGRAMME

The core financing for EIT Plus comes from the EU structural funds for 2007–2013. Other sources are: national schemes, EU initiatives, public-private partnership and a key commitment from business. Several core projects for implementation of the EIT Plus programme have been prepared in 2006/2007 in frames of EIT Plus Initiative and by Lower Silesian Centre for Advanced Technologies. Altogether, the EIT Plus programme will be supported in the 2007–2013 perspective by the Operational Programme Innovative Economy with ca 250 million EUR. The core projects of EIT Plus Programme have been already accepted by Polish authorities and are in the phase of final preparation and negotiations with EC. These are:

- Wrocław Research Centre EIT+ (140 million EUR),
- Biotechnology and advanced medical technologies (27.6 million EUR),
- Nanotechnologies in the advanced materials (30.1 million EUR),
- Library for supporting the technique and technology development (25 million EUR),
- Medical Data Centre e-Health (17 million EUR).

Beneficiary of the projects will be Wroclaw Research Centre (EIT+) Ltd., a company being under organization by City Wrocław, Marshall of Lower Silesia and Wrocław universities.

6. WROCŁAW RESEARCH CENTRE (EIT+) – A NEW PARTNER ON BUILDING A KBE IN LOWER SILESIA

On 13 April 2007 at the conference *From Lower Silesian Centre for Advanced Technologies to European Institute of Technology*, Major of City Wrocław, Marshall of Lower Silesia and rectors of four Wrocław universities: Wrocław University, Wrocław University of Technology, Medical University and Wroclaw University of Environmental and Life Sciences, have signed an intentional letter on establishing the new enterprise, which should manage the EIT Plus key projects and become leader in building the knowledge-based economy in the Region. The new organization should be a completely new form of the Lower Silesian Centre for Advanced Technologies (DCZT), a consortium of over 30 partners from academia and industry being organized from 2004 in order to build bridges between science and innovative economy. The consortium achieved much on the field by bringing professors and technologist together and by preparing important pilot programs and projects. As an example, regional Science&Economy networks organized by DCZT in three technological areas should be mentioned:

- e-Health,
- biotechnology and advanced medical technologies,
- renewable energy sources.

The networks prepared regional programmes of technology development and several projects between science and industry implementing these programmes. Over ten new innovative institutions were born at the networks, ready to continue the programme realization in next years by using – among others – Polish EU structure fond 2007–2013. For instance, Wrocław Medical Science&Technology Park (e-Health) and spin off Novasome (Biomedicine) begun their activity as result of network activities.

Wrocław Research Centre (EIT+) will continue the programme of DCZT, however on much higher level. The new organization form (limited company) will allow to prepare and lead the own projects integrating local, Polish and European partners in the specific technology fields, which can become a Wrocław or Lower Silesian specialization in near future. This should give rise to development of high-tech sector in a Region and to build best quality work places.

On 15 November, all six stakeholders of Wroclaw Research Centre (EIT+) signed an agreement to establishment of the company. It is expected to reach an operational stage in the end of 2007. The company established between local authorities and universities aimed at developing knowledge-based economy is an original solution in European scale. Wroclaw will be therefore a city checking in praxis this pioneer initiative

and collecting new experiences, which can be disseminated in other ambitious regions of our continent.

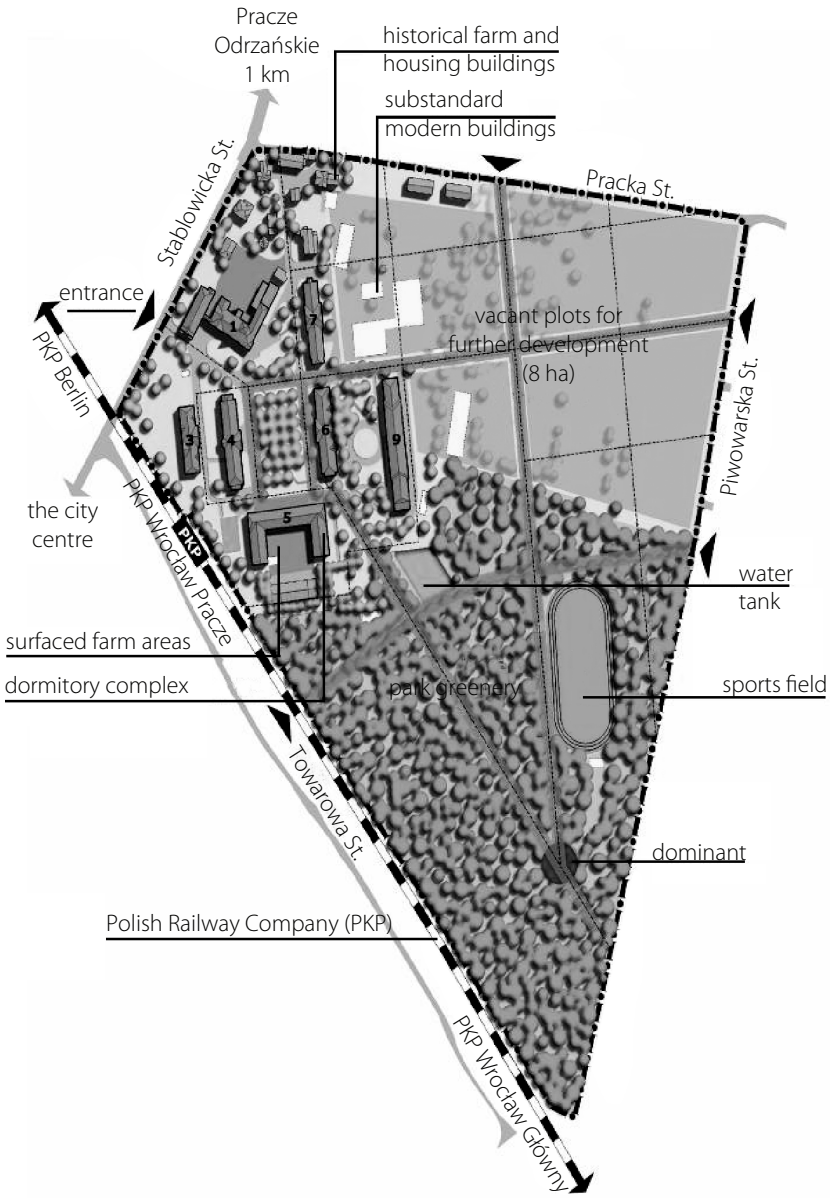
7. FINAL REMARKS

The EIT Plus is an open programme born out of a civic initiative. Although the City Office in close collaboration with the Lower Silesia Marshall Office acts as a coordination and major supporting logistic place, the mobilisation and involvement of a whole academic community and local business are prerequisites for success of its planning and implementation. Thus, the coordination group of the EIT Plus programme has been set. It is a truly interdisciplinary body consisting of high representatives of all interested parties. To assure the coherence with the government plans, direct consultative links to relevant ministries, but also to parliamentary representatives of the region, have been established. But the truly innovative part of the program is an open consultation method and transparent distribution of information. The latter will be achieved mostly by using the Internet via a dedicated web page www.eitplus.wroclaw.pl.

An important element of the EIT Plus programme is the strengthening of the regional trans-border cooperation (several letters of intent have already been signed) and with the regional partners in the country.

The EIT Plus programme, properly adapted, may be applicable as a model for metropolitan knowledge-based development in other metropolitan academic centres.

ANNEX: CAMPUS PRACZE



Marta Goetz

REGIONAL DIMENSION OF KNOWLEDGE-BASED ECONOMIES. THE CASE OF GERMAN FEDERAL STATES AND POLISH PROVINCES

1. INTRODUCTION

Knowledge-Based Economy (KBE) paradigm regards knowledge as prerequisite for growth (Snowdown, Vane 2005). Country's endowment in broadly understood knowledge resources determines future growth and welfare. Endogenous growth theory, called new growth theory, particularly widespread since mid 1970s, lays foundations for growth accounting in knowledge-based economies. It offers many models (Barro, Sala-i-Martin; Mankiw, Romer, Weil). Their formulas include long neglected factors such as human capital, expenditures on R&D on company's level as well as in the economy as a whole (Kawa 2005). MRW (Mankiw, Romer, Weil) model reads:

$$Y = K^{\alpha} H^{\beta} (AL)^{1-\alpha-\beta}$$

where:
Y – output,
K^{α} – physical capital,
H^{β} – human capital,
AL – effective labour force (labour amount as well as its quality dependent on available technology),
$\alpha + \beta < 1$, with α – production elasticity to capital, β – production elasticity to capital.

The simplified, but most comprehensive, formula may be written as suggested by models developed by Romer:

$$Y = A(R)F(R_i,K_i,L_i),$$ (Wojnicka, Klimczak 2005)

where:
$A(R)$ – external effects resulting from private R&D investments available at economy level
R_i – results of internal company's R&D expenditures and thus available only for the company
K_i – physical capital
L_i – labour force

Some models indicate the possibility of uneven growth, i.e. instead of convergence as envisaged by neoclassical models, divergence takes place. William Easterly and Ross Levine argue that *there are huge and growing differences in GDP per capita; divergence – not conditional convergence – is the big story* (Gomułka, to be published in 2008). This theoretical stipulations have found evidence in empirical results pointing to the existence of so-called "convergence clubs" (Próchnik 2006). Particularly worth stressing is the parallel process heading in opposite directions depending on the level under consideration. Martin calls these simultaneous processes "global convergence and local divergence" (Martin 2005). As he argues whereas *at the national level, (…) index of geographical concentration remains roughly constant over time (…) at the regional level geographical concentration is more pronounced and has been increasing over time.*

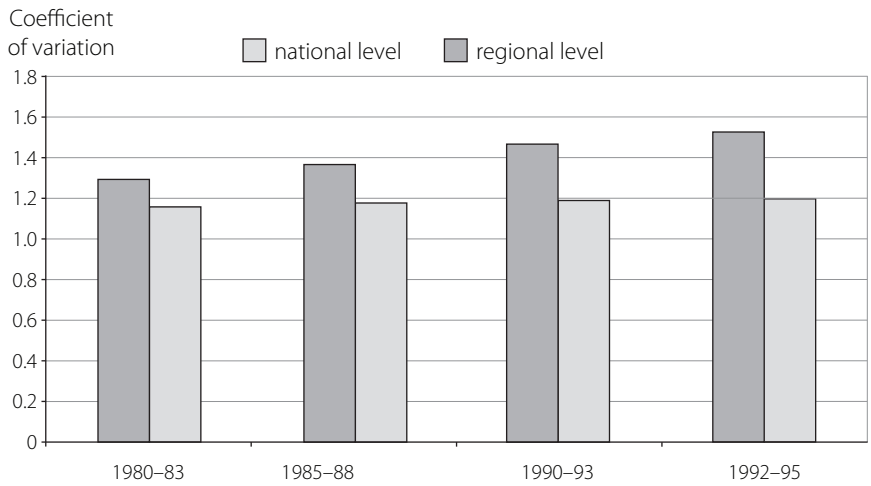


Figure 1. Geographical concentration of economic activity

Source: P. Martin (2005), *The geography of inequalities in Europe*, "Swedish Economic Policy Review", 12, p. 88.

Small initial differences in factors endowment may prove to be crucial for growth and thus irreversibly affect future development paths. These are the main premises of New Economic Geography (NGE) models (circular causality, endogenous asymmetry, catastrophic agglomeration, and locational hysteresis; Ottaviano, Thisse 2004). Thus, it seems that not only endowment itself but also internal (i.e. intra-country) spatial distribution affects future development. This paper aims at having a closer look at both endowment with knowledge-related factors and their spatial distribution in Poland and Germany.

2. METHODOLOGY

First, built upon the idea of KBE and new growth theory, this paper selects factors which then serve as framework for countries' comparison. Thus, the endowment with knowledge resources is examined at national level.

Second, the article investigates the spatial distribution of these factors. In both countries, first level of country's administrative division has been chosen, i.e. in Germany 16 Federal States and in Poland 16 Provinces. However, it shall be stressed that the regions distinguished (equal in number), represent in each case different level of EU statistical nomenclature. Polish Województwa stand for NUTS 2, whereas German Länder, due to the state size, for NUTS 1. This analysis generates information concerning knowledge landscape in each country and thus allow for comparison in terms of spatial concentration.

3. VARIABLES AND DATA

Statistical databases, predominantly Euorstat, have been used as the most reliable, comprehensive, updated and comparable source of information in this respect. Data from the dedicated section "Science and Technology" have proved to be particularly useful. Various indices have been chosen for national level investigation. To assure comparable analysis and clear visualization they are plotted in form of pentagonal charts (so called "magic pentagon")[1]. Moreover, for regional analysis, following indices have been selected:

- Gross Domestic Expenditure on R&D (hereafter – GERD), which is composed of: business enterprise expenditure on R&D, higher education expenditure on R&D, government expenditure on R&D and private non-profit expenditure on R&D.

[1] More about "magic pentagon" as a comprehensive illustration of macroeconomic situation see: Bukowski (2003).

- Total R&D personnel (hereafter – RDPERS), which encompass all persons employed directly on R&D, also those providing direct services such as R&D managers, administrators, and clerical staff.
- Human Resources in Science and Technology (hereafter – HRST), which covers individuals who have: successfully completed education at the third level in an S&T field of study or; not formally qualified as above but employed in an S&T occupation where the above qualification are required.
- Employment in high technology and knowledge-intensive sectors (hereafter – TKIS) stand for persons employed in industries regarded in Eurostat methodology as high technology sectors and knowledge--intensive services, where the definition of sector derives from R&D intensity i.e. ratio of R&D expenditure to GDP.

For each index, in every region the most updated figures have been chosen (European Commission, 2007). However, due to data availability, the reference year ranges from 2004–2007. This material has been then applied for following indices:

The Rosenbluth Index (hereafter – *RI*) is calculated in following way (Jackowicz, Kowalewski 2002):

$$RI = \frac{1}{2\sum_{i=1}^{n} is_i - 1}$$

where symbol i indicates the region's rank position, n – represents the number of regions under consideration and s stands for its share in the country's total. *RI* can range from $1/n$ to one. The maximum of 1 means the concentration in one region.

Herfindahl-Hirshman Index (hereafter – *HHI*) being well-known index is most often used to examine firm-level concentration in industrial economics (Gleeson, Ruanel, Sutherland 2006). In this respect, *HHI* is a measure of the size of firms in relationship to the industry and an indicator of the amount of competition among them. In this paper, the firm is replaced by the region and the industry by the nation. Thus the index measures the spatial concentration. It is defined as the sum of the squares of the shares of each individual region. Decreases in the *HHI* generally indicate more dispersed landscape, whereas increases imply the opposite.

$$HHI = \sum_{i=1}^{n} s_i^2$$

where, originally: *si* is the market share of firm i in the market, and n is the number of firms. Here adopted for spatial analysis *si* stands for share of region i in the country's total, and n is the number of regions. *HHI* ranges from $1/n$ to one, where n is the number of regions in

the country. Slightly modified and thus more precise formula presents spatial *HHI* by sector as being measured by (Maffiolli 2003)

$$HHI = \sum_{r=1} \left(\frac{E_{ir}}{E_i} \right)^2,$$

where E_{ir} represents employment in sector i in county r and E_i represents total employment in sector i.

The Gini Coefficient (hereafter *GC*) is a measure of statistical dispersion most prominently used as a measure of inequality of income distribution or inequality of wealth distribution. In this paper it helps assessing spatial distribution of knowledge-related factors. It is defined as a ratio with values between 0 and $(1 - 1/n)$ and is related to Lorenz curve[2]. A low *GC* indicates more equal income or wealth distribution, while a high *GC* indicates more unequal distribution. 0 corresponds to perfect equality and $1 - 1/n$ corresponds to perfect inequality (i.e. all the fund of given factor is concentrated in one region). In this paper, while estimating regional disparities, *GC* is calculated as follows:

$$GC = 1 + \frac{1}{n} - \frac{2}{n} \sum_{i=1}^{n} is_i$$

where n stands for number of regions, i indicates the firm's rank position, and s stands for region's share.

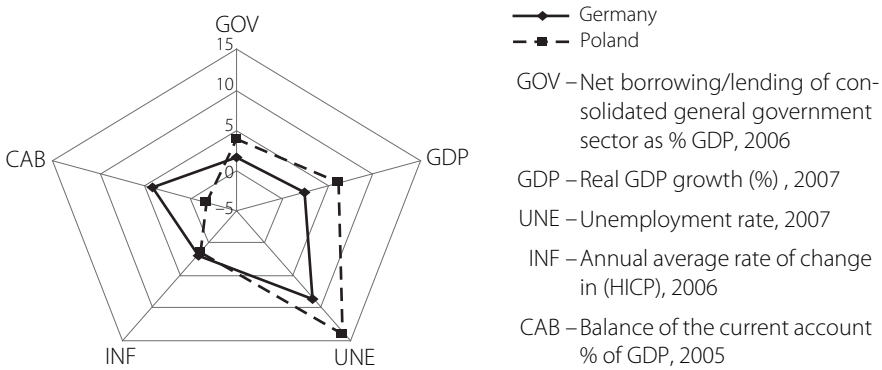


Figure 2. Macroeconomic situation in Poland and Germany 2007

Source: own elaboration.

Based on the prescribed formulas, all three indices have been calculated in excel spreadsheet. Additionally, the results are plotted on charts. Concentration curve and Lorenz curve shall depict the situation

[2] The numerator is the area between the Lorenz curve and the uniform distribution line; the denominator is the area under the uniform distribution line.

in both countries. The greater the distance between the respective curve and the 45° diagonal line (uniform distribution line), the higher the spatial concentration.

4. EMPIRICAL RESULTS

Basic analysis of macroeconomic situation in both countries indicates that Germany performs better than Poland in all aspects but one. Visualization in form of the so called "magic pentagon" makes these relations clear.

Particularly worrying is very high level of unemployment whereas Poland performs surprisingly well as far as price stability is concerned (the lowest inflation in EU27, 2007).

The very early scanning of existing statistical data points to the huge differences between both countries in terms of knowledge-based factors. However, the distance Poland has to catch up differs. Poland performs remarkably well in tertiary education. The number of students is three times higher than the EU average. Broadband access of Polish households although lower than in Germany, shall satisfy, if one bears in mind the legacy of planned economy. This suggests that Poland's ICT infrastructure is indeed catching-up. However, the existing gap is visible once knowledge indices have been plotted on pentagonal graph[3].

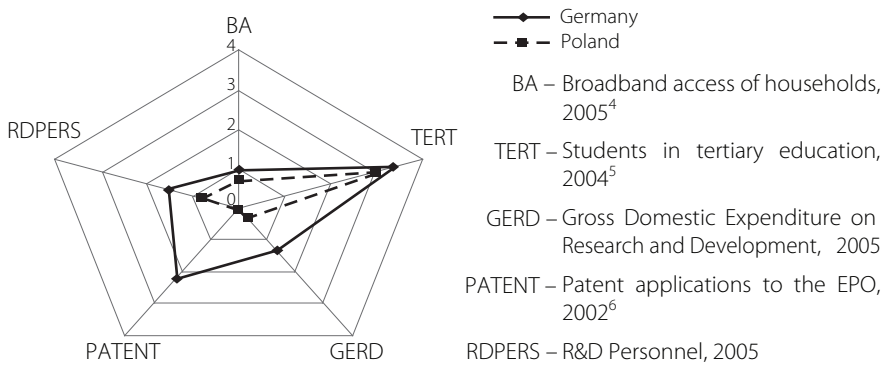


Figure 3. Knowledge factors in Germany and Poland

Source: own elaboration.

[3] All indices have been calculated with reference to the EU 25 average.
[4] Broadband access measured by the percentage of households that are connectable to an exchange that has been converted to support xDSL technology, to a cable network upgraded for internet traffic, or other broadband technologies.
[5] Tertiary education measured as persons enrolled in tertiary education ISCED levels 5 and 6.
[6] Patents application reveals number of applications field directly under the European Patent Convention to the EPO, applications are counted according to the year in which they were filed at the EPO.

Particularly severe situation exists in the field of Patent applications. Germany with 297 applications per million inhabitants outperforms Poland with barely 4.7 applications per million inhabitants nearly 60 times.

New aspects of KBE emerge when abandoning international perspective and focusing more on regions. Investigation at regional level was expected to shed more light on spatial dimension of knowledge-based economy in examined countries. It shall be stated that the make-up of leading regions for each category is relatively stable in Poland as well as in Germany. In Federal Republic top three Länder are constantly Baden-Württemberg, Bayern and Nordrhein-Westfalen, in Poland – Mazowsze, Śląsk, Małopolska and Wielkopolska. As far as top three German regions are concerned, GERD amounts to 59.01%; in Poland top three regions make up 64.21% of country's total R&D expenditures. In terms of RDPERS three best federal states have a 55.73% share in Germany's total R&D personnel, in Poland three best performers account for 50.57% share in country's total. As far as HRST is concerned, Germany "top three" make up 48.46% of country's total whereas in Poland – 39.60%. For TKIS the share of three best Länder in country's total amounts to 50.76%, in Poland – top three Provinces stand for 35.07% share. All these findings concerning "top three" shares in countries' total support the results obtained from calculating concentration indices[7].

As far as GERD is regarded, GC amounts to 0.57 in Germany and 0.63 in Poland. HHI totals 0.14 in Germany and 0.23 in Poland, and RI is 0.15 and 0.17 respectively. This is reflected in the shape and slope of concentration and Lorenz curves[8].

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[7] Poland has higher values of RI, GC and HHI indices for R&D expenditure, which is confirmed by the top three shares – 5 percentage points higher than in Germany.

[8] The visualization of obtained results may be depicted in graphs thanks to concentration and Lorenz curves. Both of them are plotted with reference to calculated indices. Their shape and slope in comparison to diagonal 45° indicates the concentration level for each respective index. The more concave the concentration curve and convex the Lorenz curve the more polarized is spatial distribution of a given factor. The pictures obtained confirm earlier results estimated by three coefficients. Vertical curve stands for cumulated shares, which add up to 1, whereas horizontal one represents 1/n for Lorenz curve and subsequent order numbers N in concentration curve.

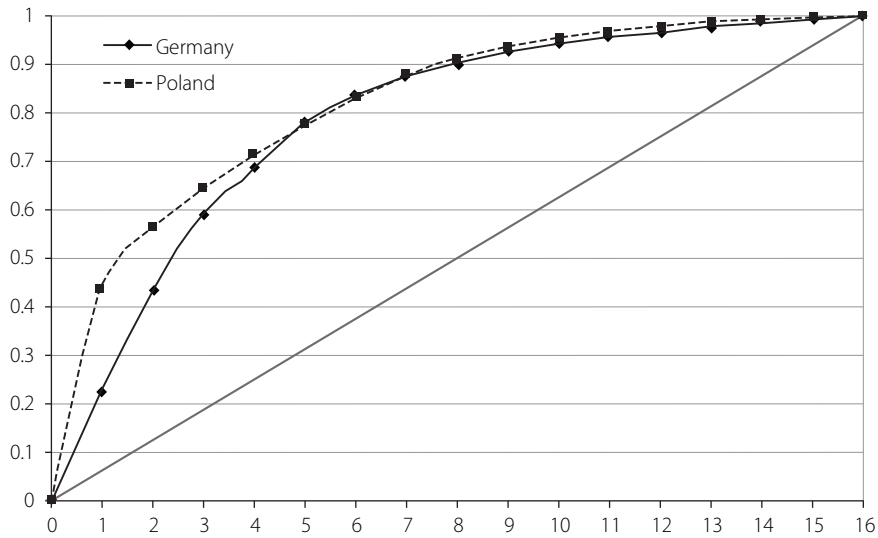


Figure 4. GERD in Poland and Germany – concentration curve

Source: own calculations.

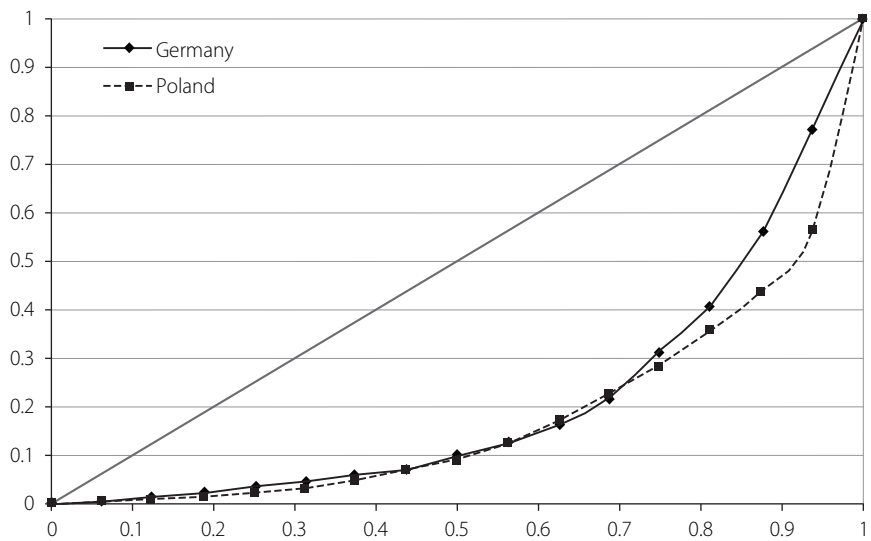


Figure 5. GERD in Poland and Germany – Lorenz curve

Source: own calculations.

Regarding RDPERS, concentration indices in Germany amount to: HHI = 0.13, GC = 0.51, RI = 0.13; in Poland they respectively come to: HHI = 0.13, GC = 0.49, RI = 0.12. Graphs below illustrate these values.

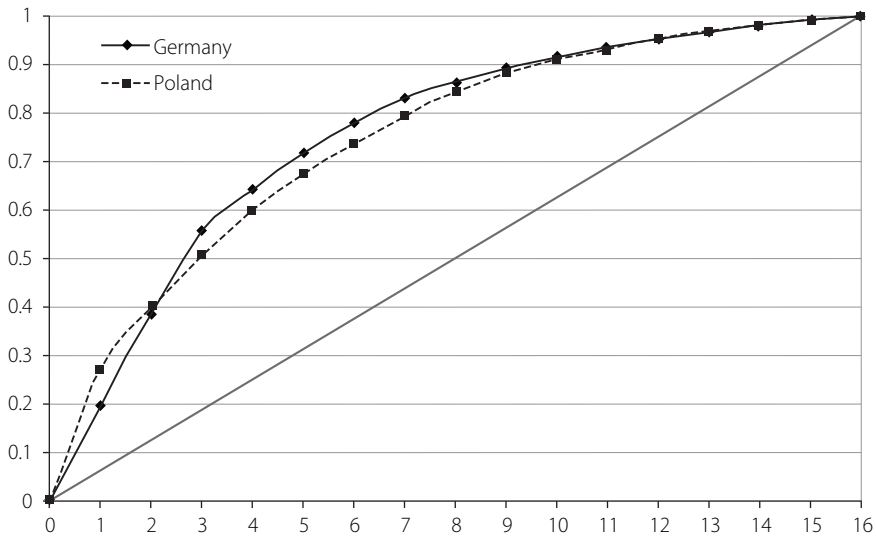


Figure 6. RDPERS in Poland and Germany – concentration curve

Source: own calculations.

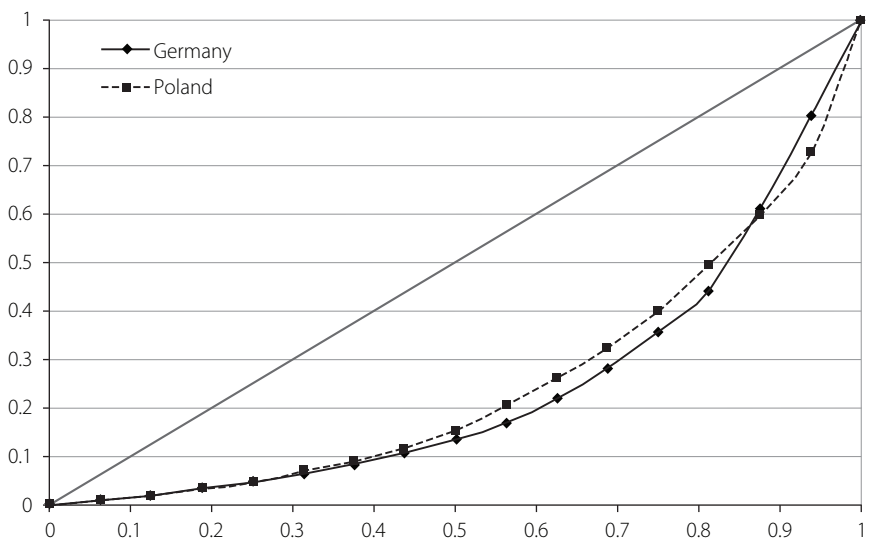


Figure 7. RDPERS in Poland and Germany – Lorenz curve

Source: own calculations.

As far as HRST is concerned, calculated indices in Germany are equal to: HHI = 0.10, RI = 0.11 and GC = 0.44; whereas in Poland they come to: HHI = 0.09, RI = 0.09 and GC = 0.33.

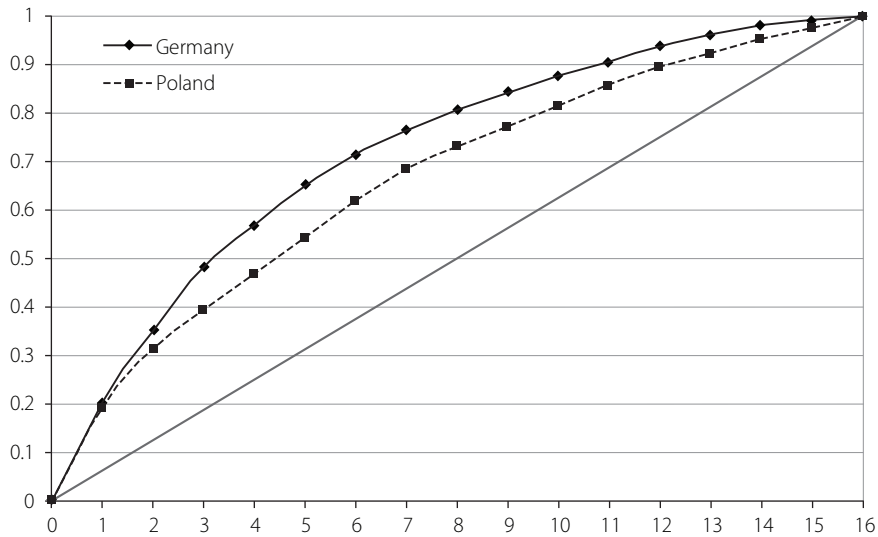


Figure 8. HRST in Poland and Germany – concentration curve

Source: own calculations.

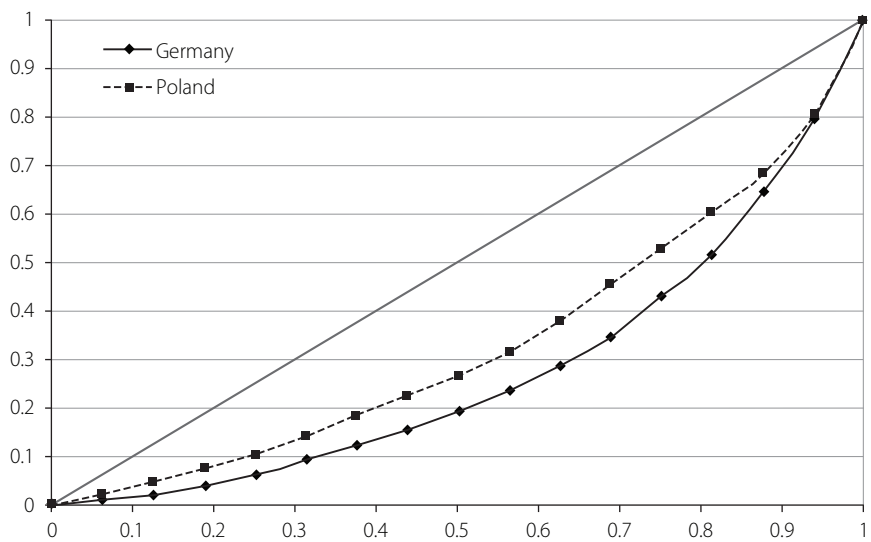


Figure 9. HRST in Poland and Germany – Lorenz curve

Source: own calculations.

Finally, indices estimating TKIS spatial concentration reach following values: HHI = 0.11, RI = 0.12, GC = 0.46 in Germany and HHI = 0.08, RI = 0.09, GC = 0.28 in Poland. This situation is illustrated by concentration and Lorenz curve.

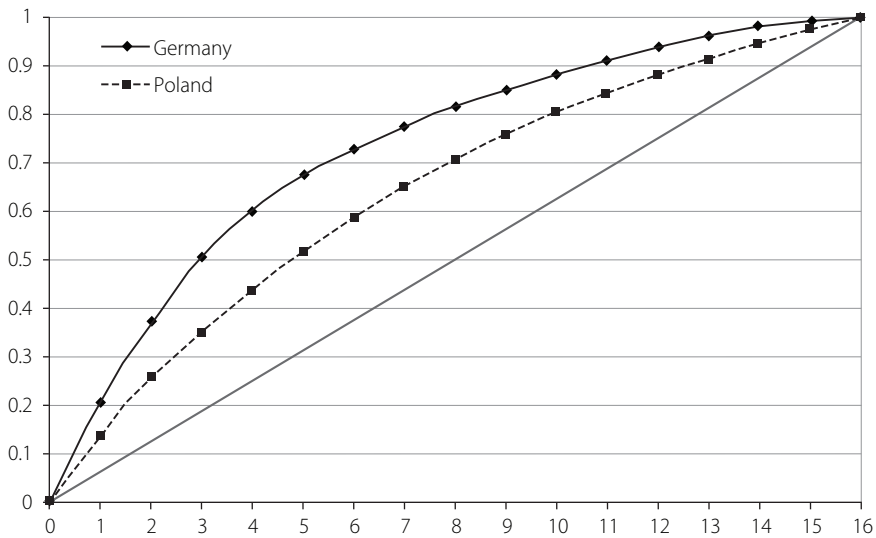


Figure 10. TKIS in Poland and Germany – concentration curve

Source: own calculations.

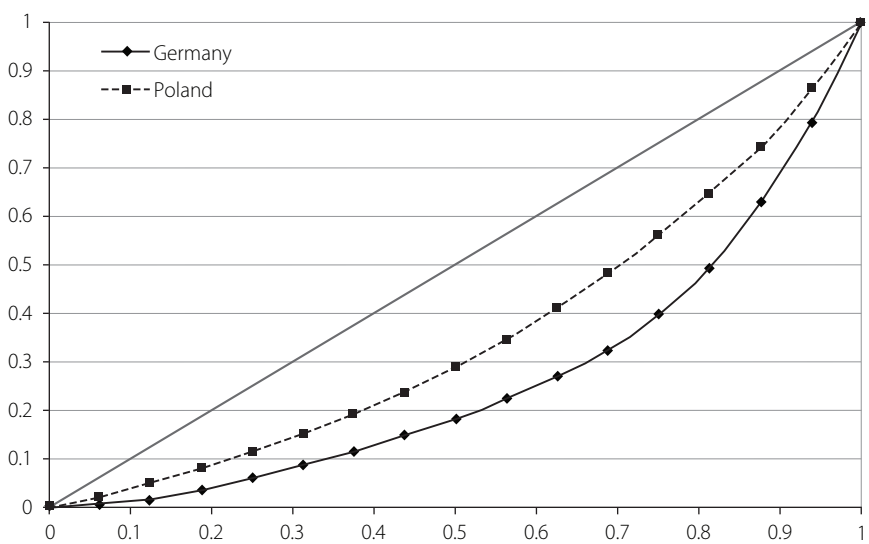


Figure 11. TKIS in Poland and Germany – Lorenz curve

Source: own calculations.

Seen from another perspective it seems that in both countries most spatially concentrated factor is GERD, followed by RDPERS.

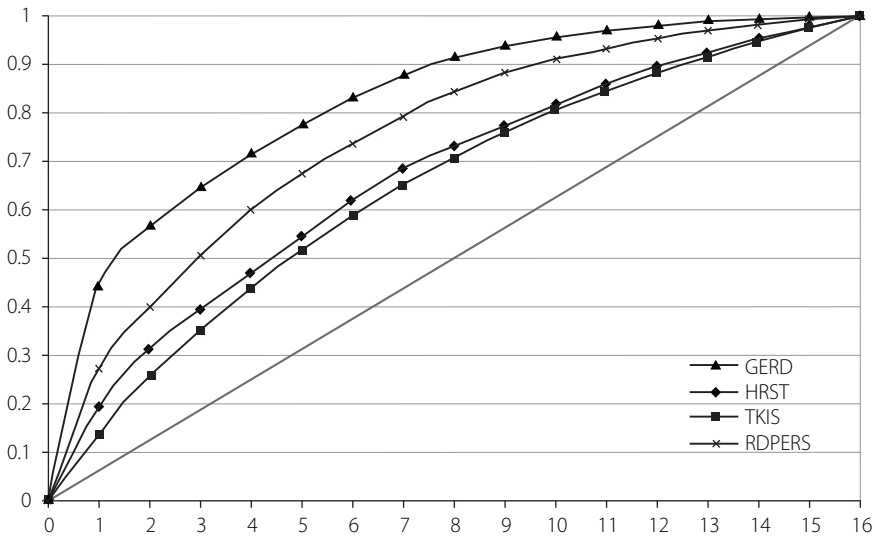


Figure 12. Knowledge factors in Poland – concentration curve

Source: own calculations.

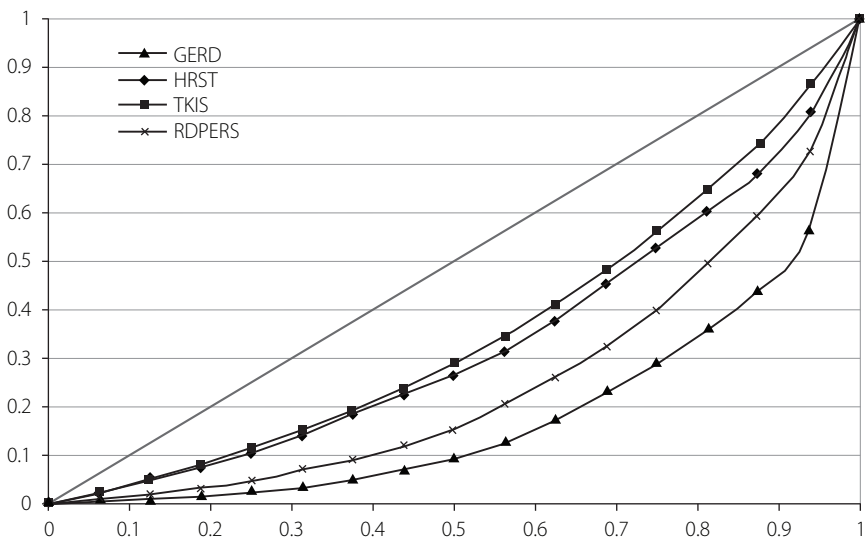
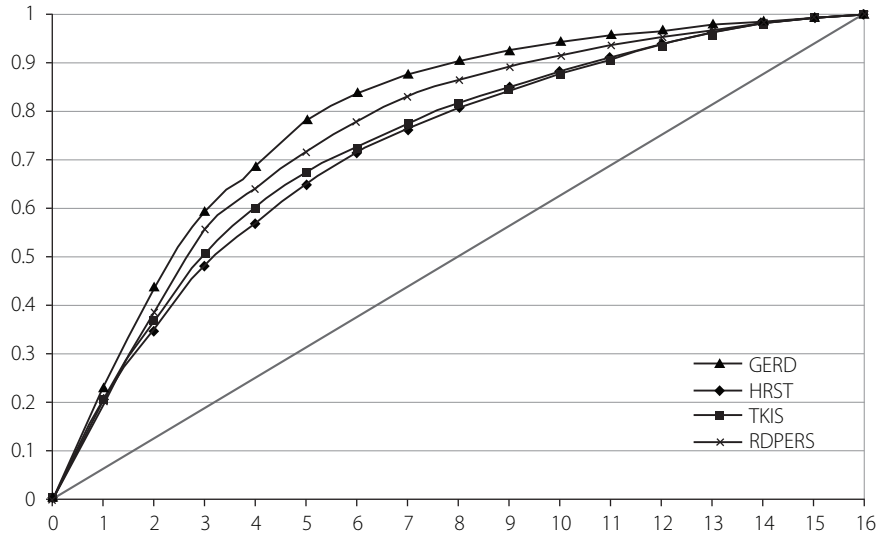


Figure 13. Knowledge factors in Poland – Lorenz curve

Source: own calculations.



Source: own calculations

Figure 14. Knowledge factors in Germany – concentration curve

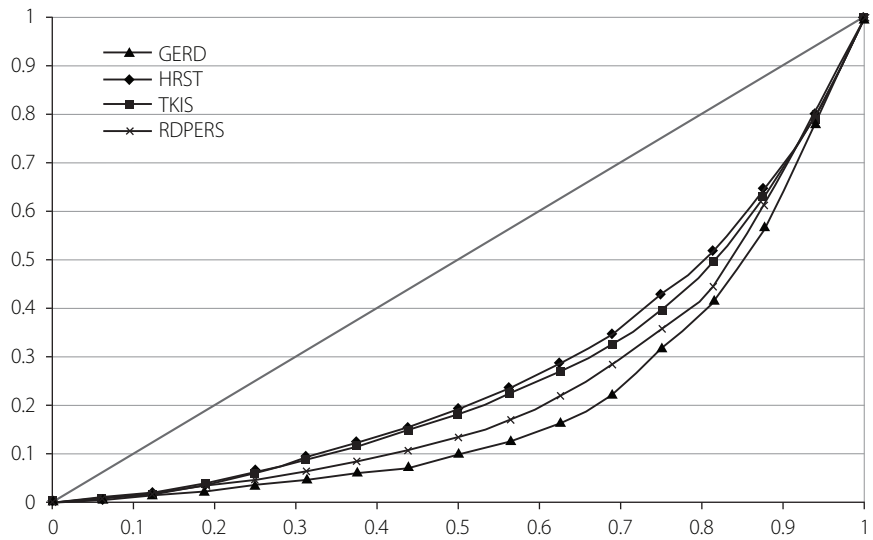


Figure 15. Knowledge factors in Germany – Lorenz curve

Source: own calculations

Calculated concentration indices suggest that Poland and Germany differ in terms of spatial distribution of knowledge factors.

5. CONCLUSIONS

Employing the most updated and reliable data from Eurostat this paper started with investigating Germany's and Poland's readiness for knowledge-based growth. Analyses at national level undoubtedly indicate Germany leadership in this respect. Expenditures earmarked for R&D, personnel employed in this sector, as well as number of patent applications are significantly higher than in Poland. However closer look at internal situation in both countries delivers interesting results. Based on the assumption that the more equal is the spatial distribution, the more evenly the future growth will be spread, comparison of spatial distribution of above-mentioned factors across Länder and Województwa proves that Poland performs better in terms of regional cohesion. More dispersed knowledge base may thus stipulate more regular growth, whereas in Germany the potential seem to be more concentrated.

Conducted analysis revealed that Poland is more polarized in terms of GERD. In remaining three categories RDPERS, HRST and TKIS concentration indices for Germany are slightly higher. Additional complementing analysis proved that Germany "11" (i.e. consisting only of old Länder) would be even more polarized. The values of calculated HHI and RI have confirmed it. Thus, one may argue that Reunification has brought more dispersion to the German knowledge landscape. Moreover, pattern revealed in both Poland and Germany suggests that the most concentrated are R&D indices, i.e. personnel and expenditure. The possible explanation may be derived from the R&D activities being academic-oriented and usually clustered around big cities. Since HRST and TKIS seem to be more industry-related, they are more widespread and aren't limited to universities' labs.

It is difficult to draw more precise conclusions at this general level of analysis. Since this paper only touches upon the spatial questions regarding knowledge-based economies, further research are desperately needed.

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PART IV

ICT AS DRIVER OF KNOWLEDGE-BASED ECONOMY AND COMPETITIVENESS

Aldona Frączkiewicz-Wronka
Agata Austen
Martyna Wronka

KNOWLEDGE MANAGEMENT IN HEALTH CARE: SILESIAN EXPERIENCES OF ICT APPLICATION

1. INTRODUCTION

The industrial revolution of the 19th century and the scientific revolution of the 20th century have prepared the ground for the rise of the knowledge-based economy and played a pivotal point in the global development process. Knowledge for a long time has been known as an important factor in economic growth and nowadays economic activities connected with the production and use of information and knowledge have become an engine of economic growth in the developed market economies. These economies are more strongly dependent on the production, distribution and use of knowledge than ever before (United Nations Economic Commission for Europe, 2002).

The Knowledge Economy is emerging from two defining forces: the rise in *knowledge intensity* of economic activities, and the increasing *globalisation* of economic affairs. The rise in knowledge intensity is being driven by the combined forces of the information technology revolution and the increasing pace of technological change. Globalisation is being driven by national and international deregulation, and by the IT-related communications revolution. However, it is important to note that the term "Knowledge Economy" refers to the overall economic structure that is emerging, not to any one or combination of these phenomena (Sheehan, Tegart 1998).

Since the early 1990s, various businesses have embraced "knowledge management" into a discipline that focuses on bringing together people, processes, and technology in a systematic way. Knowledge, based on information and supported by cultural and spiritual values, has become

an independent force and the most decisive factor of social, economic, technological and cultural transformation. The emerging knowledge-based economy has been affecting other areas of societal activity in every country, including health care (Guptill 2005). It is self-evident to claim that the sphere of health care is subject to certain economic mechanisms, though not within its entire scope and in a specific way. Investing in health and its protection equals investing in the development of the civilization and in human capital, the latter being one of the major determinants of the economic and social development of regions and countries (Sheehan, Tegart 1998).

As a result of mentioned changes, the economy becomes a hierarchy of networks driven by the acceleration in the rate of change and the rate of learning. What is created is a network society where the opportunity and capability to get access to and join knowledge- and learning-intensive relations determines the socio-economic position of individuals and firms (David, Foray 1995). This study focuses on the health sector organizations and processes of knowledge management that take place in the context of health care networks. This article presents the idea behind the Regional Health Care Network (RHCN) as the instrument of effective management of the health care sector in the region and its possible implementation into the structures of the regional (voivodeship) self-government in Poland.

2. DOES HEALTH CARE NEED KNOWLEDGE MANAGEMENT?

The IT revolution has strengthened the progress towards knowledge codification, and enlarged the share of codified knowledge in the knowledge stock of advanced economies. Hence, all existing knowledge that can be codified and reduced to information may be transmitted around the world at comparatively low cost (Soete 1997). Therefore, knowledge is obtaining more of the properties of a commodity as market transaction can be facilitated by codification, and the dispersion of knowledge had increased it speed. Codification is also reducing the significance of supplementary, duplicative investments in acquiring knowledge. It is creating bridges between fields and areas of competence and reducing the "dispersion" of knowledge. These developments promise an acceleration of the rate of growth of stocks of accessible knowledge, with positive implications for economic growth (David, Forey 1995).

Knowledge management in health care may be described as "aligning people, processes, data and technologies to optimize information, collaboration, expertise, and experience in order to drive organizational performance and growth". The interest in knowledge management and development of information technology brings opportunities as well as challenges for public health practitioners. There are multiple benefits of managing knowledge for clinicians, public health officials and citizens

(patients): (1) the coding and sharing of best practices, (2) the creation of corporate knowledge directories, (3) the creation of knowledge networks, and (4) gathering summary, comparative, and detailed data from distributed sources for collective analysis (Le Rouge, Niederman 2006). Yet being able to managing knowledge is necessary to (1) expand national and worldwide public health information clearinghouses; (2) integrate public health and clinical care; and (3) include sensitivity to issues of security and privacy (Yasnoff et al. 2001).

Public health knowledge management requires knowledge creation, storage/retrieval, transfer, and application components. Knowledge creation means both the transformation of data and the development of new knowledge as a result of conducted research that conceptualizes and refines these data into useful forms. For knowledge storage and retrieval, strategies for organizing knowledge holding and maintaining that knowledge physically and electronically are needed. Knowledge dissemination includes identifying the location of relevant information and distributing it effectively, using push and pull strategies to proactively distribute it where it can be useful. The final process is the application of components in a both straightforward way as variance analysis (which compares local performance on a given metric with an overall statewide measure) and using complex as sophisticated algorithms for forecasting epidemiological trends (Le Rouge, Niederman 2005).

The need of knowledge sharing entails number of challenges for public health agencies, for which the major goal is meeting the needs of both users and creators. Development of knowledge management systems is necessary for the possibility of being able not only to disseminate the information managing the knowledge in a systematic and systemic way (Le Rouge, Niederman 2005). Public health information and knowledge systems are characterizes by: (1) a primary concern for the health of populations rather than individuals; (2) a focus on prevention rather than treatment; (3) a concern for all stages in the causal chain including social, behavioral, and environmental influences on health; and (4) a concern for government and policy issues regarding the health of populations (Yasnoff et al. 2001). Developing knowledge management systems in health care entities requires balancing of (1) a business strategy that describes what the organization hopes to achieve in its market, (2) an operating strategy that assesses and defines how it hopes to achieve it and (3) information strategy which describes where information technology is needed to enable what the organization hopes to achieve and how it hopes to achieve it (Zazzara 2001).

The determinants of success of organizations, and of national economies as a whole, is ever more reliant upon their effectiveness in gathering and utilizing knowledge. Organizations including health care entities must become learning organisations, continuously developing skills needed to accommodate new technologies and grasp new opportunities

to incorporate knowledge management systems. They will be increasingly joined in networks, where interactive learning involving *creators, producers and users* in experimentation and exchange of information drives innovation (David, Foray 1995).

Knowledge management may be perceived as antithetical process to care delivery. While knowledge management is connected with tools, expert systems, and CRM (Customer Relationship Management) system, in which the worker touches keyboards rather than human being with a pulse, hand health care delivery is a high-human touch labor. A major part of the job is being with patients and laying hands on them for therapeutic, interventional, or comfort/caring reasons. Knowledge management practices are not embraced widely in the health care industry (Zazzara 2001).

3. NETWORKING AND THE REGIONAL PERSPECTIVE OF THE HEALTH CARE SYSTEM

Institutions providing public health services play dual roles as both users and creators of health information. As users, they identify and gain knowledge from many different sources, as creators, they gather information and disperse it to other agencies involved in supporting public health. In result, public health institutions interact with a wide range of dispersed entities creating network (Le Rouge, Niederman 2005). Large number of studies have recently emphasized the importance of networks for the formulation and implementation of public policy. The interest in networks is the result of pace and the quality of social change. In the world based on individualization, dispersed power and unification, networks produce results that could not be achieved by a single organization. Networks refer typically to multiorganizational arrangements for solving problems that cannot be achieved or achieved easily by a single organization. Networks are a unique institutional form consisting of processes different than the spontaneous coordination of markets or the visible management of hierarchy (Agranoff, McGuire 2001). Network may be understood as a "pattern of interdependence among social actors in which at least a portion of the links are framed in terms of something other than superior-subordinate relations" (O'Toole, Meier 2004).

Networks and geographical clusters of organizations are a particularly important feature of the knowledge economy. Organizations find it increasingly necessary to work with other firms and institutions in technology-based alliances because of the rising cost, increasing complexity and widening scope of technology. Many companies are becoming multitechnology corporations located around centres of excellence in different countries. Despite improved capability for global communication, organizations increasingly co-locate because it is the only effective way to share

understanding and tactic knowledge (Cantwell 1991). Consequently, skills and life-style are becoming increasingly important locational factors:

> *As we enter the age of human capital where firms merely lease knowledge-assets, firms' location decisions will be increasingly based upon quality-of-life factors that are important to attracting and retaining this most vital economic asset. In high-tech services, strict business-cost measures will be less important to growing and sustaining technology clusters… Locations that are attractive to knowledge assets will play a vital role in determining the economic success of regions* (DeVol, 1999).

The meaning of networking and knowledge has been emphasized in the Lisbon Strategy, the dominant way of development in the European Union. The main advantage of that approach is the emphasis on the fact that the idea should be materialized not on the national level, but also on the regional one[1]. The region as an economic and spatial system covers a specific portion of the economic space distinguished from the surrounding environment, permanently inhabited, managed and controlled by a specific community. The modern theory of organization and management inspires the direction of evolution of the strategic thinking about the leading determinant of regional development from the management of material resources towards the management of knowledge-based economy, the level of which determines the depth of the synergy effect while its productive use enables gaining competitive advantage. It is therefore necessary to base regional management on the production, transfer and absorption of knowledge as the determinants of generating added value (Hughes 2003).

Fulfilling the health demands of citizens which are within the scope of public health is one of the crucial areas of development from the perspective of both the state and the region. The development of a rational system of managing the health care sector presents a number of challenges for the decision-makers and executors of the idea, among which the major one is to introduce the passable system of receiving medical services. This requires introducing uniform instruments which would confirm access to the services and their scope within all the countries in the Community as well as developing the electronically integrated database with the information on the patients' medical statuses (Garrido 2005)[2].

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[1] Essential elements of the innovation processes in the regions are provided for in the National Development Plan 2007–2013.

[2] Obviously the basic formal requirement is to make the procedures uniform enough to enable their comparison regardless of the current and previous place of residence of the person willing to receive medical service, as well as to render the information accessible 24/7. To meet these requirements, since 2003 the European Commission has been working on the development of the European Health Insurance Card. Introducing the card would be tantamount to actually implementing the idea of free movement of people and establishing the system without borders, which is the primary goal behind developing the Information Society.

Modern management of health care means that the sector must be transformed to meet the basic criteria of rational action, i.e. be effective and offer the desired quality and level of access to health services. This requires, among others, establishing a suitable information instrument to be used to distribute aggregated data using state-of-the-art communication methods. At present, information is aggregated in different institutions and the scope of that information and its usability for the entities operating in the sector and the individual citizens is diversified. The major data-aggregating institutions include the Public Health Centres on the part of the public administration transformed from the Voivodeship Methodological Health Care Groups, and the branches of the National Health Fund on the part of the payers. A separate group of data are those compiled by the institutions rendering widely understood medical services, since they are forwarded partially to the two groups of entities referred to above, but also retained for individual purposes to improve the management processes in the aggregating institutions.

Despite the extensive range of data aggregation, the missing element is a uniform system, which would accumulate all the existing information on health care on the regional level and establish the grounds for formulating and realizing the rational health care policy. The solution to this problem may be the Regional Health Care Network (RHCN) that has been implemented successfully in many European countries. It is emphasized in the definition of the concept that the Regional Health Care Network connects different medical establishments in the region, enables access to and exchange of electronic information between hospitals, general practitioners, patients, healthcare centres, laboratories and other health institutions in the region. Therefore, RHCN is an excellent instrument of managing the health care sector in the region since it establishes common ground between all the actors engaged in the system.

4. IMPLEMENTING THE IDEA OF KNOWLEDGE MANAGEMENT IN THE REGIONAL HEALTH CARE NETWORK: EMPIRICAL STUDY

Determining possibilities of knowledge management in the RHCN was the subject of the multidimensional analyses carried out during the research project called *Regionalna polityka ochrony zdrowia* (*Regional Health Care Policy*)[3]. The empirical study undertaken as one of the stages

[3] *Regionalna polityka ochrony zdrowia* (Regional Health Care Policy), No. 2 HO2E05924, grant supervisor: Professor Aldona Frączkiewicz-Wronka, Ph.D., Katowice University of Economics.

of the research project was divided into two stages: categorized open-ended interviews with the individuals who met the selection criteria and questionnaire survey carried out by the auxiliary enterprise at the Silesian Public Health Care Centre. The interviews were carried out between 17th and 18th June 2004 in Nowogród during the training conference on health care in the policy of self-governments. The interviewees were experts in the field of health care policy realized by self-government bodies. The survey was carried out between December of 2004 and April of 2005 among the managers of the county self-government units in the Silesian Voivodeship, where there are 36 counties[4] and independent cities. The total of 41 correctly filled in questionnaires were returned. For the purposes of this study, only simple distributions of answers concerned with the possibility to introduce the RHCN as a management instrument were characterized.

The decision-makers engaged in the formation and realization of the health policy on the level of the council were asked to assess accessibility of the data which may be used as effective management instruments. The majority of the respondents emphasized that in the Silesian Voivodeship the information regarding health care is available from a number of sources. All the credit for that goes to a chief voivodeship medic and later the Director of the Silesian Health Fund, doctor Andrzej Sośnierz, whose passion to create a cohesive and comprehensive information system and, consequently, to thoroughly computerize the health care institutions was decisive for the highly favourable situation of the Silesian region in the discussed aspect. Yet while 28% of respondents claim that information is easily accessible, 69% find information hardly accessible.

Unfortunately, the situation was not assessed in equally favourable tone when it came to the question about the coherence of information acquired from different sources. The majority of respondents (23 out of 41 individuals) would point to incoherence of information, a commonly observed flaw of the system, pointed out in the previous works on the subject as well.

A way to fix the flaw referred to above could be establishing new institutions or expanding the scope of competences of the existing institutions engaged in collecting information; hence the question about establishing "voivodeship databanks". Developing such an instrument to support the options of making rational decisions in the health care sector has been regarded as important and urgent by 87% of respondents.

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[4] The "county" here is meant as "powiat", i.e. second-level unit of administrative division of Poland; the "independent city" is a city forming the individual administrative unit having the rights equivalent to the country.

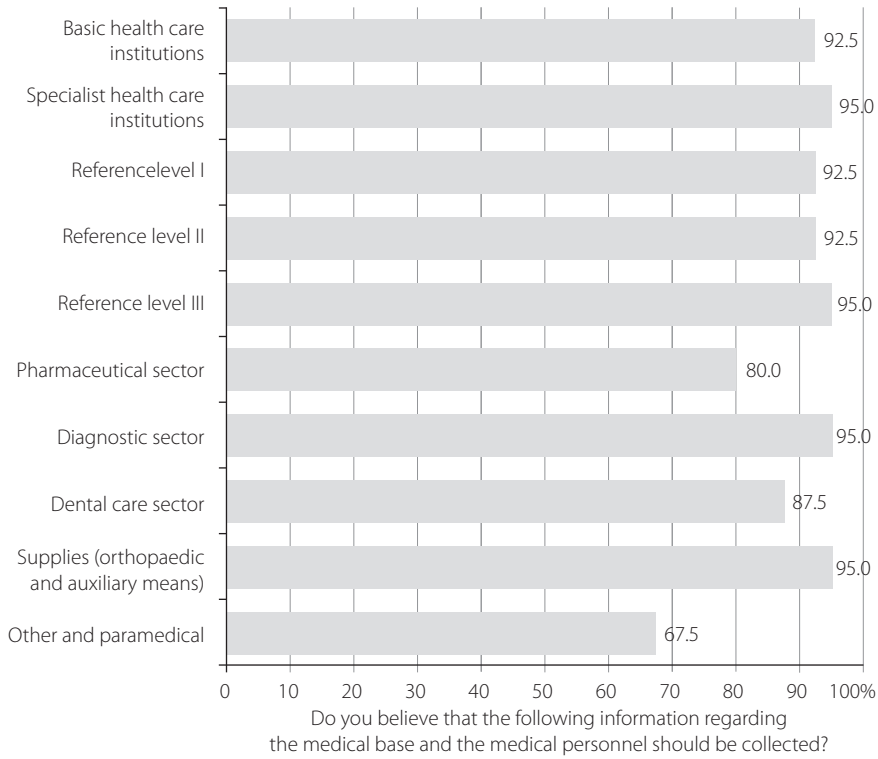

Figure 1. Assessment of the need to collect the data on the medical base and personnel to be available from the system

Source: *A report on the completion of the project: Regional health care policy*, No. 2 HO2E05924, Katowice 2006.

More in-depth deliberations on the hypothetical content of the voivodeship database were proposed in the following question where the respondents pointed to the health care institutions, which would be obliged to submit any and all information whatsoever to such a database (Figure 1).

The problem of effectiveness is the key issue for the formulated and realized health policy in the national and spatial arrangement; hence the question to the respondents to point to the problems concerned with the health care system, the knowledge of which has considerable effect on shaping effectiveness of a health care institution. From the point of view of the decision-makers in charge of the health care system on the level of the county, practically all information categories except for those concerned with the pharmaceutical market are considered important for the formation and realization of the local and regional health care policy. It is therefore necessary to gather information on the services provided by the basic health care institutions, the services rendered by

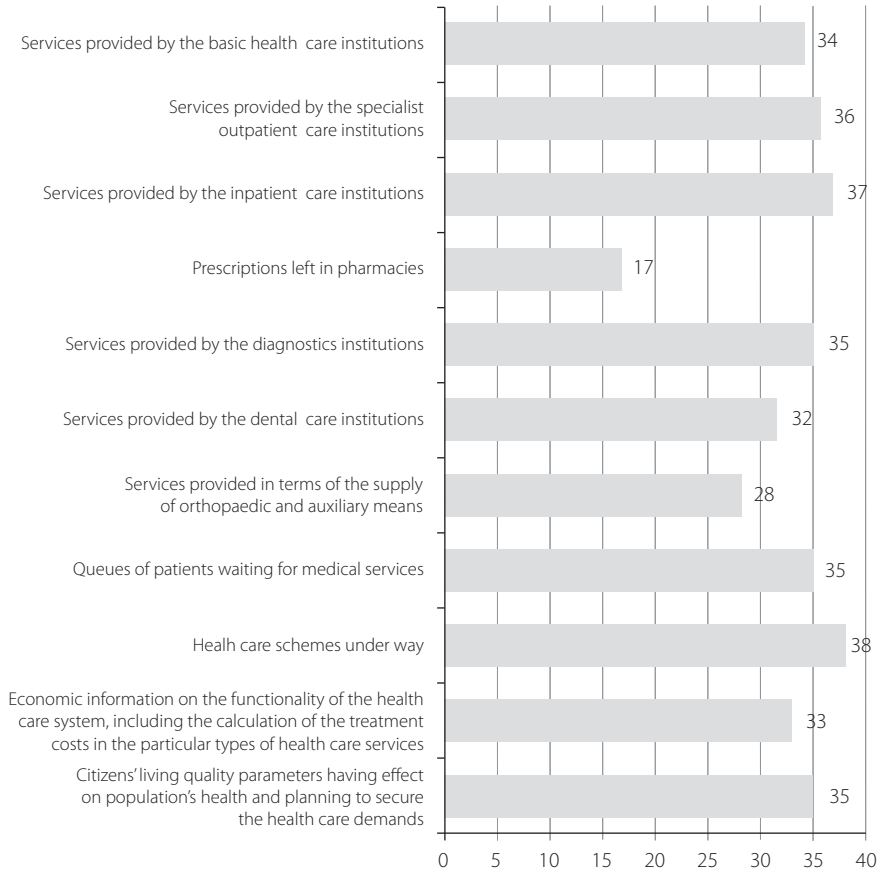

Figure 2. Assessment of the demands for collecting information regarding effectiveness

Source: *A report on the completion of the project: Regional health care policy*, No. 2 HO2E05924, Katowice 2006.

the specialist outpatient care centres, the inpatient care services, the diagnostics institution services, the dental care institution services, the supply of orthopaedic and auxiliary means, the queues of patients waiting for services, the health care schemes under way, the economic information on the functionality of the health care system including calculations of the treatment costs in the particular types of medical services and the parameters of living quality of the citizens, which have influence on population's health and planning the provision of health services. Considering all these types of information as significant for the quality of the local and regional health care policy is extremely valuable and symptomatic, since it points to the growing interest in the economics of health care as a practical discipline, which becomes increasingly "popular" in territorial self-government units (Figure 2).

The respondents strongly emphasized the need to increase the volume of available data and pointed to the requirement to extend statutorily the scope of aggregated information which, when used in a rational way, could become an instrument for optimizing the management of the resources of the health care sector within the range of the actions undertaken by public entities as well as add to effective management of the independent public health care institutions and the non-public health care institutions. Obviously, this would be an evident example of improving the quality of medical services and making them more accessible.

Should it be necessary to acquire information on the effects of the actions undertaken by the establishments and institutions in the system, the decision-makers on the level of the county must also be asked about their current knowledge regarding the health care sector. As pointed out above in this section, the Silesian Voivodeship is among the areas in Poland where diverse methods of acquiring, aggregating and utilizing information for the purposes of managing the health care sector have been implemented practically since the beginning of the 1990s. Despite the potential richness of the sources of information, many respondents evidenced certain shortages in this sphere and, interestingly enough, the majority of them would point to uselessness of particular sources of knowledge in their professional work.

The need to find a new way to collect data and develop other ways of their utilization than the existing ones was reflected in the distribution of answers to the question about extending the rights of the Silesian Public Health Centre, the institution prepared statutorily for such processes.

The respondents would emphasize the need to expand the rights of this institution, though at the same time they were rather sceptical about the proposal to establish the Regional Public Health Institute as the voivodeship institution engaged in the formation and control of the regional health care. However, systemic solutions must be developed, based on the solutions applied in a number of countries in the European Union, making use of the modern communication technologies as the basic carrier for the transmitted information. The vast majority of respondents (97%) emphasized the need to build a regional portal which would be used to gather all information being potentially useful in the sphere of rational health management and made available to the decision-makers, the service providers, the medical professionals and the patients.

A typical solution in this aspect for many countries in the EU is the Regional Health Care Network, an extremely efficient and effective system management instrument. Unfortunately, neither the notion nor the principles governing the solution are familiar to those who are professionally engaged in the organization of the regional and territorial

health care. The notion of RHCN was not familiar to 75% of respondents.

The respondents pointed to a number of obstacles for launching the Regional Health Care Sector as an instrument for effective management of health care in the region. They emphasized financial shortages (82.5%) and the lack of the reference concept on both central (77.5) and voivodeship levels (62.50).

5. CONCLUSIONS

The modern theory of organization and management inspires the direction of evolution of the strategic thinking about the leading determinant of regional development from the management of material resources towards the management of knowledge-based economy, the level of which determines the depth of the synergy effect while its productive use enables gaining competitive advantage. It is therefore necessary to base regional management on the production, transfer and absorption of knowledge as the determinants of generating added value (Hughes 2003).

Changing from administration into public management paradigm fosters the implementation of management rules and attracts attention towards effectiveness and development. This approach means introducing the idea of public management in the social reality, since *as understood dynamically, public management is about the realization of public programs which fulfil the essential social needs. Therefore when we speak of public management, we face the problem of social innovation. What we call innovation is the intentional change introduced within the social system, being new to the system, resulting from the decision-making process targeted at solving the problem which originated in the course of functioning of that system, and leading to changing the existing structure of the system* (Górniak 2001).

It is particularly important for proper understanding of the essence of shifting from administration to management in the public sphere, and hence also for a different perception of the problem of effectiveness, to understand the role of today's public sector and its importance for the global development of societies. In result of this shift health care organizations are under pressure of improving cost, quality, efficiency and effectiveness while being responsive to external influences such as customers, competitors, suppliers and changing industry standards. Health care organizations need to respond to patient needs, the community's needs, stakeholders, government policy and changes in medical, clinical and patient care practices (Van Beveren 2003).

In order for the health care system to be effective and socially acceptable, it should take into account economic capacity of the state, the socio-economic doctrine complied with as well as the environmental and

medical hazards for the population, while the role of the state is to maintain consensus between the expectations of its citizens and the capacities of that state and to look for such methods of resource management that would ensure effective use of these resources. An important element in undertaking the actions targeted at creating the best health care policy and maintaining effectiveness of the health care management system in the region is the possibility of applying knowledge management into the regional health care networks. Knowledge management practices are not very common in the healthcare industry. The underfunding of the industry explains this situation to some extent. Nevertheless, the low rate of adoption of knowledge management systems among hospitals has not only to do with the cost of technology and access to data, yet may be the result of resistance to change. Future research might examine readiness of the health care systems with regard to the attitude towards knowledge management.

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Marcin Kraska

THE STATE AND PERSPECTIVE OF DIGITAL ECONOMY IN POLAND – RELATIVE TO OTHER EU MEMBER STATES

1. INTRODUCTION

The development of information infrastructure does not guarantee coordinated development of e-commerce, however it gives it a technological platform. The progress in e-commerce depends mainly on the ability to use the infrastructure, which involves need of implementation of legal rules, services, applications and standards used by information society, companies and public administration. It is the main driving force behind e-commerce development, which has to be supported by research on changes, chances and barriers of e-commerce. The monitoring of e-commerce gives the opportunity to present its state of the art and also to define some directions for further work.

The aim of this article is the presentation of the current state, opportunities and barriers of e-commerce development in Poland. The content of the article was elaborated on the basis of the results of the nationwide studies conducted by the Institute of Logistics and Warehousing, Central Statistical Office and published in annual report titled *Elektroniczna gospodarka w Polsce – Raport 2006*.

2. INTERNET USAGE IN POLAND

The national initiatives and investments made in infrastructure and education during the recent years became the main motor of further development of information society in Poland. It is possible to observe the stable increase of Internet users from year to year.

Internet usage by Poles

The active usage of the Internet was declared by 40% of Poles of the age of 16 to 74. Over 60% of them were younger than 35 years. Taking education into account, 78% of people with higher education, 34% of people with secondary education and 32% of people with primary education used Internet in 2006.

Internet usage in Polish households

Private access to the Internet at home becomes a common service in Poland. The competition on the market starts to be stronger and in consequence the price of this service decreased. 36% of households in Poland had the access to the Internet. Comparing to the level of EU countries, Poland is still far away from the leader of the ranking

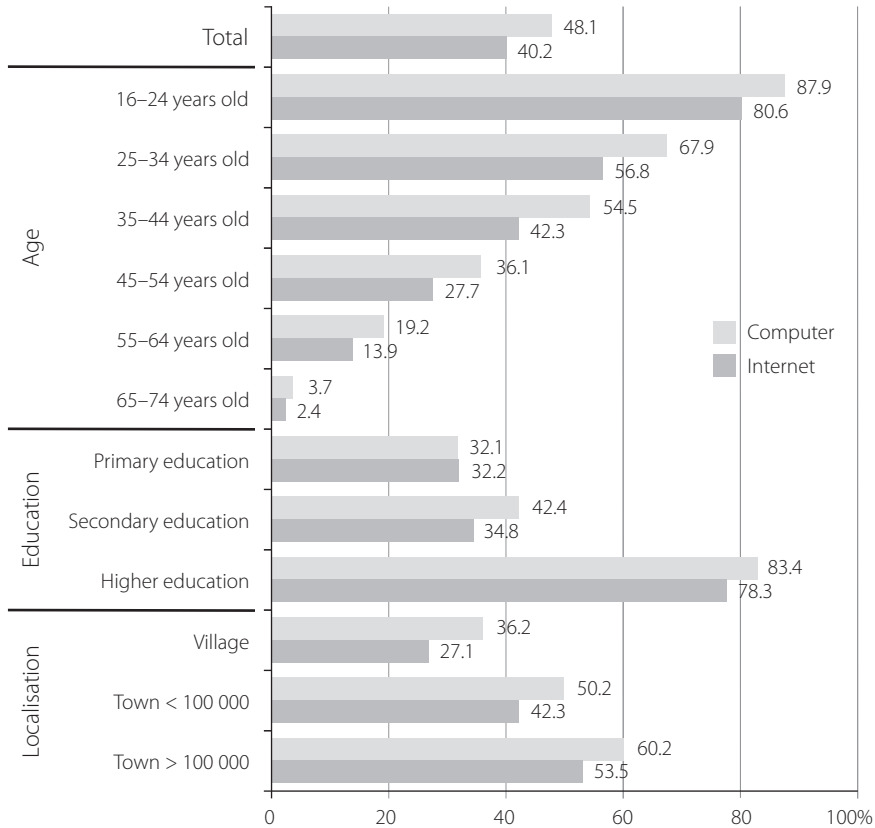

Figure 1. Internet usage and computer possession

Source: *Elektroniczna gospodarka w Polsce – Raport 2006*.

(Island 83%) but comparing the list of countries of the highest growth in the latest year of internet usage, Poland is one of the leaders with 20% of growth.

Considerable difference occurred also regarding the use of the Internet in towns and in the country. No more than 18% of households in the country had the access to the Internet, while almost 48% of households in towns had it. There were three main barriers preventing households from using the Internet: no need of Internet (28%), high costs of hardware (23%) and high cost of connections (22%).

Purpose of Internet usage

The interest in the services available by the Internet such as buying goods, services and banking increased from year to year. Mainly, the

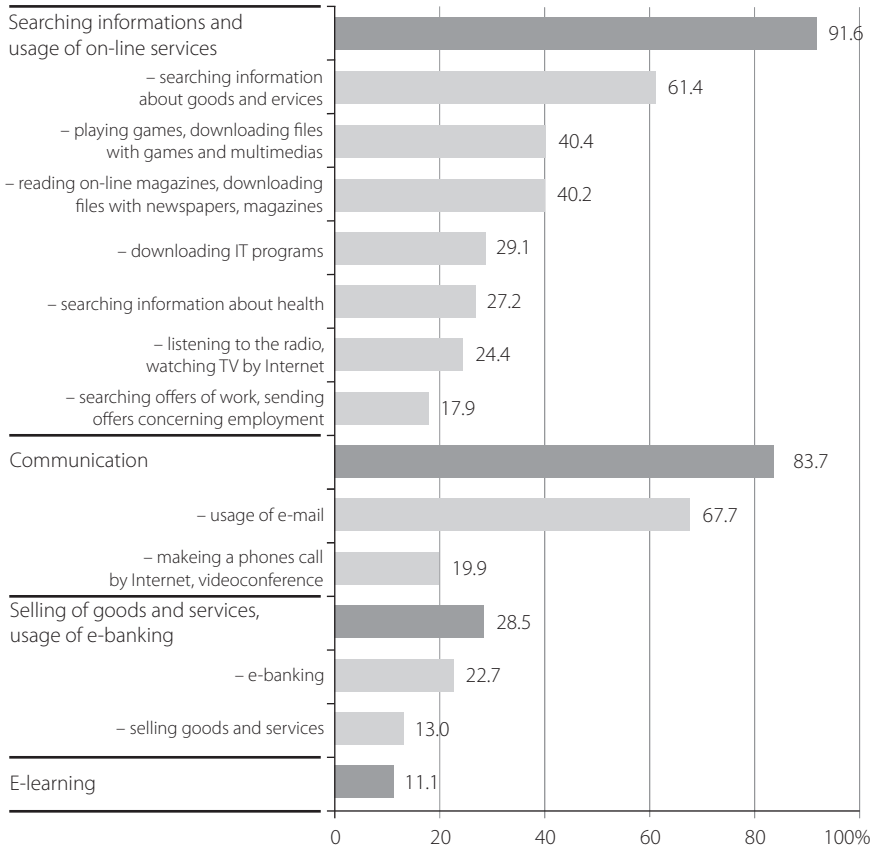

Figure 2. Purpose of usage the Internet

Source: *Elektroniczna gospodarka w Polsce – Raport 2006*.

internauts used Internet to search information (92%) and to communicate (84%).

One of the most promising internet services is e-buying, which is still expected to increase in Poland. 12% of Poles (what gives 27% of internauts) bought something by Internet during last 12 months counting from April 2006. They bought on-line goods worth of 2.7 billions PLN. The most popular goods were books, magazines, sports clothes and equipment, CDs, films, and electronic equipment. Comparing years 2005 and 2006, it was possible to observe the huge growth of interest among internauts in buying food (more than 460%) and sports clothes and equipment (40%). The success of internet shops lies in the fact that internauts have not encountered many problems in buying over Internet – only 13% of them had problems in buying on-line.

e-Banking was the most popular service of e-finance in Poland. In general, 23% of the internet users were using e-banking what gives 2.7 millions of Poles in Poland of age of 16–74 years old. It is a high growth comparing to year 2005 when 17% of internauts used e-banking. The further growth is expected as a result of big investments made by banks for development and advertising of e-banking services.

Lack of investment in development of e-services in insurance sector in the past was the main reason for the lack of offers and small number of clients of e-insurance. In the past, insurance services were usually provided by banks in cooperation with insurance companies (bank-assurance). In 2006, situation changed and insurance companies encouraged by the success of banking sector in e-banking and as a consequence of development of the bank-assurance services started to increase the offer of e-insurance. The year of 2006 is the beginning of development of e-insurance.

3. B2B SECTOR

The B2B market in Poland has grown significantly for seven years. In 1999 a low computer and internet penetration among Polish businesses was a barrier to the development of that market in Poland. It was estimated that less than a half of medium-sized and large firms, and 39% of small firms in Poland had access to the Internet. Within that group, approx. 60% of firms had their own websites, but only 12–15% offered on-line services[1].

In 2006, already 89% of enterprises had access to the Internet. It is very close to the average for Europe where 93% of European companies used Internet in 2006.

[1] *Annual Report SARS-8B1*, Telekomunikacja Polska SA, Warsaw 2001.

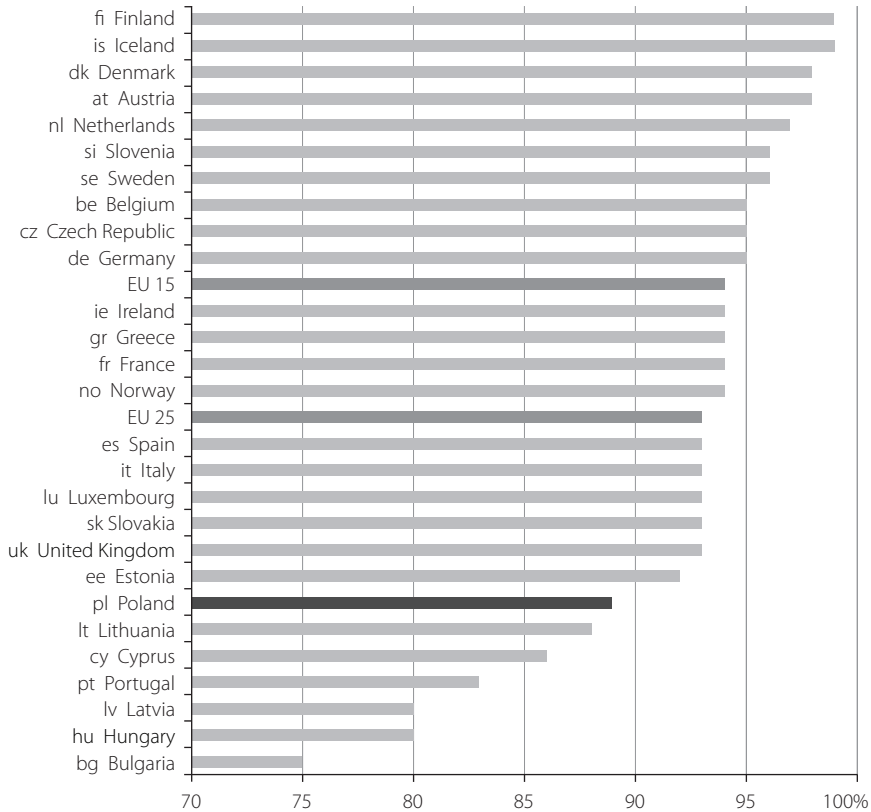

Figure 3. Internet usage in EU by enterprises

Source: Eurostat 2006.

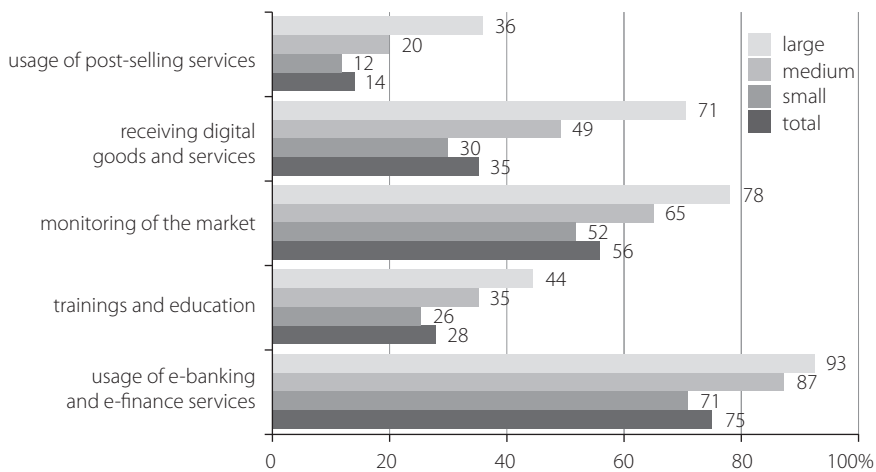

Figure 4. Purpose of Internet usage by Polish enterprises

Source: *Elektroniczna gospodarka w Polsce – Raport 2006*.

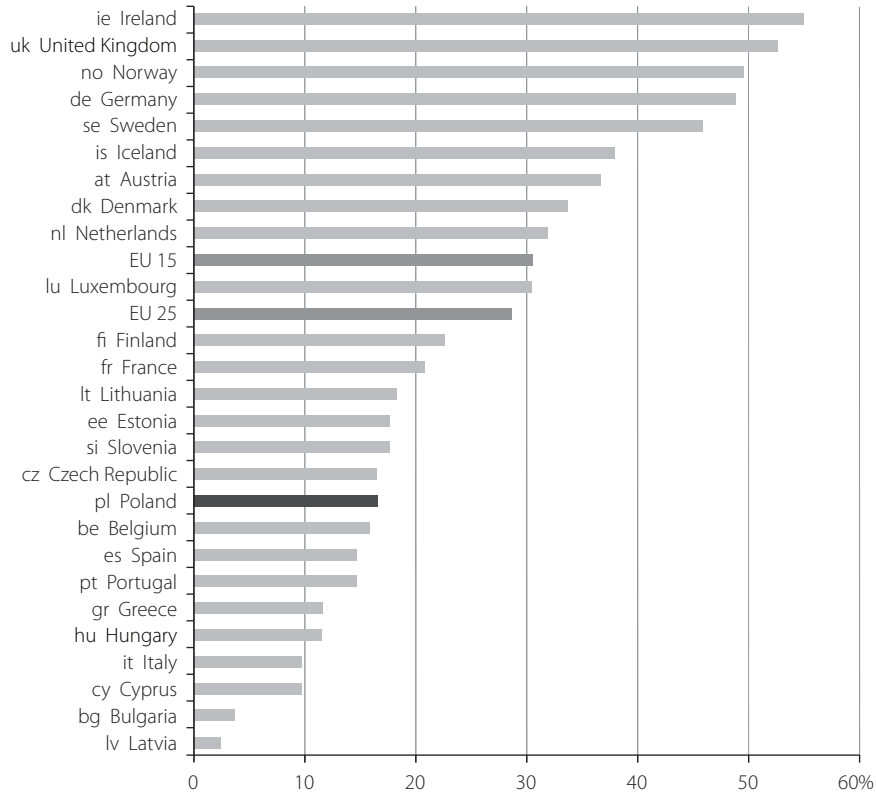

Figure 5. Purchasing by Internet

Source: Eurostat 2006.

More than half of all enterprises (53%) had home pages. Usually, the pages offered general information about company, supported marketing and provided catalogues or price lists. Entrepreneurs in most cases used Internet for the access to bank and financial services, collecting digital products and for monitoring the market. Nearly 75% of companies used e-banking and other e-finance services.

26% of all enterprises ordered goods and services over Internet in 2005, excluding orders submitted via e-mail. It concerned mainly the large enterprises (39%). It was still far from the European average and Poland placed far from leaders in Europe – over 50% of European companies ordered good and service by Internet (Ireland – 55%, Great Britain – 53%, Norway – 50%).

Further growth in on-line sales was observed. 11% of Polish companies sold their products and services on-line (17% of large enterprises, 12% of medium and 10% of small companies). Comparing to the other European countries, the percentage was considerably smaller, average for UE 25 was 15% (leader Denmark – 34%, Great Britain – 30%, Norway – 28%).

4. B2C SECTOR – E-SHOPS

First years of development of B2C sector in Poland as well as abroad could be characterized as a period of experiments and many bankruptcies of internet shops. Now, existing e-shops as well as new ones learned very fast how to sell over Internet and make businesses based on economics foundations.

According to the research of Institute of Logistics and Warehousing (IliM), there were about 3275 e-shops in Poland in 2006, what is much more than we could find in different reports so far. Most of them are however rather small, low turnover e-shops.

In most cases, combination of on-line and traditional retail was the main way of product sale. 47% of owners of e-shops were selling only by Internet, 52% of e-retailers were selling also in the traditional way.

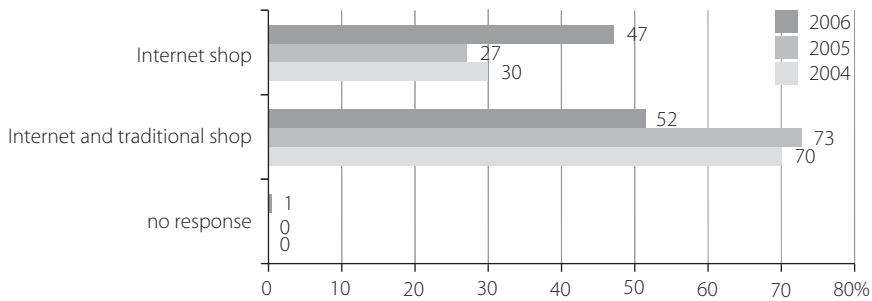

Figure 6. Way of selling goods

Source: *Elektroniczna gospodarka w Polsce – Raport 2006*.

Products available in e-shops were mostly new ones and "physical" products (80%). Only 2% of e-shops offered second-hand products. 21% of e-shops were selling services by Internet.

60% of e-shops had an offer containing less than 2000 products. The main products were: electronic equipment (13% e-shops offered this product), books (10%), clothes and shoes (10%), products for home and garden (8%), computer equipment (6%), CDs and films (6%).

Analyzing payment methods used by e-shops, it was observed for the first time that electronic payment (e-transfer) was more popular than traditional payment on delivery. 72% of e-shops enabled their clients to pay using e-transfer, 72% – on delivery, 38% – credit cards.

On average 1.5 orders were carried out in e-shops in Poland during one day per e-shop, but there was a big gap between most e-shops and leaders (for example, a leader of the market executed over 2000 orders per day).

Returns and complaints are big logistics problems for e-shops. The scale of these problems differed in shops (on average it concerned 0.8%

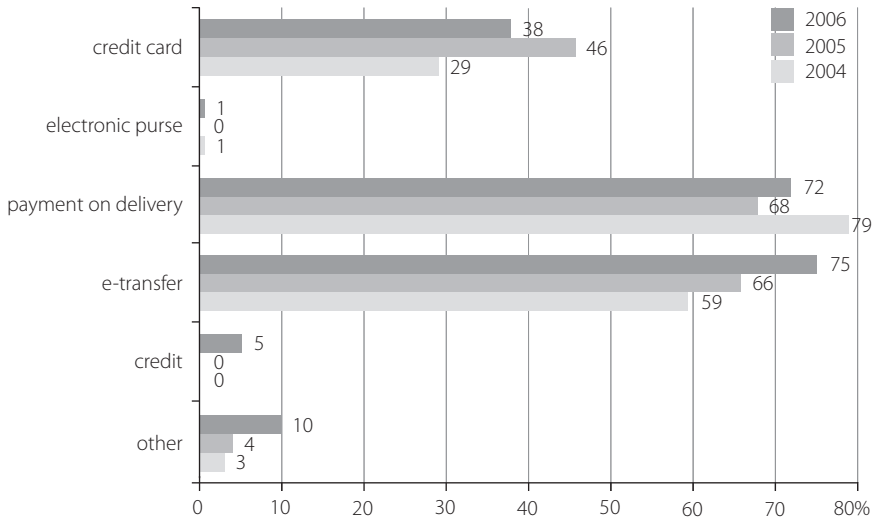

Figure 7. Method of payments

Source: *Elektroniczna gospodarka w Polsce – Raport 2006*.

of ordered goods). Almost 23% of e-shops did not have any complaints, 44% – up to 1%, 16% – 2–4% of complaints, 9% – 5–10% of complaints). 8% of e-shops could not estimate it. Among main reasons of complaints, e-shops indicated technical defects (39%) or faults in packing (9%). Concerning returns – 30% of e-shops did not have any, 41% – up to 1%, 11% – 2–4% of returns, 8% – 5–10% of returns. 8% of e-shops were not able to estimate it. E-shops indicated not collecting the product (24%) and resignation (20%) as the main reasons of returns.

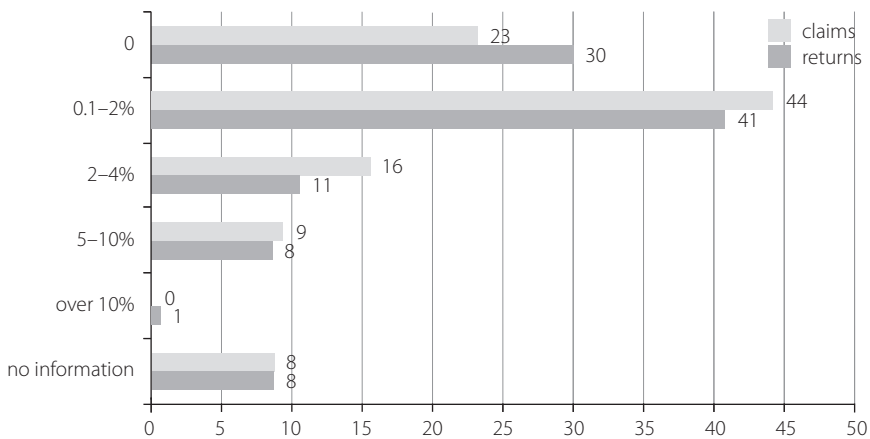

Figure 8. Percentage of returns and claims in Polish e-shops

Source: *Elektroniczna gospodarka w Polsce – Raport 2006*.

Polish e-shops have to make further investments in software. The majority of B2C companies have only front-office systems. Yet, all processes realized in back-office were not supported by any systems (only 18% of e-shops had back-office system). It limits their functionality as well as the number of orders carried out. There is a higher and higher customer potential in the market and only the e-shops with integrated front- and back-office systems will be able to take advantage of this fact.

5. E-BANKING

Polish banks have been collecting e-commerce experience for 10 years. e-Banking got down from "boom" period observed since the beginning of 2000 to the period of a stable growth directed to the process of winning over new clients, improving old and providing new electronic services in the market.

In 2006, 64% of Polish traditional banks provided e-banking services. There were also 4 internet banks.

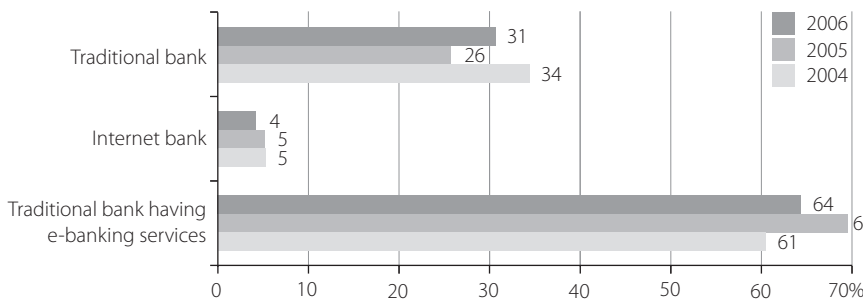

Figure 9. Kind of banks having e-banking services

Source: *Elektroniczna gospodarka w Polsce – Raport 2006*.

e-Banking services were provided by five access channels, which were distributed among: internet accounts (13%), electronic access to traditional account (70%), WAP (19%), phone-banking (53%), SMS (36%), and home-banking (64%). In the past, one bank provided e-banking services by TV, but withdrew this offer in 2006. Most of the channels were available both to individual and corporate clients with the exception of home-banking, which was dedicated to corporate clients.

Services of e-banking for individual clients are the fastest developing sphere of e-finance. Ideas for new products come usually from traditional banking activities adapted for new access channels. There are more and more complicated services, e.g. investment instruments, insurance, bonds, even credits, which were considered a domain of traditional banking only.

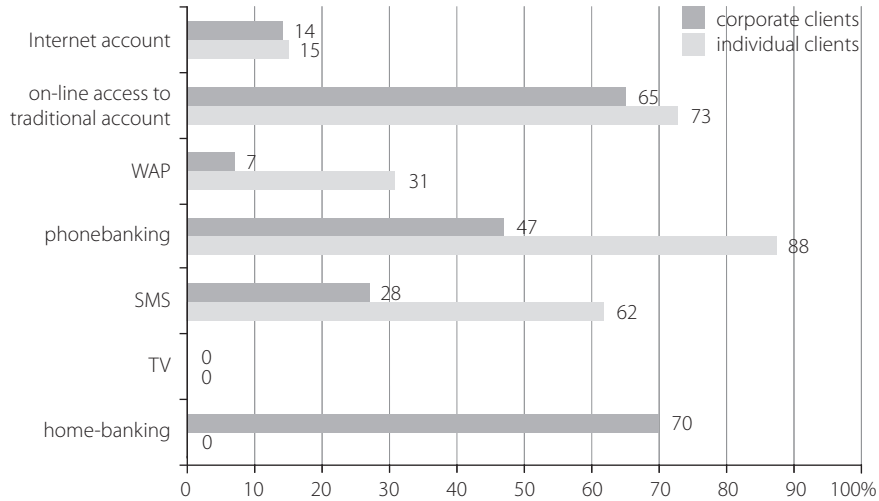

Figure 10. Access channel to e-banking services

Source: *Elektroniczna gospodarka w Polsce – Raport 2006*.

Development of corporate e-banking follows a different path because of different needs of corporate clients when compared to individuals. The beginning was connected very deeply with home-banking, which was promoted by banks as a safer channel for electronic services than Internet. Nevertheless, it changes thanks to competition and companies, which raised their new needs. Banks corrected their product policy and started to develop e-banking services also on Internet.

E-banking is still in the process of development but it was possible to observe some changes of policy. Banks stopped to use the price as a main factor for persuading clients for e-banking. Since 2004, it was possible to observe new strategy and policy of banks which was concentrated on complexity of offers of electronic services. Moreover, Polish banks became aware of the fact that e-banking is inevitable way of development and should be implemented.

6. CONCLUSIONS

E-commerce has been in developing stage for a few years in Poland, and achievements of 2006 were the confirmation of further growth of use of information technologies in society and companies. Comparing to most of the European countries, Poland has still a lot of work to do and investment to make and is placed in the last places in ranking in almost every field.

The positive factor is that every year there are more and more people using the Internet in Poland. Between 2000 and the end of 2006, the

percentage of people having an access to Internet has grown up from 19% up to 40% in Poland. The main factor that would help the further increase in use of Internet is further reduction of price of internet connection, which is still high comparing to the European countries.

The main area with the highest efficiency of using electronic tools is trade in both B2B and B2C relations. The economic processes in Polish companies developed, thanks to IT systems, much faster in 2006 than in previous years. The access to computer networks became easier thanks to new technologies and operators offering these services. The employment of retail sales network with implementations of electronic data interchange in relation with suppliers has strongly grown up. In many cases, these solutions are based on global standards of data exchange and synchronization. The positive issue is that governmental initiatives also support the development of B2B market.

Regarding B2C, numbers of e-shops increased considerably in comparison with former years. E-Shops started to plan and make businesses based on economics foundations. Most of them are rather small and the research showed that majority of the turnover was made by the biggest e-shops and internet services. The forecasts are very promising for this sector but there is a need to concentrate deeper on development of back-office functionality to succeed.

Banking developed the most in the field of e-commerce in financial market. Almost all Polish banks give the access to e-banking services, available for private persons and companies.

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PART V

TRANSITION, DEVELOPMENT AND KNOWLEDGE-BASED ECONOMY

Agnieszka Konkel

DEVELOPMENT OF KNOWLEDGE-BASED ECONOMY IN DEVELOPING COUNTRIES – CHALLENGES AHEAD

1. INTRODUCTION

"Development requires the removal of major sources of lack of freedom – poverty as well as tyranny, poor economic opportunities as well as systematic social deprivation, neglect of public facilities as well as intolerance or over-activity of repressive states. Despite unprecedented increases in overall opulence, the contemporary world denies elementary freedoms to vast numbers – perhaps even the majority of people" observes Amartya Sen in the introduction to *Development as Freedom* (Sen 1999). Should knowledge and innovation be treated as one of these elementary freedoms? As early as 1969, Peter Drucker set the groundwork for knowledge revolution (Drucker 1969) by emphasising the importance of knowledge in modern economy. It is now considered that to date developing countries have lagged behind the knowledge-generated progress. There may be various reasons for this. Droughts, famine, overpopulation, conflict, corruption and ill-conceived policies, to name a few, have hindered the recuperation of the socio-economic condition in scores of developing countries and inhibited a common understanding of the need to step on the path of innovation-based development.

While it is relatively easy to paint a bleak picture of developing countries, this study aims to point out the bright spots of modernity and pays considerable attention to the challenges for developing countries on the path to knowledge-based economy (KBE). Before the knowledge-based economy and its implications for the developing world are discussed, a

clear formulation of the concept is provided. Then the study applies the four lenses of Knowledge for Development framework (Dahlman 2007) to analyse the potential for and barriers to the development of KBE in developing countries. As a method of research, the study makes use of the case study approach to provide for a deeper understanding of the phenomenon under examination. In the course of the research, the case of Rwanda heralded as the "Singapore of the Great Lakes" (Rice 2006) or the sub-Saharan Africa's hub for information and communication technology (Cunningham 2007), is examined. In the concluding remarks, the potential of the knowledge-based development and the key messages are highlighted.

2. KNOWLEDGE-BASED ECONOMY – INTRODUCTION TO THE CONCEPT

In recent years, there has been a growing interest in knowledge and its influence on the development of modern economies. Assigning a considerable significance to knowledge, considered as "the key economic resource and the dominant – and perhaps even the only – source of comparative advantage", Drucker (1995) echoed and enforced five centuries old observation of the British philosopher Francis Bacon – "the knowledge is power". The OECD, in turn, describes the knowledge-based economy as one which is directly based on the production, distribution and use of knowledge and information (OECD, 2006). In broader terms, as the Leung (2004) notes, the knowledge-based economy includes not only innovation, education and science, but incorporates knowledge in all aspects of the economy. Furthermore, apart from the impact of knowledge on economic growth, the structural changes affecting the societies are given a wider recognition. The most comprehensive definition, thus, is the "one where organizations and people acquire, create, disseminate, and use knowledge more effectively for greater economic and social development" (Dahlman 2007).

Although in recent years there has been an increasing amount of literature on the significance of knowledge and its implications for economic development (Drucker 1969; OECD 1996; Rooney et al. 2003), far too little attention has been given to developing countries. The first serious discussions and analyses emerged during the late 90's. *The World Development Report of 1998/1999*, considered to be the primary and the most elaborate study, which has outlined the context for knowledge-based economy in developing countries, states: "knowledge is like light, weightless and intangible, it can easily travel the world, enlightening the lives of people everywhere. Yet, billions of people still live in the darkness of poverty – unnecessarily" (World Bank 1999). This statement corroborates the opening notice, where it is claimed that knowledge is denied to vast numbers of people. Even though Sachs's prescriptions

for leveraging developing countries out of the poverty trap might, in general, be accused of far-flung generalization and he himself called the "intellectual leader of the utopian camp" (Easterly 2005), his notion of treating innovation as the key driver for development deserves more in-depth discussion. In one of the works, he argues that "today's world is not divided by ideology but by technology[1]" (Sachs 2000), drawing attention to the disparities in the development of KBE.Indeed, when the Knowledge Economy Index (KEI) is examined, the disproportions become obvious. Graphical analysis demonstrates that the most advanced countries have acknowledged the potential of innovation and technology, while in less industrialized settings the notion of knowledge-based economy has not gained such recognition, probably as a result of more challenging environments, in which these settings operate.

Figure 1. The Knowledge Economy Index worldwide

Note: 0 is the lowest score and 10 is the maximum score
Source: Knowledge Economy Index, World Bank 2007.

Particularly difficult is the situation in Sub-Saharan Africa and some countries in South-East Asia. On the other hand, in the KEI there are many positive changes indicating a step up in the role of knowledge in modern economies. Noteworthy are the examples of China (+29), Mongolia (+19), Angola (+22), Sudan (+11), which in the KEI index ranked up most in comparison to 1995, when the first measurement was taken (World Bank, 2007). Even though Africa lags behind in the world economic race, there are islands of modernity, the example of which should

[1] A clarification is due at this point. To avoid oversimplification, the present study does not herald technology and science as a panacea for healing the situation of some developing economies, but points to the perception of knowledge as a driver or a common groundwork for sector policies, while adopting a cross-cutting approach to development.

be recognized to set a benchmark for others to take the inspiration from. Before the case study analysis is presented, the research methodology is discussed in the section below.

3. METHODOLOGY

The case study approach is adopted as the method of research in the present analysis. Although the analysis of case studies has been frowned upon because of its alleged lack of representativeness and generalization (Walsham 1993), it is also believed that the aim of case study analysis is to deepen the explanation and understanding of the research phenomenon (Miles, Huberman 1994), which is considered suitable in the case of the relative novelty of the research topic. Various models pertaining to the issue of knowledge-based economy will be discussed before the analysis proper is undertaken.

In the table below, the comparison between the World Bank Institute (WBI) and the OECD models pertaining to the issue is presented. Most notably, the OECD points at four key aspects, the inclusion of which is vital to the concept of KBE; these are: the importance of a stable and open macro-economic environment with effectively functioning markets, the diffusion of information and communication technology (ICT), fostering innovation, investing in human capital and stimulating company creation. In the framework of the WBI, similarities can be identified, namely, in the Knowledge Economy framework the prominence is assigned to: overall performance of the economy, economic incentives and institutional regime, education and human resources, innovation system and information infrastructure.

The analysis shows a similar approach to knowledge-based economy and an overlap of the main assumptions. In the analysis of the case of

Table 1. Comparison of KBE frameworks of OECD and the World Bank Institute

OECD	World Bank Institute
Stable and open macro-economic environment	Overall performance of the economy
Diffusion of ICTs	Information infrastructure
Fostering innovation	Innovation system
Investment in human capital	Education and human resources
Stimulation of company creation	Economic investment and institutional regime

Source: developed from the OECD (1996) and Dahlman (2007).

Rwanda the Knowledge Economy will be employed and the overall performance of the economy, information infrastructure, innovation system, education and human resources, economic investment and institutional regime will be assessed.

4. RWANDA – THE SINGAPORE OF AFRICA?

In this section, the article takes up the analysis of knowledge-based economy in Rwanda, heralded as the "Singapore of the Great Lakes" (Rice 2006) or the sub-Saharan Africa's hub for information and communication technology (Cunningham 2007), using the aforementioned framework. While the comparison to Singapore highlights the potential of Rwanda, it should be firmly stated that the same pattern of achievement of KBE cannot be applied to the country which operates in a completely dissimilar environment and has experienced gruesome atrocities, although it sets the horizon towards which the country can sail. Before the discussion shifts to the analysis, a few words must be said about the context.

In the course of its recent history, Rwanda has been traumatized by a hundred-day genocide. Over the time, in round numbers, 800,000 Rwandans were slaughtered and further 3 million refugees fled the country to neighbouring Tanzania, Burundi, Uganda and the Democratic Republic of Congo. Furthermore, GDP in real terms fell by 50 per cent while the inflation amounted to 60 per cent rate (Government of Rwanda 2007); 80% of the population fell into poverty, the infrastructure was completely destroyed (*Vision 2020*). In late 1994, with the help of international community, Rwanda started to emerge from its dire straits. There were a number of decisions to be taken, one of which concerning the direction in which Rwanda should go. Taking the decision to transform a depressed agricultural economy into one driven by ICTs, Rwandan government in 2000 in *Vision 2020* set a clear goal for development – knowledge-based economy. In the present day, in November 2007, in recognition of the efforts for development, Kigali hosted the International Telecommunication Union's [ITU] summit. One of the foremost commitments resulting from the summit – ConnectAfrica – refers to the industry-led initiative to drive USD 55 billion investment in ICT infrastructure in Africa. Furthermore, it has been decided that by 2012 all capitals and major African cities should get interconnected by broadband networks. Moreover, there is an important statement of President of Rwanda Paul Kagame, which should be publicized: "Investment and trade – as opposed to aid and charity – must drive the transformation of our economies" (ITU 2007). In the next section, the article will undertake the analysis of Rwanda's efforts towards the KBE, with the use of the aforementioned framework.

5. OVERALL PERFORMANCE OF THE ECONOMY

Rwanda' s economy is primarily agrarian and 90% of the population sustains on agriculture. In 2006, the real GDP growth amounted to 5.8%, which in actual terms meant 1,600 USD per capita. The rate of inflation has recently dropped to 8.8% (CIA, 2007). Even though the economy has shown the symptoms of improvement since the genocide, around 60% of the population still live under the line of poverty, perceived by the UN to be one dollar per day (Baldauf 2007). The country is the most densely populated state in Africa, though the human capital has been awfully strained by the stress of mass killings. In 2006, the aforementioned factors placed Rwanda among the least-developed countries in the world (UN 2007). Having acknowledged the limited availability of land, natural and mineral resources on which the development strategy could be based, Rwanda set the development of human capital as the core of its development process.

Education and human resources

In 2000, when the target of creating a knowledge-based economy was outlined in *Vision 2020*, only one school in Rwanda had a computer, there was one internet café and a dozen or so of science graduates. There were fewer than 100,000 phones for the population of almost 8 million people. These days half of the schools have a computer, public Internet access points have been mushrooming, and the Kigali Institute for Science and Technology boasts 2000 graduates (Rice 2006). Furthermore, the government intends to incorporate technical education with commerce, industry and the private sector in general (Conway 2007). Although, as Baldauf (2007) notes, the Rwandese society is to some extent exceptional when it comes to the development of human capital due to its high literacy rate of 70% and a homogeneity of the language. Even though educational progress can be observed and 12.2% of government spending goes to education (3.8% of GDP in 2005; UNESCO, 2007), there are many obstacles to overcome. As Rwandese minister of science argues *we have no scientists with necessary skills to undertake quality research and there are no skilled and experienced trainers, teachers and lecturers to provide quality science and technology education* (Ngandwe 2006), which creates a barrier for effective enhancement of education and human resources. Even though Rwanda is not isolated in its phenomenon of brain drain – according to the International Organization for Migration, there have been 20,000 African professionals fleeing the continent since 1990 – initiatives such as Tokten Rwanda emerge to counter the effects of brain drain and to create mechanisms for bringing the expatriates back home, thus attracting

the very people Rwanda needs for its progress. Even if the scope of such schemes it to some extent limited, it nonetheless signifies the positive trend in the overall course of the policy.

Information infrastructure

When KBE was set as a long-term policy target in 2000, the plans for the development of information infrastructure were introduced. To address the rural-urban gap in access to the ICT infrastructure, the government committed one billion dollars to build a national network of telecentres with access to the Internet and telephones. It is worth pointing out that the availability of main telephone lines is virtually non-existent with 0.36 lines per 100 inhabitants (ITU 2006). In the face of the scarcity of fixed-line infrastructure, the mobile phone often appears to be the only means of communication. Worth mentioning is the joint enterprise of Nokia and the Grameen Foundation USA, which attempts to bring mobile communication access to the Rwandese peripheries. The initiative intends to set up over 3000 small businesses spread across the country (Cunningham 2007). Furthermore, in 2006, in recognition to its progress in technological development, Kigali was selected as the headquarters of the 23-country Eastern African Submarine Cable Project (Rice 2006), which is 9900 fibre optic cable which will connect the east coast of Africa to the international high-bandwidth submarine cable, starting in Mtuzini in the vicinity of Durban in the South and Port Sudan at the other end (Jagun 2007). With $65 million committed to the development of broadband, Rwanda hopes to move to high-tech service economy (Baldauf 2007). The initiatives sketched above manifest genuine concern about the role of the ICT infrastructure in the socio-economic development in Rwanda.

Innovation system

Globally, Rwanda is typically ranked somewhere in the lower or bottom echelons of international indices[2], which attempt to measure the development of information society. In 2005/2006 Rwanda stayed at the bottom of the digital opportunity index[3], ranking 164 out of 181 countries examined (ITU, 2007). However, in the ICT diffusion index[4] in 2005 the

[2] The country is not ranked in ITU/Orbicom Digital Opportunities (Infostates) Index, in e-readiness index of the Economist Intelligence Unit, the Network Readiness Index of the World Economic Forum.
[3] The index is based on 11 ICT indicators, grouped in 3 clusters: opportunity, infrastructure and utilization.
[4] The Index is designed to evaluate ICT development using indicators of ICT diffusion across countries. It measures the average achievements in a country: connectivity and access.

situation looked better, as the country ranked 137 out of 180 countries (UNIDO 2006). The year of 2006 brought to the political scene of Rwanda the Ministry of Science, Technology and Scientific Research, thus indicating the significance of innovation in the policy of the government. One of the assumptions of the policy is to reinforce the capacity of the industry, particularly to conduct applied research supporting the innovativeness of the industry (Murenzi 2007). As a part of the innovation programme, centres of excellence are to be established in sectors perceived as drivers for future development in Rwanda, that is, biodiversity, technology, energy and geographic information systems (Balancing Act 2006), hence focusing the activity on promising sectors. Indeed, Rwanda aims at adapting innovation ambitions and strategies to its technological capability by building on its strengths and specificities (including traditional forms of knowledge and governance) and, where possible, by correcting identified weaknesses Aubert 2005).

6. ECONOMIC INVESTMENT AND INSTITUTIONAL REGIME

Incentives to attract private investment were introduced with the start of *Vision 2020* strategy. Among others, the government offers exemptions from import duties and sales taxes, investment allowances of 30% of the value of invested capital during the first years of operation, deduction from taxable income of 50% of training, research and product development costs or the right to fully expend the cost of providing infrastructure to the site of business operations. Furthermore, in free export economic zones the investors are entitled to pay a 10% company income tax rate and exemption from all other taxes (Rwanda Gateway 2007). Enabling investment environment impels more encouraging attitude of the donors, i.e. DFID, which in joint initiative with government and the World Bank will attempt to explore innovation in science and technology with relation to economic growth. At present, the government spends 2% of its overall budget on the ICTs (Cunningham 2006), thus establishing a clear vision for its development policy. Furthermore, establishing efficient institutions and organizations, operating with autonomy in a manner enabling the delivery of the support required at legal, financial and technical fronts should encourage the process (Aubert 2005).

7. RWANDA AND ITS CHALLENGES AHEAD

Whilst the analysis of the development of knowledge-based economy in Rwanda provides a very optimistic scenario and the improvement can be observed in many sectors, Porter (2007) points to some unique features of Rwanda that make this small African country to some extent distinctive.

Rwanda is characterized by rather moderate corruption, stability and social progress. A well-thought-out vision for Rwandan development emerges from the analysis; nonetheless, there are a number of challenges to overcome. First of all, there is a need to create and strengthen science and innovation capacity where the information and communication technologies serve as the groundwork for the achievement of progress. Furthermore, the locally – or internationally – acquired knowledge requires reinforcement to solve the pressing socio-economic hitches. Rwanda is confronted with, among others, the overexploitation of land and inability to provide food and nutrition for the population at large. Moreover, there is a need to diversify the production by creating more value added and knowledge-intensive goods for both internal and external markets. Since Rwanda is classified among the landlocked least developed countries (LLDCs), the country has neither the location nor the topography to produce mass and bulk production; hence, the development should be based on the specialization of production. Taking into consideration the aforementioned restricting factors, it might appear that only low volume, high quality and high value goods and services should serve as a driver for levering the country out of poverty (Murenzi 2007). The government should provide support for enterprise upgrading at the micro level, at the meso level for the development of specific industries, and at the macro level for enhancing the climate for innovation based on good business environment, educated human capital and robust infrastructure (Aubert 2005).

8. CONCLUDING REMARKS

The aforementioned challenges considered, the state of affairs in Rwanda does not seem markedly dissimilar from other developing countries. What is to some extent different is the stigma of genocide, entrenched in the minds of Rwandans. The graveness of the tragedy, however, did not prevent the nation from stepping on the path towards an innovative vision for development. Furthermore, the responsiveness and visionary leadership of President Paul Kagame, who states *we all know that the application of science and technology is fundamental, and indeed, indispensable in the social and economic transformation of our countries* (Kagame 2006), clearly shows the understanding of the indispensability of the incorporation of innovation into modern Rwandese economy. While it is too early to assess the success or failure of Rwanda in the creation of KBE, and the analysis of the case study, due to its unique features, cannot serve as generalization for other developing countries, it does highlight the need for the creation of national innovation systems and for setting long-term visionary development plans based on human capital and its potential. There is a need not only to think broad,

but also to develop knowledge-based economy mindset and to create winning opportunities, with the focus on becoming globally competitive. Above all, apart the vision, a method is needed for the achievement of KBE; the government needs to become a challenger and an integrator supported by a coalition of standing champions (World Bank 2003). Although Rwanda and other developing countries, as mentioned above, cannot closely follow the pattern of Singapore due to utterly different conditions and settings, they may follow the overall direction of development which led to creation of robust KBE in this small Asian country. Singapore kept its foreign investment in check, which played a critical role not only in terms of capital, but the access to markets and the technology it brought along, which, as Stiglitz (2002) observes, was the primary reason for the success of Singapore. There is no easy solution and there are no easy answers, but access to technology, reproduction of knowledge and enhancement of local capital might fulfill their promise. Years back, Alvin Toffler wrote *Get ready for the journey which might be the most fascinating in our times*. The time for developing countries has already come. Why not be optimistic, why not take the risk? If knowledge- and technology-based solutions worked elsewhere, they can undeniably work in developing countries as well. If there is a will and a vision to bring the change about, there is an opportunity to remove the lacks of freedom that Sen (1999) highlighted in the opening paragraph.

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INFLUENCE OF EDUCATIONAL POTENTIAL TO ECONOMIC GROWTH IN REGIONS IN SLOVAKIA

1. INTRODUCTION

During last ten years, Slovakia demonstrates the steady economic growth and one of the important tasks is development of knowledge-based economy. This is a new challenge for Slovak economy and it requires the creation of a complex program for enhancement of human capital endowment and new industrial policy. Development of human capital is concerned with lifelong learning (LLL) conception. The elaboration of the policy paper *LLL Conception for the Slovak Republic for 2002 to 2010* was included into the 2002 Work Plan of the Ministry of Education and the main tasks of LLL are outlined now (Institute of Information and Prognoses of Education 2001), At the same time, the main preconditions for LLL are the implementation of the reforms in the national educational system and improving the labour market policy. Slovak national education system is changed towards the new standards. Especially, the significant reconstruction is observed in tertiary education system. In tables (Caplanova 2000; Institute of Information and Prognoses of Education, 2005) the dynamics of key indexes of tertiary education system is shown. Despite of the visible state monopoly in preparation of graduates in higher education institutions, the private higher institutions are growing in Slovakia too, but more slowly. During last years, the unemployment rate has decreased and the highest indexes of unemployment rate are observed for people with basic, secondary

vocational and secondary specialized education. The lowest indexes of unemployment rate are registered for people with higher professional and tertiary education (www.uips.sk , www.statistics.sk). Nevertheless, the strong recent tendency for increasing number of students in higher educational institutions can lead to surplus of the well-educated labor force. Also the depreciation of vocational training for workers and lack of well-skilled specialists have negative consequences for development of industry. That's why the balanced core concept of national employment strategy is important. For instance, National Action Plan of Employment (NAPE) is created in Slovakia and the special measures are established for each year. Overall crucial objectives of the employment policy in the forthcoming years as outlined in NAPE are as follows: implement new measures of economic policies aimed at supporting the creation of new employment and stepping up restructuring of existing employment, in concert with the processes of sectoral, branch and industrial modernization (Country Report: Slovak Republic 2004; Institute for Forecasting 2003; Institute of Information and Prognoses of Education 2001). New industrial policy is aimed to increasing of competitiveness of Slovak economy and further integration in the crucial economical processes in EU and in the world. Production factors (capital, labour, technologies) must be therefore shifted toward new areas, while taking account of the global context, trends in crucial factors influencing future developments of the competitive environment, in which Slovak industry will be operating in the decades to come. Also, the significant regional disparities must be taken into account for developing of new economic strategies in regions of Slovakia (Bucek 2000; Buek, Sipikal, Skotta 2000). Thus, the problem of evaluation of influence of production factors in economic growth by regions is acute and the investigation of the role of the education potential in the regional development is important.

2. METHODOLOGY AND DATA

Using panel data of 1995–2004 for regions of Slovakia, we have constructed a set of some productive functions (Cobb-Douglas-Tinbergen function with neutral technological progress for rates of GDP, total employment and gross fixed capital formation, non-linear and functions with labor-saving technological progress for GDP, total employment, fixed capital formation). Such types of productive functions were constructed for economical sectors (A+B or agriculture, hunting, forestry and fishing; C_F or Industry and construction, G_P or Services) of Slovakia regions. The influence of different types of technological progress and elasticity labor and capital factors were estimated for these main economical sectors in regions of Slovakia. It should be mentioned that the special regional effects exist, which can be estimated by means

of pool time-series and cross-data analysis. Special regional effects are concerned with many factors, but we aimed to reveal the influence of technology progress and educational potential to features of regional economic growth.

Analysis of influence of technological progress to economic growth in regions of Slovakia

Formation of gross domestic product is non-uniformly distributed within regions of Slovakia. Region of Bratislava has about 25% of total GDP. The lowest share (9%) in GDP formation belongs to Presov region. Other regions keep 10–12% of total GDP. During last years, GDP has demonstrated a strong increasing tendency in all regions (Figure A.1, Appendix) and the outstanding position of Bratislava region is apparent. In Table 1 the annual growth rates were calculated for GDP in current prices.

It should be noted that some regions have significant high values of cross-correlation between annual growth rates of GDP. For example, growth rates of GDP are correlated for Bratislava region and Nitra region. The similar situation is observed for Zilina region and Kosice region or for Zilina region and Presov region.

Dynamics of total employment in regions of Slovakia was different and the tendency for each region is presented in Figure A.2 (Appendix). In Table 2, the annual growth rates of total employment are shown. Dynamics of total employment was not steady for each region. For example, in Bratislava region in 1997, 1998 and 2002 the numbers of employees decreased in comparison to previous year. In Banska Bystrica the growth rates of total employment are negative since 1997 to 2004. Such tendencies reflect different and complicated reasons in regional labor markets, branch specialization and governmental regulation of unemployment in regions.

The dynamics of gross fixed capital formation (in current prices) is shown in Figure A.3 (Appendix). Generally the tendencies of this index for regions were similar. The growth rates of gross fixed capital formation were calculated (Table 3) and in 1996 we can see the highest values of growth rates. On the one hand it reflects the influence of the inflation process, but on the other hand it's the start of massive investments. In 1999, the rates of gross fixed capital formation were negative for all regions, but in 2004 these values were positive and high, especially for Bratislava and Trnava regions. Perhaps, it is one of the effects of accession of Slovakia to EU (Sergi, Bagatelas 2004).

Despite the growing tendency of expenditure on research and development (R&D) during 2000–2006 the share of expenditure on R&D in GDP is small and it consists about 0.5–0.6%. Also the innovation activities of many enterprises in regions of Slovakia are weak. Nevertheless,

Table 1. Growth rates of GDP (year of year in %) by regions

No.	Region	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	Bratislava	9.542	13.027	8.990	6.544	12.436	7.259	11.784	8.684	13.313
2	Trnava	11.847	8.864	6.704	9.234	8.542	5.672	6.549	13.696	10.331
3	Trencin	12.918	8.428	8.855	8.910	10.891	7.833	5.614	9.659	10.781
4	Nitra	12.351	9.030	8.873	11.405	8.859	5.983	8.422	11.511	11.670
5	Zilina	13.147	11.182	9.326	7.187	10.715	9.774	7.578	6.998	13.713
6	Banska Bystrica	12.050	10.661	9.552	6.734	10.252	10.229	11.573	8.202	8.039
7	Presov	11.381	9.825	7.287	6.482	10.299	9.639	10.806	7.098	11.990
8	Kosice	14.248	11.050	11.692	7.703	9.519	12.285	6.162	7.618	12.101

Source: www.statistics.sk

Table 2. Growth rates of Total Employment (year of year in %) by regions

No.	Region	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	Bratislava	3.500	–2.511	–1.912	1.368	2.081	3.228	–2.213	2.371	1.160
2	Trnava	–3.144	–13.202	6.363	–1.477	–1.044	2.288	1.231	1.316	2.585
3	Trencin	14.961	10.224	–0.839	–6.774	–0.837	0.61	1.377	1.406	1.755
4	Nitra	–1.665	–1.681	–1.010	–1.825	–3.984	–1.202	0.064	0.748	1.246
5	Zilina	3.090	2.155	–0.085	-6.438	0.187	–2.364	2.434	4.995	–5.135
6	Banska Bystrica	3.374	–0.076	–5.443	–0.704	–2.289	–1.36	–1.030	–1.928	–3.998
7	Presov	4.409	–5.062	5.198	–3.630	–4.046	–0.072	–2.237	4.280	0.942
8	Kosice	–3.063	0.182	–2.818	–3.086	–5.794	2.517	–2.304	0.683	–1.390

Source: www.statistics.sk

Table 3. Growth rates of Gross Fixed Capital Formation (year of year in %) by regions

No.	Region	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	Bratislava	50.943	16.517	15.388	–7.297	8.048	–0.239	24.635	–8.701	16.672
2	Trnava	41.435	17.495	17.531	–11.114	1.615	14.494	6.232	2.872	14.687
3	Trencin	44.799	17.832	21.334	–13.609	–7.567	43.959	–2.643	0.202	4.322
4	Nitra	40.123	19.812	14.365	–7.090	–5.946	26.532	–0.982	1.120	3.269
5	Zilina	39.074	17.569	20.552	–13.584	–1.89	30.133	–8.764	10.468	5.290
6	Banska Bystrica	42.010	25.623	12.884	–16.485	–3.335	19.205	7.115	–5.920	3.480
7	Presov	37.633	30.030	9.118	–6.419	–7.883	10.134	12.594	–2.055	1.033
8	Kosice	39.614	9.670	14.985	–16.187	–14.591	38.713	–11.572	9.364	6.429

Source: www.statistics.sk

in some regions the research centers and industrial parks are created, the branch economic clusters with good competitiveness are formed. It is therefore possible to say that innovation policy is developing and government tries to support it. Successful implementation of innovation policy however requires targeting massive investments in the prospective technologies in industry, related research activities and preparation of research staff. Of course, it's a difficult task and it needs to develop public-private partnership for support of innovation policy.

So on base of statistical data, it is possible to estimate the role of main production factors (labour, capital and technology) in economic growth of Slovakia. We used the production function of Cobb-Douglass--Tinbergen with neutral technological progress for econometric model.

Usually this function is given as:

$$Y_t = a_0 e^{\lambda t} X_{1,t}^{a_1} X_{2,t}^{a_2},$$

where Y_t is gross domestic product (or gross value added), $X_{1,t} X_{2,t}$ – are labour and capital resources, t – is time, λ, a_1, a_2 – are the parameters for this model.

In our models, Y_t is gross domestic product (or gross value added in economic sector), Mill.SKK; $X_{1,t}$ – total employment in economy (total employment in economic sector), person; $X_{2,t}$ – gross fixed capital formation, Mill.SKK.

By means of simple transformation, this model can be written in linear form. The linearized model is given as:

$$\ln(Y_t) = \ln(a_0) + \lambda t + a_1 \ln(X_{1,t}) + a_2 \ln(X_{2,t}).$$

Parameter λ reflects the influence of neutral technological progress and it means continuous rate of neutral technological progress. Parameters a_1, a_2 are elasticity for labour and capital resources.

Using the statistical data for regions of Slovakia during 1995–2004, the production functions of Cobb-Douglass-Tinbergen with neutral technological progress were constructed using pool models for all economy and main economic sectors.

The results of estimated parameters are given in Table 4.

According to our results, the estimates of parameters are different for each sector. Change for each sector reflects the features of contribution of labour and capital factors in GDP formation and the role of neutral technological progress. For example, the sensitivity of sector 1 to implementation of new technology was bigger than in other sectors. In Figure A.4 (Appendix), we can see the dynamics of the productivity of labour in different sectors. Despite of different start values in 1994, the productivities of labour for sectors in 2004 were approximately at the same levels. It should be noted that the correlation coefficients are

Table 4. The results of estimated parameters for Cobb-Douglass-Tinbergen production function with neutral technological progress

	$\ln(a_0)$	λ	a_1	a_2
All economy	–4.549320[1]	0.077621[1]	0.996561[1]	0.317195[1]
Sector 1 or A+B (agriculture, hunting, forestry and fishing)	0.221674[3]	0.114292[1]	0.718793[1]	0.104554[2]
Sector 2 or C_F (Industry and construction)	8.921330[1]	0.066482[1]	0.006648	0.108746[3]
Sector 3 or G_P (Services)	2.980731[1]	0.075814[1]	0.428704[1]	0.236025[1]

Source: own elaboration.

rather high for these models, but positive autocorrelation of residuals is observed too. That's why there is need to investigate regional features in production model.The possible forms of production model on panel data and their expressions are presented below.

The model with fixed effects and common estimates of parameters for labour and capital resources is given as:

$$\ln(Y_{t,j}) = r_j + \lambda t + a_1 \ln(X_{1,t,j}) + a_2 \ln(X_{2,t,j}),$$

where r_j – fixed effect for region j.

Also, it's possible to testify the other types of model based on panel data. For example, one of the production models can be written as:

$$\ln(Y_{t,j}) = r_j + \lambda_j t + a_{1,j} \ln(X_{1,t,j}) + a_2 \ln(X_{2,t,j}).$$

In addition, it's possible to consider the production models with different estimation for all parameters in each region. This model is written below:

$$\ln(Y_{t,j}) = \ln(a_{0,j}) + \lambda_j t + a_{1,j} \ln(X_{1,t}) + a_{2,j} \ln(X_{2,t}).$$

After series of testified models on panel data, we selected some of the best models. The results of estimation of production models for all economy and for main sectors are presented in Table A.1–A.4 (Appendix).

[1] Estimation of parameter is significant for $p < 0.01$
[2] Estimation of parameter is significant for $p < 0.05$
[3] Estimation of parameter is significant for $p < 0.1$

Due to estimation of the production model with fixed effects or with different coefficients for explanatory variable, we can reveal the specific regional influence to economic growth. It should be noted that estimations of parameters indicated on role of neutral technological progress are significant in all models from Appendix. At the same time, the estimation of parameters for labour factor is not significant.

The different values of parameters for neutral technological progress can be in accord with non-uniform development of high-tech industry or non equal conditions for R&D activities. So it's interesting to analyze that correspondence between education potential and regional features expressed in different estimation of parameters in production models.

3. ESTIMATION OF THE EDUCATION POTENTIAL IN REGIONS OF SLOVAKIA AND ITS ROLE TO GDP GROWTH

The education and research facilities are different in regions of Slovakia. A big part of higher education institutions is concentrated in Bratislava. Number of organizations in knowledge and research branch is equal 109 in Bratislava region, more than 40% of total number of students study in different higher education institutions in Bratislava. Other important education and science centers are Banska Bystrica, Nitra and Kosice. In these regions, the rapid growth of students of full-time and part-time study is observed. The attractive conditions for life standards, big wages and good infrastructures lead to the concentration of people with tertiary education in the big regional centers. According the census of population in 2001, approximately 18% of inhabitants in Bratislava have tertiary education. In other regions, the shares of people with tertiary education are lower. There are also regional differences in distribution of people with tertiary education obtained in universities and other types of higher education institutions. In addition, a significant correlation between share of people with tertiary education and GDP per capita in regions is observed. However, although education potential can accumulate in the big regional centers, the necessary conditions of its efficient exploitation may not be created. It means that despite of significant increasing of people with tertiary or professional education, the sensitivity of economic growth in high-tech industry or in services is small.

Education potential is a complicated definition and the estimation of the education potential must be based on evaluation of a set of the parameters. For quantitative estimation of the education potential in region we selected a set of fifteen parameters, such as: x1 – share of people with tertiary education (%), x2 – share of people with tertiary education among economically active population (%), x3 – number of higher

education institutions, x4 – number of faculties in mathematical, technical or military science, x5 – number of faculties specialized in law, public administration, economic and social sphere, x6 – number of faculties specialized in natural, medical and pharmaceutical sphere, x7 – share of academic staff in R&D institutions with tertiary education, x8 – number of students, x9 – growth rate of students number during last three years, x10 – expenditure for R&D per employee in R&D activity (SKK), x11 – number of organizations in knowledge and research branch, x12 – number of centers in knowledge and research of higher education institutions, x13 – number of researchers per 1000, x14 – active licenses per 1000 inhabitants, x15 – passive licenses per 1000 inhabitants. The data for these indexes by regions are given in the Table A.7. For estimation of education potential in regions of Slovakia, we used one of the taxonomic methods (Młodak 2006) based on the special procedure of the convolution of initial values of fifteen or less indexes. Results of calculation of the education potential values in regions are given in Table A.8 (Appendix).

We analyzed correspondence between estimated regional fixed effects and education potential and revealed the strong significant correlation for these values for industry and construction sector. It means that potential of education in the regions is related to regional industrial basis formed earlier. In that way it's possible to explain the static effect of influence of education potential to economic growth in industry and construction. At the same time, the positive correlations between education potential and neutral technological progress rate are observed for such sectors as agriculture and services. This demonstrates the dynamic effect of influence of education potential to economic growth in agriculture and services.

4. CONCLUSIONS

In recent years in the area of higher education, Slovak governments followed the policy of establishment of new public institutions of higher education, mainly in regions outside the capital. Next to the increasing of enrolments at existing universities, this has been one of ways to increase the participation rates in the tertiary education and bring the country closer to the developed world in this indicator. The establishment of new schools and study programs outside the capital should have brought the education geographically closer to students coming from different Slovak regions and at the same time contribute to the development of these regions. The expansion of education potential, especially in high-tech sphere (Klas 2005; Tiruneh 2004), in the remote regions of Slovakia will lead to increasing of the economical growth and to raising of their competitiveness.

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APPENDIX

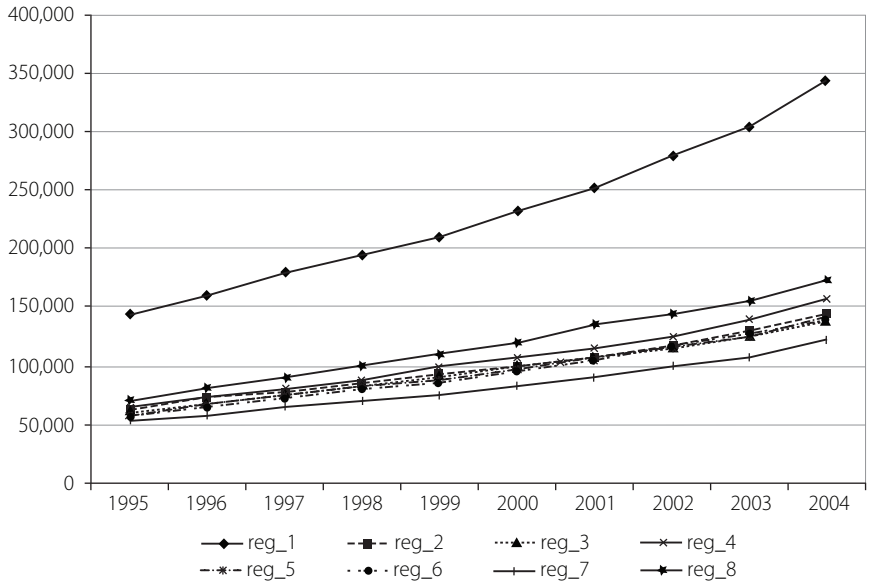

Figure A.1. Dynamics of GDP (in Mill.SKK) by regions

Source: own elaboration based on www.statistics.sk

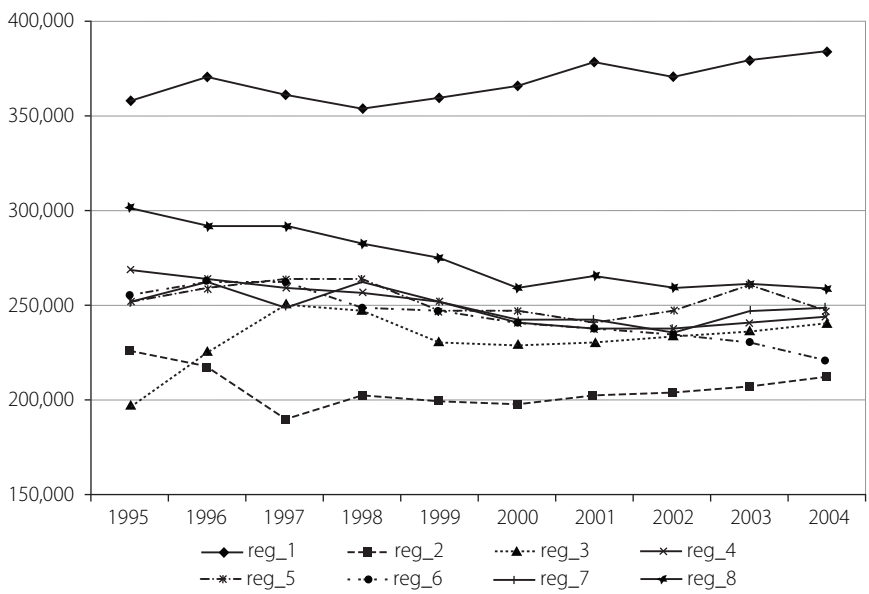

Figure A.2. Dynamics of Total Employment (in physical person) by regions

Source: own elaboration based on www.statistics.sk

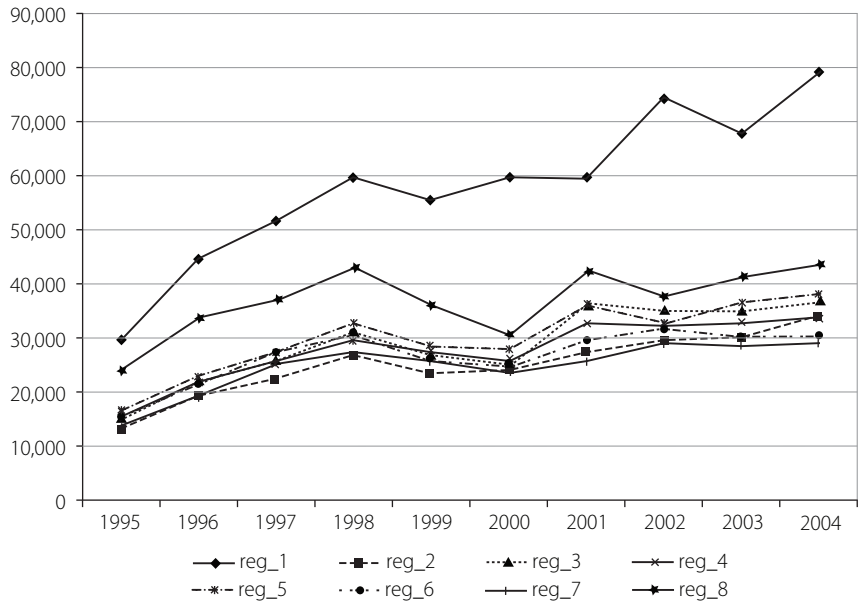

Figure A.3. Dynamics of Gross Fixed Capital Formation (in Mill.SKK) by regions

Source: own elaboration based on www.statistics.sk

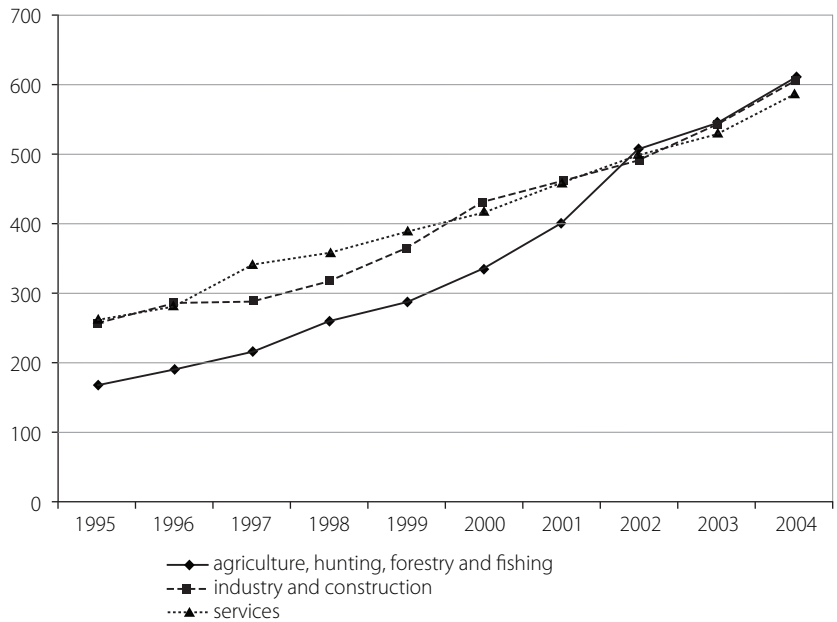

Figure A.4. Dynamics of labor productivity (thous. SKK per employer) by sectors

Source: own elaboration based on www.statistics.sk

Table A.1. Estimation of parameters for production function on panel data (case of all economy)

Dependent Variable: LGGDP?				
Method: GLS (Cross Section Weights)				
Date: 11/12/07 Time: 00:40				
Sample: 1901 1910				
Included observations: 10				
Number of cross-sections used: 8				
Total panel (balanced) observations: 80				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
_R1--T_R1	0.090510	0.004231	21.39156	0
_R2--T_R2	0.077318	0.005982	12.92587	0
_R3--T_R3	0.085509	0.004421	19.34024	0
_R4--T_R4	0.091130	0.004422	20.60780	0
_R5--T_R5	0.080779	0.003281	24.62362	0
_R6--T_R6	0.092310	0.001255	73.54301	0
_R7--T_R7	0.086281	0.004043	21.33848	0
_R8--T_R8	0.074647	0.002137	34.93845	0
_R1--LGEMP_R1	–0.045750	0.293953	–0.15563	0.8770
_R2--LGEMP_R2	0.036006	0.197860	0.181977	0.8564
_R3--LGEMP_R3	0.151534	0.158581	0.955564	0.3441
_R4--LGEMP_R4	0.279838	0.435047	0.643238	0.5231
_R5--LGEMP_R5	–0.189910	0.163838	–1.15915	0.2521
_R6--LGEMP_R6	0.185983	0.051198	3.632591	0.0007
_R7--LGEMP_R7	0.051654	0.185756	0.278075	0.7821
_R8--LGEMP_R8	–0.721590	0.075670	–9.536010	0
_R1--LGCAP_R1	0.046067	0.031685	1.453883	0.1525

_R2--LGCAP_R2	0.058944	0.070961	0.830656	0.4103
_R3--LGCAP_R3	–0.014340	0.073561	–0.194980	0.8462
_R4--LGCAP_R4	0.028401	0.049092	0.578523	0.5656
_R5--LGCAP_R5	0.120173	0.027831	4.317932	0.0001
_R6--LGCAP_R6	0.050188	0.006133	8.183921	0
_R7--LGCAP_R7	0.020506	0.033912	0.604673	0.5482
_R8--LGCAP_R8	0.154821	0.009889	15.655740	0
Fixed Effects				
_R1--C	11.892220			
_R2--C	10.014780			
_R3--C	9.254765			
_R4--C	7.262625			
_R5--C	12.131690			
_R6--C	8.107938			
_R7--C	9.976270			
_R8--C	18.641650			
Weighted Statistics				
R-squared	0.999992	Mean dependent var		13.244380
Adjusted R-squared	0.999987	S.D. dependent var		4.388871
S.E. of regression	0.015561	Sum squared resid		0.011623
Log likelihood	246.7780	F-statistic		273220.1
Durbin-Watson stat	2.160037	Prob(F-statistic)		0
Unweighted Statistics				
R-squared	0.999039	Mean dependent var		11.57403
Adjusted R-squared	0.998418	S.D. dependent var		0.391286
S.E. of regression	0.015561	Sum squared resid		0.011623
Durbin-Watson stat	2.014420			

Source: own elaboration based on www.statistics.sk

Table A.2. Estimation of parameters for production function on panel data (case of sector 1)

Dependent Variable: LGGDPS1?				
Method: Pooled Least Squares				
Date: 12/02/07 Time: 00:06				
Sample: 1 10				
Included observations: 10				
Number of cross-sections used: 8				
Total panel (balanced) observations: 80				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	5.153543	1.053897	4.889989	0.0000
LGCAPS1?	0.051525	0.022740	2.265864	0.0270
_R1--T_R1	0.032317	0.009884	3.269625	0.0018
_R2--T_R2	0.077768	0.011153	6.972669	0.0000
_R3--T_R3	0.058219	0.008759	6.646466	0.0000
_R4--T_R4	0.092686	0.011028	8.404541	0.0000
_R5--T_R5	0.073073	0.011208	6.519705	0.0000
_R6--T_R6	0.099867	0.011052	9.035704	0.0000
_R7--T_R7	0.098789	0.011777	8.388616	0.0000
_R8--T_R8	0.097152	0.014163	6.859611	0.0000
_R1--LGEMPS1_R1	0.246888	0.115914	2.129931	0.0372
_R2--LGEMPS1_R2	0.272185	0.102643	2.651769	0.0102
_R3--LGEMPS1_R3	0.254457	0.110008	2.313087	0.0240
_R4--LGEMPS1_R4	0.295611	0.100081	2.953720	0.0044
_R5--LGEMPS1_R5	0.253614	0.106660	2.377779	0.0205
_R6--LGEMPS1_R6	0.271365	0.102025	2.659780	0.0099
_R7--LGEMPS1_R7	0.253164	0.101861	2.485386	0.0157
_R8--LGEMPS1_R8	0.250463	0.102566	2.441973	0.0175
Statistics				
R-squared	0.981087	Mean dependent var		8.456732
Adjusted R-squared	0.975901	S.D. dependent var		0.397575
S.E. of regression	0.061719	Sum squared resid		0.236175
Log likelihood	119.4933	F-statistic		189.1831
Durbin-Watson stat	1.690535	Prob(F-statistic)		0.000000

Source: own elaboration based on www.statistics.sk

Table A.3. Estimation of parameters for production function on panel data (case of sector 2)

Dependent Variable: LGGDPS2?				
Method: GLS (Cross Section Weights)				
Date: 12/02/07 Time: 01:54				
Sample: 3 10				
Included observations: 8				
Number of cross-sections used: 8				
Total panel (balanced) observations: 62				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LGCAPS2?(-2)	0.045179	0.023142	1.952276	0.0585
_R1--T_R1	–0.150832	0.045308	–3.329016	0.0020
_R2--T_R2	0.070610	0.010565	6.683115	0.0000
_R3--T_R3	0.083855	0.004507	18.605830	0.0000
_R4--T_R4	0.107812	0.009805	10.995860	0.0000
_R5--T_R5	0.093268	0.006481	14.390000	0.0000
_R6--T_R6	0.094754	0.012666	7.481114	0.0000
_R7--T_R7	0.087548	0.006233	14.045700	0.0000
_R8--T_R8	0.074705	0.015033	4.969579	0.0000
_R1--LGEMPS2_R1	–4.706855	1.983797	–2.372650	0.0230
_R2--LGEMPS2_R2	0.704784	0.534380	1.318881	0.1953
_R3--LGEMPS2_R3	0.028983	0.147357	0.196685	0.8452
_R4--LGEMPS2_R4	0.739729	0.327156	2.261088	0.0297
_R5--LGEMPS2_R5	–0.147435	0.193063	–0.763662	0.4499
_R6--LGEMPS2_R6	0.381764	0.342752	1.113818	0.2725
_R7--LGEMPS2_R7	–0.060106	0.248801	–0.241583	0.8104
_R8--LGEMPS2_R8	–0.017241	0.422793	–0.040778	0.9677
Fixed Effects				
_R1--C	64.287440			
_R2--C	1.900977			
_R3--C	9.330904			

_R4--C	1.083457			
_R5--C	11.166340			
_R6--C	4.905079			
_R7--C	9.834243			
_R8--C	9.828546			
Weighted Statistics				
R-squared	0.999988	Mean dependent var	19.02731	
Adjusted R-squared	0.999980	S.D. dependent var	11.04577	
S.E. of regression	0.048861	Sum squared resid	0.088334	
F-statistic	194836.8	Durbin-Watson stat	2.348775	
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.985360	Mean dependent var	10.43416	
Adjusted R-squared	0.975863	S.D. dependent var	0.315711	
S.E. of regression	0.049049	Sum squared resid	0.089014	
Durbin-Watson stat	1.778241			

Source: own elaboration based on www.statistics.sk

Table A.4. Estimation of parameters for production function on panel data (case of sector 3)

Dependent Variable: LGGDPS3?				
Method: Pooled Least Squares				
Date: 12/02/07 Time: 01:47				
Sample: 1 10				
Included observations: 10				
Number of cross-sections used: 8				
Total panel (balanced) observations: 80				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LGCAPS3?	0.103163	0.022917	4.501591	0.0000
_R1--T_R1	0.102682	0.009867	10.406140	0.0000
_R2--T_R2	0.092585	0.004371	21.182150	0.0000

_R3--T_R3	0.078719	0.005621	14.004710	0.0000
_R4--T_R4	0.113662	0.009058	12.548020	0.0000
_R5--T_R5	0.091762	0.006453	14.220520	0.0000
_R6--T_R6	0.097094	0.003309	29.345060	0.0000
_R7--T_R7	0.089479	0.004995	17.912750	0.0000
_R8--T_R8	0.102707	0.003161	32.489360	0.0000
_R1--LGEMPS3_R1	–0.564308	0.536646	–1.051545	0.2976
_R2--LGEMPS3_R2	–0.315683	0.208901	–1.511161	0.1365
_R3--LGEMPS3_R3	0.381243	0.211491	1.802650	0.0769
_R4--LGEMPS3_R4	–2.676616	1.122362	–2.384807	0.0206
_R5--LGEMPS3_R5	–0.416183	0.397928	–1.045876	0.3002
_R6--LGEMPS3_R6	0.705409	0.574259	1.228382	0.2245
_R7--LGEMPS3_R7	–0.221187	0.349742	–0.632430	0.5297
_R8--LGEMPS3_R8	0.013437	0.637223	0.021087	0.9833
Fixed Effects				
_R1--C	17.28335			
_R2--C	12.75590			
_R3--C	4.803328			
_R4--C	40.75445			
_R5--C	14.17275			
_R6--C	0.935347			
_R7--C	11.82665			
_R8--C	9.280011			
Statistics				
R-squared	0.997955	Mean dependent var		10.88924
Adjusted R-squared	0.997062	S.D. dependent var		0.492200
S.E. of regression	0.026678	Sum squared resid		0.039146
Log likelihood	191.3847	F-statistic		1677.185
Durbin-Watson stat	1.626699	Prob(F-statistic)		0.000000

Source: own elaboration based on www.statistics.sk

Table A.5. Distribution of population according education in regions of Slovakia (in %) for 2001

Highest level of education	Bratislava	Trnava	Trencin	Nitra	Zilina	Banska Bystrica	Presov	Kosice
Elementary school	15.2	22.9	18.9	24.8	20.0	23.2	21.8	20.9
Secondary and vocational school without maturity exams	19.2	26.5	26.9	24.9	25.3	22.2	22.3	21.5
Complete vocational school with maturity exams	22.0	18.9	22.1	18.6	20.6	21.1	19.8	20.5
Complete secondary school with maturity exams	7.0	4.6	3.9	5.0	4.1	4.2	4.0	5.2
Tertiary education	18.0	6.4	7.4	6.9	7.4	7.6	6.5	8.0
Non-university education	1.4	0.7	0.8	0.7	0.8	0.9	0.7	0.8
Higher	0.9	0.4	0.4	0.4	0.5	0.5	0.4	0.5
Bachelors	0.5	0.3	0.4	0.3	0.3	0.4	0.3	0.3
University education	16.6	5.7	6.6	6.2	6.6	6.7	5.8	7.2
Masters, Specialists, PhD	14.9	5.5	6.4	5.9	6.3	6.4	5.6	6.8
PhD students	1.7	0.2	0.2	0.3	0.3	0.3	0.2	0.4

Source: A. Klas (2005), *Technologický a inovačný rozvoj v Slovenskej republike*, p. 115.

Table A.6. Distribution of population with tertiary education for 2001

Sphere	Bratislava	Trnava	Trencin	Nitra	Zilina	Banska Bystrica	Presov	Kosice
University	6.8	2.7	2.9	2.9	3.0	3.2	3.0	3.3
Technical	4.9	1.5	2.1	1.3	1.9	1.7	1.6	2.5
Economical	3.3	0.8	1.1	0.9	0.5	0.8	0.4	0.4
Agricultural	0.5	0.5	0.4	0.9	0.5	0.8	0.4	0.4
Others	1.5	0.5	0.4	0.5	0.3	0.3	0.3	0.4

Source: A. Klas (2005), *Technologický a inovačný rozvoj v Slovenskej republike*, p. 115.

Table A.7. Data for estimation of education potential by means of taxonomical methods

Region	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
Bratislava	18.0	24.1	8	9	12	4	77.5	45,551	28.432	267.7	109	9	16.5	0.5	16.7
Trnava	6.4	9.7	1		3	1	60.4	13,953	27.034	567.7	24	2	3.2	2.9	9.8
Trencin	7.4	9.6	2	3	2		55.6	4,214	34.646	761.8	36	2	2.1	1.2	6.6
Nitra	6.9	7.7	3	2	6	3	79.8	20,682	148.345	182.8	18	3	2.6	0.4	1.7
Zilina	7.4	10.7	2	8	2	1	86.8	13,146	147.909	388.6	23	3	2.4	0.1	3.0
Banska Bystrica	7.6	9.7	3	2	4	3	76.3	17,949	44.934	207.6	20	3	2.6	0.6	2.1
Presov	6.5	9.4	1		1	2	80.2	9,833	32.198	227.8	16	1	1.0	0.3	1.5
Kosice	8.0	9.7	3	9	3	3	84.8	19,530	28.909	250.8	24	3	3.6	0.0	6.7

Source: own elaboration based on www.statistics.sk

Table A.8. Results of calculation of education potential index

Region	I (x1–x15)	I* (x1, x2, x7, x9, x10, x12–x15)
Bratislava	0.864	0.763
Trnava	0.347	0.403
Trencin	0.284	0.327
Nitra	0.393	0.269
Zilina	0.377	0.379
Banska Bystrica	0.381	0.285
Presov	0.168	0.143
Kosice	0.427	0.323

Ivan Peshkov

A POST-SOVIET STATE, KNOWLEDGE-BASED ECONOMY AND TRANSITION. THE CASE OF RUSSIA

1. INTRODUCTION

The transformation of the Russian Federation from an "economic dwarf"[1] into an internationally recognized economic leader of the region and a BRIC[2] member provokes questions concerning the use of the technological potential inherited from the previous system. If we additionally asked about the effectiveness of the technological transfer to Russia's economy and about the role of the state in that transfer, we would raise one of the most important problems of the Russian society, i.e. the trajectory of development for the next decades. Of all the BRIC countries Russia has the smallest reserves of cheap labor, the highest literacy rate and the best qualified manpower. It also has at its disposal outstanding research and technical personnel capable to compete with the most advanced innovation centers in the world. The consistent growth of efficiency and competitiveness of the economy based on its technological potential might seem a natural path of Russia's development. Nonetheless, the transformation of the country into a high technological standard economy meets considerable institutional, structural and administrative barriers.

The essential problem of the Russian Federation is the simultaneous occurrence of a low demand for inventions and certain obstacles connected with the implementation of the knowledge possessed by the

[1] The term used by P. Krugman (1999).
[2] BRIC – refers to combination of Brazil, Russia, India and China.

society in the market. The rapid development of the economy following 2001, based largely on high prices for carbohydrogen resources, has caused not only the consolidation of the country, but also the emergence of state projects aimed at modernizing the economy. Nevertheless, the experience of transforming the socialist economy in Russia has by no means come to an end, regardless the revolution of consumption standards and the radical changes in supply. The problem of Russia's economy lies in the discrete and inconsistent gradualist path of development that allows neither for restructuring the economy, nor for establishing the critical minimum of market institutions. Significant changes in the standard of living, the consumption preferences and the efficiency of particular manpower segments are not able to cause radical changes in general. It concerns particularly the microeconomic restructuring, the introduction of functional proprietorship, as well as the modernization of infrastructure. In this respect the economy has not been stimulating thorough modernization of the production apparatus. Simultaneously, the consolidation of the administrative apparatus – together with the budget surplus – has caused the supply for global investment projects. Thus, the analyzed phenomenon can be considered in two levels, i.e. the one connected with the grass-roots development (the emergence of the sectors based on knowledge in the conditions of the unfinished restructuring of the economy) and the one related to the attempts to develop state macroprograms. It is worth mentioning that the integration of the two levels is possible only provided that the reforms are continued and that competitive environment is established.

This paper will study the connections between the specificity of a post-Soviet statehood and the development of a knowledge-based economy in the conditions of system transformation in Russia. It will aim at exploring three issues: the reasons for a low demand for economic innovations, the limited opportunities for the market implementation of the knowledge that has remained after the collapse of the previous system and the effects of state programs supporting the modernization of Russia's economy. The main conclusion is the necessity for a critical minimum of institutional development and of administration quality for the development of technologically advanced economy sectors. Only the real needs of the reformed economy will determine the effectiveness of government programs.

2. THE ISOLATION OF KNOWLEDGE FROM ECONOMY – A STRUCTURAL PROBLEM OF THE SOVIET AND RUSSIAN SOCIETIES

The socialist project was based on the idea of overcoming the limitations related to using knowledge and capital in a free market system

that, regardless its incredible technological potential, was limited as far as the access to knowledge and the investment indecisiveness were concerned (Alexandrov 1999). As early as 1627, Francis Bacon proposed in his work *The New Atlantis* a conception of knowledge and invention centralization as a basis for social progress (Bacon 1982). In the models developed by Marx and his followers it was precisely the centralization of investments and knowledge that allowed to gain socialist solutions undeniable advantage and guaranteed the progress of economy and civilization.

The socialist system of the USSR constituted a symbiosis of Marxism adapted to the conditions of an agrarian country and the experiences of the Russian Civil War with general mobilization of resources and disrespect for human life. The industrialization initiated in 1928 was at first planned to be the temporary centralization of knowledge and capital with a possibility of the future introduction to the market. Technology imports, the annexation of industrialized territories and technological espionage became the ways of reducing economic backwardness.

Regardless the traditionally high level of education in the fields of physics and mathematics as well as the access to new technologies and the emergence of qualified manpower, the socialist economy was not able to eliminate technological backwardness. Paradoxically, the reason for that situation was the centralization of knowledge and capital. The government administration of technological progress could not guarantee the continuing technological advancement of the economy. Structural and institutional conditions made companies concentrate on the maximization of reserves, which limited supply opportunities and condemned the Soviet economy to permanent imbalance in demand. For the same reasons, there was no demand for innovation, which in turn hindered technological progress in the socialist economy. What is more, the Soviet research personnel focused on certain sectors of the economy connected with the armaments industry and there were not any institutions that could turn inventions into innovations. The high engineering technology standards did not influence the mass production ones. Research and technical personnel lived its own life, isolated from the economy. Therefore, the USSR constituted a unique example of the simultaneous occurrence of qualified manpower, high investment dynamics and capability to generate inventions, as well as unbelievably low efficiency, high waste of resources and technological backwardness.

Paradoxically, the change of a system only exacerbated the situation. The reduced financing of science caused stagnation and mass migration of researchers to other fields of activity, and thus, their negative selection (Gohkberg 2002). The degradation of technological base resulted in further limitation of a demand for innovation. The underdeveloped financial institutions and selective restructuring made mass technological transfer impossible. The specificity of Russian transformation lied in

the strengthening of the Soviet model separating technological knowledge from the economy, as well as in the simultaneous degradation of its elements. The explanation of such situation requires the comparison of a demand for inventions in a market economy, a socialist and a transforming one. A market economy is based on restructured enterprises operating according to specific proprietorship[3]. The main objective of a market economy enterprise is to maximize its profits. It produces a constant imperative to search for organizational or technological methods of cost reduction in the consumer market conditions typical for a modern market economy. Thus, innovations become the essential element of a strategy for staying in the market. It produces notable effects on the macroeconomic level[4].

There are significant differences between the priorities of capitalist and socialist enterprises. Regardless the fact that in both cases boards aim at the optimal use of the existing assets and at meeting the shareholders' or owners' expectations (in the case of a socialist economy there is only one owner), the objectives and the possibilities of reaching them are considerably different. The specificity of a socialist economy (in its Soviet version) was the central control of all the forms of economic activity. In a socialist economy, the fundamental objective of an enterprise is to carry out its plan in the given working, capital and technological conditions. In this situation, there are solely the intensive forms of asset use optimization at company boards' disposal. They must guarantee their companies as broad access to resources and capital as possible using both formal and informal means to put pressure on the center. Because of that, in the conditions of a socialist economy, achieving priorities can be based only on resource and material reserves[5]. A cumulative macroeconomic effect of such an attitude is the chronic imbalance in demand, i.e. the emergence of bottlenecks, low work efficiency and technological backwardness. In the given institutional circumstances, the access of socialist economy enterprises to more efficient production organization models could not change the low demand for new technological solutions for the part of those enterprises[6].

Russian enterprises of the reforms period were characterized by a mixed (conservative) form of adaptation to the collapse of the socialist

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[3] In his respect, the Russian market is *in statu nascendi*.

[4] Upon the influence of innovation on economic development (Rostow 1975; Lucas 1988; Romer 1990; Romer 1994).

[5] Stocking up on reserves is the only form of the optimal use of means in the given technological and institutional conditions. It is the optimization of the part a board can control. Because of the institutional specificity of socialist economy manpower, technologies and customer selection come under the government of the Center (Balicki 1998).

[6] The Russian sociologist Starikov wrote: "80–85% of the machines and devices used in the USSR at the time of industrialization were imported" (Starikow 1996; Sutton 1968; Sutton, Stanford 1971).

economy[7]. The institutional environment stimulated restructuring inconsistently. Regardless the existence of the essential elements of a formal legal basis for a market economy, the real institutional and cultural situation encouraged company boards to operate in a mixed regime, combining the characteristics of both socialist and capitalist enterprises. The features of that regime included:

- The emergence of increasingly strict budget limitations;
- Politically and mentally conditioned fear of layoffs;
- Competition, especially the competitiveness of Western goods;
- The lack of funds and qualifications to intensify production radically;
- Payment arrears for the part of the consumers, suppliers and the state.

The priority of an enterprise during the first stage of market economy development is to remain in the market at all costs. It loses its central support and comfortable market conditions, but it is unable to restructure, which would allow for its further existence. An enterprise is viewed by its employees and board as valuable in itself, regardless its economic results. Nonetheless, the new conditions such an enterprise keeps functioning in differ considerably from the socialist ones. Even the most conservative adaptation strategies cannot guarantee selling up all products. The competition as regards imported goods and the lack of pressure to buy make companies learn to sell its production. Since the possibilities to minimize costs are limited, the only form of adaptation is keeping the prices low (Dzarasov 1997). Because of technological backwardness, inefficient models of work organization and the neglected production basis inherited from the previous system, it is possible solely thanks to shifting the costs to the state, clients and manpower (payment arrears, forced barter, delayed or barter pay). Such a staging post was in a sense inevitable because of the dominant mass of socialist type enterprises being practically the basis of social structure. All the social and geographical infrastructure was based on conglomerates of socialist enterprises, the malfunction of which could cause humanitarian catastrophes in numerous regions of Russia in the given institutional and political conditions (Sinyavsky 2003).

Radical changes in the conditions of running businesses resulting from the crisis of August 1998 caused positive dynamics of production, which was not directly connected to technological modernization. The selective liberalization, maintaining the favorable exchange rate and mass tax evasion make the scale of market constraint still insufficient to result in a mass demand for innovation. This situation is preserved

[7] It refers particularly to the production sector. The companies offering services were modern from the start since they had to face competition, lacked the support from the state and were more flexible.

due to the underdeveloped financial sector and incredibly short-term economic decisions.

Regardless the resource character of its economy and the enormously long transformational recession, the Russian Federation has managed to start the modernizing its economy and establishing the basis of an informational society. Since the late 1990s, it has been catching up with transferring informational and communicational technologies incredibly fast despite its infrastructural limitations, unadapted legal basis and the low purchasing power of a statistically significant segment of its population. The main problem of the recent stage of reforms is the increase of administrative control over the economy, seriously limiting development opportunities (Bean 2004).A lot of factors indicate that the separation of technological knowledge from the economy has been overcome thanks to the increasing technological transfer. It has resulted in the gradual loss of the remaining (post-socialist) intellectual capital owing to emigration and low popularity of science in the society. The lack of institutional infrastructure, poorly efficient scientific administration and the decrease of interest for the part of enterprises have lead to the widening of the gulf between the still poorly technologically advanced economy and the research and technical personnel, which according to some sources constitutes 10% of the world's research potential[8]. Science is still state-supported and does not consider the market as an important decision-making factor. Russia can clearly afford maintaining the research sector, but it cannot use it. The Russian society is still capable of surprising technological inventions, but it has remained incredibly uninnovative.

3. A POST-SOVIET STATE AS A CAUSE AND EFFECT OF SYSTEM TRANSFORMATION

The capability of power structures for positive or negative influence on economic phenomena constitutes one of the key economic issues. The range, directions and legitimization of this influence are until this day a challenge for economic theory and practice. Despite the systematic growth of state participation in all economies in the world, the decreasing number of economists view states as a panacea for all economic diseases. Discussions in economics concerning the scale and range of state activity are directly related to the question of the capability of the

[8] The large research personnel does not translate into its market efficiency: in the years 1992–2001 only 5% of the registered inventions were sold. Additionally, there are problems with certification, standardization and the concentration on obsolete technologies (Gokhberg 2002)

market system to guarantee an optimal level of social and economic development, both in the short and long term. The grounds for state intervention in economic life always lay in the assumption that the market system is effective, as for providing the optimal amount of goods and services, only to a limited extent. The convictions of complete inability of the market system to guarantee a high level of production in the long term and of constantly unjust product distribution are also essential for socialist doctrines.

The situation becomes complicated when an economy has to overcome technological backwardness. From the economist viewpoint, state is routinely perceived as a tool for modernization. The works of the New Institutional School have changed such a research perspective completely. The idea of exogenic state disappeared. For the recent decades, we have also been witnessing the shift of attention from the objective and result analysis of economic interventions to the structures that generate them:

> *It is oversimplifying to treat government as a uniform entity capable of fast and coherent action. This entity has a complex hierarchical structure. Particular elements of the latter in reality can and do have different horizons of activity* (Kowalski 2001).

The above has special consequences for the research on the reforms conducted in the Russian Federation, since the role of the state has been, on principle, special in the development processes and the statist tradition dates back to long time ago. Such a perspective limits excessive expectations from post-Soviet state economic activity, at the same time emphasizing the issue of government quality, i.e. the general standards of functioning of a given state. Referring to the concept of an Oriental despotic state, Ye, Gaydar determined the limits of using a normative analysis of economic politics:

> *It is not about the lack of state intervention in the economy, but about the rules of this non-intervention, i.e. about the future shape of the state in question, which is in fact the most important. Until the Eastern state tradition is overcome, it is impossible to talk about intervention* (Gaydar 1995).

Determining the role that the state can play in the modernization processes of the Russian economy requires a precise definition of its nature. Post-Soviet states developed from the ruins of the Soviet society, preserving the continuity of the law, personnel and culture[9]. The geographic, demographic and infrastructural conditions inherited from the USSR were the reason why the new states had no possibility to react flexibly and effectively to the dynamic decommunization processes.

[9] Regarding the administrative culture.

Apart from a standard set of transformational problems, post-Soviet states had to "establish" the societies and countries their reform policy was addressed to. Thus, the issues of establishing new social order, new models of ethnic relations and a new form of elite selection played a more important role than the objectives of economic reforms (Kulpin, Pantin 2004).

The collapse of the Soviet state initiated disintegration processes of all the social and economic structures. The closed character of the USSR's economy and the specificity of the socialist modernization influenced the special nature of adaptation to the growing malfunction processes of the Soviet state. The transformation of infrastructure (both mental and physical) that was shaped by the previous regime could not keep up with fast political changes (Klugman, Braithwaite 1998). Because of the malfunction of the Soviet state on the legislative and executive levels, economic entities started to establish institutional infrastructure at the grass roots, i.e. the one that was supposed to correspond with economic reality (Volkov 2005). The process caused the emergence of a specific synthesis of formal and informal institutions, which enabled to begin economic changes on the conditions acceptable for the key agents (the lack of restructuring, remaining on the market preserving certain elements of the previous system, Nikipelov 1996).

The malfunction of the socialist state caused the control (or substitution) of state institutions by new forms of social integration called post-Soviet organizations. The organizational model was characterized with an exceptional set of features and functions that enabled the society to introduce conservative adaptation to the system changes. First of all, post-Soviet organizations had a very distinct function of objective, i.e. taking over, preserving and monetizing the former Soviet assets. That influenced the characteristic features of that form of organization, i.e. preferring violence, being morally ambivalent, persistent aiming at monopolization at all costs and interpreting reality very conflictually. In the first decade, the newly established state structures were trying to limit the impact of informal institutions on the social and economic life, although at the same time they were controlled by the latter. The consolidation of institutions and the delayed economic growth enabled the state structures to marginalize that factor. However, numerous conditions indicate that there was a transfer of patterns from the analyzed model of organization to the structures of the post-Soviet state. In this context, the latter has been shaping on the basis of the previous nomenklatura in the conditions of a continuous conflict concerning the distribution of assets. This in turn has influenced the preference of social and economic strategies (a tendency to monopolize decisions in the key economic sectors).

The post-Soviet state has been acting as the only power having undisputable social legitimization and able to eliminate its opponents.

Table 1 presents the "level of relationship" between the new structure and its Soviet prototype. It is worth to notice the structural similarity with the gradual correction of social (consent for mass impoverishment) and economic (concentration solely on the sectors guaranteeing high return) responsibility.

Table 1. The "level of relationship" between the new structure and its Soviet prototype

Type of state	Soviet state	Post-Soviet state
Influence on the economy	direct	indirect
Key sectors control	direct	direct/indirect
Social responsibility	high	nominal/low
Knowledge expenses	high	low and inefective

Source: own elaboration.

In such a context, rather than with a dilemma of intervention we are dealing with a triangular structure including the low-technology economy with dominating non-market strategies, the post-Soviet state and the uninnovative science sector supported by the latter. All the elements of the triangle require fundamental institutional and organizational reforms. The restructuring and liberalization of the economy needs to be finished, the distance between the post-Soviet state and its Soviet predecessor has to grow and the management, financing and market strategies of the research sector require radical changes.

4. CONCLUSIONS

The main conclusion is that the character of the institutional background for economic activity proves decisive for knowledge distribution processes in a given economy. Only the introduction of a market-led economy and the emergence of the infrastructure that would allow for marketing inventions can guarantee the growing technological advancement of Russia's economy. The case of the transforming economy with institutional barriers for modernization analyzed above can be viewed as the confirmation of a thesis concerning the high influence of institutions on the character of economic growth. The specificity of the state structures that have developed from the ruins of the former USSR will determine the possibilities of development for the post-Soviet societies in the next decades. It regards the character of economic impulses rather than the ability of the post-Soviet states to intervene effectively. Only the complete restructuring, reformed infrastructure and respected

proprietorship can contribute to modernization processes based on a mass demand for innovation. This is the condition for the emergence of the chances for a successful technological transfer or even for the development of the possessed scientific potential. Otherwise, the gap between the economy and the research capital inherited from the previous system can only grow.

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