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KNOWLEDGE-BASED ECONOMY AND KNOWLEDGE SOCIETY: SOME STARTING POINTS

FROM KNOWLEDGE ECONOMY TO KNOWLEDGE SOCIETY

Scholars, policy makers and the public would all agree that we live in a knowledge based economy and in a knowledge society (KBE/S). But, despite the growing body of literature and analytical studies on the subject, these terms still have a variety of meanings. Nevertheless, they all share the underlying assumption that a knowledge based economy/society appears when capital is replaced by knowledge as the main source of economic growth.

Therefore, the standard definition of knowledge based economies would be: "economies which are directly based on the production, distribution and use of knowledge and information (OECD, 199:7). We could say that KBE/S tends to mark a new economic and social regime where "the capacity and ability to create new ideas, thoughts, processes and products, and to translate these into economic wealth" (Huggins, 2004) is essential.

Although the productive power of knowledge could be traced back to the dawn of civilization, the KBE/S is substantially different from the previous regimes due to the growing, fast, systematic and organized integration of scientific achievements, methods, and instruments into industrial and economic processes. KBE/S has roots in the 2^{nd} industrial revolution (at the turn of the 19^{th} century) marked by the emergence of the first knowledge-based industries in USA – chemical and electrical engineering (Rosenberg & Nelson, 1994; Nelson, 1990) based on the scientific achievements in chemistry and physics. These industries were supported by the simultaneous development of chemical and electrical engineering as academic disciplines taught at universities for the fist time in the history of science. In 1996 Simon Kuznets wrote that "the epochal innovation that distinguishes the modern economic epoch is the extended application of science to the problems of economic production" (Abramovitz, 1989:55), providing us with a criterion for making a distinction between this type of modern society and the earlier ones.

"The father of modern economics" Adam Smith in his great book *Wealth of nations*, 1776 (Abramovitz, 1989:4) says that the improvements in machinery could also be made by a philosopher and a men of speculation (Arora & Gambardella, 1994), recognizing as early the productive power of knowledge and the significance of science as an economic activity.

The foundations of the contemporary KBE were laid down by the mid twentieth century neoclassical growth theories which perceive technological change as a driver of economic growth (Solow, 1957; Abramovitz, 1956) together with the new growth theories formulated by Paul Romer some thirty years later (Romer, 1989, 1990). All of these theories consider knowledge and related technological change as drivers of economic growth. However, the former consider technology as an exogenous factor, a phenomenon unrelated to the pace of economic growth and social change while the latter believe that technology change is endogenous to economy and society and requires deliberate human action. Particularly stressed are the government policy and incentive measures focused on the public investments in knowledge and science as a pool for generating new ideas and technologies (Romer, 1994).

The endogenous growth theory has helped recognize that social action and socio-economic and cultural factors also matter when technology and economic development is concerned. Paul Resnick, one of the leading authorities in socio-technical capital noted[1] that the growing literature on social structures and dynamics, usually defined as "social capital" confirmed its correlation with the positive individual and collective outcomes in different areas of human life like health, crime, good government and economic development. In this context he particularly emphasized Putnam's analysis of the American society (Putnam 1993 and 2000) and Knack and Keefer's paper on social capital (1997).

The social aspects of KBE are rarely discussed independently. Knowledge society is usually considered a by-product or side effect of KBE. For that reason is the distinction between knowledge economy and knowledge society often obscured. One of the first papers dealing with knowledge society is the article "The Use of Knowledge in Society" (Hayek, 1945).[2] Peter Drucker, according to many the guru of the knowledge society, wrote in 1957 that "productive work in today's society and economy is work that applies vision and concepts – work that is based on the mind rather than the hand".[3]

Similarly, Stan Davis and Jim Botkin (1994) pointed out that the next wave of economic growth is going to come from knowledge-based business. They also tried to emphasize the difference between information economy/ society and knowledge economy/society. They deem that "we are in the cusp of the transition from information to knowledge, with knowledge meaning the application and productive use of information" (Davis and Botkin, 1994). Even if information economy/society and knowledge economy/society are quite close in meaning, there is also a significant difference resulting from the different ways of information exploitation and computer technology usage. Information economy is based on the exploitation of information in the sense of "taking data which consist of numbers, words, sounds and images – and putting them into meaningful patterns: a printed page, a photography, a musical score, etc., and their processing by the *"crunching" power of* computers". Knowledge economy, on the other hand, is based on "smart products" that put this meaning-composed information to productive use, while the application of computer is shifted from "computing" to "connecting" or "communicating" that make the modern concept of information and telecommunication technologies (ICT).

MOVING TOWARDS KNOWLEDGE BASED ECONOMY/SOCIETY: THE NEED FOR A NEW POLICY PARADIGM AND SOCIAL CHANGE

Davis and Botkin, (1994) stressed that the emergence of KBE/S requires not only a *technology change* embodied in new technologies and innovations, but also "a new way of thinking". In other words, technological change requires social recognition, assimilation and adaptation embodied in *social change*. The recent works dealing with the long-waves of economic development such as technological regimes and techno-economic paradigms (Perez, 2003) recognize the importance of social change for acceptance of new technologies. The new techno-economic paradigms such as KBE/S require social change embodied in the new organization of institutional infrastructure, management and origination, political and socio-cultural adaptation and absorption (Perez, 2003).

The recognition of the social impact of technology and understanding of economic growth as a social process begin with new conceptualization. The macroeconomic interpretations of the crisis in the seventies based on the environmental growth theories were challenged by the new conceptualization of innovation process (Mytelka & Smith, 2002:1473). The definition of the process of analytical change as formulated by evolutionary economists (Nelson & Winter, 1982; G. Dosi, 1982; Freeman, 1988a, 1988; Abramovitz, 1989) led to the conclusion that "technological change is, in its development and application, fundamentally a social process, not an event, and should be viewed not in static, but in dynamic terms (OECD, 1992). The 1988 Sundqvist Report[4] on "the interdependence of technical, economic and social change", and its conclusion in particular, (OECD, 1992) marked for the developed (OECD) countries the turning point in their approach to technology. It was finally recognized that the emerging technological change or innovation as a driving force of economic growth is not a spontaneous process but a process constructed within certain economic and social system (Freeman, 1988). Economic growth could, therefore, be accelerated by creating proper socio-economic and institutional environment which fosters innovations. The national system of innovation (NSI), a concept developed by Lundvall (1988), recognizes such an environment. Christopher Freeman was the first to apply NSI in practice (1988) in his comparative studies of American and Japan post war economies (Mowery & Oxley, 1995). NSI is a concept that has had an astonishing take-up and still has the greatest impact on policy thinking (Mytelka and Smith, 2002:1472) when networks and interactions among different actors are needed for the knowledge production and exploitation.

The concept of NSI is rooted in the recognition of the rapid economic rise of some Far East countries e.g. Japan and Korea which, if compared with the USA, the leader in the organized efforts to apply scientific knowledge to industry, must be considered scientifically underdeveloped. This recognition has seriously shaken the faith in the power of scientific achievement as a driving force of economic development and has shifted the multitude of strategic policies from science to technology innovation and NSI as a comprehensive system for the effective materialization and commercialization of knowledge (Nelson, 1990; Rosenberg and Nelson, 1994; Mowery, 1992)

The linear model of innovation in which science is an implicit factor in generating new technologies was abandoned as "primitive" (Abramovitz, 1989:29) and was substituted by the interactive model in which innovations are expected to appear at any phase of innovative chain, scientific research not necessarily involved.

Once the "European paradox" (European Commission, 1995) was identified, the concepts of innovation, innovation capacity and NSI have spread all over Europe and have become the focus of EU development polices (Arundel et al., 2000). The concepts were fully fledged at The Lisbon European Council Summit held in March 2000, where the new strategic goal for the EU "to become the most competitive and dynamic knowledge-based economy in the world" was set. This goal was further expanded by the Barcelona European Council in 2002 and by the Commission Communication on Innovation Policy in 2003 (European Commission, 2004).

Countries like Sweden, United States, Korea, Finland, Ireland and Australia (OECD, 2001) that closely correspond to KBE/S have developed a range of new institutions, organizations, methods and models that encourage innovations. The new institutional structures for technology transfer and commercialization of research like technology/business centers and science parks; the new organization of scientific research like public-private partnerships and research consortia; the new financial sources for technology based business like venture and seed capital; the protection of intellectual property rights in academic sphere; the domination of business sector in performing and investing in R&D; the heavy public investment in education and generic technologies (bio- and nanotechnologies); these are just some elements of the deliberately created models for accelerating knowledge based economic growth.

Following the conclusion that scientific research is indispensable but not sufficient to achieve competitiveness, scientific policies are gradually being replaced by innovation policies and by the national systems of innovation (NSI) which accept technological innovation as a driving force of economy and which incorporate science and research as important but not exclusive factors in innovation generation.

Universities and academic community are, for the first time since the "golden 1950s and 1960s", facing a growing demand for the justification of public expenditures.

The changing role of universities and public research has became the issue for many scholars (Lucas, 1996, Horgan, 1996, Readings, 1996) culminating with T. Kealey's (1996) rather shocking book in which he claims that the public funding of science and technology is not only unnecessary but also counter-productive.

Since the success of NSI is determined by the efficient translation of research results and knowledge into commercially successful innovation and economic wealth, universities and public institutes, the traditional creators of new knowledge, are facing dramatic changes in organization, functioning, evaluation, institutional arrangements etc. Presently, these changes reflect the concepts of the new knowledge production (Gibbons, 1994, Nowotny et al., 2001), the 2nd university revolution (Etzkowitz, 1989), and the new contract between science and society (Ziman, 1989).

The essence of these changes is in the growing demand for close co-operation between academic science and industry in order to accelerate technological change and innovation. Therefore, "it is not surprising that the link between universities and industry has become a political issue" (Lundvall, 1988).

Indeed, in the 1990s, many economically successful countries replaced their national science policies with innovation policies as *new policy paradigms* offering a new way of political and economic management of national resources that grounded growth in knowledge and research. But in the transition countries innovation policy has been poorly understood and the construction of the national systems of innovation has been neglected. Policy measures aimed at innovation capacities, technological change or knowledge-based growth factor have been pushed aside to give way to other, politically and socially approved, priorities like macroeconomic stabilization, privatization, trade liberalization, foreign direct investment, social cohesion, etc. So, the questions remain: Why haven't transition countries recognized knowledge and innovation as new driving forces of economic growth? Why have they missed a chance for fast progress towards KBE?

The two key reasons could be identified. The first has to do with the obsolete growth model based on traditional industries and with the linear model of innovation which hindered the adaptation of socio-economic structures and management to the new techno-economic paradigm based on the appropriation of knowledge. The other is deeply socially rooted since it is closely related to the ability of a human being or a nation for adaptation and assimilation of KBE as a new techno-economic paradigm. Such adaptation and assimilation would require a brake with the existing organizational habits in technology, economy, management and social institutions all strongly influenced by the country-specific and historically inherited socio-cultural factors like norms and values, business and political ethic, leading personality, organizational and management habits, etc.

Therefore, moving towards KBE calls for tremendous social changes simultaneous with technological and economic changes.

Unfortunately, the transition and developing countries still ignore the need for social change. In contrast to the developed countries, they have neglected the fact that a new economy requires a new society. Semi-modernism (de-industrialization, de-scientization and re-traditionalization) (Županov, 2002) is the main feature of the transition countries as well as the reason why they can't understand that the role of human and social capital in creating economic growth is equal to the role of physical capital (including technologies as embodied knowledge). Human capital by definition consists of knowledge, skills and health embodied in individuals while social capital refers to the norms and networks facilitating co-operation either within or between groups. The well-being of nations, the role of human and social capital, mutual trust and respect, honesty, team work, transparency, open-mind, tolerance, cultural diversity and similar values build up social capital needed for economic growth based on knowledge and innovation. Political, institutional and legal arrangements interact with social and human capital to influence the well being of humans (OECD, 2001:12).

In other words, the promotion of technological change and innovation into a driving force of economic growth is not possible without social change towards modern knowledge society. Knowledge society implies adoption and diffusion, at practical and reflexive levels, of the idea of knowledge, innovation and education as the key concepts with regard to human well being and the standard of living. All of the main segments of society entrepreneurs, political and intellectual elite as well as labor should be prepared to accept novelty, to permanently learn and to change traditional values, norms and behavior towards the promotion of knowledge, innovation and education. Only the educated people, the cosmopolites who feel like the citizens of the global word could overcome cultural and historical heritage that hinders a nation's innovation capacities and willingness for constant learning. Therefore, the human capital in terms of educated citizens and the social capital in terms of an open mind, trust, tolerance, readiness to accept novelty and adapt to constant change are of the highest importance.

Following this line of argument that, in addition to the economic resources, economic growth requires social recognition, assimilation and the deliberate action the conference intended to highlight the social aspects of becoming a KBE. The first chapter discusses the science–industry-government interplay seen through the Triple Helix model as a NSI. The second chapter deals with the potentials and obstacles for KBE in Central and Eastern Europe while the third chapter brings some case studies from these countries. In fourth chapter the emphasis is on the role of innovation, technology and organizational change in economic growth. The last, fifth chapter discusses education, values and ethics required for knowledge based society. Finally, the appendixes provide the guidelines for an innovation policy for Croatia seen as a typical transition country, as well as some basic statistical data on knowledge intensity and related factors for the transition and developed countries.

THE CONFERENCE CONTRIBUTION

The first part of the Conference was devoted to the triple helix (TH) as a national innovation system. As **Prof. Henry Etzkowitz**, one of the authors of the Triple Helix theory, stressed in his plenary speech, both the industrially advanced and the developing countries have been experimenting to find the better mixtures of functions and institutions in the triple helix of university-industry-government relations. They have been applying different models of TH. The developed countries have been inclined towards the "laissez faire" triple helix regime (the USA was a prototype for such models) while the East European Countries or the ex-socialist block where the state governed both the universities and the industry as well as the cooperation between the two, used to have a "static" triple helix model. Both are now moving towards the same format of TH, the so-called TH III which transcends the national boundaries and which can be described as the "full functioning TH model". TH III consists of the three parts: the knowledge space, the innovation space and the consensus space. From the CEE countries point of view the most difficult as well as the most important is the consensus space as it represents the meeting point for different groups to discuss problems and strategies. Such meeting place requires the existence of the civil society – the category still non-existent in some countries as "it presumes collaboration between actors in which all partners have a say".

To be successfully integrated into the EU networks of knowledge the transition countries need to upgrade their national innovation systems. As **Franz Mali** suggests, for the small CEE transition countries the adherence to the strategic goals of the European Research Area (ERA) should be at the heart of innovation policy. ERA advocates the revolutionary new idea of research and the new innovation paradigm based on the integration of R&D polices with other policies: educational, competition, regulatory, regional and foreign policies. The acceptance of the ERA philosophy as well as the possible integration with ERA is typically hindered by the inherited scientific system and the provincial spirit which feels threatened by the openness to the world and which causes scientific inbreeding.

In the second chapter, "Potentials and Obstacles for KBE in CEEC", **Slavo Radošević** points out that the growth of the CEE was not based on domestic R&D or on the local technology effort but on the low and medium technology FDI, the "re-allocations" (from the unproductive parts of industry to the services, from the less to the more efficient firms) and the purchase of "embodied" technologies (machinery, equipment, plants). Enterprises do not innovate on their own; their technology capability depends on the "supply chain" i.e. the immediate business environment the suppliers, the buyers, the clients, the competition and the related social networks. The demand for new technology and R&D was lacking as innovation consisted of the downstream activities like the reverse engineering, the process/product imitation and the purchase of the new, most often imported, equipment.

The combination of the decrease in governmental funding and the low demand for R&D from local industry has blocked the structural change of R&D towards an innovation system and has resulted in the overall shrinking of R&D. Most intriguingly, the R&D systems started to decline in both kinds of CEE countries: in those with the economic growth like Poland, as well as in the growth declining countries like Russia. The transformation of some CEEC during the 1990s e.g. Poland, Hungary and Slovenia shows that R&D system plays a relatively limited role in economic recovery. Innovation does take place even if the innovation policy is ineffective, which points to the crucial question: is innovation policy indispensable for CEEC?

The CEEC' business surveys provided by **Slavo Radošević** revealed that CEEC businesses have, for the first time, been encountering the problems of the supply of the trained work force and new technology. This, rather new, phenomenon suggests that growth based on reallocations, supply chain and FDI has reached its limits and that international competitiveness and technology upgrading requires, in the long run, an innovation system that will connect domestic R&D and industry development. Therefore, NIS as a link between science (in the broadest sense), universities and industry seems to be an indispensable tool for establishing the KBE/S.

Devrim Göktepe's comparative analysis of the six developed countries' national programs for fostering networking among the users and producers of knowledge clearly stresses the crucial role of government in increasing innovation, competitiveness and the commercialization of knowledge. In all of the six countries programs follow the top-down approach and the governments' agencies provide the institutional, legal and financial structures necessary for innovation networks.

The key factor of the EU success is networking especially in the light of the forthcoming enlargement, as the EU is based on the network of relations between national governments, industries and knowledge centers.

As CEEC have suffered, **Željka Šporer** stresses, the different degrees of isolation from the globalization trends of the Western economies, entering the EU can be very painful and frustrating. CEEC have, in the 1990s, failed to adapt their institutions to the new technology paradigm based on information and telecommunication technologies (ITC) and knowledge transformed into innovations. The comparative analysis of the indicators of knowledge-based growth clearly demonstrates that that majority of CEEC significantly lag behind in basic infrastructure necessary for developing knowledge based economy. For example, the proportion of the GNP spent on R&D as well as the number of researchers in the total population is much lower than in the developed countries, all of which suggests the low capacity for innovation. The state still dominates the business sector in financing and performing R&D, which illustrates the low level of using knowledge and research for production and economy. The lag behind in ITC (mobile phones, Internet users, number of personal computers) is the most serious problem, as ITC is the back-bone of a knowledge based-economy.

Still, some indicators like the educational indicators (the number of students, the proportion of GDP spent on higher education) as well as the indicators of the openness of economy do not differ much from those of the EU countries, demonstrating that CEEC have the potential for faster development.

The third chapter is devoted to the four case studies illustrating the potentials and obstacles for KBE in Central and Eastern Europe as analyzed in Chapter II. **J. Švarc and J. Lažnjak** have identified the four main failings of the Croatian NIS for which the state of semi-modernism and the lack of social capital are to be blamed.: /1/ the insufficient technology capabilities of business companies, /2/ the inadequate structure of R&D sector, /3/unsatisfactory science-industry cooperation and /4/ the inappropriate environment. These are the same shortcomings that other CEE countries must deal with. The authors emphasized the so called "Croatian research paradox" which reflects the fact that, although the total investment in R&D (GERD) in Croatia (amounting to 1.2 % of GDP) is quite satisfactory, the industrial R&D sector almost disappeared during the transition period and the public R&D sector, the national knowledge pool, is seriously weakened. A general diagnosis would be that the problems are not so much in "inputs" as in "outputs", resulting from the inadequate structure of R&D sector and an inefficient NIS.

The Croatian R&D system is, like in many CEE countries, still dominated by the public sector since the state invests about 0.55% of GDP and employs about 83% of researchers, while the industry invests the modest 0.43% of GDP and employs only 18% of researchers. In comparison, in the developed countries the science system is dominated by the industry which invests more then 1% of GDP (in the fast growing countries more then 2% of GDP) and employs the majority of researchers and scientists (from 50% of the total number of researchers in the EU to 65% in the OECD countries).

Vesna Andrijević-Matovac offers a brief overview of the Croatian NIS and of the innovation activities of Croatian business firms for the purpose of exploring the possibilities for the improvement of the Croatian NIS. Although the state administration[5] has introduced new measures and established institutions that have paved the way for an innovation system, the Croatian NIS is still in its infancy. The measures for its improvement should concentrate on ensuring /1/ a suitable environment (legal, administrative measures), /2/ an adequate input (skilled work force, basic science) and /3/ a communication improvement (science-industry cooperation, raising the public awareness of the importance of innovation).

To sum up, the Croatian NIS is suffering from the lack of institutions and mechanisms for brining ideas, innovations and research results to commercial products as well as for creating enterprises. Therefore, the construction of NIS and the articulation of an innovation policy is a major challenge for every CEEC with a tendency towards KBE.

Our Slovenian colleagues, **Maja Bučar and Franz Mali** confirmed the above stated ideas. Slovenia is one of the most developed EU accession countries. It is, according to the Candidate Countries Innovation Scoreboard, ranked fourth and has 5 indicators out of 18 close to or above the EU average. Nevertheless, it is still without a sound innovation policy and there are wide gaps in its innovation performance, particularly in the areas of the business sector such as high tech venture capital, the ratio of BERD to GDP, the SME's innovation activity, the employment in the high-tech services, the number of patents, etc. The science policy is still dominant over the innovation policy while business firms are too slow in changing and innovating their production programs, products and techniques. In Slovenia, same as in other CEE countries, the powerful orthodox scientists who acknowledge only basic science and the so called "high-quality" publications together with the orthodox economists who believe in the market–driven technological restructuring oppose its innovation policy. **Maja Bučar** emphasizes Freeman's observation that the technological leapfrog catch-up with the technology of the next decade was always supported by the conscious action of the government. Institutional innovation, infrastructure, investment in education and S&T as well as the science-industry-government cooperation are the necessary prerequisites for such change.

The two case studies of agricultural sector in Croatia (seed potato and *pyrethrum* flowers) by **Mira Krneta** and **Anči Leburić** testify that in countries like Croatia TH a democratic procedure of decision making has so far not been practiced in the domains of entrepreneurship, science and technology. Since these domains are the social spheres where (sub) political decisions on innovations could be made and implemented, the failure of social changes is even greater.

Therefore, as Etzkowitz points out, the meeting place for reaching the consensus between the different actors is immanent for the civil society and thus the civil society is immanent to TH. After the collapse of socialism CEEC broke with their bureaucratically organized innovation systems, but each of them failed to build up a TH exactly because they lack a meeting point, a consensus place to build up an innovation policy. The developed countries are gradually replacing the obsolete linear model with the "assisted linear model" a series of innovative policies and programs at the national level to assist the translation of research results into economic uses. The developing countries lack such structure. The CEEC industrial model based on foreign direct investments (FDI), concludes Etzkowitz, had no need for domestic R&D resources or national innovation policy.

The **fourth chapter** explores the role of innovation, technology and organizational change in economic growth. **Sonja Radas'** analysis of business firms' satisfaction with the collaboration with research institutions in Croatia, clearly points out that the first and the foremost pre-condition for the science-industry cooperation is strengthening firms' innovation and technological capacity.

There are three major motives for firms to cooperate with science: seeking new technologies that bring competitive advantage, resolving specific problems or using the name of a research institution as a product quality guarantee. Still, only innovative and technology-based firms are prepared to collaborate with science because they have the technological capability to benefit from more demanding and innovative projects. Correspondingly, firms with sufficient financial resources supported by financial institutions, investors and the tax system are more likely to engage in the science-industry cooperation, all of which speaks in favor of building up a proper environment.

Similar data on Croatia's lag behind in technology, education and research are provided by **Sanja Tišma, Krešimir Jurlin and Anamarija Pisarović.** They have stressed the utmost importance of active innovation policy in contrast to passive market liberalization or substitution by import. The traditional, relatively inflexible model of research activities at universities traditionally organized and financed by the state should be modernized. Accordingly, the business R&D devastated by defensive restructuring, privatization and mere survival should be revitalized. The government has the crucial role and should take the risk of technological renewal and the introduction of innovation to companies. Therefore, the government should support R&D in the business sector and the science-industry cooperation to promote the recognition of knowledge and technology as production factors.

Maybe the most important as well as the most neglected aspects are the intellectual property rights in the research sphere, business consultancy and venture or seed capital that complements more traditional banking resources for knowledge-based entrepreneurship.

The comparative overview of the role of venture capitalists (VCs) in the developed and CEEC economies is provided by **Domagoj Račić** and **Ilian Petkov Iliev**. In the developed economies VCs play an important role that goes far beyond the "pure financial intermediary" and helps to develop the sector of innovative and new-technology based firms (NTBF). VCs act as facilitators of a firm's entry into the corporate networks, they assist the development of a firm's growth strategy and help the technology transfer from the research sector to the industrial sector by means of the commercialization of research results thorough the company start-ups or spin-offs. VCs could connect financiers, entrepreneurs, corporate executives, headhunters, consultants, customers, suppliers, researchers and the government profitable and innovative entrepreneurial projects. VC's mark the high-quality projects since their support means that a company has passed the due diligence process and has a reliable management team. However, in CEEC the role of a VC is hindered by the low innovative capacity of firms, the lack of the demand for SME's from the corporate buyers as an important exit route and by the low level technology transfer from science to industry. The domination of the technologically exhausted, non-attractive traditional industries and the power of multinationals (MNE) influence the selection of investments that fit into MNE usually low-tech and insignificant for national development, all of which dispels the VC's interest. Building VC industry in CEE countries requires substantial changes in entrepreneur culture, the improvement of skills of all actors (management, marketing, accountant, investment), the promotion of business angles and seed capital and the government administration's willingness to help this process by legal acts, financial help and innovation promotion.

Marina Dabić suggests that the need to build the technological capabilities of companies and the global competition pressure open the floor for an increased attention to the management of technology (MOT). Although there is little agreement on what MOT is, the most important aspect of MOT in the transitional countries is the "absorptive capacity" that enables companies to recognize the value of, acquire and use a new technology. The absorptive capacity is closely connected to the learning process, the accumulation of technology capabilities and social knowledge (knowledge grounded in close bonds within networks). MOT is, therefore, strongly connected to business and organizational culture which stimulates learning, flexibility and novelty. The successful managers of technology must demonstrate not only a considerable knowledge of engineering and business but must also possess basic skills in human interaction, leadership, teamwork and problem solving. Present business is "funky business" (Nordström, K. A & Ridderstrle, J. Differo, 1999 *Funky business*), therefore investing in organizational and cultural capability as well as in human resource management is becoming more profitable than investing in technology itself.

Jonathan Cooper and Ascendant Capital Advisory demonstrate how business consultancy works in practice, how an idea is brought to the market. When entrepreneurs as well as the state administration shall routinely use the consultancy services of this kind for supporting the science-industry cooperation, and when professionalism and transparency become the standard and not an exception, the infancy of the Croatian NIS will be over, and it will be ready for the next qualitative step. However, Ascendant Capital Advisory is an exception, not the rule.

The last, **fifth chapter** focuses on some very important dimensions of knowledge based society: education, values and ethics. The way to knowledge based economy is paved with learning and education as factors that form the human capital, intellectual and working skills. Therefore, the idea of "European education space", as **Denisa Krbec** explains, resembling the proposal for the "European research area" is fundamental to the contemporary structuring of the EU. The transition countries are facing the challenges of taking a part in the process of the "europeanization of education" and of adapting their university systems to the demands of integration, standardization and harmonization with Europe. However, the europeanization of education implies a changed role of universities according to the philosophy of the "second university revolution" i.e. the introduction of the commercial activities and university's contribution to the economic and technological development of the local community or a nation as a whole.

The traditional university paradigm is challenged by the paradigm of the entrepreneurial university that has a great impact on researchers' professional ethics. A shift from traditional values, norms and cognitive standards usually described as a Mode 1 towards the new model of knowledge production known as Mode 2 is in progress. **Katarina Prpić'** examination of the ethical code of the eminent young researchers (even if it couldn't reflect the general change of Croatian researchers' attitudes towards knowledge-based societies) revealed that the social dimension of young researchers' science ethics (responsibility to society, colleagues and funders/clients) is more similar to what is called the "new" research ethics than to the traditional academic, socially isolated value matrix. Unlike the social dimension, the cognitive dimension corresponds to the epistemological realism with an emphasis on objective, reliable, measurable and precise new knowledge. The essence of the knowledge based society is the production, diffusion and the commercialization of knowledge, all of which is much closer to the "new knowledge production" than to the traditional pursuit of truth. Therefore, the research ethics, the researchers' cognitive and social norms and values attract the growing interest of the policy makers who have research that corresponds to the needs of the knowledge economy in mind.

Željka Šporer particularly stressed the problem of social capital – the system of norms, values, networks and trust that help market economy and democratization. The most important goal of the societal policy is to decrease the uncertainty, regain the confidence into the institutional system and at the same time control negative elements of the social networks established in the previous, communist system. Similarly, **Matko Meštrović** concludes that the developing countries have failed to find a path of dynamic economic growth because of the missing links in the overall functioning of their economic and social systems. The need for the participatory forms of governance and efforts to strengthen social integration is evident now.

WHAT HAS THE CONFERENCE REVEALED: SOME POLICY IMPLICATIONS FOR CEEC

After almost the 15 years of transition, the economic growth of CEE countries has come to the point when catching up strategy should be planed, like those of the developed countries, according to the knowledge based factors. However, using R&D as economic and production factors demands a considerable change in the mindset of the political and intellectual elite tuned to the traditional economy that doesn't not recognize the management of technological change and innovation as a driving force of economic growth. The industrial as well as the science policy the two critical aspects of the new economy call for a radical change, because in the 1990s the role of R&D has been substantially changed and has come to be closely identified with the field of innovation. Similarly, the price-cost competitiveness has been turned into the innovation-based competitiveness and "innovate or liquidate" has become the new philosophy of industrial production. Still, in SEE countries the industrial as well as science policies have for decades remained almost the same.

CEEC are the typical examples of the institutional inertia (Freeman & Perez, 1998) and the institutional sclerosis (Lundvall & Johnson, 1992) preventing the recognition of innovation as the key concept of the economic development and the structural adjustment to the new techno-economic paradigm of the knowledge based society. There is an urgent need in CEE countries to overcome this institutional inertia and to change the science and industrial policies towards the **pro-active innovation policy** that should integrate R&D sector with the other parts of the social and economic system (education, industry, financing, administration, etc.). The final target is the production of innovation, new technologies, and human skills and, of course, the knowledge for human well-being.

Therefore, the construction of the national innovation system and the articulation of the innovation policy are the major challenges for any CEEC intent to achieve KBE. In contrast to the *laissez faire* and liberal market economy, an innovation policy is a deliberate and conscious action on the part of the political and intellectual elite to create the proper conditions for the innovation creation and the acceleration of the technological change surpassing pure market incentives. Therefore, new organizational mechanisms and institutions should be invented, introduced and deliberately experimented with in order to implement the interactive as well as the "assisted linear model" of innovation. The new financial tools like venture capital, the new institutions like technology and science parks and business incubators, the new organizational forms like technology foresight exercises, industrial clusters, development agencies and generic research are just some of the manifestations of numerous mechanisms intensively used by the innovation policies in developed countries, but so rarely in CEEC.

The significant differences in national innovation systems and policies across the countries and regions demonstrate that national innovation policy is deeply socially rooted and depends on historical heritage, culture, ethics, political attitudes and such.

Understanding that the establishment of NIS and the development of technology are fundamentally social processes creates a chance for social sciences and sociologist to analyze the political and historical development of their countries to understand the patterns of their technology development. Social studies should help construct the national innovation system and speed up economic growth. Today, the theory of Triple helix (TH) emerges as the most useful theoretic platform, analytical framework and normative approach for social research and social action for building NIS. Its strength is rooted in the basic assumption that TH shares with NIS the knowledge flow, cooperation and communication between science, industry and government, enabling co-evolution of these three helices (or players) and constructing the socio-economic system which encourages the commercialization of knowledge through innovations and new technologies. Such system is usually defined as national innovation system and social sciences are called to reflect, consider and analyze the social and economic aspects of NIS and take an active part in accelerating economic growth and social welfare.

Many suggestions for building NIS in CEEC can be found in the presented papers and conference discussions, but it seems more useful to concentrate on a few mutually linked factors that make the pillars of an active innovation policy aimed at entering KBE/S.

Technology capability building

The first and the foremost prerequisite for entering KBE is improving the companies' absorptive capacity for innovation, new technologies and research results through technology capability building (TCB) based on technology learning and accumulation. Investments in scientific research and human knowledge could be capitalized only through the individual business companies. The aggregation of the companies' technology capability generates the industrial technology development on the national level and, in the end, enables the structural adjustment to the new economy.

The higher the level of technology capability the more intensive the use of R&D. Therefore, each of the CEE countries could create and implement its own mechanisms, organizational and infrastructural institutions that support applied and commercially relevant research in the private industrial sector.

However, there are three common and basic infrastructural preconditions for further upgrading technology capability:

- strong information and communication technologies (physical communication networks, information literacy, computerization, "internet-nalization"),
- the effective system of standardization and quality management (harmonization with international standards, effective accreditation system)

- accelerated and permanent training in business management through a system of consultancy, seminars and courses with a view of introducing life-long learning.

Human capital

The human capital in terms of educated and skilled labor is the most decisive factor for entering KBE. The importance of human capital is two-fold: human capital, by nature, has the ability to learn, to achieve better skills for creating, absorbing, adapting, diffusing and using new technologies and innovations. On the other hand, human capital provides high literacy and technical skills that might help minimize cultural and historical heritage that hinders techno-economic development in transition countries. Learning has become the fundamental strategic process at the business firms' as well as the national level.

However, the traditional concept of education-work-retirement is no longer valid in KBE.

Different countries are now reorganizing their educational systems to enable people to learn continuously and to acquire new skills in the application of knowledge throughout their entire working lives. In CEEC significant governmental and private investments in vocational, university and life-long learning are imperative for the structural adjustment of the labor to the needs of KBE. It can not be disputed that he number of researchers and engineers as well as PhDs in natural and technical sciences is an indicator of labor adjustment. The most efficient techniques, measures and incentives to increase these numbers are open for discussion. The modernization of the curricula, the computerization of schools, the internalization of higher education, the quality guarantees, the efficient studies and the harmonization with the employment needs all of these are the educational policy issues of public concern.

The revitalization of the business R&D sector

Growth analysis shows that entering KBE is closely related to the strength of business R&D. In the developed countries the industry and the business sector dominate the science system since they invests much more (in relative and absolute terms) in R&D and employ almost the two thirds of all the researchers. However, R&D in CEEC countries is still heavily financed by the government and R&D is mainly conducted by the researches from the public sector. It simply means that the research activities are not focused on the commercialization of knowledge serving the industry or on the production of innovation which make the essence of KBE. Therefore, the urgent task of NIS in the transition countries is to strengthen industrial R&D in order to re-structure R&D systems towards the predominance of business R&D. The restructuring of R&D system heavily depends on the business firms' absorptive capacity for innovation and research results as only innovative and technology based firms are prepared to collaborate with the science sector. Therefore, the structural changes of R&D system are closely connected to the development of the first two factors firms' technology capability and human capital.

The science-industry cooperation

The science-industry cooperation is a mechanism widely used in the developed countries for the translation of R&D potentials into the new marketable technologies as well as for upgrading the innovative capacities of companies is. Since the distance between research and its application is narrowing and since the capitalization of the publicly funded research by business companies occurs regularly, the close science–industry co-operation has become a critical issue of modern innovation polices. The role of the government is decisive for the cooperation facilitation since the government, by the way of different measures and programs, shapes the legal and the administrative framework for that cooperation. In addition, it provides the financial incentives as well as suffers the risks of introducing new technologies and of commercializing the research results; all of which the business sector is usually reluctant to do. The models, programs and institutions for fostering science-industry cooperation that the national (or regional, e.g. the EU) governments are involved with are various and numerous. Joint science-industry -research projects, research consortia, the centers of excellence, fostering intellectual property rights in academic sphere, the concept of "Entrepreneur University", generic research, innovation centers, research/science parks, technology transfer centers; these are the aspects of the science-industry – government cooperation.

Speaking from the long-term economic growth perspective, the science-industry –government cooperation serves to speed up the technology development (technological change) above the market incentives or spontaneous economic growth. That is the reason why innovation polices concentrate so heavily on the phenomenon of the science-industry-government cooperation.

Social capability and consensus place

The integration of different sectors involved in innovation and knowledge production is the back-bone of the national system of innovation. This integration presumes the communication and cooperation between different actors and sectors, the free flow of information and the knowledge needed to discuss national priorities. The final goal is the harmonization of different interests and attitudes towards national consensus on the targets and tools of the national development. The national consensus requires a "meeting place" where the convergence of partial interests can take a place. The various aspects of the science-industry-government co-operation serve as such meeting place where co-evolution of the three key-players of the knowledge-based society should happen. However, from the CEEC point view, this meeting place is very difficult to achieve since, to establish a transparent discussion and spontaneous harmonization towards common policies and strategies, it requires democratic procedures and the institutions of the civil society.

The civil society is, in CEEC, hindered by the spirit of provincialism and semi-modernism that permeates all the levels of society. It is, therefore, imperative that the intellectual and political elite should emanate through the whole society the social capital in terms of establishing mutual trust and respect, honesty, team work, transparency, norms and values of an open mind, tolerance and cultural diversity. The frontier of technological development and economic growth depends on the laws, programs, policies, organizations, institutions, strategies and overall environment demanding societal changes: changes in culture, norms and values that meet the needs of the knowledge based society. Shortly, the technological capability is conditioned by the social capability.

The national knowledge pool

The fact that the 90% of the world's scientific knowledge and technology advances is produced in the developed countries could make the countries in transition think that nurturing the national scientific base is a waste of money and energy. However, *catching-up process* with the technology leaders is, for the transition countries, different from catching up among technology peers. The transition countries should have the three basic capabilities. The first is the capability to use high-tech and generic technologies (not necessarily to create them), to adopt and to modify foreign technological innovation for own development. The second is the capability to get the advantage of the foreign technologies primarily through the foreign direct investments and multinationals. The third is the ability to produce the small high technology products in order to enter some special or small niches in the international market. These challenges are not possible without the national pool of knowledge and domestic R&D resources.

In other words, the enlargement of the existing pool of knowledge is an essential input in the creation of the new technologies and innovations and the creation of the new technology capabilities needed for catching up. Therefore, the development of the national knowledge stock thorough the basic and the academic type of research as well as through the codification of tacit knowledge through the university education is a prerequisite for the long-term technological development and for the immediate involvement in the technology race. The national pool of knowledge enables countries to enter the new technology paradigm. Since sooner or later all technological paradigms run out, the countries which do not take care of their own R&D resources are in danger of a serious decline.

The case of the transition countries proves it.

FOOTNOTES

[1] Cited from Paul Resnick's speech: "Beyond Bowling Together: SocioTechnical Capital" at the Workshop on SocioTechnical Capital held in Ann Arbor, March, 2000: A slightly edited version appears in Human and computer interaction in the New Millennium, ed. By John Carroll, Addison-Wesley, 2001, chapter 29, pages 647-672.

[2] Cited from: Human and social capital in the knowledge society: background paper, Conference on "Social and Human Capital in the Knowledge Society: Policy Implications" Brussels, 28-29 October 2002.

[3] Ibid.

[4] OECD (1988), New Technologies in the 1990s: A Socio-economic Strategy, Paris.

[5] Ministry of Science and Technology and the Ministry of crafts and small and medium enterprises.

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