A present stuck in the past Innovation and commercialization activities in the OECD and the CEEC[1]

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The trajectory of development defined as top-down model in the CEEC and bottom-up model in the OECD left long lasting effects on the institutional collaboration, innovation output and commercialization activities. Using international statistics data for 19 OECD and 13 Central and Eastern Europe countries the analyses reveals the following differences.

The bottom up model in the OECD results in a close positive relationship between sub-systems. The high level of inter-connectiveness between institutions positively influences the efficiency of sub-systems. The level of innovation output is higher and is a function of development indicators and of economic openness. The commercialization activity shows that business-industry R&D expenditure stimulates the patents and publication.

The top down model in the CEEC is still present and is keeping the sub-systems relatively separate. That results in a less intensive and positive relationship between education and economy and consequently in less efficiency of sub-systems. The level of innovation output is extremely low and indicates low system effectiveness. The government is the dominant source of R&D expenditures which has a negative impact on commercialization, patents and publications.

Key words: *INSTITUTIONAL COLLABORATION, INNOVATION, COMMERCIALIZATION, THE OECD, THE CEEC*

The long-term economic growth and value-adding activities in contemporary society increasingly rely on the innovation and commercialisation capabilities of nations. The challenge for the social sciences, and an important question for the policy makers, is to find out, what characteristics of economy and society contribute to innovation activities, and what will consequently create more jobs and better economic performance. In the OECD countries the focus is more how to increase innovation and commercialisation while in Central and Eastern Europe countries (the CEEC) is still the problem how to find the right way to "catch up" with the West and in that process convert their human capital into competitive advantage.

Innovation is a complex process based on combination of existing knowledge and new way of applying that knowledge to different situations or problems. The theories trying to explain innovation activities in sociological literature are those based on science and technology "push" and market "pull" model (Leydesdorff, and Etzkowitz 1998, Muller and Etzkowitz 2000). From that perspective, the relationship between scientific and technology production and the characteristics of social systems is stressed. In the economic literature Evans and Koop (1991:4) define "innovation as a transformation of existing knowledge and ideas (inventions) into new or better commercial product that adds value to the customer." The focus is on the profit through commercialization. In this perspective the market competition is a main driving force for innovation implementation (Schumpeter1934; Evans Carter & Koop 1991; Holbrook, 1997; Gans, Hsu and Stern 2002; Lundvall, 2002; Sheehan, and Messinis 2003).

The ideas for new products, processes or services are coming from a variety of sources; new science, new technology or market demand. Innovation is a complex interactive process that can re-

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spond to new science and technology or to the market demand or perception of that demand. Technological innovation does not necessarily depend on scientific progress, quite the contrary, more often it precedes scientific explanation and it pushes for new scientific research. Science and technologically driven innovations do appear to play a larger role than market demand in radical (revolutionary) innovations (U.S. Congress, 1995:39). Market driven innovations play an important role in incremental (evolutionary) innovation. The technology push and market pull is the combination for success. The pathway through innovation is going in both directions. Market perception generates new ideas, or some problem initiates need to be solved and in turn stimulates scientific research and technological application that again reinforce a new generation of products, services and processes.

Within the contemporary societies we can see great differences in the capability and flexibility to produce and use the innovations. Going further back in history we can also find many examples of inventions not corresponding to the productive capacity of society for application. There is a fundamental difference between knowledge and its application. For a long time through history the process of knowledge creation was not closely related to its application. Only in the modern market-capitalist economy and particularly in its latest form labelled as a knowledge-based society, does the nexus between new knowledge production and its immediate application become the crucial system characteristic producing an increased speed of change. The question is can we design a society and/or a set of policies that can ensure knowledge production, innovation and its commercialization that can lead towards economic growth?

One of the extreme examples of an attempt to control and direct the process of knowledge creation and its application was centrally planned systems of the Soviet type. The relationship between science (knowledge push) and the market (pull) did not exist. The scientific production was not only financed but also more importantly, directed by the government, with the main goal of being used for military purposes or in the space program. The system was guided by the arms race as a component of the geopolitical competition between the two blocks but it was also ideologically based on the modernity project. The competition process, which existed on the inter-state level in the form of the geopolitical competition, did not translate into the competitive process within the boundaries of the planned society. Spillover effects from new knowledge produced in military or space programs did not spread into the civilian, non-military sector. Where, on the other, American side, innovation in the military sector was an important source of innovations used by the "civilian" economy. The market demand for innovation did not exist in Soviet system because the main goals of all actors were satisfying the central plan. Within the centrally planned system, an invention might work as the "disturbance" factor because it might disrupt the designed system and its stability. The entrepreneurial behavior, which is a constitutive part of that process in the West, was almost forbidden and considered more a crime than a desirable quality. The Soviet system made huge investments in science and technology, but this sub-system stayed isolated from the rest of the economy and society. As a remnant of that system the Russian federation still has a large number of scientists 3.39% per thousand in 1999 (Sporer 2004). The economic absorption capacity for those scientists in its old form does not exist any more. The oversupply of highly educated people is also the consequence of the modernity project that was dominant in the socialist systems.

The centrally planned systems can concentrate a large amount of societal resources on the goals preferred by those who decide the goals. In the Soviet system this was the central part of bureaucracy. In spite of the fact that that type of system can produce some success, like the space programs, strong military and also high development in a relatively short period of time, accompanied by a high number of scientist and engineers, and high literacy level, the problem was the unbalanced nature of this success. Other sub-systems were starved of resources. The market driven and relatively open economy insures that innovations in one sub-system find its ways into other sectors of the economy and that is producing more balanced system development.

The Soviet model went to the extreme in designing institutions in the **top-down** form and controlling all the processes within and between institutions using political power as a main mechanism.

The consequence was and still is that institutions do not work together, they do not complement each other, and they do not reinforce each other. When the modernization and development is top down planned project it tends to avoid any uncertainty and "creative destruction" (Shumpeter 1934), which is the essential part of the innovation process.

On the other side the capitalist Western democracies were characterised by the **bottom- up** approach where the institutions have been built gradually through the permanent process of social accommodation and change. They are interdependent and consequently tend to change together and reinforce each other to adjust and complement each other. The vibrancy of these institutional connections (Branscomb, 2004) is necessary to make innovation and commercialization activities successful.

The main aim of the paper is to compare the OECD and the CEEC in the dimensions of innovation output and commercialization activities and to reveal how the path to dependency – the determination of the present by the past – operates and whether or not it works.

Research design

A distinction has to be made between innovation capabilities, innovation activities and innovation output. We will compare innovation capabilities with innovation output. The activity transforms the capability into output. *Innovation capabilities* are related to the characteristics of human capital of the nation. The indicators of this are the average level of schooling, number of students enrolled in higher education, investment in education, spending per student in the education process and critical mass of scientists, researchers, engineers who are capable of new knowledge production.(European Commission–Research, 2002). An *innovation* activity leads to the concrete *output* of innovation measured through the number of patents by residents, patent by non-residents, and the number of publications. In addition we are analyzing commercialization activities. *A commercialization activity* is the relationship between businesses and research activities assuming that enterprises finance research in order to solve problems, produce new products or improve production though new processes. Indicators used to tap into that relationship between enterprises and research activities are R&D expenditures by business and industry.

The research is designed to measure the influence of the independent variables of innovation capabilities, development, R&D investment, globalization, and communication and information technology, exercise on the dependent variables of innovation output and commercialization activities. The assumption is that independent variables influence dependent variables and therefore that they precede in time. Because of that, the data for independent variables are taken from 1988 to 1999 and the data for dependent variables as patents and publications are taken from 1995 to the last available data 1999 (and in some cases 2001). International statistics were used to collect data for 32 countries, 19 OECD and 13 CEEC countries.

Sample of the countries

	Countries
The OECD	Australia, Austria, Canada, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK, USA
The CEEC	Bulgaria, Croatia, Czech, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovak, Slovenia, Ukraine

Group of indicators serving as *independent variables:*

• **Innovation capability:** Total investment in education as also -public expenditure on education, -expenditure per student, – student enrolments in higher education, – and percentage of science and engineering students.

• **Development and investment:** GDP per capita, and total R&D expenditure.

• **Globalization** measured as: exports as a percentage of GDP, import as a percentage of GDP, FDI as a percentage of GDP.

• **Communication and information technology:** phone lines, computers, and internet.

Group of indicators serving as *dependent variables:*

• **Innovation outcome:** patents by residents, patents by non-residents, and publications, patent applications to EPO and patents granted to USPTO.

• **Commercialization activities:** business expenditure on R&D, government expenditure on R&D, or higher education expenditure on R&D.

The data will be standardized as a percentage of population or as percentage of GDP and then the average for each indicator for the period of 10 years will be calculated. In that way the average for each indicator will be used in further statistical analysis, **first** to determine the general pattern of relationship between all variables separately for the OECD and the CEEC using that as the first step toward finding indications of institutional framework and collaboration. The **second** step is to analyze relationship between dependent variables patents, publications and independent variables innovation capability, development and investment, globalization and communication and information technology to determine what are the innovation levels and the eventual difference in determination of the innovation outcome in the OECD and the CEEC. Indicators measuring communication and information technology (phone, computers and Internet users) will be put together into a CIT (communication and information technology) index. The creation of the index is prompted by the fact of high intercorrelation (or colinearity) among the individual indicators, indicating that they are measuring essentially the same phenomena. The **third** step is to analyze the state and dynamic of commercialization activities using R&D expenditure as dependent variable.

It is necessary to stress that because the goal was to compare those two groups of countries we limit the number of indicators used only to those available in both groups of countries. Many potentially useful indicators are left out because the data is not collected in all observed countries.

Results

Institutional collaboration

Pearson's correlation coefficients for the OECD had been calculated to find the relationship among all indicators used in the analysis. Table 2 shows mostly positive and strong relationships between the majority of variables included. The only variables having no relationship with other variables are number of science and engineering students and higher education R&D expenditure. All variables show a positive and strong relationship with patents and publications. The interpretation of these findings can be that development (GDP per capita) investment in education (public expenditure for education, expenditure per students) R&D expenditure and CIT all increase the number of patents and publications. The only significant and negative relationship is with government R&D expenditure. In societies where government invest more in R&D the number of patents and publication is lower and the society spend less on R&D in total and is less developed.

The same analysis for the CEEC (table 3) indicates lower number of significant correlations among all variables and weaker correlation among the statistically significant ones. The only variables having positive relationship with patents and publication are development indicators: GDP per capita, total R&D expenditure and CIT but relationships are weaker than in the OECD. The relationship between government investment and business investment in R&D shows a negative relationship; when governments invest more, the businesses invest less.

The different results for two groups of countries can be interpreted as the indication that in the OECD there are much closer and multiple relationships between education and economic institutions; while in the CEEC there is a weak and less intensive inter-institutional relationship. These differences can be attributed to the different history of institution building, (to the bottom-up model of the OECD and top-down model of the CEEC.) The bottom-up approach, where institutions have been built gradually results in strong relationship among educational and economic institutions. The top-down model is based on the central coordination and with the removal of it; the new mechanism creating the inter-institutional is not created. The vibrant, close, positive relationship between these two sub-systems is missing.

We explore these initial findings in more details using factor analysis (table 4). The goal is to find if the observed relationships could be reduced to the basic group of factors underlying them. The result of the factor analysis for the OECD indicates that all independent variables are grouped into three factors.

Model 1 –The OECD "bottom-up"

The OECD factors	***Components***	***Variance explained***
Development indicator	CIT index	38.57%
	GDP per capita 1990–99	
	Total R&D expenditure 1991–99	
	Public expenditure for education 1988-99	
	Expenditure per student 1988–96	
Economic openness	Export as a % of GDP 1990–99	28.64%
	Import as a % of GDP 1990–99	
	FDI as % of GDP 1990–99	
Education characteristics	Enrolment in high education 1998–99	16.92%
	Science and engineering students 1988–97	

The first factor is composed of *development indicators* and the components are CIT index, GDP per capita, total R&D expenditure public expenditure for education and expenditure per students in that order of significance. The variance explained with this factor is 38.5%. The important thing to notice is that educational and economic indicators are part of the same factor. All these components have the same underlying factor that can best be described as development.

The second factor is composed of export, import and FDI and the variance explained is 28.6%. This factor obviously indicates *economic openness.*

The third group of components coming together are enrolment in higher education and science and engineering students and the underlining factor can be called *educational characteristics*. This factor explains the 16.9% variance. It is important to mention that enrolment in higher education is negatively related to the number of science and engineering students. The higher the enrolment of students, the proportionately smaller the number of science and engineering students is. The most important finding from the factor analysis is the indication of joint working of economic and educational institutions (and CIT index).

The same analysis for the CEEC shows a different pattern. First there are 4 groups of components (Model 2) with different underlying factors. The factor producing the highest proportion of variance explained (43.48%) is *economic openness* and the components are import, export and CIT index. CIT index is part of economic openness in the CEEC, and not of development like in the OECD. That is plausible because new communication and information technology (CIT) in the CEEC is imported and is clearly related more with export and import than with other variables.

Model 2 – The CEEC "top-down"

The CEEC factors	*Components*	*Variance explained*
Economic openness	Import as a % of GDP 1990-99	43.48%
	Export as a % of GDP 1990-99	
	CIT index	
Education and economy	Expenditure per student 1988-96	23.22%
	FDI as % of GDP 1990-99	
	Science and engineering students 1988-97	
Development indicators	Total R&D expenditure 1991-99	15.39%
	GDP per capita 1990-99	
Education characteristics	Enrolment in high education 1998-99	10.7%
	Public expenditure for education 1988-99	

The second factor is related to some dimensions of *education* and *economy*, composed of expenditure per student, FDI and number of science and engineer students. The variance explained with this factor is 23.2%. It follows the pattern that the number of science and engineering students is negatively related with other components in the factor. The higher the spending per student is, the lower the percentage of students in sciences and engineering. The trend in the OECD and in the CEEC is that the university is producing a number of new semi-professions and professions as a response to the newly created demand for highly skilled positions in a knowledge based economy. The sciences and engineering education as core knowledge relevant for the production of innovations, particularly innovation that depends heavily on scientific breakthroughs, is proportionally decreasing in that new environment. Even if they are growing in absolute numbers in relation to the mushrooming of other professions, they decline proportionally. The tendency in contemporary society is expansion of new professions and semi-professions necessary to almost every activity in society. We can only speculate what is the underlying factor that causes the FDI to come together with educational characteristics. Probably the mushrooming of the professions related to business activities like management, marketing, accounting, enterprise and commercial specialists are coming together with the FDI in the CEEC. The FDI probably directs demand for the specific educational profiles.

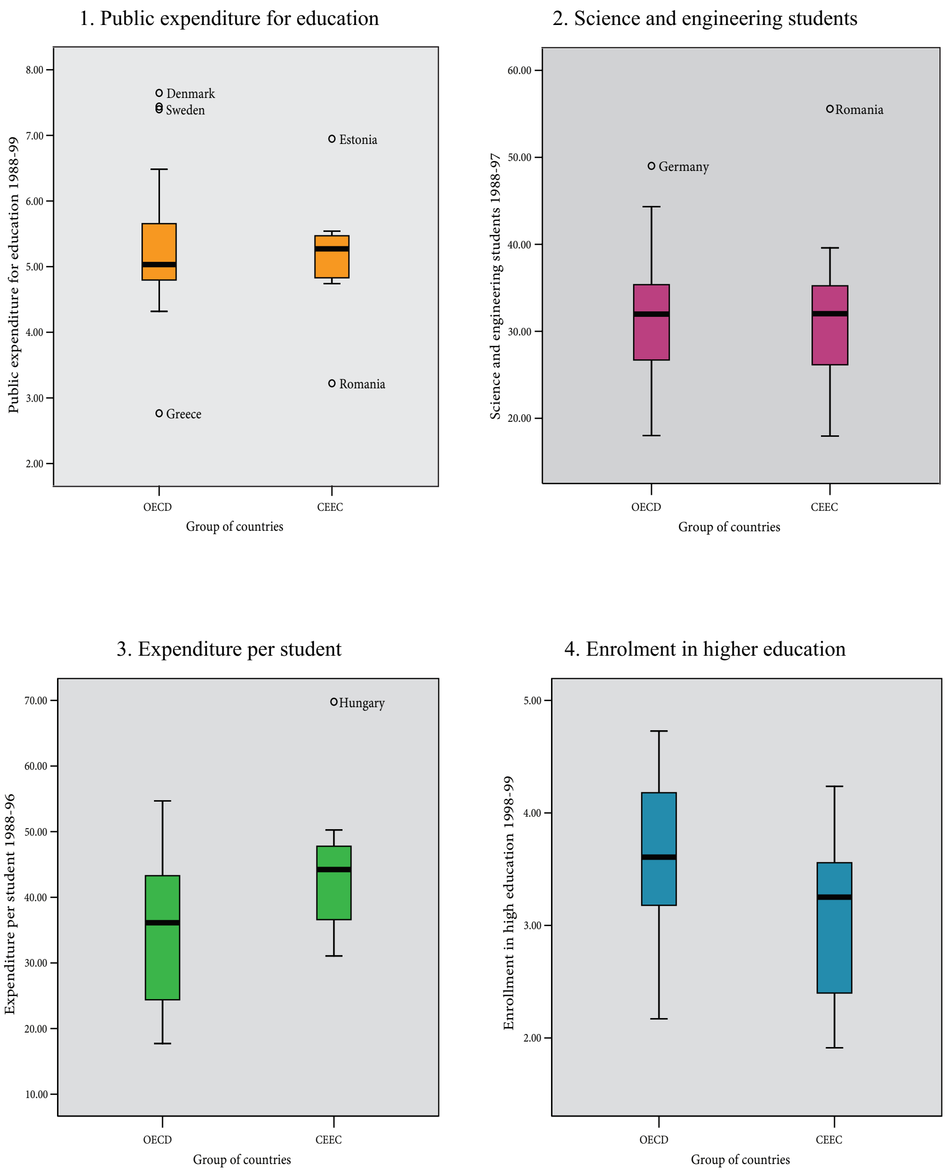
The third factor is composed of *development indicators* and consists of only two components; total R&D expenditure and GDP per capita. This factor is explained by 15.3% of the variance. Only two components indicate development in the CEEC while in the OECD it consists of five components: two of them are educational and one is research.

The fourth factor is composed of *educational characteristics* that are enrolment in higher education and public expenditure for education. These two components are going in the same direction. In the CEEC, the more money being spent on public education, the higher the number of students enrolled in higher education. The correlation (table 3) between those two variables is positive and significant. At the same time this relationship is not significant in the OECD.

The most important finding is the very different factorial structures for the two analyzed groups of countries. The different number and composition of factors are indications of different levels of development and, what is even more important, of different interrelationships of different components of the system. The variation in the OECD countries is predominantly explained by the factor comprising together developmental, educational and technological indicators. In the CEEC only economic openness and technological indicators are strongly connected. The general conclusion is that economy and education are more closely connected in the OECD were in the CEEC they are less integrated. The substantive explanation for this finding is in different institutional trajectories of these two groups of countries.

In order to explore education characteristics in more detail we decided to compare all educational variables for both groups of countries. Graphs 1-4 below are revealing the main differences and similarities in those dimensions.

Graph 1–4. Box Plots for educational variables for the OECD and the CEEC



The public expenditure for education (1) is in average 5.36% of GDP in the OECD and 5.16% in the CEEC. The variation in that respect among the members of the OECD is larger (north versus south Europe). The CEEC are more similar. But in both groups there are some countries that are way above or below average. In the OECD Denmark and Sweden are way above in public spending for education and Greece is way below. In the CEEC, Estonia is spending above average on public education and Rumania is below average. This finding has to be taken with precaution because it reflects only public without private expenditure, and the private expenditure is high in the OECD countries. In the CEEC, private education funding is almost non-existent. Taking into account the difference in GDP per capita in those two groups of countries, the burden of education on public finances in the CEEC is much higher.

Both groups of countries have equal (as percentage of population) number of students enrolled in science and engineering (2). In the OECD, Germany is the country that has above average and in the CEEC, Romania has an above average number of students in science and engineering.

Expenditure per student (3) is much higher in the CEEC than in the OECD and in one country particularly: Hungary. However, within the OECD, the differences between countries regarding expenditure per student are again greater than in the CEEC where there is more similarity. The enrolment in higher education (4) is much higher in the OECD than in the CEEC. The majority of the countries in the OECD are in the upper percentile and the majority in the CEEC are in the lower percentile.

Those findings indicate that the main difference between the OECD and the CEEC is in the institutional collaboration and efficiency. In the OECD educational and economic institutions work closely together, as indicated by the results of the factor analysis. Secondly, the high demand for higher education comes from environment (society and business) and that shapes the educational institutions' performance and also attracts private funds. Thirdly, the education system is more efficient because it spends less per student and enrols more students. In the CEEC, the educational institutions that are more "isolated" stay in their sphere and a close connection with economy is non-existent. The investment in higher education was designed in the former political system as a part of the planned modernity. The demand for higher education was defined by the government and probably only recently by business, particularly through the FDI. The demand for the efficiency of the educational system was not part of the previous system and incentives for it are still missing.

The OECD shows efficiency and interconnectivity within their institutions, in the CEEC it is other way around. That is the legacy of how institutions have been built and matured in those two traditions. The question is how these two types of traditions are influencing innovation output?

Innovation output

Following the factor analysis results, the components of each of the factors have been standardized and computed into indexes. For the OECD, we operate with 3 indexes (Model 1) and for the CEEC, we operate with 4 indexes (Model 2). These indexes now serve as independent variables and innovation output (patents and publications) as dependent variables. The regression analysis takes into account the influence of all independent variables simultaneously. The results for the OECD countries are shown in the upper panel of the table 5. The high R square in all models indicates that our variables are explaining a large portion of the variation in the dependent variables (.719, .808, .687, .432). All dependent variables are best explained by the development index, except in the case of patents by non-residents that are better explained by economic openness. Patents by non-residents are having also the lowest R square that means that it is less explained by the variables in the model. The first factor based on the combination of developmental, educational and technological indicators is giving us the best explanation of patents and publications by residents. Taking into account the components of that index we may conclude that communication and information technology, general development, investment in R&D, investment in public education and high expenditure per student results in high innovation output in the OECD. The dependent variable, patents by non-residents, can be explained with openness of economy. Although the Beta coefficient is only on the edge of significance it has relatively higher value than the other two indexes. The total explained variance is .294.

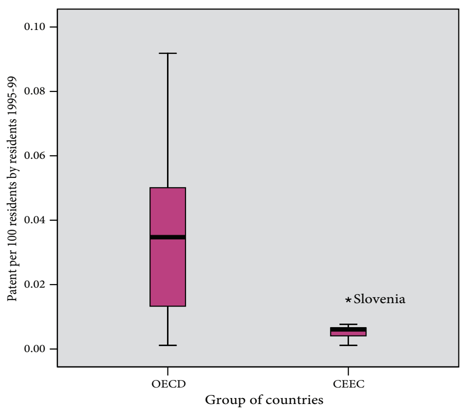
The same analysis for the CEEC (Table 5 lower panel) shows that patent by residents, patent application to EPO and patent granted by USPTO as measurement of innovation output, are explained only by the development index. That index is composed of only two variables: R&D expenditure and general development. That can be interpreted that only development (GDP per capita) and total investment in R&D prompt increase in innovation output in the CEEC.

We can see that in the case of the CEEC the development index is also the only explanatory variable (having significant Betas). But we must keep in mind that the composition of this index is different for these countries. Our dependent variables, innovation outcomes, are more influenced in the OECD by the broader spectrum of independent variables (a complex development index) that includes a combination of economic, educational and technology variables. That reflects integrated institutions working together. Opposite to this, in the CEEC, the innovative output is more narrowly related to the GDP and the total investment in R&D. It is remarkable that the indicators of education are not contributing to the innovative output in these countries. It is worth noting that economic openness index has an independent and negative relationship with patents by residents in the CEEC. As the country is more open, it has fewer patents per residents. A patent by a non-resident does not show any significant influence by other variables although the R square is high.

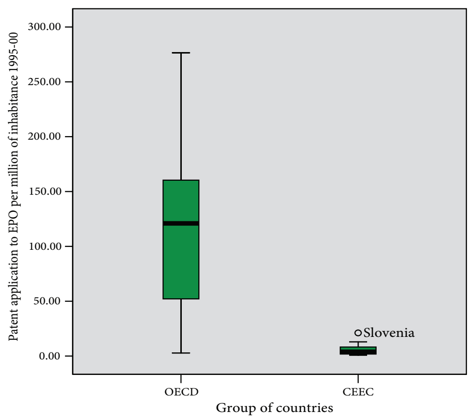
The innovation output in the form of patents and publications can also be taken as an indicator of the system efficiency. Table 7 indicates that in the OECD, the production of patents and publications is higher than in the CEEC. The detailed analysis is given in the graphs 5-9 and it reveals this difference even more.

Graph 5–9. Box Plots for patents and publications in the OECD and the CEEC

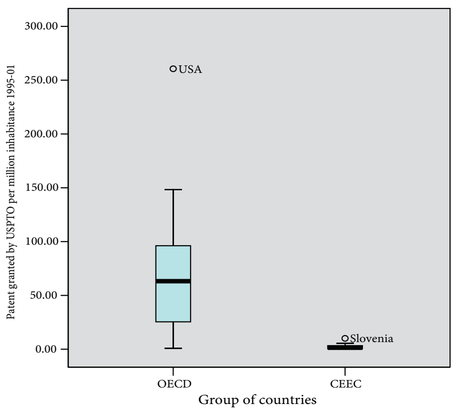
5. Patent by residents



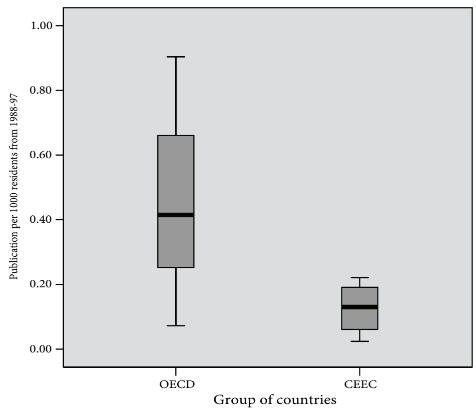
6. Patent application to EPO



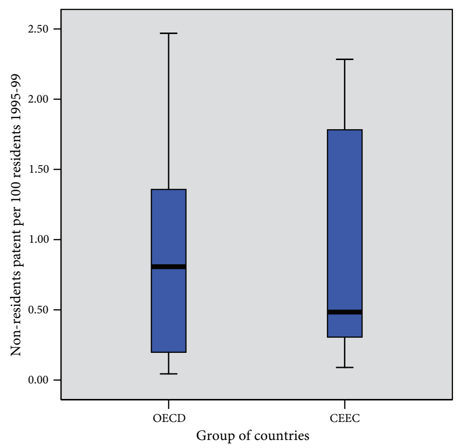
7. Patents granted by USPTO



8. Residents' publications



9. Non-residents' patents



The CEEC countries have extremely low patenting rate per resident (5), and consequently low patent application to the EPO (6) and patent granted to the USPTO (7). The only outlier is Slovenia that has some patents in all of these institutions. Publication rate (8) is also much lower in the CEEC than in the OECD. Finally the level of non-residents' patent is similar in both groups of countries and the CEEC seams to have more non-residents' patents. If that is a sign of technology transfer, then the CEEC is catching up in that respect.

Patenting and publications as measures of innovation outcome in the CEEC are extremely low. There are a number of possible explanations for that pure performance. "Patents are exclusive rights issued by authorized bodies to inventors to make use of and exploit their inventions for a limited period of time (generally 20 years)" (the OECD 2004:35). The patenting process depends on the specific culture based on the history of introduction of the intellectual property law and on the practices of enforcement of that law. In cultures dominated by collectivist values, the intellectual property law is rudimentary and the enforcement almost non-existent, as was the case in the CEEC. The socialist model treated knowledge and innovation as a collective, not the individual or group property, because the society was based on collective and state property. For that reason, registering patents was not a wildly spread way to protect invention. That was consistent with the egalitarian ideology dominant in these societies (Zupanov 1969). These dimensions of culture may be an obstacle that prevents innovation and patenting to occur or to be counted properly. This is contrary to the USA, where every piece of invention, innovation and scientific discovery is protected by patenting ensuring economic benefit to the inventor. We are leaving aside the discussion what types of discoveries can be patented, and whether a scientific discovery should be treated by law as a patent. In the USA, this problem of over-patenting exists resulting in a big patenting rate. Obviously, we are dealing here with two different traditions and approaches to patenting which can contribute to the big differences in patenting that we discovered.

Secondly, as we can see from the previous analysis, there is no interconnection between institutions and other elements of development in the CEEC. That relationship is vital for student education and training that responds to the business demand and the feedback loop is created. More education is created in society, spreading knowledge, influencing performance and elevating business. That is raising the demand for more knowledge. Furthermore, this relationship directs research activities to focus on solving relevant problems for business and society. Mainly doing research out of intellectual curiosity or for enhancing the prestige of the nation is not sustainable from an economic development standpoint. Research and education are part of the economic activity that ensures economic growth and need to be closely related to all business activities.

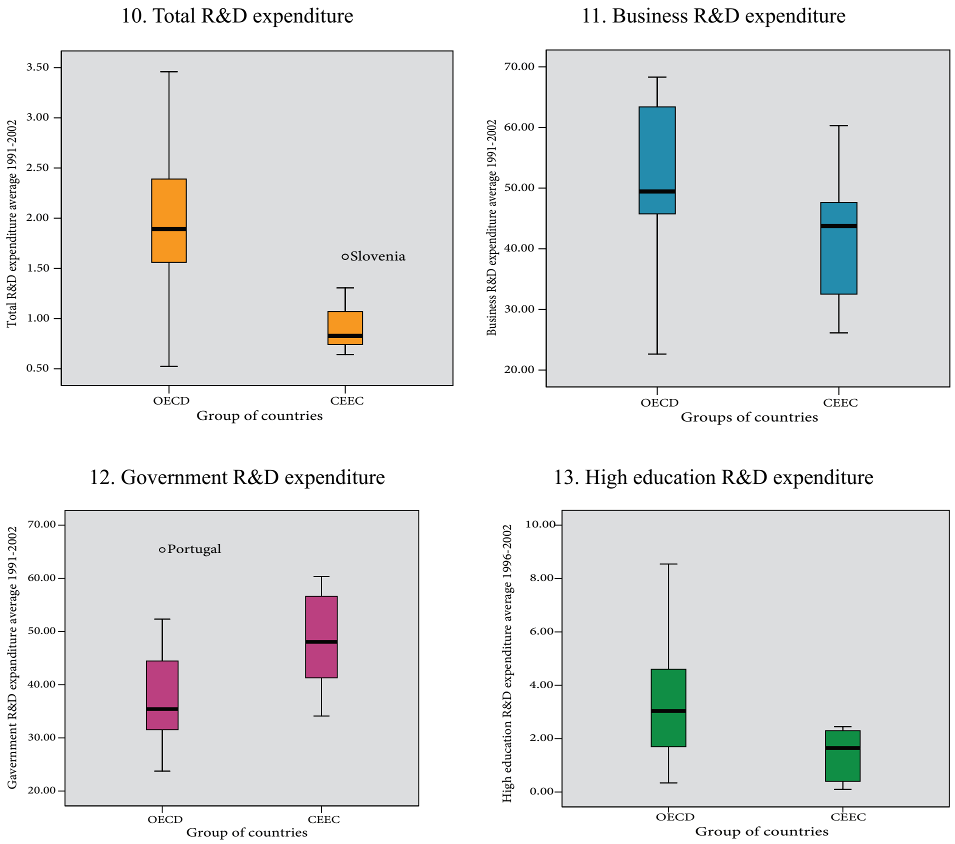
Innovation culture has to be nurtured on all levels of society. Managing innovation in an organization is particularly important. Smart and creative people are capable of developing ideas and solving problems if they work in the organization that has a culture of innovation. Ensuring and maximizing creativity is a relatively new requirement of managerial skills. But this type of managerial practice and skill is in contradiction with the long tradition of planned economy where satisfying the Central plan was more important than creativity. In short, the top-down model left long-lasting effects that need more time to be corrected.

Commercialization activities

Only innovation that has been used for production of new products, or introducing new processes or services that increase productivity has been considered as a valid innovation (Evans, Carter & Koop 1990; Gans and Stern 2003; Oslo Manuel 1997). What are the practices in countries having high commercialization levels that make them capable of absorbing knowledge? This is a complex question with many answers. A large part of the economic literature emphasizes the existence of economic clusters as crucial in that process (Gans and Stern 2003), as they contribute to the production and, at the same time, to the absorption of new knowledge. Other dimensions such as social capital and entrepreneurial behavior also contribute to the commercialization process. Market driven innovation is a process where firms translate market demand into a product. This process is called "*demand articulation*," where firms are searching for the best technology or product to meet the need (U.S. Congress, 1995:44). The prerequisites for market driven innovations are a highly developed, competitive, flexible market with a number of large firms and sophisticated national demands.

We start with the assumption that enterprises finance research in order to help them solve problems, produce new products or improve production through new processes. By looking at the data about the different types of investors in R&D we can create a picture of dominant players in these activities.

Graph 10–13. Box plots for R&D expenditure in the OECD and the CEEC



In comparing R&D expenditure, the box plots in graphs 10–13 repeat the same pattern. Total R&D, business R&D, and higher education R&D expenditures are much higher in the OECD while the government R&D expenditure dominates in the CEEC. Assuming that business-industry R&D expenditure is an indicator of "demand articulation" that indicates that commercialization is much more present in the OECD than in the CEEC. That can also indicate that the OECD has flexible and sophisticated market with large organizations capable to derive innovations from market demand.

The question is whether the type of R&D expenditure influences innovation activity? Table 2 of Pearsons' correlation coefficients for the OECD shows that business-industry R&D expenditure has a strong and positive relation with many variables like GDP per capita, total R&D, export and CIT. It has a positive and significant influence on innovation outcomes as patents by residents, publications and patent application to EPO and patent granted to USPTO. Business-industry R&D expenditure is the most significant dimension of development and innovation activity. Government expenditure for R&D shows a mainly strong and negative relationship with all variables that are in positive relationship with business-industry investment in R&D. The same finding follows from the regression analysis in table 6. The dependent variables patent by resident and patent granted by USPTO are explainable by business-industry R&D expenditure in the OECD. R&D investment by business-industry in the OECD increases patents. R&D investment by government or higher education does not increase innovation performance.

The same analysis in table 3 for the CEEC shows a much lower relationship among all the variables and R&D expenditure because commercialization activities are weak. The only relationship that can be found is a strong negative relationship between business R&D expenditure and government R&D investment. Government R&D investment suppress business industry investment. Patents and publications (table 6) can not be explained by commercialization activities because of its non-existence. That is also visible from the much lower R squares for the CEEC countries than for the OECD countries.

If we want to find out whether the CEEC countries are changing their approach to financing R&D and promote more commercialization and market driven innovation we should calculate R&D growth rate. Table 8 indicates that almost all the OECD countries are moving in the same direction of less R&D investment by government and more by business-industry and high education. The CEEC still has high government R&D investment with some countries slightly moving into the new direction of more business-industry relationship (examples are Lithuania, Estonia and Russia) and/or toward more high education R&D expenditure. It is interesting to notice that the CEEC countries are more inclined to increase R&D expenditure by higher education. Our analyses are indicating that higher education R&D has similar performance in innovation outcome as when governments invest in R&D. Are we faced with a new wind and genuine effort of high education to invest in R&D with the intention to become future independent players in innovation and commercialization activities or is it an indirect way of governments investing in fundamental research through high education? That has to be seen and it will be relatively easy to detect through innovation outcomes in the future.

Conclusion

This analysis can be treated as a diagnostic study of how the past is influencing the present and still shapes performance in innovation and commercialization activities. The trajectory of development results in different outcomes for those two groups of countries. The bottom-up model that exists in the OECD, results in close positive relationship between sub-systems of economy and education. The high level of inter-connections among institutions is positively influencing the efficiency of sub-systems.

The top-down tradition that characterized the CEEC is still present and is keeping the sub-systems relatively separate. That resulted in a less intensive relationship between education and the economy and consequently in a less efficient educational system.

The level of innovation outcome is a measure of effectiveness of those two systems. It clearly indicates that the OECD produces more patents and publications and the CEEC is way behind. The patents and publications in the OECD are the function of development (indicated by CIT index, GDP per capita, total R&D expenditure, public expenditure for education and expenditure per student) and of economic openness (import, export and FDI) that work together and complement each other. The indicator that explains the production of patents in the CEEC is economic openness (import, export and CIT) and general development (total R&D expenditure and GDP per capita). The level publications are not explained by indicators used.

The commercialization activity shows that business-industry R&D expenditure stimulates the patent production in the OECD. Increasingly more market demand articulation arises from the business and industry. In the CEEC the government is the dominant source of R&D expenditures and its determination of patents and publications is very low. The slow change can be noticed in the direction of R&D expenditures by higher education growing.

In the context of the Triple Helix paradigm this findings indicate that dynamical relationship among sub-systems, namely between business-industry and higher education is extremely low or does not exist at all in the CEEC. Implementing Triple Helix model as a policy issue in those countries, promoting market and collaboration, can gradually build this type of relationship in the future. But the danger in the CEEC remains because of the continuous role that governments play in policy creation and implementation process. That can inhibit development of vibrant, dynamic, spontaneous relationships between institutions.

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APPENDIX

Table 1. Description of Variables and Sources

Variables	Description	Sources
Innovation activities *Patents by residents*	This series has information on number of applications received every year for patent rights by residents.	World Bank, 2002. *World Development Indicators (WDI)*.
Patents by non residents	This series has information on number of applications received every year for patent rights by non- residents.	World Bank, 2002. *World Development Indicators (WDI)*.
Patents application EPO	This series contains information on application filed under European Patent Convention (EPO).	EUROSTAT. Long Term Indicators. Folder: Innovation and Research http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat (accessed: 18 March 2004).
Patents granted USPTO	This series contains information on patents granted by United States Patent and Trademarks Office (USPTO) per million inhabitants.	EUROSTAT. Long Term Indicators. Folder: Innovation and Research http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat (accessed: 18 March 2004).
Publication	This series has information on number of scientific and technical journal articles.	World Bank, 2002. *World Development Indicators (WDI)*.
GDP per capita	This series was obtained by dividing total GDP by total population.	Source of GDP data: World Bank, 20002. *World Development Indicators (WDI)*. Source of Population data: U.S. Bureau of the Census, International Data Base. Available at http://www.census.gov/ipc/www/idbconf.html (accessed: 1 January 2004)
Education *Public expenditure on education, 1988-2000*	This series has information on Public expenditure on Education as% of GDP. The information from 1988-1998 is from WDI and from 1998-2000 from UNESCO.	1988-1998: World Bank, 20002. *World Development Indicators (WDI)*. 1998-2000: UNESCO Institute for Statistics. Table: Public expenditure on education as% of GNI, GDP, and government expenditure. Available at http://www.uis.unesco.org/ev.php?URL_ID=5187&URL_DO=DO_TOPIC&URL_SECTION=201 (accessed: 1 January 2004)
Expenditure per students 1988-1996	This series contains information on expenditure per tertiary student, (% of GNI per capita).	World Bank, 2002. *World Development Indicators (WDI)*.
Students' enrolment in high education 1998-2000.	This series contains number of students enrolled in tertiary education.	UNESCO Institute for Statistics. Table: AP – Enrolment in tertiary education. Available at http://www.uis.unesco.org/ev.php?URL_ID=5187&URL_DO=DO_TOPIC&URL_SECTION=201 (accessed: 15 January 2004)
Science and Engineering students 1988-1997	This series contains information on Science and Engineering students (% of total tertiary students)	World Bank, 2002. *World Development Indicators (WDI)*.

Variables	Description	Sources
R&D *Total R&D expenditure, 1991-2002*	This series contains information on R&D expenditure as% of GDP. The data for all the countries is from the EUROSTAT, except for Croatia, Ukraine and Russian Federation which is from UNESCO Institute for Statistics.	UNESCO Institute for Statistics. Table: Percentage distribution of gross domestic expenditure on R&D by source of funds. Available at http://www.uis.unesco.org/ev.php?URL_ID=5218&URL_DO=DO_TOPIC&URL_SECTION=201 (accessed: 20 January 2004).
Commercialization *Business expenditure on R&D, 1991-2002*	This series has information on percentage of GERD financed by businesses. The data for all the countries is from the EUROSTAT, except for Croatia, Ukraine and Russian Federation, which is from UNESCO Institute for Statistics.	EUROSTAT. Long Term Indicators. Folder: Innovation and Research http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat (accessed: 20 January 2004). UNESCO Institute for Statistics. Table: Percentage distribution of gross domestic expenditure on R&D by source of funds. Available at http://www.uis.unesco.org/ev.php?URL_ID=5218&URL_DO=DO_TOPIC&URL_SECTION=201 (accessed: 20 January 2004).
Government expenditure on R&D, 1991-2002	This series has information on percentage of GERD financed by government. The data for all the countries is from the EUROSTAT, except for Croatia, Ukraine and Russian Federation which is from UNESCO Institute for Statistics.	EUROSTAT. Long Term Indicators. Folder: Innovation and Research http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat (accessed: 15 March 2004).
High education expenditure on R&D, 1991-2002	This series has information on percentage of GERD financed by high education. The data for all the countries is from the EUROSTAT, except for Croatia, Ukraine and Russian Federation which is from UNESCO Institute for Statistics.	UNESCO Institute for Statistics. Table: Percentage distribution of gross domestic expenditure on R&D by source of funds. Available at http://www.uis.unesco.org/ev.php?URL_ID=5218&URL_DO=DO_TOPIC&URL_SECTION=201 (accessed: 20 January 2004). EUROSTAT. Long Term Indicators. Folder: Innovation and Research http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat (accessed: 15 March 2004). UNESCO Institute for Statistics. Table: Percentage distribution of gross domestic expenditure on R&D by source of funds. Available at http://www.uis.unesco.org/ev.php?URL_ID=5218&URL_DO=DO_TOPIC&URL_SECTION=201 (accessed: 20 January 2004).
Globalization *Imports as a % of GDP, 1990-2002*	This series was produced using data for Total Imports from World Trade Organization and GDP data from World Bank.	Imports: World Trade Organization (WTO). Available at http://www.wto.org/english/res_e/statis_e/webpub_e.xls (accessed: 20 January 2004)
Export as a % of GDP, 1990-2002	This series was produced using Total Exports obtained from World Trade Organization and GDP data from World Bank.	Exports: World Trade Organization (WTO). Available at http://www.wto.org/english/res_e/statis_e/webpub_e.xls (accessed: 20 January 2004)

Variables	Description	Sources
FDI as a % of GDP, 1990-2001	This series was produced using FDI and GDP data from World Bank.	World Bank, 2002. *World Development Indicators (WDI)*.
Communication and Information Techno *Phone line, 1990-2002*	This series contains information about Telephone lines and cellular subscribers.	United Nations Statistics Division. Telephone Lines and cellular subscribers (ITU estimates). Available at http://unstats.un.org/unsd/mi/mi_source_xrxx.asp?source_code=36 (accessed: 25 January 2004).
Computers, 1990-2002	This series contains information about number of personal computers.	United Nations Statistics Division. Personal Computers (ITU estimates). Available at http://unstats.un.org/unsd/mi/mi_source_xrxx.asp?source_code=36 (accessed: 25 January 2004).
Internet, 1990-2002	This series contains information on number of internet users.	United Nations Statistics Division. Internet Users (ITU estimates). Available at http://unstats.un.org/unsd/mi/mi_source_xrxx.asp?source_code=36 (accessed: 25 January 2004).

Table 2. Pearson correlations coefficient among all indicators in the OECD

	Expenditure per student 1988-96	Enrolment in high education 1998-99	Science and engineering students 1988-97	GDP per capita 1990-99	Total R&D expenditure 1991-99	Import as a % of GDP 1990-99	Export as a % of GDP 1990-99	FDI as% of GDP 1990-99	CIT index	Patent by residents 1995-99	Non-residents patent 1995-99	Publication 1988-97	Patent application to EPO 1995-00	Patent granted by USPTO 1995-01	Business-industry R&D expenditure 1991-99	Government R&D expenditure 1991-99	High education R&D expenditure 1996-99
Public expenditure for education 1988-99	.627 **	.071	-.196	.623**	.561*	-.043	.168	.287	.784**	.494*	.354	.655**	.595*	.345	.360	-.306	.077
Expenditure per student 1988-96	1	-.265	.174	.471*	.52*	.178	.324	.518*	.61**	.687**	.507*	.671**	.672**	.217	.380	-.364	-.101
Enrolment in high education 1998-99		1	-.670**	-.360	-.288	-.223	-.172	.099	.091	-.293	-.129	-.113	-.384	.165	-.168	.125	.421
Science and engineering students 1988-97			1	.058	.116	.375	.347	.141	-.245	.255	.249	-.190	.351	-.180	.254	-.145	-.561
GDP per capita 1990-99				1	.767**	-.051	.145	.059	.754**	.702**	.194	.730**	.712**	.626**	.685**	-.539*	-.247
Total R&D expenditure 1991-99					1	-.100	.082	.259	.764**	.865**	.067	.819**	.906**	.81**	.747**	-.647**	-.116
Import as a % of GDP 1990-99						1	.929**	.680**	-.257	-.232	.386	-.122	-.042	-.256	.212	-.333	-.103
Export as a % of GDP 1990-99							1	.756**	-.050	-.034	.455	.041	.145	-.118	.464*	-.529*	-.152
FDI as% of GDP 1990-99								1	.151	.197	.467*	.266	.234	.045	.435	-.527*	.081
CIT index									1	.722**	.156	.883**	.718**	.710**	.488*	-.420	.055
Patent by residents 1995-99										1	.231	.735**	.918**	.684**	.679**	-.525*	-.280
Non-residents patent 1995-99											1	.079	.109	-.150	.253	-.262	-.367

	Expenditure per student 1988-96	Enrolment in high education 1998-99	Science and engineering students 1988-97	GDP per capita 1990-99	Total R&D expenditure 1991-99	Import as a % of GDP 1990-99	Export as a % of GDP 1990-99	FDI as% of GDP 1990-99	CIT index	Patent by residents 1995-99	Non-residents patent 1995-99	Publication 1988-97	Patent application to EPO 1995-00	Patent granted by USPTO 1995-01	Business-industry R&D expenditure 1991-99	Government R&D expenditure 1991-99	High education R&D expenditure 1996-99
Publication per residents 1988-97												1	.789**	.713**	.572*	-.599**	.268
Patent application to EPO 1995-00													1	.657**	.656**	-.530*	-.303
Patent granted by USPTO 1995-01														1	.605*	-.484	.086
Business-industry R&D expenditure 1991-99															1	-.894**	-.172
Government R&D expenditure 1991-99																1	-.033

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 3. Pearson's correlations coefficient among all indicators in the CEEC

	Expenditure per student 1988-96	Enrolment in high education 1998-99	Science and engineering students 1988-97	GDP per capita 1990-99	Total R&D expenditure 1991-99	Import as a % of GDP 1990-99	Export as a % of GDP 1990-99	FDI as% of GDP 1990-99	CIT index	Patent by residents 1995-99	Non-residents patent 1995-99	Publication 1988-97	Patent application to EPO 1995-00	Patent granted by USPTO 1995-01	Business-industry R&D expenditure 1991-99	Government R&D expenditure 1991-99	High education R&D expenditure 1996-99
Public expenditure for education 1988-99	.456	.628*	-.724**	.355	-.045	.741**	.571	.589*	.719**	-.319	.610	.332	.252	.156	-.364	.225	.223
Expenditure per student 1988-96	1	.037	-.701*	.399	-.158	.234	.212	.636*	.260	-.100	.082	.424	.359	.324	-.093	.001	-.485
Enrolment in high education 1998-99		1	-.544	.384	.235	.167	.140	.008	.466	.315	.601*	.151	.352	.373	-.614	.264	.244
Science and engineering students 1988-97			1	-.440	.075	-.314	-.212	-.628*	-.482	.071	-.325	-.351	-.378	-.387	.248	.138	-.021
GDP per capita 1990-99				1	.591*	.346	.491	.081	.738**	.540	.566*	.735**	.933**	.935**	.167	-.252	-.001
Total R&D expenditure 1991-99					1	-.023	.344	-.326	.264	.675*	.071	.613*	.807**	.785**	.463	-.465	.182
Import as a % of GDP 1990-99						1	.887**	.444	.809**	-.487	.689**	.382	.203	.075	.116	.100	.299
Export as a % of GDP 1990-99							1	.236	.792**	-.218	.570*	.675*	.460	.333	.360	-.072	.179
FDI as% of GDP 1990-99								1	.365	-.470	.239	.135	-.001	-.089	-.213	.142	.302
CIT index									1	-.002	.829**	.611*	.649*	.570	.040	.057	.375
Patent by residents 1995-99										1	.040	.259	.813**	.893**	.027	-.104	-.258
Non-residents patent 1995-99											1	.225	.413	.398	-.357	.380	.253

	Expenditure per student 1988-96	Enrolment in high education 1998-99	Science and engineering students 1988-97	GDP per capita 1990-99	Total R&D expenditure 1991-99	Import as a % of GDP 1990-99	Export as a % of GDP 1990-99	FDI as% of GDP 1990-99	CIT index	Patent by residents 1995-99	Non-residents patent 1995-99	Publication 1988-97	Patent application to EPO 1995-00	Patent granted by USPTO 1995-01	Business-industry R&D expenditure 1991-99	Government R&D expenditure 1991-99	High education R&D expenditure 1996-99
Publication per residents 1988-97												1	.747*	.660*	.462	-.399	-.082
Patent application to EPO 1995-00													1	.980**	.249	-.175	-.146
Patent granted by USPTO 1995-01														1	.224	-.243	-.187
Business-industry R&D expenditure 1991-99															1	-.717*	.010
Government R&D expenditure 1991-99																1	-.088

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 4. Factor analysis of all indicators for the OECD and for the CEEC

	Components for the OECD			*Components for the CEEC*			
	1	**2**	**3**	**1**	**2**	**3**	**4**
Public expenditure for education 1988-99	.826	.161	-.269	.596	.478	-.061	.606
Expenditure per student 1988-96	.703	.400	.095	-.026	.921	.177	.020
Enrolment in high education 1998-99	-.173	.002	-.930	.102	-.003	.165	.977
Science and engineering students 1988-97	-.127	.276	.856	.035	-.698	-.136	-.649
GDP per capita 1990-99	.877	-.055	.258	.245	.122	.874	.321
Total R&D expenditure 1991-99	.858	-.001	.200	.146	-.105	.946	-.009
Import as a % of GDP 1990-99	-.141	.913	.244	.987	.064	-.006	.082
Export as a % of GDP 1990-99	.066	.936	.178	.907	.027	.354	-.062
FDI as% of GDP 1990-99	.241	.894	-.124	.183	.795	-.312	.037
CIT index	.934	-.082	-.243	.759	.007	.419	.451
% of Variance Explained	38.585	28.641	16.929	43.489	23.220	15.390	10.703
% Cumulative Variance Explained	84.154			93.801			

Table 5. Regression coefficients of innovation activities in the OECD and the CEEC

	Independent variables	*Dependent variables*									
		Patents by residents		**Patents by non-residents**		**Publications per residents**		**Patent application to EPO**		**Patent granted to USPTO**	
The OECD		Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
	Development index	.922	.000	.163	.518	.838	.000	.845	.001	.686	.016
	Economic openness index	-.225	.164	.495	.061	-.014	.916	-.013	.947	-.275	.298
	Educational characteristics	.246	.146	-.020	.939	-.156	.258	.077	.689	.138	.597
	R Square	.719		.294		.808		.687		.432	
The CEEC	Economic openness index	-.515	.059	.442	.266	.315	.323	-.071	.727	-.198	399
	Educational & FDI	-.094	.634	-.188	.569	.099	.709	.200	.289	.106	595
	Development index	.971	.004	.022	.950	.694	.049	.955	.003	.977	.005
	Education characteristic	.040	.848	.404	.278	-.025	.931	.138	.481	.130	.548
	R Square	.854		.592		.729		.878		.849	

Table 6. Regression coefficients of R&D expenditure in the OECD and the CEEC

	Independent variables	*Dependent variables*									
		Patents by residents		**Patents by non-residents**		**Publica-tions per residents**		**Patent application to EPO**		**Patent granted to USPTO**	
The OECD		Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
	R&D expenditure by business-industry 1991-99	1.140	.030	-.247	.695	.667	.210	1.135	.074	1.368	.044
	R&D expenditure by government 1996-99	.530	.275	-.454	.468	.041	.936	.548	.358	.800	.206
	R&D expenditure by high education 1996-99	-.066	.755	-.425	.138	.384	.106	-.178	.432	.233	.327
	R Square	.527		.197		.455		.513		.471	
The CEEC	R&D expenditure by business-industry 1991-99	-.105	.864	.083	.888	.257	.664	.162	.811	.081	.903
	R&D expenditure by government 1996-99	-.206	.738	.357	.553	-.176	.766	-.010	.988	-.166	.803
	R&D expenditure by high education 1996-99	-.275	.551	.283	.523	-.100	.818	-.132	.800	-.176	.732
	R Square	.090		.157		.165		.050		.086	

Table 7. Number of patents and publication

		Patent per 100 residents by residents 1995-99	Non-residents patent per 100 residents 1995-99	Patent application to EPO per million of inhabitance 1995-00	Patent granted by USPTO per million inhabitance 1995-01	Publication per 1000 residents from 1988-97
The ECD	**Australia**	.05	.22	.	.	.62
	Austria	.03	1.37	125.20	62.48	.36
	Canada	.01	.17	.	.	.75
	Belgium	.02	.84	123.91	73.47	.41
	Denmark	.05	2.04	150.29	80.19	.73
	Finland	.07	1.89	243.61	114.81	.65
	France	.03	.16	117.97	63.97	.42
	Germany	.08	.14	232.46	112.13	.41
	Greece	.00	.78	5.87	2.06	.16
	Ireland	.03	2.47	43.77	24.97	.26
	Italy	.01	.17	60.46	25.91	.25
	Netherlands	.04	.60	170.46	79.30	.66
	Norway	.04	.83	106.30	49.14	.56
	Portugal	.00	1.21	2.80	.86	.07
	Spain	.01	.31	15.73	6.27	.21
	Sweden	.09	1.35	276.52	148.29	.90
	Switzerland	.07	1.67	.	.	.87
	UK	.05	.23	98.68	58.88	.66
	USA	.05	.04	126.41.	260.63	.69

		Patent per 100 residents by residents 1995-99	Non-residents patent per 100 residents 1995-99	Patent application to EPO per million of inhabitance 1995-00	Patent granted by USPTO per million inhabitance 1995-01	Publication per 1000 residents from 1988-97
The CEEC	**Bulgaria**	.00	.36	2.69	.55	.12
	Croatia	.01	.25		.	.12
	Czech	.01	.31	8.20	3.28	.19
	Estonia	.00	1.92	4.38	.35	.14
	Hungary	.01	.33	12.90	5.48	.16
	Latvia	.01	1.78	3.40	1.86	.06
	Lithuania	.00	1.19	1.26	.81	.05
	Poland	.01	.09	1.83	1.03	.10
	Romania	.01	.20	.89	.31	.02
	Russia	.01	.03	.	.	.12
	Slovak	.00	.60	4.70	1.67	.19
	Slovenia	.02	2.28	21.09	10.07	.22
	Ukraine	.01	.05	.	.	.05

Table 8. R&D expenditure average growth rate from 1991-2001

		Total R&D expenditure growth rate from 1991-2001	Business-industry R&D expenditure growth rate from 1991-2001	Government R&D expenditure growth rate from 1991-2001	High education R&D expenditure growth rate from 1996-2001
The ECD	**Australia**	.97	.98	1.00	1.03
	Austria	1.03	.98	.99	.95
	Canada	1.03	.98	.99	1.03
	Belgium	1.03	1.00	.99	1.08
	Denmark	1.04	1.03	.95	.85
	Finland	1.05	1.04	.94	1.09
	France	.99	1.02	.97	1.01
	Germany	1.00	1.01	.99	1.07
	Greece	1.11	1.08	.96	1.56
	Ireland	1.03	1.03	.98	1.18
	Italy	.99	1.02	1.01	.
	Netherlands	1.00	1.01	.97	1.03
	Norway	.98	1.05	.95	.
	Portugal	1.08	1.11	1.00	.84
	Spain	1.01	1.01	.99	1.03
	Sweden	1.08	1.04	.91	1.20
	Switzerland	.96	1.02	.86	.
	UK	.99	.99	.99	1.04
	USA	1.00	1.02	.97	1.02

		Total R&D expenditure growth rate from 1991-2001	Business-industry R&D expenditure growth rate from 1991-2001	Government R&D expenditure growth rate from 1991-2001	High education R&D expenditure growth rate from 1996-2001
The CEEC	**Bulgaria**	.90	.97	1.11	.86
	Croatia	1.69	.	.	.
	Czech	.96	.97	1.05	1.71
	Estonia	1.10	1.13	.94	1.13
	Hungary	.99	.95	1.03	.98
	Latvia	.98	1.01	1.00	.
	Lithuania	1.05	1.18	.91	.
	Poland	.98	.97	1.02	1.02
	Romania	.94	1.04	.97	2.37
	Russia	1.05	1.02	.99	1.02
	Slovak	.96	1.00	1.02	.79
	Slovenia	.97	1.02	.98	1.04
	Ukraine	.79	.	.	.

SADAŠNJOST ZAROBLJENA U PROŠLOSTI
Inovacijske i komercijalizacijske aktivnosti u OECD i Srednjoistočnim europskim zemljama

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Putanja razvoja definirana kao model od vrha prema dolje u Srednjoistočnim europskim zemljama i model odozdo prema vrhu u OECD-u ostavio je dugotrajne efekte na institucionalnu suradnju, inovacijski output i komercijalizacijske aktivnosti. Koristeći međunarodne statističke podatke za 19 zemalja OECD-a i 13 Srednjoistočnih europskih zemalja analiza otkriva slijedeće razlike.

Model odozdo prema vrhu u OECD-u rezultira u bliskoj pozitivnoj povezanosti između podsistema. Visoka razina međupovezanosti institucija utječe pozitivno na efikasnost podsistema. Razina inovacijskog outputa je viša i funkcija je indikatora razvoja i gospodarske otvorenosti. Komercijalizacijske aktivnosti pokazuju da izdaci za istraživanje i razvoj u gospodarstvu stimuliraju patente i publikacije.

Model od vrha prema dolje je još uvijek prisutan u zemljama Srednje i Istočne Europe i održava podsiteme relativno odvojenim. To rezultira manje intenzivnom i pozitivnom povezanošću obrazovanja i gospodarstva i konzekventno u manjoj efikasnosti podsistema. Vlada je dominantni izvor izdataka za istraživanje i razvoj što ima negativni utjecaj na komercijalizaciju, patente i publikacije.

Ključne riječi: *INSTITUCIONALNA SURADNJA, INOVACIJE, KOMERCIJALIZACIJA, OECD, SREDNJA I ISTOČNA EUROPA*