

# Technology Development and Innovation:Where do west Balkans Stand?

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## Abstract

Much of the current debate on the influence of technology in economic development emphasizes the positive impact of institutions. The proponents of this approach argue that institutions reduce the risk of technological innovation, facilitate effective domestic technological absorption, low transaction cost and strengthen property rights.

The article analyzes the role of technological policy in West Balkans, during the last fifteen years, taking into account the divergence of their initial economic conditions. Moreover, it underlines the major targets of their national innovation strategies, as well as their preferred national modes of technological performance.

After a brief introduction we review the major theories of technological policy, stressing their hypothesis, recommendations and differences. Section two, focuses on the strengths and weaknesses of technological policy records of West Balkan states, taking into consideration national science and technology indicators. Finally, section three, summarizes the discussion, providing proposals of how technology policies can influence national innovation performance. Our basic argument is that policies should strengthen the absorptive capacity of west Balkan states, facing the complementarities between human and capital resources in a more globalized business network.

Keywords: Transition countries, technological growth, Economic development, West Balkans.

## **Introduction**

Technology and Innovation are without doubt at the heart of the process of economic development and growth (Grossman and Helpman, 1991). They make possible new organizational and geographical arrangement of business activity, they facilitate growth and high rates of productivity ,(Porter, 1990) and they influence heavily modes of capital accumulation and investment. To shift production and economic structures in the direction of market economies, the West Balkan states, (Bosnia and Herzegovina, Croatia, Albania, FYROM, Montenegro and Serbia), therefore, need to build strong national innovation systems. But, why focus in six economies of West Balkans?

In part our interest reflects recent attention by the development policy and academic experts to the linkages between economic growth and public policies in transition countries, and in part it reflects the fact that each of the six countries is in a different stage of European/International economic integration and thus faces problems and challenges, sometimes unique to each country. Moreover, as in all transition economies, also in West Balkan states, the entire, set of institutions dealing with innovation has been remodeled in the 1990's. This process took place in a very unfavorable domestic environment with several conflicts and political instability which retarded market reforms. Indeed, economic difficulties led to underfunding of Science and Technology Policies and to underperformance of National Knowledge -producing systems. Last but not least, scientific ties built within COMECON were broken, leaving National Innovation systems of West Balkan states, without crucial resources and capital.

The article is organized as follows. Section One briefly reviews theoretical explanations for technological breakthroughs, and explores the fundamental approaches (evolutionary and neoclassical), on the relationship between innovation and economic growth. Section Two, presents the data available in innovation performance of West Balkan states, pointing out the major hurdles of national policies. Finally, Section three, concludes with a discussion on how new innovation policies, can help West Balkan countries, to improve their performance in the long-term.

We argue that the success of innovation strategies in West Balkan region not only depends on market conditions but also on institutional conditions. Technological improvements and performance are closely related to the quality of institutions. The later form a crucial part of the created assets at West Balkan countries and shape fundamentally the incentives faced by both local and foreign companies to create technology. Accordingly, specific institutional arrangements between firm and state agents, have an impact on technology options and that is why research should go beyond understanding how institutions regulate technology policy to focusing on how the interaction of state agents, domestic and international firms and global productive/research networks shape national innovation systems in West Balkan area. Within the context, companies are not independent in their options but rather situated in different kinds of relational settings which influence their technological strategy.

Before proceeding in our analysis, we should stress that statistical data on Science and Technology on West Balkans, are not readily available and in many cases do not systematically cover all crucial information. Moreover, there are indicators that are not mutually comparable because of different systems of reporting in West Balkan states. For this reason, apart from international sources of information (databases of UNESCO, World Bank and European Union), additional national sources of information have been used.

### **Section Two:**

#### **What determines Innovation? A brief Survey of the literature**

Assessing technology performance can be derived from an analysis of how innovation takes place. Theoretically, two approaches study in a coherent way technological breakthroughs, namely the neoclassical and the evolutionary approach.

The former rejects selectivity and institutional intervention, assuming no significant failures or coordination gaps in technological activity of firms (Posner, 1975; Buchanan et al, 1980). It stresses, that institutions and government agencies lack the ability to substitute market forces and that the cost of state failure always exceeds the cost of market failure. Governments should follow neutral policies which boost competition, liberalize investment and trade across sectors, eliminate institutional intervention, strengthen financial markets and improve education enrollment ratios. Free markets and competent firms, (possessing full knowledge of alternatives), optimize resource and capital flows. Thus, entry and exit barriers severely distort the readjustment of factors of production, creating conditions of long-run innovation inefficiency within economic sectors. Moreover, state subsidies drive managers in lobbying politicians, to maintain policy-created rents, (Murphy et al, 1993) leading to significant distortions in production networks. Furthermore, there are no cumulative processes or even path dependence in technology development. To sum up, neoclassical theorists, argue that externalities are not technology specific and that no government measures apart from strong intellectual property rights and creation of efficient education systems, should be taken.

However neoclassical approach in technological change and innovation presents three basic problems. Firstly, it conceives firms as single-minded profit maximisers, possessing all information on the technological strategies, from which they can select, acting without important internal coordination problems (i.e. transaction costs), or external constraints. Secondly, firms do not operate in isolation, without interlinkages and spillovers. More precisely, three types of networks might influence the content of technological option: organizational and productive networks between foreign firms and local companies, financial and organizational networks among local / foreign firms and state institutions and clusters of domestic firms. Thus instead of considering firms as autonomous, it is important to treat them as inherently constitutive of economic relations, enabling as well as constraining, (i.e. oligopoly situations), specific technology options. Finally, absorption and competitive deployment of technology, depend on an adequate supply of labour skills, making education, academic infrastructure, and life-time learning significant for the ability to promote local technical change. Without the full development of original and natural human resources capabilities, productivity gains will remain within the limits of a handful transnational corporations.

From the perspective of institutional economics, (North, 1990), new technologies are developed progressively and are closely related with high firm productivity (Stiglitz and Atkinson 1989). The presence of institutions is vital to support the efficiency (Metcalfe, 1993), of markets and to create the conditions of innovation (Nelson, 2002). Markets within which technological change occur are subject to five basic hurdles. The first one is asymmetric information (Arora et al, 2001), in the meaning that technology producers cannot fully demonstrate their knowledge, while buyers cannot fully determine the value of the knowledge before buying it. This leads in high transaction costs and low exchange - edge technology. In the presence of such information asymmetries then, it makes sense to subsidize, subject to specific performance / commercial criteria, the acquisition of new technology. A second problem derives from the fact that strong local or foreign firms, which possess substantial market power, may rise barriers to entry to new firms in sectors where initial sunk costs of investment are high. Given high financial and competitive barriers, technology policies may favour entrance of many corporations into technology-intensive activities. Thirdly, even when no strong players exist, strong externalities may arise if the costs and benefits of technology are not internalized by participants of National Business Networks. Taking into consideration that the patent systems are, too often, weakly defined in developing and emerging markets, there is a strong disincentive for technological learning. To overcome the high fixed investment costs due to the non - rival and non - exclusive nature of technology, an activist policy is required. Fourth, the effectiveness and suitability of research output in emerging markets depends largely on the level of integration and on the intensity of interaction between multiple agents of National Business Networks. Institutions then, can play a crucial role as intermediaries to coordinate and to regulate those highly complex

interactions. Finally, carefully designed institutional arrangements can address adequately the distributional conflicts and social tensions driving from the spillovers of new processes and technologies.

To sum up, institutional approach insists that technological effort is cumulative and path-dependent and that there is a clear relationship between institutions and the preferences / behaviour of market agents, leading to the incorporation of more advanced technology and high-value added managerial practices / routines into production processes. Externalities are embedded in National Business Networks and institutions provide the necessary framework for technology development and diffusion. Which are then, the most serious problems to the implementation of this activist policy?

Firstly, financial backing by state agents, may give rise to strong sectoral lobbies, minimizing both entry of competent corporations and exit of technologically, underperformed, firms. In this case, non-economic criteria replace economic criteria for credit allocation, giving rise to moral hazard issues. Secondly, no one can guarantee that state bureaucracy possesses both the information and the ability to intervene properly and promptly, in highly sophisticated technological targets. The solution lies perhaps in the quality of interaction and accountability of National Business systems, which can put in place strong and transparent decision- making procedures on technology issues.

## **SECTION TWO**

### **A Comparative study of Science and Technology Indicators in West Balkan states**

Science and Technology performance is closely related to National Business Network that support it. Although all six countries declare research to be a central aim, their research and technology performance remains below the critical threshold for attaining any significant national priority.

Before evaluating science and technology activities in West Balkans, it is vital to provide an overview of their socio- economic features. The six states of the area are in a less favorable economic condition than other transition states of Central Europe, in terms of f.d.i. flows, employment rates, savings and investment rates and structural problems.

Table One shows that there is no considerable diversity between West Balkan states in terms of population, life expectancy at birth and adult literacy rates. The UNDP Human Development classification, reveals that West Balkan states perform better than the World average and are very close to Central and C.I.S. average. Unfortunately, G.D.P. at purchasing power parities, varies from 2.200 US dollars (Serbia/Montenegro) to 12.191 US dollars (Croatia) and is lower, (in the exception of Croatia), than the world average and Central and Eastern European countries average.

Table Two also reveals that regarding financial and human science and technology input indicators West Balkan status lag behind those of high human development countries. This is true for example as far as if concerns investment in research and development where West Balkans perform substantially lower than the world and high human development countries. For Albania research and development (R and D) expenditure remains very low, while in Croatia, has declined initially to 0.71% (1998), reached a peak in 2000 (1.23%) and then declined again to 1,1%. In FYROM R and D expenditure declined substantially in the second half of 1995 from 0,5% of G.D.P. in 1995 to 0-3% during the period 2000-2003. However, the problem as in the other states, is that most research is financed by the government and business sector provides only 5% of Rand D investment. In Serbia- Montenegro, R and D rose from 0.1% of GDP in 2000, to 1.4% in 2002, and R and D spending per researcher has also increased from around 1347 Euro in 2000, to 6.888 Euro in 2003, with private spending however at rather low levels. Finally, funding of R and D in the Confederation of Bosnia/Herzegovina is limited to 0,05% of GDP, due to serious budgetary constraints. There is little doubt that significant delays in privatization, lack of adequate bank credit and scarce flows of international capital (despite foreign donors efforts), limited private sector research ability.

Public expenditure on Education (as a percentage of GDP), seems to follow a steady increase from early 2000's onwards, although it deals more with primary and secondary education than with applied research.

As regards human resources, West Balkan states suffer from a brain- drain problem, deriving from political and military conflicts of the 1990's and from a lack of interest for Science and Technology Professions, due to their low pay and limited research incentives. This is crystal clear in Bosnia/Herzegovina where the civil war destroyed the country's technological infrastructure and led to migration of the best researchers to North America and West Europe. Although in 1990, B/H counted about 2000 researchers, who spend annually 43.5 million US dollars, by the end of the 1990's, there were only 1300 University Professors and lecturers (UNESCO Science Report, 2005). In Croatia, the number of full-time researchers per million of population was 1.296 in 2003, significantly lower than in Central and Eastern European countries.

TABLE 1: Key socio-Economic Indicators of West Balkan states

Country	Population (millions) 2005	GDP per Capita Cppp us Dollars 2004)	Human Development Index(2004)	Life Expectancy at birth (years) (2004)	Combined Enrolment ratio (%)	Adult Literacy Rate (% age 15 and older)
Slovenia	2	20.939	0.910	76.6	95	99.6
Croatia	4	12.191	0.846	75.2	73	98.1
Bosnia and Herzegovina	4	7.032	0.800	74.3	67	96.7
FYROM	2	6.610	0.796	73.9	70	96.1
Albania	3	4.978	0.784	73.9	68	98.7
Serbia and Montenegro	8	2.200 (2002)	0.775 (2002)	73	N.A.	96.5 (2002)
Central and Eastern Europe and the CIS		8.802	0.802	68.2	83	99.2
High human Development		26.568	0.923	78.0	91.0	N.A

Information and Communication for Development 2006, UNESCO Science Report, 2005.

However, the important increase of Croatia researchers with Ph. D.'s from late 1990s, and the tendency for greater involvement in European projects, is promising for future intensification of high value-added research activity. Finally, FYROM seems to lose ground during the 1990's in comparison to both world and Central and Eastern European countries. The number of researchers has declined and in 2002 just under half of them (UNESCO, 2005), held a Ph.D., (47% in engineering, 13% in Agriculture, 11% in Medicine, 6% in natural science and the remainder in the Social sciences and the humanities).

Internet penetration also varies considerably among West Balkans states and is desperately low in Albania, Bosnia/Herzegovina and FYROM, (although the situation in the latter is changing rapidly as a consequence of the "Macedonia connects" project, supported by USAID).

Another critical measure of scientific productivity is publications in journals. Again, per capita output of Science and Engineering articles is rather low, (Table two, column five), in all West Balkan states in the exception of Croatia. However, since the adoption of the Stability Pact for South-East Europe (Cologne, 1999), and the initiation of the UNESCO Venice Process (November 2000), an effort in rebuilding technological cooperation among South/ East European states and between West Balkans and the rest of Europe is in place, and already contributes to a better scientific productivity of researchers.

In the same manner, the small share of high-technology exports, exerts a negative influence on the acquisition of cutting-edge technological capabilities in two ways. Firstly, having no significant pressure for innovation, West Balkan firms, perform poorly in both learning by doing and reverse engineering. Secondly, specialization in low value-added activities restrict better integration of West Balkan Corporations in Transnational corporations commercial and productive networks.

The quality of institutions is also vital for innovation and economic growth. The first half of the 1990's was characterized by the lack of solid Science and Technology strategy and unstable institutional settings. According to World Economic Forum institutional score (2007), all West Balkan States lag behind best performers, Albania ranks 108<sup>th</sup>, Bosnia and Herzegovina 106<sup>th</sup>, Croatia 66<sup>th</sup>, FYROM 103<sup>th</sup> and Serbia/ Montenegro 97<sup>th</sup>, and the same occurs as far as IT concerns technological readiness (Albania 104<sup>th</sup>, Croatia 47<sup>th</sup>, Bosnia and Herzegovina 108<sup>th</sup>, FYROM 91<sup>th</sup>, and Serbia/ Montenegro 73<sup>th</sup>) and innovation (Croatia 50<sup>th</sup>, FYROM 27<sup>th</sup>, Serbia/Montenegro 83<sup>th</sup>, Bosnia and Herzegovina 99<sup>th</sup> and Albania 121<sup>st</sup>). Among the West Balkan States, Croatia and Albania, improved their Global Competitiveness Index relatively to 2006 research, (Albania, only marginally), while others lost ground. World Bank indicators listed in Table three, measure country progress in pro-market reforms, allowing cross-country comparisons. According to Aggregate Rankings, most of the improvement is observed in Serbia/ Montenegro mainly as a result of significant initiatives during the last years. By contrast, Croatia came 124<sup>th</sup>, Albania ranked 120<sup>th</sup> and FYROM ranked 92<sup>th</sup>. Indices in columns one to seven, in table three reveal that economic progress is still constrained by numerous factors, including a heavy regulatory burden, and market unfriendly policies which constrain innovation and technology diffusion. It is also clear, that there are still challenges with regard the safeguard of property and investor rights, (Javorcik, 2004) the enforcement of contracts, and inadequate credit for private sector.

It is obvious then, that despite declarations, science and technology strategies have been reduced to a secondary role in development, in all West Balkan countries. To sum up, it seems that five are the major constraints on West Balkan "technological take-off":

1. At the national level, there wasn't a clear strategy of deciding upon the trade-offs between national economic and technological targets. This policy discontinuity and uncertainty resulted in high transaction costs, and costly research activity. Evidently, there were no important complementarities between the policies of industry, technology and research and development, not even an alignment of the National Science and Technology systems with the needs of a modern knowledge based society. Research and Development policies were thus undefunded, undervalued and underpaid, restricting dramatically the innovation potential of West Balkan nations. Of course, the Current situation is better than in 1990's, (for example the Serbian Ministry of Science and Environment Protection announced specific objectives of the National Investment Plan and targeted criteria for defining investment priorities regarding scientific research in 2006, while Croatia also put in place the New Science and technology policy of the period

2006-2010, in order to increase the funding for Science and technology to 3% of GDP), although it remains to see the practical results of new policies in the foreseeable future.



Table 2, Science and Technology Indicators of West. Balkan states

Country	Public Expenditure on Education as % of GDP (2002-2004)	R and D Expend. as % GDP (2000-2003)	Researchers in R and D (per million) 1990-2003	Internet users (per 1000 people) 2004	Per Capita output S and E Articles 2003 (million+ inhabitants (World Share))	High Technology exports as % of manufactured Exports (2004)
Slovenia	6.0	1.5	2,543	476	456.43	6
Croatia	4.5	1.1	1,296	293	165.52	13
Bosnia and Herzegovina	N.A.	0.05	N.A.	58	3.61	N.A
FYROM	3.4	0.3	547 (UNESCO 2002)	78	30.57	1
Albania	2.9 (2003)	0.18	N.A.	24	3.68	1
Serbia and Montenegro	3.3 (2000)	1.4 (2002)	1.085 (2000)	400 (2000)	57.04	N.A
Central and Eastern Europe and the CIS	-	1.0	2,204	139	-	10
High human Development	-	2.5	2.968	470	-	

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National Statistical Yearbooks of West Balkan States, 2006.

**Table 3: Ease of doing Business in West Balkan states**

Country	Procedures to start a business (number)	Cost to start a Business (% of income per capita)	Procedures to obtain a license	Rigidity of Employment Index (0-100)	Procedures to Register Property (number)	Investor Protection Index (0-10)	Total tax Rate (% of commercial profits)	Ease of doing Business (Aggregate) rank (out of 175 countries)
Slovenia	9	9.4	14	57	6	5.7	39.4	61
Croatia	10	12.2	28	50	5	3.0	37.1	124
Bosnia and Herzegovina	12	37.0	16	42	7	5.0	50.4	95
FYROM	10	7.4	18	54	6	5.0	43.5	92
Albania	11	22.4	22	38	7	2.7	55.8	120
Serbia	10	10.2	20	38	6	5.3	38.9	68
Montenegro	15	6.6	22	34	8	6.3	33.9	70

Source: World Bank, Doing Business 2007 Report

2. The absence of a modern and reliable framework of policy evaluation and technology strategy assessment deprived West Balkan states from critical international benchmarking and necessary technological adaptations. Major shortcomings in the institutions themselves, (absence of modern organization, lack of on going scientific activities, poor implementation and usage of R and D programmes, moderate participation in International partnerships, and inconsistency between institutional functions and policy implementation), restricted the transformation of regional research networks into integrated national innovation systems. Thus, there is a need to standardize practices in national research and to harmonize national science and technology strategies with those of triad market countries. Equal focus should be put on the commercial application of scientific - technological products, parallelly to basic research projects.

3. Budgetary constraints, limited significantly public expenditure on R and D, giving priority to macroeconomic stabilization and fulfillment of I.M.F. conditionality terms, while private sources have not been in a position to compensate for the lack of funds. Moreover, weak national financial structures didn't provide decisive stimuli for innovation activities, creating many times crowding- out effects in favour of ailing state- owned entities. Additionally, the lack of venture capital and private equity restrained spin-off initiatives and technological networking. Similarly, financial assistance received from abroad was not provided on a systematic and organized way.

4. Innovation policies did not respond to the dynamics of externalities. Diffusion channels were insufficient and collective learning concerned more the static diffusion of technology, rather than the diffusion of organizational and productive innovations. Again, West Balkan states have undertaken during the last years, important initiatives to overcome this obstacle. The Serbian Ministry of Science and Environmental Protection (Department of Information Society), started to encourage activities concerning e-management and the internet, including a strategy for the development of the information society, while the Academic Network of Serbia has become a constituent part of Pan-European research and education network (GEANT), which provides connectivity between the national research and education networks throughout Europe (Steering Platform on W. Balkans: Serbia country Report). Similarly, the Government of Montenegro also adopted a document, called "Strategy of Introducing ICT into the Education System of Montenegro- Up to the University Level"(Steering Platform on W. Balkans: Montenegro). Among the plans of its Ministry of Education, is to improve the number of students per computer to five by 2010, which would place Montenegro in line with the most developed European countries. In Croatia 176 institutions at 263 locations were connected to Croatian Academic and Research Network (2006), making scientific resources, accessible to wide range of users (Steering Platform W. Balkans: Croatia), and in Bosnia- Herzegovina a new cross- border dark fibre cable (2007) provides high speed internet connection for the local research community, as part of the South- Eastern European Research and Education Network.

5. Finally, due to poor links between business enterprises, higher education institutions and research institutions, commercialisation of new processes and new services was rather inexistent. Moreover, technology parks contributed very little in industrial clustering and in the development of International technological alliances. Past experience clearly shows that in order to benefit from the technology acquired abroad by local firms, West Balkan states should develop their absorptive capacity.

#### **Discussion and Conclusions: The Need for a new Innovation Agenda**

The article analyzed the framework of technological policies in West Balkan states after 1990. It suggested that an evolutionary approach which underlines institutional variables is more suitable to evaluate West Balkan innovation policies, than neoclassical approach which tends to assume automatic learning with private investment.

Obviously the process of technological development in West Balkans region is fraught with both market imperfections and institutional imperfections. The combination of poor Science and Technology inputs, together with a poorly organized and unstable economic system as a whole resulted in the West Balkan states producing poor science and technology performances. Attracting than, research and development investments demand a new integrated technological policy approach, addressing, efficiently, high transaction costs and complex links between the actors of national business networks.

Rebuilding the Science and Technology framework of Western Balkan states requires the adoption of new "road-maps" which apart from national priorities would have four general mid and long term targets. Firstly, increased access of local corporations to the

international stock of knowledge, which involves strong vertical links with international productive and trade networks. Secondly, reduction of the costs of acquiring, absorbing or using technologies for domestic firms and clusters of domestic economic activities. Third, building an innovation-friendly environment, which involves not only heavy and long-term investment in human resources but also elimination of all obstacles to technological activities. Finally, there is an urgent need to support under-funded research projects.

Ultimately, the article indicates that in order to improve innovation and technological performance, West Balkan countries need to invest heavily in both human and financial resources according to well-defined national strategies that link policies covering industry, competition and science and technology and are accompanied by an overhaul in the National Business Networks. Equally important favoring effective science and technology cooperation and integration between and South-East European states will most likely improve Science and technology development and long-term economic growth in the region.

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