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**RESEARCH AND DEVELOPMENT AND
COMPETITIVENESS IN SOUTH EASTERN EUROPE:
ASSET OR LIABILITY FOR EU INTEGRATION?**

Slavo Radosevic^a

^aUCL School of Slavonic and East European Studies
s.radosevic@ucl.ac.uk

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Centre for the Study of Economic and Social Change in Europe
UCL School of Slavonic and East European Studies
Gower Street, London, WC1E 6BT
Tel: +44 (0)20 7679 8519
Fax: +44 (0)20 7679 8777
Email: csesce@ssees.ucl.ac.uk

RESEARCH AND DEVELOPMENT AND COMPETITIVENESS IN SOUTH EASTERN EUROPE: ASSET OR LIABILITY FOR EU INTEGRATION?¹²

Prof. Slavo Radosevic

School of Slavonic and East European Studies

University College London

s.radosevic@ucl.ac.uk

Abstract

This paper explores the relationship between research and development (R&D) and competitiveness of the SEE economies from the perspective of the EU integration and the EU as a knowledge based economy. Specifically, paper addresses the question of whether SEE is a potential asset or a liability in this process.

SEE countries are quite diverse in terms of levels of competitiveness, with visible effects on the role of R&D which is confirmed by analysis of the demand and supply factors of R&D. Although tentative, results show that innovation policy that takes account of the supply and demand side factors of R&D is essential to knowledge based growth in the SEE economies. This poses some limits to traditionally defined S&T policy as a sectoral activity and calls for new approaches, which are discussed in the paper.

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1. Introduction

In several respects South-eastern Europe (SEE) is the most complex region in contemporary Europe³. Its complexity originates in the Cold War era when this area was primarily a geographic notion and did not exist as economic region. Ex-Yugoslavia, Romania and Bulgaria, Albania and Greece were neighbouring countries, but for a long period in the 20th century did not communicate either economically or politically to any significant extent despite their proximity. At a time when the countries of central Europe have embraced the opportunities afforded by EU accession this area was held back by the bloody break up of Yugoslavia which continues today in the uncertainties regarding the status of Kosovo and the very complex institutional system of Bosnia and Herzegovina. As a result of a various factors part of the region is in the EU (Greece, Slovenia, Bulgaria, Romania) while other parts either have EU candidate status (Croatia, Turkey, Macedonia) or have rather uncertain prospects regarding membership (Albania, Bosnia and Herzegovina, Serbia and Montenegro).

In a Europe that aims to become ‘the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion’ (European Council, Lisbon, March 2000)⁴ much of the SEE could remain what it has been for the major part of its modern history - a backward periphery, a liability for the prosperity and stability of Europe in a globalised world economy increasingly dominated by the Asian countries. On the other hand, accession to the EU of four out of 11 SEE countries and candidature of three others represents quite new possibilities for integrating these countries into the European core.

Within this context we want to explore the relationship between research and development (R&D) and competitiveness of the SEE economies⁵. This issue has relevance from the perspective of the EU as a knowledge based economy and directly

³ SEE includes Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, FYR, Macedonia, Albania, Bulgaria, Romania, Greece, and Turkey.

⁴ See http://www.europarl.europa.eu/summits/lis1_en.htm

⁵ In this paper term R&D is used in very broad meaning covering not only R&D but also innovation activities.

addresses the question of whether SEE is a potential asset or a liability in this process. In particular, the diversity of this region represents a significant obstacle to intra-regional integration and integration with the core of the EU. As a result of historical legacies and developments in the 1990s, differences between SEE countries in terms of levels of development as well as the role played by S&T, are very substantial. Also, socio-institutional characteristics of the SEE countries in terms of quality of life, demographic indices and prevalence of the rule of law are very significant. On the other hand, R&D is essential to sustainable long-term growth and is potentially important driver of growth and prosperity in the region.

In the second part of the paper, we briefly review key findings in the academic literature on the relationship between R&D and economic growth. Based on this rationale, in section three, we discuss a variety of competitive positions for the SEE countries and the differences in R&D in individual countries that follow from this variety. In the fourth part of the paper, we review the process of transformation of R&D systems in SEE; the fifth part outlines the policy options and role of international assistance.

Our main conclusion is that SEE countries are quite diverse in terms of levels of competitiveness which, it is believed, should have strong effects on the role of R&D. This is confirmed by analysis of the demand and supply factors of R&D. Although very tentative these results show that innovation policy, which is able to take account of both the supply and demand side factors of R&D, is essential for knowledge based growth in the SEE economies. A key policy message is that there are limits to traditionally defined S&T policy as a sectoral activity. We argue that there is a need to: broaden the focus of S&T policy; build public R&D linked to countries' industrial, agricultural and medical care sectors; and make better use of international assistance to integrate R&D in SEE into the European Research Area (ERA) and to facilitate linkages in local systems of innovation.

2. S&T and economic growth or why support R&D in SEE ?

A traditional economic argument to justify public support for S&T is market failure. By this economists mean that the market is not the best allocator of resources for S&T because those that perform S&T cannot enjoy all the benefits of their investments due to knowledge 'leakage'. A solution to the problem is public subsidies for R&D coupled with an intellectual property rights (IPR) regime that excludes the use of new knowledge by those that have not paid for it. However, this argument reduces the rationale for public R&D as being a useful source of codified information. It overlooks a variety of other benefits that science makes to the economy that go beyond support which increases the stock of useful knowledge. Science is essential to the training of skilled graduates, the creation of new scientific instrumentation and methodologies, the formation of networks and social interaction between individuals involved in R&D, the capacity of firms to solve technological problems, and the creation of new firms through spin-offs (see Salter and Martin, 2001, for an elaborated argument). In short, the way S&T is generated cannot be explained through the 'right incentives' as spillovers and institutions for sharing knowledge are essential to its generation and diffusion. Accordingly, the rationale for S&T cannot be explained within a 'market failure' framework, which is confined to the issues of incentives and appropriability of codified information. The rationale for S&T needs to be much broader and to acknowledge its tacit, network and systemic aspects.

In accordance with the traditional perspective which focuses on the public – private character of knowledge, 'catching up' or growth behind the technology frontier is perceived as an almost automatic process given the right incentives. Due to the public nature of knowledge countries that are behind the technology frontier can enjoy the advantages of free knowledge through imitation and import at reduced prices.

However, 'latecomer advantages', which supposedly arise from mere imitation of already available technologies whose knowledge base is free, are rare. Catching up is not a process of mere imitation; it requires adaptation and innovation (Fagerberg and Verspagen 2003). Successful catch up has historically been associated not just with the adoption of existing techniques in established industries within a different environment,

but also with innovation, particularly of the organisational kind, and with inroads into nascent industries (Fagerberg and Godhino, 2005).

If the scope for imitation were so large we would have seen many more cases of convergence and catch up with developed economies. As Fagerberg and Srholec (2005) demonstrate the potential for diffusion (imitation) in developing countries is more than counteracted by better financial systems, better governance and faster growth of knowledge in other countries. As a result, technology gaps can be not only exploited through imitation, but also created through innovation. Hence, the capability to innovate and thus the importance of science for catching up remain essential.

Along a similar line of thinking Salter and Martin (2001) argue that no nation can ‘free-ride’ on the world scientific system.

In order to participate in the system, a nation or indeed a region or firm needs the capability to understand the knowledge produced by others and that understanding can only be developed through performing research. Investments in basic research enable national actors to keep up with and, occasionally, to contribute to the world science system. (Salter and Martin, 2001, p. 512)

As Mowery (2005, p. 29) argues, public investments in R&D have been a central component of economic catch up strategies for the past 125 years. Moreover, it seems that the importance of public R&D will increase in the future. Mowery argues that:

Economic catch up in the 21st century is if anything likely to place a greater demands on the knowledge related capabilities of developing economies, reflecting the faster growth of output and exports of knowledge intensive products, the more prominent role of basic scientific knowledge in the innovation process and the importance of stronger national absorptive capacity to exploit a much richer body of global S&T knowledge. (Mowery, 2005, p. 30)

Richard Nelson (2005, p. 19) argued that ‘the role of indigenous public research is more important today than it was in the 20th century’. He points to the changing conditions for

catching up which lie primarily in the increased importance of indigenous capabilities in R&D, and in particular the increasingly important roles of indigenous universities and public laboratories as vehicles for technology transfer.

An important lesson from historical analysis of catch up is the overwhelming importance of the institutional context and specific conditions rather than policy principles. What matters is the implementation and institutional system, which can ensure autonomy, and relevance of R&D for the economy. In the current World Trade Organization (WTO)-dominated institutional regime, the need for public R&D investments to complement market oriented development strategies has actually increased (Mowery, 2005). An institutional system that nurtures openness, but which also fosters technology based competition, is at the core of the problem. In terms of policy this expands our initial concern with the market failure rationale for supporting R&D with a variety of new types of failures, which are endemic to systems of innovation. As pointed out by Arnold (2004) these are capability failures in the business sector, failures in institutions, network or system failures and framework failures or failures in regulatory systems.

This brief overview of the arguments for investing in R&D shows that building strong S&T systems linked to private and public users is essential to economic growth and catching up in SEE countries. Research also shows that there are no quick fixes to growth from building a S&T system unrelated to the economy or from building only efficient market mechanisms. A dynamic system of innovation is historically specific and the evolutionary outcome of a variety of complementary advantageous factors and solutions that compensate for disadvantages or missing or inhibiting factors. A public system of support for science is important, but only one of the ingredients in the process. Below we provide a broader picture of the SEE economies and the differentiated roles of S&T in individual countries.

3. Competitiveness and R&D in SEE

In the previous section we tried to explain the rationale for investing in R&D in SEE. We now analyse the role of R&D in SEE countries' competitiveness. We use data on the so

called pillars of competitiveness as defined in the World Economic Forum *Global Competitiveness Report 2006-07*. The pillars are factors of competitiveness which constitute the new Global Competitiveness Index (GCI) and they include institutions, infrastructure, the macroeconomy, health and primary education, higher education and training, market efficiency, technological readiness, business sophistication and innovation. Each of these pillars is based on a large number (two thirds of them) of mainly subjective answers on different aspects of the local economy. Answers are assessed on a scale of 1-7 with hard data rescaled to this range. As they are subjective indicators they undoubtedly have weaknesses, but also enable insights into a variety of qualitative aspects of the economy which are not accessible from hard data.

We have used the pillar values as reported in GCR 2006-07 and clustered SEE countries and also some countries which could be considered as recent members of the European periphery (Baltic States, Czech R, Hungary, Poland, Slovakia, Portugal, and Ireland). The objective is to establish where SEE stands in the context of the wider Europe. Countries are clustered based on nine dimensions of their competitiveness, using hierarchical and K-means cluster analysis. The results suggest that the most robust three-cluster solution i.e. the biggest differences between groups is achieved when countries are divided into three groups. These are:

Cluster 1: Slovenia, Ireland, Portugal, Czech R and Estonia

Cluster 2: Serbia and Montenegro, Macedonia, Bosnia and Herzegovina and Albania,

Cluster 3: Hungary, Latvia, Lithuania, Poland, Bulgaria, Romania, Croatia, Turkey, Greece and Slovakia

Table 1 shows the distances between cluster centres on which basis we can identify several points. First, countries do not divide into the Cold-War 'East' vs. 'West' divide but into three tiers that only partly resemble the pre-Cold War lines of development. Second, SEE is present in all three clusters which suggest that it is appropriate to treat SEE not as a region in the economic sense, but as an area of sub-regions. Slovenia shares features of competitiveness with Ireland, Portugal, Czech R and Estonia. Six of the SEE

countries are in a group with the rest of the new members states from CEE (Latvia, Lithuania, Poland and Slovakia). It is interesting that Turkey and Greece are in this cluster, together with the ex-socialist SEE countries. These results conform to other similar analyses of the enlarged EU (see Radosevic, 2004) as well as the results of the European Innovation Scoreboard⁶.

Table 1: Distances between cluster centres

Cluster	1	2	3
1		4.385	1.974
2	4.385		2.542
3	1.974	2.542	

Third, the area of the Western Balkans, which comprises Serbia & Montenegro, FYR Macedonia, Bosnia & Herzegovina and Albania (but not the other countries usually included in this group), has more similarities in terms of competitiveness with the countries within it than with the rest of the countries in our sample. The distance between cluster centres of the ‘Western Balkans proper’ (cluster 2) and cluster 3 is greater than the distance between cluster 3 and cluster 1. Finally, this clustering of countries based on their competitiveness profiles suggests that the role of R&D will also differ widely in the various SEE countries and in particular between ‘Western Balkans proper’ and the rest of the SEE.

Table 2 shows that seven out of nine pillars are significantly contributing to clustering. Health and primary education and the macroeconomy contribute significantly but at less than 10% and 5% levels of significance respectively. This suggests that these countries cannot be easily distinguished based on macroeconomic and health/primary education variables. This is further confirmed in the analysis of SEE countries only (Figure 1)

⁶ See <http://trendchart.cordis.lu/scoreboard>

Table 2: Analysis of Variance

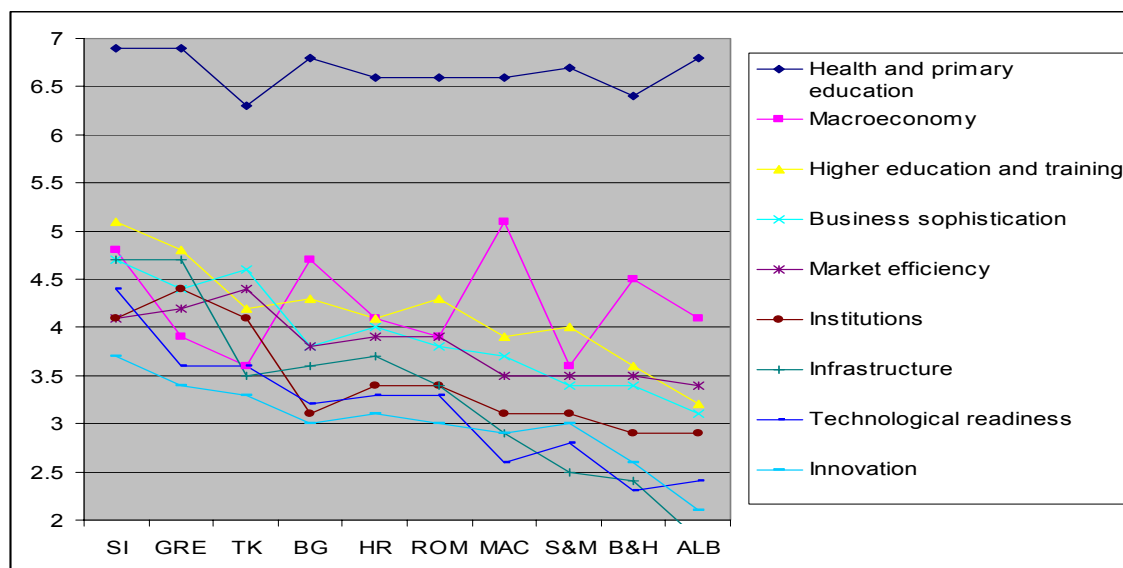
Pillars of competitiveness	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Institutions	2.604	2	.158	15	16.437	.000
Infrastructure	6.056	2	.107	15	56.428	.000
Macroeconomy	.721	2	.229	15	3.147	.072
Health & primary education	.094	2	.026	15	3.685	.050
Higher education and training	2.297	2	.097	15	23.712	.000
Market efficiency	1.401	2	.075	15	18.761	.000
Technology readiness	5.050	2	.137	15	36.742	.000
Business sophistication	2.125	2	.095	15	22.396	.000
Innovation	1.665	2	.093	15	17.898	.000

Figure 1 ranks pillars based on the estimated average level for all ten SEE countries. SEE countries rank best for health and primary education. A good ranking of the SEE in these areas is partly due to the GCR methodology, which takes into account illnesses that are not present in the SEE, such as malaria, or are not an acute economic problem, for instance tuberculosis and HIV. Another pillar that is relatively well ranked is macroeconomy, which has a cyclical dimension and reflects the specific situation in individual SEE countries, which is not necessarily related to their level of competitiveness but mainly reflects government determination to stabilise the economy. In terms of higher education and training the position of SEE countries corresponds to their levels of development.

The biggest differences among SEE countries relate to infrastructure. This clearly reflects not only the lower levels of development in Albania, and FYR Macedonia but also the effects of the war on Bosnia and Herzegovina, which for this measure rank lower than Albania.

Figure 1: Quality of Pillars of Competitiveness of South East European Economies

(Ranking based on scale 1-7)



Source: Based on WEF (2006)

The worst ranked pillars are innovation and technological readiness. The latter category illustrates the degree to which the country is able to absorb foreign technology while innovation indicates the degree to which it is able to generate new knowledge. When compared to external conditions for innovation and technology absorption (business sophistication, market efficiency and infrastructure) SEE countries score on average better than for their capabilities to innovate and absorb technology. External conditions for innovation, such as institutions, market efficiency and business sophistication, are variables that have improved in the SEE transition economies through institutional changes that have occurred in the last 10 – 15 years⁷. However, these changes have not necessarily been accompanied by changes in the capabilities of firms to absorb new

⁷ Market efficiency indicators encompass efficiency of goods markets (openness of markets, level of distortive government interventions, size of market), efficiency of financial markets and efficiency and flexibility of labour markets. Business sophistication index measures the quantity and quality of local suppliers, well developed production processes, and the extent to which companies in a country are turning out the most sophisticated products.

technology and to innovate. Intra-regional differences in technological readiness are pronounced. Figure 1 suggests that FYR Macedonia, Bosnia and Herzegovina, Serbia and Montenegro, and Albania have very low absorptive capacities (cf. technological readiness) which will hinder their progress in competitiveness despite their better performances on external institutional and business conditions.

In summary, the analysis clearly shows what careful observers would intuitively guess: that SEE countries are quite diverse in terms of levels of competitiveness. Although, innovation and technological readiness are the worst dimensions of their competitiveness, differences in the levels of these dimensions suggest that the role of R&D and training varies widely across different SEE countries. This is confirmed by the analysis below which portrays a variety of different situations in the SEE R&D systems. The very poor infrastructures of Albania, Macedonia, Bosnia and Herzegovina, and Serbia and Montenegro negatively affect their ability to absorb new technologies or to innovate.

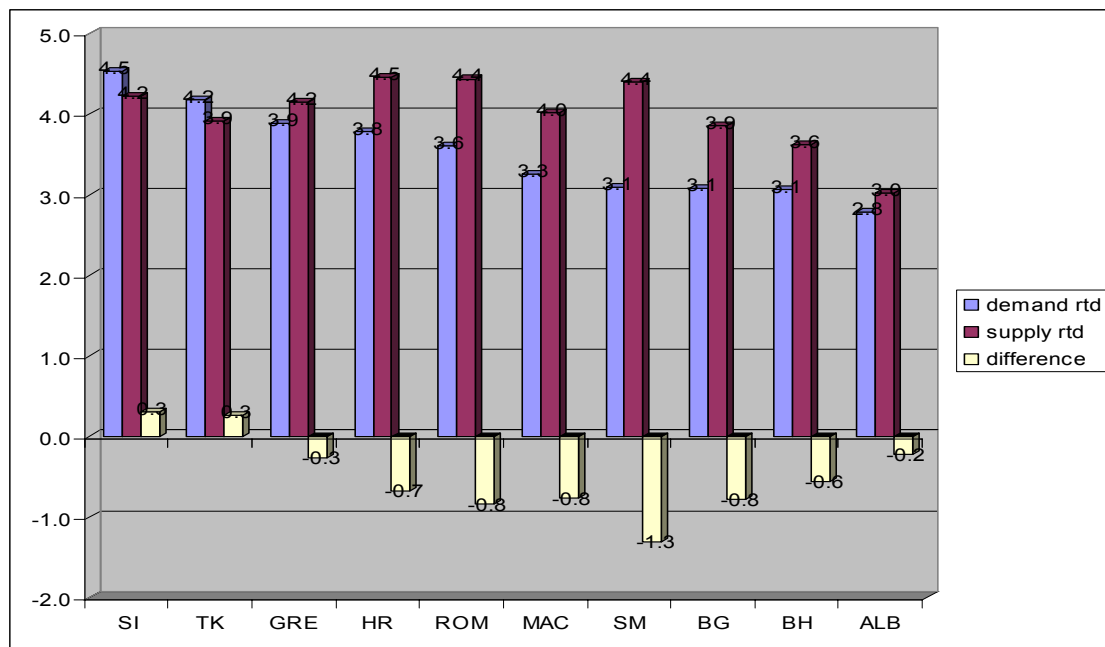
Next we probe more deeply into the issue of demand and supply for R&D in the SEE countries, again using GCR data. Tables 3 and 4 present list of variables that could be considered proxies for quality of supply and demand for R&D in SEE. Based on simple averages of each of these groups Figure 2 depicts 'aggregate' demand and supply for local R&D in SEE. In interpreting these data it is essential to bear in mind that these are based on the responses of local business communities, which are assessing demand and supply for R&D from the perspective of their economy, not some external objective benchmark. Hence, we should not expect positive relationship between levels of income per capita and levels of demand and supply for R&D⁸. In addition, these figures should not be confused with macroeconomic aggregates of supply and demand.

This simple analysis shows two things (Figure 2). First, with the exception of Slovenia and Turkey, supply is ranked higher than demand for R&D in all SEE countries, i.e. most SEE countries have a demand gap. This basically means that despite limited R&D

⁸ Correlation indexes between our proxies of supply and demand for R&D and GDP per capita (PPP) in this case are actually close to zero.

capacities their major constraint is limited demand for local R&D. Slovenia and Turkey, on the other hand, show signs of a R&D supply gap i.e. limited R&D capacities or perhaps types of capacities, given their demand for R&D. In the case of Turkey, this could be expected given its level of development and recent economic growth; in the case of Slovenia this situation is related more to the structure of its R&D system than to its overall size given its 1.6% GERD/GDP share.

Figure 2: Assessment of demand and supply for local R&D in SEE



Source: Author based on WEF 2006 data

Similar to other Balkan states Greece suffers from weak demand for R&D, which is most likely due to its industry structure which is dominated by small firms in traditional industries.

The small R&D demand – supply gap in Albania is mainly a sign of very low levels and quality of demand and supply for R&D. This is what economists refer to as ‘low level equilibrium’ and is a symptom of developmental gaps rather than a situation that should

be considered optimal from a growth perspective. The bigger R&D gap in the case of Bosnia and Herzegovina should be interpreted from a similar perspective, and also its specific post-war situation must be taken into account.

The largest group of SEE economies (6) have a noticeable R&D demand gap meaning that they are not able to employ their R&D capacities effectively. This result for the SEE countries conforms to previous research which indicated that demand for R&D is the most significant weakness of the new member states in the enlarged EU (Radosevic, 2004). In the case of the SEE, this demand gap may be due to several factors, such as low level of businesses processes which do not use new technologies, or inappropriate structure or quality of R&D capacities. The problem is worst in Serbia and Montenegro which have the biggest demand – supply gaps. In Serbia this is probably due to the low sophistication of business processes which do not generate sufficient demand for local R&D, and to extensive R&D capacities, which in conditions of limited international cooperation are not accompanied by local R&D demand. In addition, based on its being part of the former Yugoslavia Serbia inherited several large R&D capacities from the centralised period, which continue to be characteristic of its R&D system today.

Figure 2 shows that according to the local business communities the quality of R&D supply seems to be highest in Croatia and poorest in Albania. The high assessment of R&D supply in Serbia and Montenegro (4.4) stands in stark contrast to the very poor assessment of quality of demand for R&D (3.1.) The very low estimation of quality of R&D in Bulgaria (3.1) is striking, and given its EU membership it ranks particularly poorly for supply of R&D (3.9).

Tables 3 and 4 show what lies behind the aggregate rankings. One of the positive legacies of socialism is the assessment of high quality maths and science teaching in Romania, Serbia and Montenegro. The availability of scientists and engineers is a result of the size of countries and not just of relative investments in R&D. Also, data on R&D supply should be seen in relation to demand for R&D, which perhaps explains the very high

assessment of availability of scientists and engineers in Greece (5.5) and low assessment in Slovenia (only 3.8).

Table 3: Factors of supply for R&D in SEE countries

	Quality of education	Quality of math and science teaching	Local availability of spec. research and training	Quality of public (free) schools	Quality of scientific research institutes	Availability of scientists and engineers
Slovenia	3.8	4.6	4.4	4.5	4.2	3.8
Bulgaria	3.1	4.4	3.5	3.7	3.7	4.7
Croatia	3.8	4.9	4.5	4.6	4	4.9
Romania	3.8	5.5	4.3	4.4	3.7	4.9
Macedonia	4	4.6	3.3	4.1	3.4	4.7
SerbMont	3.9	5.1	4	4.4	4.1	4.9
BosniaHerz	3.5	4.5	3.6	3.4	2.9	3.8
Albania	3.1	3.9	2.5	3.1	2.2	3.3
Greece	3.6	4.5	3.9	3.7	3.7	5.5
Turkey	3.2	4.3	4.3	3	3.9	4.8

Source: WEF 2006

On the demand side, Slovenia ranks first followed by Turkey. The range of rankings for demand is much bigger than that for supply (1.2 points vs 0.7), which again highlights that the key weaknesses are on the demand side.

Table 4: Factors of demand for R&D in SEE countries

Extent of staff training	Firm level technology absorption	Production process sophistication	Buyer sophistication	Customer orientation	Company spending on R&D	Government procurement adv. techn	Capacity for innovation
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						products		
Slovenia	4.4	4.6	4.4	5	5.3	4.1	3.6	4.8
Bulgaria	2.6	3.5	2.5	3.2	4	2.7	3.2	2.9
Croatia	3.6	4.4	3.6	3.9	4.4	3.3	3.7	3.3
Romania	3.3	4.6	3.3	3.8	4.2	3.1	3.6	2.9
Macedoni	3.5	3.6	3	2.9	3.9	2.6	3.4	3.1
SerbMont	2.3	3.8	2.7	2.8	3.6	3	3.9	2.6
BosniaHerz	3	3.5	2.7	2.9	3.8	2.9	3	2.7
Albania	2.7	3.7	2.9	3	3.9	2.1	2.1	1.9
Greece	3.8	4.4	4.1	4.4	4.7	3.1	3.6	3
Turkey	4.2	5.4	4.1	4.2	5	3.2	3.8	3.5

Source: WEF 2006

These results show that innovation policy should take account of both the supply and demand side factors of R&D. Weak innovation demand at firm level and weak innovation support systems (external conditions for firm level R&D) are the biggest bottlenecks to the greater contribution of S&T to growth and social development in the SEE countries. Demand side constraints are further reinforced by supply side constraints through still strong processes of external and internal brain drain (see below) and the ageing of the R&D sector. We discuss some of these issues in the next section.

4. Restructuring of R&D systems in SEE

The military and political conflicts of the 1990s coupled with transition related changes have significantly impacted on R&D capacities in the majority of the SEE countries. A sudden change from exclusively state directed economies and research capacities to market economies (Albania, Romania, Bulgaria) introduced a degree of uncertainty into the R&D system, which led to erosion in terms of quantity as well as quality of R&D. The exceptional reduction in national expenditures on R&D in most of the post-socialist SEE countries driven by economic crises and related collapse in demand for local R&D, has led to a brain drain. The loss of critical mass due to the formation of new states (ex-Yugoslav states) has promoted additional restructuring. However, these changes have not

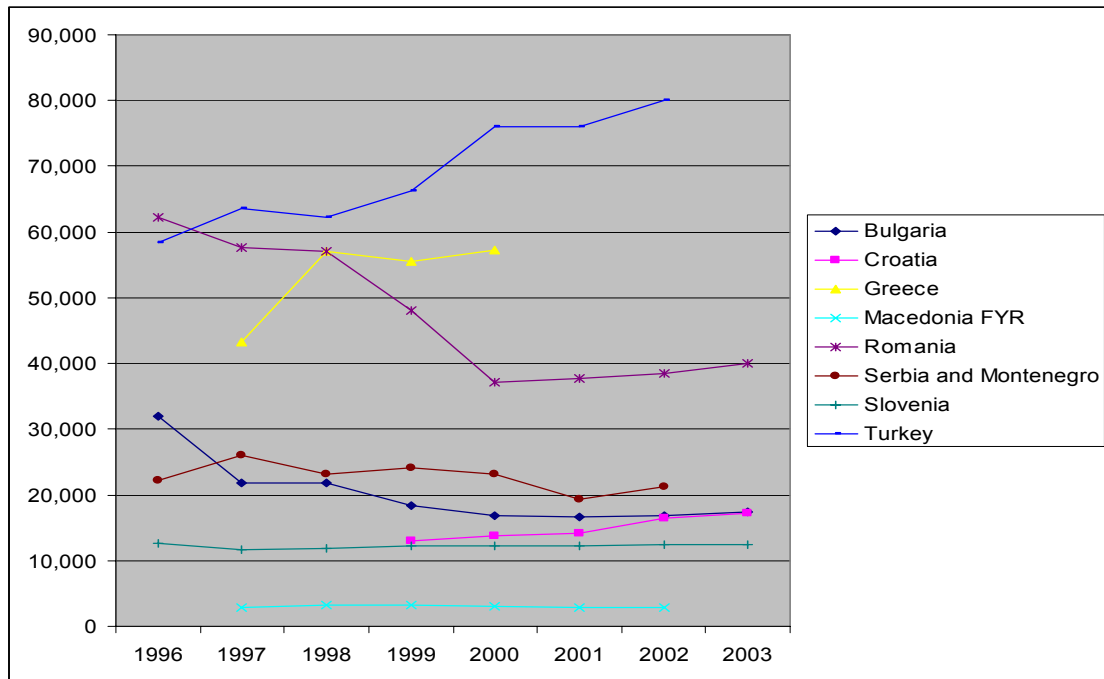
affected Turkey, Greece and partly Slovenia. In effect, it has led to a prolongation of the historically inherited polarisations and incoherence in the R&D systems in the region.

A review of changes in individual SEE countries (see GFF, 2006; Uvalic, 2005 and contributions from International conference ‘Why invest in science in South Eastern Europe?’⁹) shows very large differences in the degrees of development and pace of restructuring of SEE countries’ R&D systems. The R&D systems of Bosnia and Herzegovina, Albania and partly FYR Macedonia are the most disadvantaged. These countries are still trying to establish functioning R&D systems and are primarily addressing science policy issues. Reforms in other countries range from initial rather tentative and limited changes, for example in the cases of Serbia and Montenegro, to very much EU driven and inspired changes in other countries (Romania, Bulgaria and partly Croatia). In these latter three countries and Turkey there has been a genuine attempt to shift the focus from conventional science policy towards innovation policy. Individual national initiatives such as the Turkish 2005 National S&T initiative have introduced a new momentum, which if it continues could produce an example of good practice for other countries in the region.

Figure 3 shows divergent trends in R&D employment. On the one hand, Bulgaria and Romania are suffering significant decline amounting respectively to 7.3% and 5.4% annually. On other hand, Greece, Croatia (for the years where data are available) and Turkey have seen continuous expansion of their R&D employment. Serbia and Montenegro and FYR Macedonia have recorded a gradual but continuous decline in employment in R&D while Slovenia’s employment level has remained virtually unchanged.

⁹ See <http://www.investsciencesee.info/>

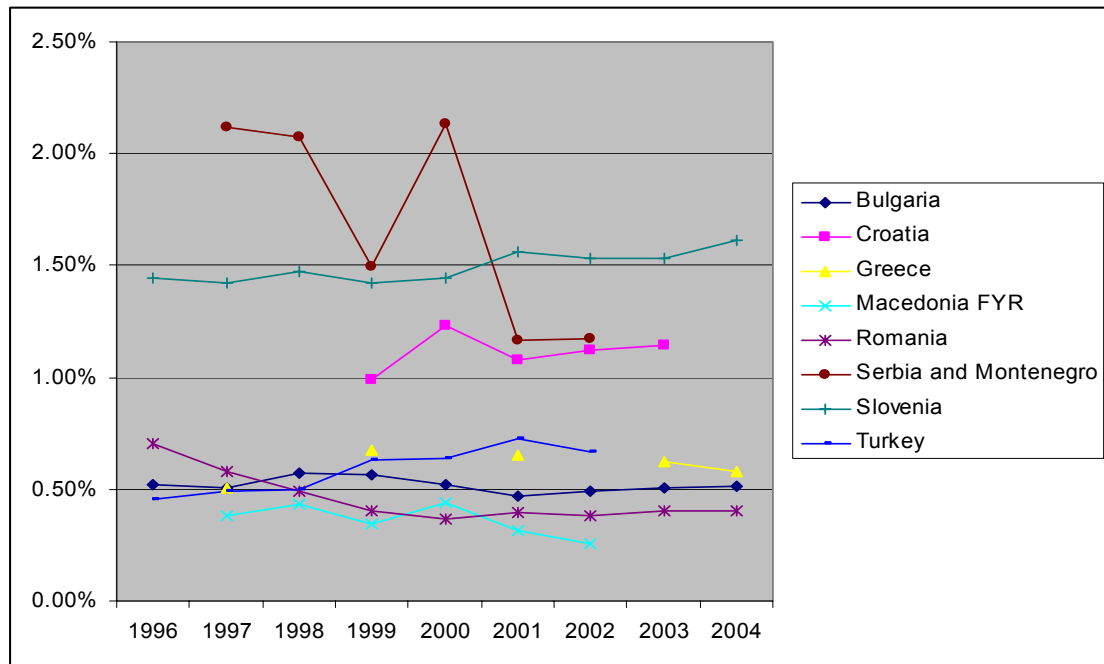
Figure 3: R&D personnel employed in R&D in SEE Europe, in head counts



Source: UNESCO S&T statistics database

In the EU, R&D expenditure as a percentage of total GDP has been stable and in 2003 was around 1.9% (target is 3%). In SEE, we can identify three trends in this respect. First, the collapse of R&D funding in Serbia where expenditure has declined from very high levels of above 2% in early 1990s to levels of just above 1% (Kutlaca, 2006). Second, the gradual increase in relative funding in Slovenia, Croatia and Turkey is compatible with either increased employment or increased capital intensity in this system (Slovenia). Third, relative funding in other countries has either stagnated or has been continuously declining. Bulgaria and Romania have recorded a turnaround in relative funding since early 2000 and we can expect their relative funding to start to rise. The relative stagnation of gross expenditures on R&D in Greece is inconsistent with the increase in employment, which suggests either statistical problems or an increasing shift towards less costly types of research.

Figure 4: Gross Expenditures on RD (GERD) as percentage of GDP in SEE countries



Source: UNESCO S&T statistics database

The general conclusion concerning funding of R&D activities in SEE is that relative GERD is quite low in all countries except Slovenia, Croatia and Serbia. In the countries of the Western Balkans R&D is poorly funded, undervalued and underpaid, and the lack of funds is having a major impact on the development of a science and research infrastructure and therefore the quality of research (Kozmus, 2006). As these countries have not been beneficiaries of full EU Framework funding the share of foreign funding has been very low for most of the past period. This should change significantly with the accession to the EU of Bulgaria, and Romania and with the full member status of other countries in the EU FP7.

Table 5 ranks countries based on the dominance of the business enterprise sector (BES) in funding and performing R&D. It is only in Slovenia's R&D system that the BES plays a dominant role in terms of both funding and performing. In Romania, Croatia, Turkey and to an extent in Greece the BES is important in terms of funding, but except for

Romania and to a degree Croatia, the BES plays a relatively smaller role in terms of performance of R&D. Bulgarian R&D is dominated by the government sector for both funding and performing and this is probably the case in Serbia and Montenegro and FYR Macedonia. There are no comparable data for Bosnia and Herzegovina and Albania which suggests that the R&D systems in these two countries are marginal to the economy. For example, there is no company R&D in these two countries. Unlike Albania, in Bosnia and Herzegovina this is mainly due to the war, which devastated the previous relatively developed BES R&D (Papon and Pejovnik, 2006).

Table 5: Dominant sectors in R&D funding and performing¹⁰

Funding	Country	Performing
Business Enterprises sector (59%); Government (35%);	Slovenia	Business Enterprises sector (60%); Government (22%); Higher education sector (16%)
Government (48%); Business Enterprises sector (45%)	Romania	Business Enterprises sector (55%); Government (34%); Higher education sector (10%)
Government (56%); Business Enterprises sector (42%)	Croatia	Business Enterprises sector (43%); Higher education sector (35%); Government (22%)
Government (51%); Business Enterprises sector (41%)	Turkey	Higher education sector (64%); Business enterprise sector (29%)
Government (47%); Business Enterprises sector (31%)	Greece	Higher education sector (49%); Business enterprise sector (30%); Government (21%)
Government (67%), Business enterprise sector (27%)	Bulgaria	Government (67%); Business Enterprises sector (24%)
???	Serbia and Montenegro	Higher education sector (52%); Government (44%)
???	Macedonia, FYR	Government (76%)

¹⁰ Other sectors, which should add to 100%, are omitted.

??	Bosnia and Herzegovina	??
??	Albania	??

Source: author based on UNESCO S&T database

In addition to the BES, we should consider the university sector as another bottleneck to technology based growth in SEE. Its importance stems from the historical experience of catching up economies which suggests that an important factor in their catch up was the design of the higher education and research system based on the emerging needs for knowledge and skills relevant to industrial development (see Mazzoleni, 2005).

The 21st century universities are developing in the direction of the entrepreneurial university, which nurtures expanded links with large firms and local SME networks. Their restructuring is very much based on the Triple Helix model (Etzkowitz and Ranga, 2006). However, the emergence of this model in the SEE region is constrained both by weak universities and also by weak firms and very weak local demand for local R&D and innovation. A third pillar – government – is engaged in establishing innovation governance and often in restructuring the fourth actor - R&D institutes.

SEE universities have so far not been able to respond to the new challenges. Capacity to grow local spin-offs is complex and especially so in small and semi-developed research systems like those of the SEE countries, faced with numerous missing factors. Partnerships among universities and R&D institutes through consortia may be a specific SEE response designed to enhance local research and innovation capabilities.

Local and foreign firms could be important partners who could contribute to the restructuring of universities. Top ‘blue chip’ companies in the region are aware that they will not be able to sustain the inflow of new people unless they support local universities. Projects such as the joint Hewlett Packard - UNESCO project on alleviating the brain drain in SEE are good examples of initiatives, which need to be replicated on a much larger scale (Kozak, 2006).

However, such measures will alleviate but not resolve the brain drain problem, which is extremely significant in the West Balkan countries. If we take the perceptions of the business community as objective then it would seem that this problem is worst in Bulgaria, Serbia and Montenegro, Romania, Albania, Bosnia and Herzegovina and FYR Macedonia (Table 6). These countries are ranked from 109th to 121st in the list of 125 countries. With the accession of Bulgaria and Romania to the EU we can expect that this will lead to significant new diasporas in the ‘old EU’. Brain drain seems significantly less of a problem in Croatia, Turkey, Greece, and Slovenia. However, we can expect that in the majority of the SEE countries the Europeanisation of their R&D and education systems will aggravate this problem. The Bologna process will increase the speed of the brain drain as a result of increased mobility based on the diplomas of young graduates and researchers being recognised in other parts of Europe.

Table 6: Relative problem of brain drain in SEE compared to other countries

Your country's talented people (1 = normally leave to pursue opportunities in other countries, 7 = almost always remain in the country)		
RANK	COUNTRY	SCORE
33	Hungary	4.0
34	Spain	4.0
37	Estonia	3.9
40	Portugal	3.9
41	Slovenia	3.9
44	Czech Republic	3.8
49	Greece	3.6
52	Russian Federation	3.5
58	Turkey	3.3
61	Croatia	3.2
62	Poland	3.2
63	Latvia	3.2
64	Slovak Republic	3.2
71	Lithuania	2.9
87	Ukraine	2.6
109	Macedonia, FYR	2.3
111	Bosnia and Herzegovina	2.2
112	Albania	2.2
114	Romania	2.2
119	Moldova	2.1
120	Serbia and Montenegro	2.1

121	Bulgaria	2.0
122	Zambia	1.9
123	Zimbabwe	1.7
124	Lesotho	1.6
125	Guyana	1.3

Source: WEF (2006), p. 488

Whether old and newly created diasporas will contribute to technology based growth or to growth generally, depends on whether diasporas are seen as adjuncts rather than adversaries of domestic elites, on the ability of diaspora to connect the domestic and the world economies, and on the opportunities in the global economy (see Kuznetsov and Sabel, 2006b). Past diasporas from SEE were low skilled but the new diasporas are increasingly highly skilled. This increases the probability that they will act as an intermediary between global firms and local markets. For the time being, most of the SEE countries do not see expatriate talent abroad as an opportunity, and those that do recognise (Greece, Slovenia and Croatia) have not managed to make best use of their skilled expatriates. The bottom line is that diasporas cannot substitute for weak domestic institutions, they can only complement the activities of and be instrumental in strengthening home country organisations (Kuznetsov, 2006).

In summary, the size of R&D system is important, but is secondary to the issues of restructuring for improved quality, increased relevance and international integration of R&D. In that respect, the trends in the different SEE countries are divergent; some were summarised earlier in this section.

The actual patterns of restructuring are the result of complex interaction between domestic demand, willingness of government to undertake R&D restructuring and the EU accession process which plays an important role in terms of the Europeanisation of R&D systems. In Serbia, we can see an ongoing process of spontaneous transformations, in which R&D organisations are searching for all possible sources of income, and performing activities usually with no R&D content (Kutlaca, 2006). This stands in sharp contrast to changes in the R&D system in Turkey and new trends in Romania. Bosnia and Herzegovina and Albania remain quite specific in the sense that their R&D systems have to be built (Albania) or re-built (Bosnia and Herzegovina).

Despite these differences a common feature in most of the SEE is that improvements are largely related to research and are reflected in publishing activities. This trend will strengthen through the Europeanisation of their R&D systems, which will serve to ‘plug-in’ the best R&D groups to EU research networks. We may expect improvements in terms of improved balance between incentives (selection through project funding) and stability (share of institutional funding). However, the key bottleneck – weak domestic demand for R&D – is likely to remain a major structural weakness in SEE R&D systems.

5. Searching for a broader framework for R&D policies in SEE

In section 2 we pointed out that a public system of support to science is important but is only one of the ingredients in the catching up process. Investing in R&D is essential to long-term growth, but it is not sufficient given the very high unemployment, low levels of investment and generally poor competitiveness of the majority of the SEE economies, and especially the Western Balkan countries. The key activity in this process is entrepreneurship, or the act of innovating. In this process, R&D is an important component, but its links to innovation and growth are multiple and complex.

In order to maximise the contribution of local R&D to growth and catch up it is essential that the Western Balkan countries embark on an active search for ways out of their current unfavourable situation. In our view, academic research will not find the solutions to this problem; they can only be found by practitioners, through trial and error processes of experimentation and active search. However, analysis can help define the problems and develop frameworks for how to approach these developmental problems.

We can identify three key areas for policy action: broadening the focus of S&T policy; building public R&D linked to countries’ industrial, agricultural and medical care sectors; and better use of international assistance to integrate R&D in SEE into the ERA and to facilitate linkages in local systems of innovation.

1. A key message is that there are limits to traditionally defined S&T policy as a sectoral activity. This is not to deny the importance of the S&T system, but the role of S&T in growth cannot be confined to the R&D sector.

A key challenge for all SEE countries is *to abandon the only R&D confined framework* of science and innovation policy and expand the policy focus to include other elements of national innovation capacity such as absorption capacity, diffusion and transfer and demand for R&D (see Radosevic, 2004). The abilities of individual countries to follow that route are very different and the differences between countries in these respects are substantial.

Hence, the key issue is not how the pie should be shared, i.e. size of R&D budget, but to initiate a process of search for growth opportunities based on the coupling of domestic and external knowledge. This will induce demand for local R&D which is what is currently lacking (see section 3 above). It is essential to go beyond the traditional focus on background conditions and improvement of the investment climate, which are the focus of World Economic Forum reports and World Bank *Doing Business* reports. These are useful benchmarks, but they do not take into account that factors of growth and catch up are always specific. Hence, it is important to understand the policy implications of country specific 'binding constraints' to growth (Rodrik, 2004). In addition, policy should rely on the 'islands of excellence' which exist in (almost) every country to reform those parts that are lagging¹¹. As no one, government included, has full knowledge of the growth opportunities and constraints it is essential to create private-public partnerships and programmes which should bring together better performing segments of the public sector and better performing segments of the productive sector in an attempt to relax and unblock binding constraints (Kuznetsov and Sabel, 2006; Sabel, 2005).

2. In the area of S&T policy proper, it is essential to promote R&D as a 'non-political issue' i.e. to try to isolate it from the day to day politics of government. Lack of real long-

¹¹ This approach is behind the idea of so called new industrial policy developed within the World Bank. See <http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/0,,contentMDK:20753860~pagePK:64156158~piPK:64152884~theSitePK:461198,00.html>

term commitment to S&T as well as the instability of the organisational sets up of governments hinder normative commitment to increasing the role of R&D in economic development. Instead of lobbying for R&D it would be more fruitful to work towards an effective system of public research and training **linked to** countries' industrial, agricultural and medical care sectors, in a way that supports technological development in these latter (see Nelson, 2005)

Analysis of S&T and innovation policies in the new EU member and candidate states suggest that benchmarking and continuous monitoring and evaluation are essential in the development of capacity for research and innovation policy. There is a need for national as well as regional initiatives in this respect. However, SEE countries should not be blinded by the 'best practice' perspective which all too often inhibits the search for country specific solutions. Europeanisation of S&T and innovation policies is inevitable and will undoubtedly bring a large number of benefits to SEE. Equally, however, it is not panacea and may often block the search for local solutions (Bucar and Stare, 2006).

An increase in R&D funding, even though the benefits can sometimes be quite long term, is essential if the SEE countries, and in particular the Western Balkan countries, are not to fall further behind in economic development. However, this increase should be accompanied by a strong focus on funding excellent but also locally relevant research. This will further require fair competition, priorities, transparency and international experts.

3. S&T and innovation systems in SEE, especially in the Western Balkan countries, are very weak and fragmented. Up to the present, international assistance in S&T in the region has been very limited. Most donors do not have a single home for R&D and innovation. Many actors work across different networks with little coordination. This creates segmentation and duplication. There is an absence of overall purpose and strategic direction. However, with the establishment of the Southeast European Era-Network (SEE-ERA.NET), whose aim is to integrate EU member states and Southeast European countries in the European Research Area (ERA), the situation has started to change.

There has been some limited progress on key issues related to the integration of the Western Balkan countries into the ERA. The international stakeholders are aware of the need to support S&T in the SEE region for integration into ERA, and as a tool for economic growth. However, huge improvements are needed in infrastructure and in the restructuring of S&T systems. The current unsatisfactory situation has come about as the result of a combination of internal factors as well as limited and inadequate sources of external funding for example, EU FP6, InterReg, NATO and, in particular, lack of support from CARDS programme¹². It is essential that R&D component is assigned a bigger role within the CARDS activities.

There is now a much better understanding of R&D needs in the region. These are primarily related to infrastructure, human potential, institution building, joint research and funding (Kozmus, 2006). There is a large scope for individual country initiatives at the bilateral level. For example, Slovenian initiatives which include six month fellowships, bilateral projects, information services and joint referee systems, could be used as examples of good practice. In addition, it is essential that new approaches in international assistance should be initiated as soon as possible, focusing on improving interfaces within local innovation systems. A good example of such an approach is developed by Klaus Schuch (2006).

6. CONCLUSIONS

We analysed the relationship between research and development (R&D) and competitiveness of the SEE economies from the perspective of the EU integration and of the EU as a knowledge based economy. Analysis shows that the diversity of the SEE region represents a significant obstacle to intra-regional integration and integration with the core of the EU. The SEE countries are quite diverse in terms of levels of competitiveness which has strong effects on the role of R&D. Weak innovation demand at firm level and weak innovation support systems (external conditions for firm level R&D) are the biggest bottlenecks to the greater contribution of S&T to growth and social

¹² CARDS stand for *Community Assistance for Reconstruction, Development and Stabilisation*. See http://ec.europa.eu/enlargement/financial_assistance/cards/index_en.htm

development in the SEE countries. Demand side constraints are further reinforced by supply side constraints through still strong processes of external and internal brain drain.

Although very tentative these results show that innovation policy, which is able to take account of both the supply and demand side factors of RTD, is essential for knowledge based growth in the SEE economies. A key policy message is that there are limits to traditionally defined S&T policy as a sectoral activity. There is a need to: broaden the focus of S&T policy; build public R&D linked to countries' industrial, agricultural and medical care sectors; and make better use of international assistance to integrate RTD in SEE into the European Research Area (ERA) and to facilitate linkages in local systems of innovation.

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