

## MACEDONIAN NATIONAL INNOVATION SYSTEM – MAIN CHALLENGES

Radmil Polenakovik \*, Ivana Stankovska \*\*, Bojan R. Jovanovski \*\*\*

### ABSTRACT

*It is generally accepted that the National Innovation Systems (NIS) are one of the most comprehensive systemic approaches that give insight into innovative and economic performance of a country. This insight is essential for policymakers to develop legislatives for enhancing the innovative performance and success of today's knowledge based economies. The development of the NIS is a complex, path-dependant process due to the differences in the development of the main sectors involved: the academia and the industry.*

*Macedonian later emergence of the NIS is explained by the fact that after 1990, with the collapse of the Socialist Federal Republic of Yugoslavia (SFRY) there were significant losses in the Yugoslav, East and Central European markets. This process was accompanied by disintegration of many large industrial complexes, leading to a large number of bankruptcies and lay-offs. The existing strong governmental support for the scientific and research projects in the Federation was disrupted and disabled by these rapid changes, which was also reflected in the breakdown of direct links between academia and industry.*

*The following two decades were transitional, and this period of recovery was terminated with the adoption of several strategic documents such as: industrial policy; program for science-research work and technological*

*development; innovation strategy; and strategy for intellectual property. Finally, in 2013 the Law on Innovation Activity, which includes establishment of Innovation Fund, was adopted.*

*This paper aims to retrospect the main activities for developing innovation infrastructure and enhancing innovation capacities. Moreover, it offers critical assessment of the improvements and the main challenges faced. The presented overview is designed to assist policymakers in further monitoring, evaluation and improvements, and to provide researchers with a solid base for the additional in-depth analysis of the impact of the implemented and proposed measures.*

**Keywords:** *National Innovation System, innovation strategy, knowledge-based economies, Republic of Macedonia*

**JEL:** *O21, O25, O38*

### 1. INTRODUCTION

The huge advantage of growth rates of certain countries, which is result of economic growth over longer period, is attributed to the presence of social capability for institutional change, especially if the change facilitates or stimulates technical change such as innovation systems (Freeman 2002). Despite the diminished importance of the National Innovation Systems (NIS) caused by the globalization (Ohmae 1990), many scholars insist on their central importance for gaining insight into the economic and innovative

\* Faculty of Mechanical Engineering, Ss. Cyril and Methodius University in Skopje, radmil.polenakovik@mf.edu.mk

\*\* National Centre for Development of Innovation and Entrepreneurial Learning, ivana.stankovska@ncdiel.mk

\*\*\* Faculty of Mechanical Engineering, Ss. Cyril and Methodius University in Skopje, bojan.r.jovanovski@mf.edu.mk

performances of countries, because the NIS are one of the most comprehensive systemic approaches (Freeman 1995; Hu 1992; Porter 1990; Patel 1995). This insight is essential for policymakers to develop a legal framework for enhancing the innovation performance, which is the main pillar of the knowledge-based economies. The earlier growth models developed were focused on accumulation of tangible assets, in first line investments and growth of the labour force, while the so-called "New Growth Theory" (Romer 1986; Grossman & Helpman 1991) moved intangible assets, education, research, and development to the centre of the stage. Therefore, the development of the NIS has to be analyzed through the development of both sectors: the academia and the industry, with a great attention to the interaction between them.

Historically speaking, *the development of the Macedonian NIS could be divided into four periods*: before the 1990s, the period between the 1990s and 2001, between 2001 and 2008 and after 2008. In the first period, Macedonia was one of the states in the SFRY. In 1991, Macedonia proclaimed its independence, and the following decade was transitional, ending with insurgency in 2001. After this point, Macedonia has been constantly working on policy reformation and building a solid legal setting on a national level for encouraging the development of innovations.

**2. HISTORICAL BACKGROUND**

Before the 1990s (the *first period* of the Macedonian NIS development), the Yugoslavian organizational system of collaboration between the main sectors of the society - industry and academia, was mainly regulated by the government through the central institutions that were planning the whole strategy. This organizational and institutional setting is closely described by the state model of the triple helix analysis (Figure 2.1). At the time, there were only two state universities in Macedonia where professor

was considered one of the most prestigious professions. The study programmes were relatively adapted to the industry needs and enriched with significant applied activity. The universities were financially supported by the government. There were funds for science and research projects, which were a strong lever for creating knowledge-based intangible assets. The links between universities and industry were direct, based on personal contact between professors and companies. Professors were members in boards of directors, advisors (consultants) to enterprises, directors of research centres in companies, and most of all, involved in preparation of the new legislation. The industrial sector was consisted of big organizational systems mainly state-owned, usually with more than 1,000 employees, sometimes even more than 5,000. Therefore, it was possible for the national economy to be planned centrally, which led to over-employment that later resulted in huge layoffs. Usually, all bigger companies had their internal research and development (R&D) departments that collaborated closely with universities. The strength of the economy and individual companies was in the big domestic market and huge exports. The movement of the labour force was very limited; however there were very low unemployment rates thanks to the relatively strong economy.

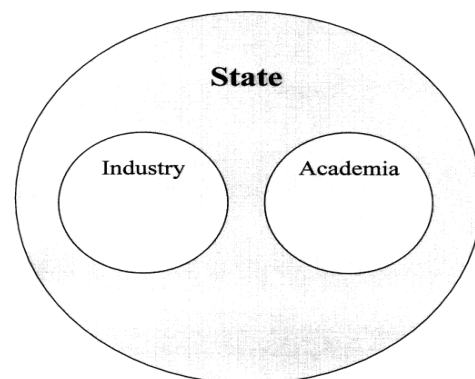


Figure 2.1. A state model of university-industry-government relations (Etzkowitz & Leydesdorff 2000)

The *second period* is disruptive and transitional because of the major changes caused by the secession and disintegration of the Yugoslav Federation. In the early 1990s, most of ex-Yugoslavian states registered hyperinflation and macroeconomic instability due to the break-up of the Yugoslav political, economic and monetary union (Uvalic 2012). The consequences of these events that the states faced were deep recession, long transitional period and delays of economic reforms and integration of most ex-Yugoslavian states with the European Union (EU). Macedonia is classified as an early reformer together with Croatia and Albania (Bartlett 2008) because it has successfully implemented macroeconomic stabilization measures with a financial and technical support of the IMF and the World Bank, and later the EU. The restrictive monetary policies that were introduced decreased the inflationary pressures in 1995-96. However, according to Kadas (2010), these countries ran into severe problems toward the end of the decade because the implemented measures were not accompanied by simultaneous structural reforms on a microeconomic level. The disintegration of the Federation tempted the interrupting of the traditional economic and trade links, as well as breaking the established connections between the universities and industry. The applied activity over this period was dramatically decreased and the governmental support for science and research projects was reduced to a minimum level. Privatization of state corporations was a major hit for the triple helix activities, reducing them to a limited number of isolated successful examples of collaboration, not only because of the research staff cuts, but also due to selling the best Macedonian capacities to foreign companies that brought know-how from abroad. In addition to this and in response to the increased unemployment rates, newly established companies emerged, mainly small and medium enterprises (SMEs) and family

businesses that were not aware of their need for expertise from universities, or simply did not possess the capacity to re-establish the extinguished link of collaboration with academia.

Since 2001 onwards (the *third period* of Macedonian NIS development), after resolving the insurgency with the Ohrid Framework Agreement, Macedonian government has devoted significant attention to developing an ecosystem for innovations and re-establishing the links between the industrial and academic spheres. Up to 2007, the gross expenditure on R&D was in a steady decline (Figure 2.2). In that period, it was not clearly defined who will be in charge of establishing the NIS in Macedonia, although the main dialogue was between the Ministry of Economy (MoE) and the Ministry of Education and Science (MoES). In addition to the insufficient expenditure on R&D, the country lacked the national innovation strategy. The role of the National Entrepreneurship and Competitiveness Council was to raise a dialogue of private, public and civil sectors on strategic issues for achieving competitive business climate. The Macedonian SME Strategy 2002 – 2013, accompanied by entrepreneurial programmes for measures and activities defining general directions for SME development was in force. Although there was not a dramatic improvement in the economic indicators at the end of this period, the strategic steps ahead for SME development and setting of the institutional infrastructure for innovation and entrepreneurial support was assessed as very important for the progress of the country (Machacova & Dall 2008). Overall, the key innovation infrastructures that were established before 2008 are: industry clusters, technology and innovation centres, and other related organizations for entrepreneurial support. It should be noted that many of the initiatives in this – the third period of the Macedonian NIS development, were driven by different donor projects in the country (USAID

(United States Agency for International Development), GTZ (Agency for Technical Cooperation), ADA (Austrian Development Agency), SIDA (Swedish International Development Agency), SINTEF (Foundation for Scientific and Industrial Research), World Bank, EU technical assistance, etc.)

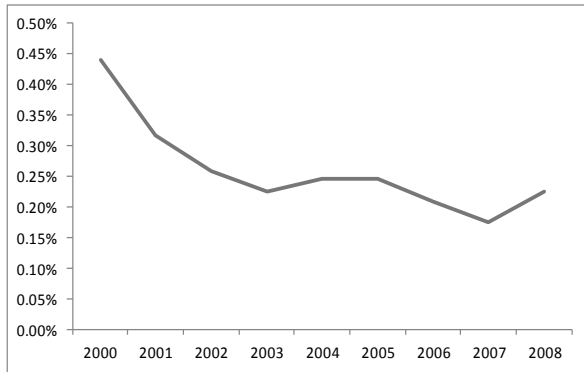


Figure 2.2. Gross expenditure on R&D-period 2000-2010 (World Bank 2013)

From the established infrastructures, the technology transfer centres were located at universities or individual faculties. The technology transfer centres / offices established at Faculty of Mechanical Engineering – Skopje, Faculty of Electrical Engineering and Information Technology (FEIT) – Skopje, Faculty of Technology and Metallurgy – Skopje, Faculty of Agriculture – Skopje and Faculty of Technical Studies – Bitola were financially supported by TEMPUS (Trans-European Mobility Scheme for University Students) and GTZ programmes. In addition to these, the centre of excellence – CIRKO-MES CE (Centre for Research, Development and Continuing Education: Mechanical Engineering Systems – Centre of Excellence) and Business Start-up Center (BSC) were founded in 2005 and 2006 respectively; both are still active and are based at the Faculty of Mechanical Engineering – Skopje. The former provides the access to new technology and training to partner companies in order to enhance their capabilities, increase the quality of their products and improve their production process, while the latter serves as a creative

incubator of innovative technology based and service oriented solutions, providing entrepreneurial and small business management training, assisting students and recent graduates to start their own business and increase their employability.

Independently from the academic sphere, eight business incubators were formed. Seven of them were financially supported by the World Bank, while the last one – YES incubator, still very active, was supported by the Open Society Foundations and Norwegian technical assistance. Also, the Foundation for Management and Industrial Research was established in 2002 by SINTEF, and offers support to SMEs in a variety of areas. The Council of Foreign Investors was founded in 2006 and aims to improve the investment and business climate in the country through the establishment of public-private dialogue, exchange of experience with countries where member-companies propose solutions to overcome business barriers, exchange of knowledge among member-companies and promotion of sound business principles, etc. The Center for Entrepreneurship and Executive Development (CEED) was launched in 2007 with the goal to stimulate growth of SMEs through training, mentoring and development of enterprise management teams.

The most important governmental infrastructural initiatives are: the Agency for Promotion of Entrepreneurship of the Republic of Macedonia (APERM), established in 2003 for support of entrepreneurship and competitiveness of the small business sector, and the Macedonian Bank for Development Promotion (MBDP), which is also a governmental institution for providing financial support to start-ups, developing businesses and export oriented companies through a variety of credit lines with favourable credit terms, investment credits, technical assistance, as well as insurance of

claims based on performed export against short-term commercial risk.

### 3. RECENT ACTIVITIES AND CURRENT SITUATION

The government has recognized the necessity of the innovation infrastructure and thus it has set the goals for its development and growth (the *fourth period* – after 2008). One of the most important events was the establishment of the inter-ministerial group responsible for development of innovation policy. The main challenges in delivering the innovation strategy were recognizing and supporting the most proactive public and private innovation drivers. More subtle goals set were reversing the brain-drain of highly educated people and strengthening the capacity of public institutions that deal with science, technology and innovation related issues. The progress in structural reform and liberalization of the tax regime for foreign investors was a reason behind better performance of Macedonia compared to other countries from the region, according to the World Bank analysis of the business environment (Bartlett 2010). When it comes to Foreign Direct Investments (FDI), despite many positive developments during the 2000s, the Balkan countries still attract lower rates of FDI than the central European and Baltic countries, because of the image problem. For many potential foreign investors associate the Balkan area to war and conflict, political and economic instability, rather than investment opportunities (Cviic & Santfey 2010).

This section will retrospect the activities in each of the spheres of the Macedonian society in the last five years, ending with the most recent attempts and initiatives that are currently at a very early stage.

#### 3.1. Governmental (state) infrastructure

A new law on technological development defining the legal framework for

establishment of incubators and technology parks was approved by Macedonian Parliament in 2008. Since then, four main strategies which define the activities for enhancing innovativeness and industrial development have been adopted (SEE Project FINNO 2014).

The first is the Strategy for Intellectual Property of the Republic of Macedonia (2009-2012). This strategy aims to strengthen the legal framework in the area of intellectual property law, effective and efficient enforcement of intellectual property rights, developing capacity of individual holders and the business community for protection and enforcement of intellectual property rights, as well as strengthening the public awareness of the benefits of intellectual property.

The second strategy, “Industrial Policy of the Republic of Macedonia (2009-2020)”, is a national strategic document for enhancing Macedonian industry and economy. This policy is a pro-active, development-oriented, horizontal strategic document that requires integration with all relevant policies for enhancing the competitiveness of the industry. The main weaknesses of the Macedonian industry determined in 2008 addressed with this policy are: inadequate environment for R&D and innovation activities, low level of cooperation and coordination with higher education, underdeveloped networking, technological obsolescence and low firm-level technology absorptive capacity. With the implementation of the industrial policy, a stable development of the country will be secured, based on diversification and modernization of the economy with the creation of conditions for production of competitive products, employment increase and export growth. Industrial policy development also recognizes the need for a shared vision among the Macedonian business, academia and policy leadership for a pro-active industrial policy that will encourage the orientation of

Macedonian industry towards higher value added products and services based on knowledge, innovation and collaboration. The Industrial Policy includes five areas of intervention: international cooperation and FDI stimulation; applied research development and innovations; eco-friendly products and services for sustainable development; development of SMEs and entrepreneurship; and collaboration via clusters and networks.

The third strategic document entitled "Program for Scientific Research and Technological Development in the Republic of Macedonia" has been developed under the Law on Science-research Activity and the Law on Stimulation and Support of Technological Development. Scientific R&D is an essential pre-condition for the development of a country, which poses a need to place development of this field as one of the priorities for advancement of the country and the economy. Besides the importance of science and research for the country, Macedonia faces a lack of strategic documents. The Macedonian academics and researchers have to be more actively involved in wider scientific projects and advanced research activities, starting from the regional level, through the European, to become part of the global scientific communities. The position of small countries depends on their ability for adaptation to global processes. The adaptation to these processes is based on universal knowledge, knowledge on new technologies and computer science innovation.

And finally, the fourth strategy is the Innovation Strategy of the Republic of Macedonia for the period 2012-2020. The competitiveness of the private sector is recognised as the key indicator for economic growth, especially through improving knowledge and innovation. This strategy, therefore, aims to transform the national economy into knowledge-based economy capable to compete on the global market with

skilled workforce and innovative companies. The strategy was designed within the framework of the Regional Competitiveness Initiative, the project conducted by the OECD (Organization for Economic Co-operation and Development) Investment Compact for South East Europe with the financial support of the EU. The focal strategic objectives are: enhancing the business sector propensity to innovate; strengthening human resources for innovation; creation of regulatory environment in support of innovation and increasing the knowledge flows between innovation actors. The governance structure of the National Innovation System is presented in Figure 3.1.

Additional governmental documents that relate to the Innovation Strategy are: National R&D Programme (2012-2016) – for facilitating the transformation of Macedonia into a knowledge-based society; Programme for Promotion and Support of the Technological Development (2012-2015) – promotes smart, sustainable and inclusive development based on knowledge and innovation and focused on strengthening the business sector; Action Plan for Competitiveness – prepared by the analysis according to the Global Competitiveness Report for 2012 and adopted by the Government in 2012; and Program of the Government of the Republic of Macedonia 2014-2018. Since 2011, the annual programmes of MoE and APERM have replaced the programme for support of SMEs in Macedonia. The two programmes include a series of support, promotion and capacity-building activities. A number of other strategies, programmes and guidelines relate directly to Macedonian ambition to further strengthen its private sector, competitiveness and social cohesion. In this context, the *Strategy for Regional Development 2009 – 2019* will also influence the improvement of business environment in the regions.

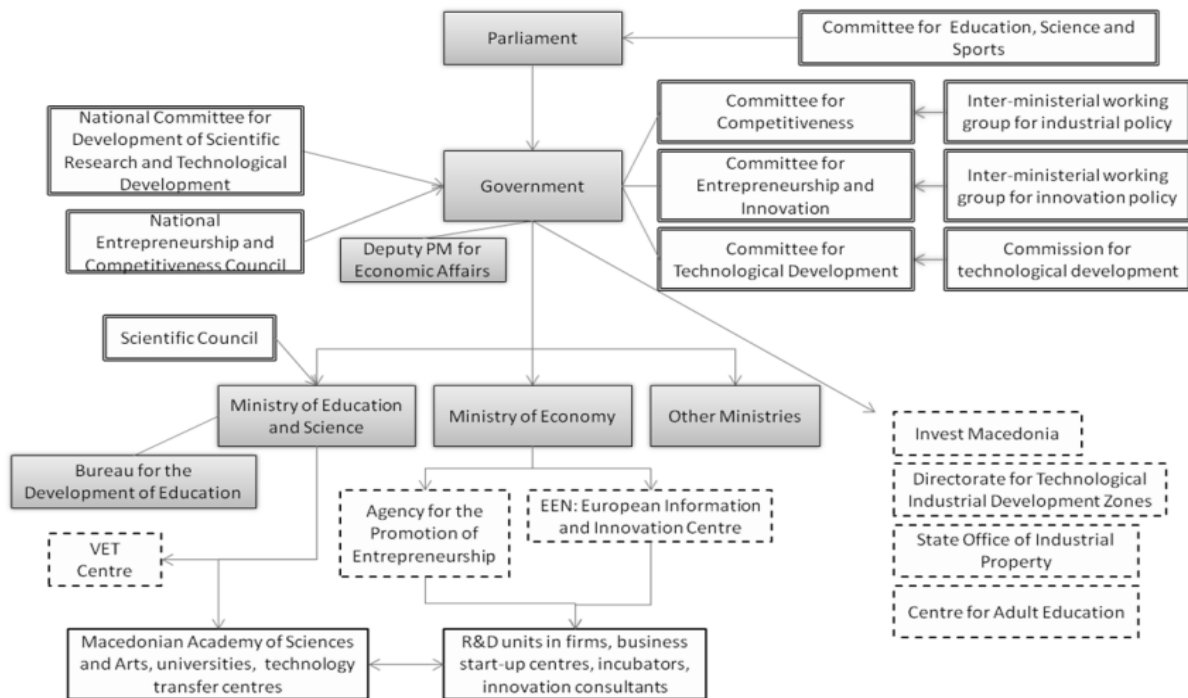


Figure 3.1. Governance structure of the National Innovation System  
(Innovation Strategy of the Republic of Macedonia for 2012-2020, p. 12)

The focus is on supporting implementation of measures for improvement of entrepreneurship and support to broader economic development, as well as measures for creation of a competitive environment in the planning regions and the creation of functionally spatial structures for improved integration of rural and urban communities.

The Law on Innovation Activity was adopted by the Government in May 2013. It determines innovation activity, principles for commercialization of the innovation outcomes and interactions among different innovation actors. Different forms of organizations for infrastructural support for innovation activity have been determined. Such examples are: business technological incubators and accelerators, science and technology parks, and centres for technology transfer. In order to monitor development and commercial exploitation of innovations, the Committee for Entrepreneurship and Innovations, consisting of president and 16 members, has been created. The president of this Committee is the Prime Minister, while the members are relevant ministers and deputy ministers.

According to this law, MoES is responsible for preparing the innovation strategy and delivering action plans for a three year period.

The Fund for Innovations and Technology Development (FITD) is also foreseen by the Law on Innovation Activity. The main role of this body is financial assistance for research, development and innovations to companies, especially SMEs, through grants, conditioned loans (royalty), equity investments, facilitation of access to regional funds, and so on. The process of allocation of available resources will consist of: call for projects announcement, collection of applications, process of evaluation, approved projects for co-financing, results monitoring and their public presentation. It is envisioned that this body will be developed in two stages, the first funded only by the Government, and the second stage to be funded by the World Bank and IPA funding scheme, in addition to the Government. In the first stage, start-ups will be supported with grants up to €10,000, commercialization of innovations with funds up to €30,000, while the financial support for

equity and mezzanine investments will be up to €80,000 per project.

The two most important governmental infrastructural organizations reviewed in the previous historic period, MBDP and APERM, keep their continuity and successfully fulfill their roles. Since 2009, MBDP has maintained intensive cooperation with the European Investment Bank (EIB) resulting in several contracts for EIB credit lines, whose finances would be used for support of the SME sector and development of other priority areas. APERM continuously implements its activities in cooperation with regional centres and other enterprise support organizations. One of the activities is innovation voucher scheme for boosting the knowledge-capacity of SMEs by building links with the knowledge providers.

### 3.2. Non-governmental sector

Although many of the infrastructural facilities for innovation and entrepreneurial support established in the previous period disappeared, due to lack of constant financing or other difficulties, their efforts and outcomes have had a great impact on the development of the non-governmental sector. Among the most successful organizations that still operate is Youth Entrepreneurship Service (YES) Foundation. Its main component is YES business incubator, which supports SMEs in the ICT (Information and Communication Technology) field through the process of business incubation, offering access to services for accelerating their growth and development. Similar positive activities are evident from the Business Start-up Centre located in Bitola (first funded by the Holland technical support, and lately by the USAID support).

Business Angels are new on the market represented by the Superfounders, who started operating in 2012 with primary focus on the software development industry. The Enterprise Europe Network (EEN) assists

“small companies make the most of the business opportunities in the European Union” and provides information on EU business matters (e.g. EU markets, business cooperation, partner search, EU funding and tenders, EU legislation, EU standards, etc.).

The non-governmental sector is additionally strengthened with new civil organizations, as well as with private organizations for infrastructural support of innovation activities, defined by the Law on Innovation Activity. One of the most active non-governmental organizations is the National Center for Development of Innovations and Entrepreneurial Learning (NCDIEL), established in 2009 by the financial support from Austrian Development Cooperation. The center supports the realization of innovative, technology-based and profit oriented ideas through the provision of capital for start-ups, counseling and coaching of established SMEs in order to strengthen survivability, capacity and newly established enterprises. There are more than 20 registered clusters in the country. However around 10 of them are active, including the ICT Chamber of Commerce - MASIT, Textile cluster, MAP cluster (Macedonian Association of Food Processors), Food cluster, Wine cluster, etc. In July 2014, NCDIEL received support from MoE to establish the National Training Cluster Academy with the aim of offering tailored training programs for clusters and their members. A representative of privately owned companies for infrastructural support of innovations is NewMan's Business Accelerator (NMBA) established in 2014. The mission of this Macedonian-US company is to bridge the gap between all actors of the NIS through providing professional education of young talents and business-technical support.

### 3.3. University-based activities

In the last five years, the academic sector experienced rapid changes governed mainly centrally by the Government in both,



educational and business roles. On the one hand, the reforms in the educational system had its beginnings in 2006, with gradual improvements of educational programmes in respect to business and entrepreneurship. Up to now, the curricula for primary, secondary and tertiary studying cycles have been enriched by an extended set of business and entrepreneurial learning. Structurally, the high-educational segment was reframed by the establishment of new universities, resulting in five state and 15 private universities at present.

On the other hand, the business role of academia was disrupted by new legislature. However, some of the organizations, such as CIRKO-MES CE and BSC, managed to keep their continuity. In 2013, the academic sector was enhanced by two very significant infrastructural facilities: SEEUTechPark, located on South-East European University Campus, and Regional Hub for Social Innovation based at the Faculty of Computer Science and Engineering (FINKI), founded with the financial support of UNDP. The main role of the former is incubating new firms from the ICT industry, while the later serves as a technology transfer office for social innovative solutions.

### 3.4. Planned activities

The current period is marked by the planning of radical structural changes and initiatives that are expected to have significant influence on the development of national knowledge-based economy. Therefore, we have decided to emphasize them despite of their very early development stage.

The MoES, which is becoming a dominant governmental unit for the establishment of the triple helix setting (Polenakovik & Pinto 2010), has announced its restructure. The planned restructuring envisages the establishment of the new National Centre for Technology Transfer that will integrate all

activities for transferring novel technology from high-educational and research institutions to industry. The Centre should serve as an umbrella to different technology transfer activities that already exist at universities and businesses. Another anticipated activity is the foundation of the National Cluster Academy (supported by the Ministry of Economy). The academy will strengthen and integrate the industrial clusters. The FITD, which was initiated by the Government and founded as an independent national body, is to announce its first call for innovative projects soon.

Recently, a new initiative for establishment of the Technology Park was undertaken by the Faculty of Electrical Engineering and Information Technologies, Ss. Cyril and Methodius University. The park is to be situated at the campus for technical faculties and the park is planned to satisfy the needs of all technical faculties at the state university.

## 4. DISCUSSION AND CONCLUSION

This paper reviews the main activities for developing innovation infrastructure and enhancing the innovation capacities in the Republic of Macedonia. The constraints experienced in the development of the NIS are similar to those of other ex-socialist countries (Huggins & Strakova 2012). In these two decades of independence, the country has constantly been undertaking evolutionary strides in each of the three spheres of the society: academic, industrial and governmental. From the given historical perspective, it can be noticed that many of the infrastructural organizations created during these two decades were destroyed due to their inability to adapt to the changed legal framework, or lack of continual financing. However, these organizations were a crucial lever in improving certain aspects of the society during their existence and their impact can be considered as a significant contribution to the prosperity of the country.

In the last decade, the reforming steps for improving the competitiveness by deepening the regulatory reforms and strengthening the rule of law to attract foreign investments are assessed very positively by the European and international experts (World Bank 2013). The reforms of the business environment and simplifications of the business registration system encourage the opening of new businesses. However, despite being committed to a reform program for over a decade, including fiscal consolidation and reforms in the public sector, labour market and business environment, the reforms are yet to lead to sustainable results. In fact, the country still suffers from low growth in GDP, high unemployment and low FDI in comparison to other countries in South East Europe (World Bank 2014).

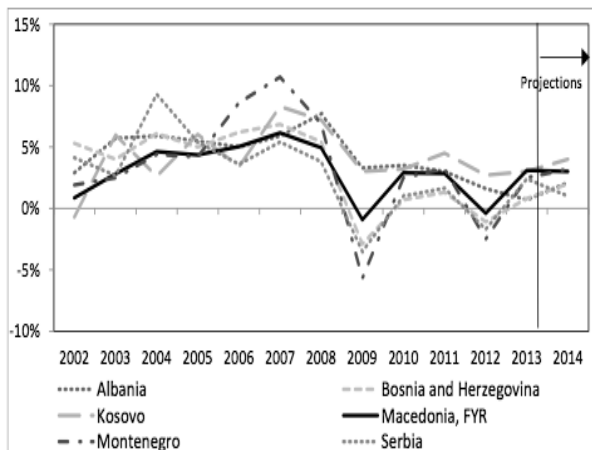


Figure 4.1. GDP level of Macedonia in comparison to other South East European countries (World Bank 2014, p. 2)

In 2009, GDP (Figure 4.1) shrank by 1%, and then it bounced back in 2010 and 2011 with an annual growth of 3%, while falling flat in 2012. In 2013, GDP showed a recovery of approximately 2%, the growth which appears to continue in the first two quarters of 2014 (average growth of 3.1%), making Macedonia one of better economic growth performers in the region in recent years. This recent growth is primarily a result of a boost in construction, driven by public investments (World Bank 2014). On July 28 2014, the IMF predicted that

the country's GDP would expand by 3.4% in 2014, while inflation would be as low as 1%.

According to the European Innovation Scoreboard (EIS) and the Innovation Union Scoreboard (IUS) for the last four years, the Summary Innovation Index for Macedonia fluctuates (Figure 4.2), with the highest noticed index for 2011 (0.252). Generally, the enabler indicators measured are in a steady rise, which is the result of improvements in the quality of human resources, research systems and the additional funding sources available (Business Angel Network, Balkan Venture Forum, Accelerator Program and several international donor grant schemes). The governmental decision for equipping 80 laboratories in public institutions, the investment totaling to around €60 million, is an excellent initiative for boosting the R&D. In addition to this, scholarships for studying abroad are provided and a brain gain strategy is adopted. The educational role of educational institutions has been significantly improved with respect to innovations and entrepreneurship (introduction of courses *Innovation and Entrepreneurship* in 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> year in secondary schools since 2012, and *Innovation* in 9<sup>th</sup> class of primary schools since 2014), although the results are intangible and very difficult to be measured especially on a short term basis. Indeed, developing a soft and difficult-to-measure infrastructure, such as the knowledge networks present in the competitive regions as a source for generating higher level of innovativeness and growth is often part of the problem in the developing countries (Todtling & Trippl 2005). The core of the triple helix model is the academic sphere where the universities are increasingly entrepreneurial institutions that create the knowledge spillover (Etzkowitz 2006). This role for universities as sellers of knowledge, skills and technology is secondary or business oriented, and it should be facilitated by infrastructure, such as

technology and science parks, business incubators, as well as human capital development programmes.

activities of the national program for competitiveness and entrepreneurship of the Ministry of Economy support triple helix

	2010	2011	2013 (for 2012)	2014 (for 2013)
<b>Summary Innovation Index (SII)</b>	0.228	0.252	0.238	0.246
<b>Current performance - MK</b>				
<b>ENABLERS</b>				
Human resources				
1.1.1 New doctorate graduates	0.3	0.4	0.5	0.6
1.1.2 Population completed tertiary education	14.3	17.1	20.4	21.7
1.1.3 Youth with upper secondary level education	81.9	82.8	85.3	87.1
Open, excellent and attractive research systems				
1.2.1 International scientific co-publications	N/A	117	134	147
1.2.2 Scientific publications among top 10% most cited	N/A	N/A	3.08	3.6
1.2.3 Non-EU doctorate students	3.36	1.31	7.04	7
Finance and support				
1.3.1 R&D expenditure in the public sector	0.14	0.14	0.14	0.2
1.3.2 Venture capital investments	N/A	N/A	N/A	0.289
<b>FIRM ACTIVITIES</b>				
Firm investments				
2.1.1 R&D expenditure in the business sector	0.04	0.04	0.04	0.02
2.1.2 Non-R&D innovation expenditure	0.9	0.9	0.9	0.9
Linkages & entrepreneurship				
2.2.1 SMEs innovating in-house 31,8	11.3	11.3	11.3	11.3
2.2.2 Innovative SMEs collaborating with others	9.6	9.6	9.6	9.6
2.2.3 Public-private co-publications	N/A	N/A	0	0
Intellectual Assets				
2.3.1 PCT patent applications	0.13	0.22	0.18	0.42
2.3.2 PCT patent applications in societal challenges	N/A	N/A	N/A	1.47
2.3.3 Community trademarks	0.06	0.24	0.26	0.49
2.3.4 Community designs	0.06	0.03	0	0.03
<b>OUTPUTS</b>				
Innovators				
3.1.1 SMEs introducing product or process innovations	39.2	39.2	39.2	39.2
3.1.2 SMEs introducing marketing/organisational innovations	30.8	30.8	30.8	30.8
3.1.3 Fast-growing innovative firms	Not measured	Not measured		18
Economic effects				
3.2.1 Employment in knowledge-intensive activities	N/A	10.6	7.2	7
3.2.2 Contribution MHT product exports to trade balance	30.45	53.43	5.42	5.92
3.2.3 Knowledge-intensive services exports	28.66	29.35	27.85	22.5
3.2.4 Sales of new to market and new to firm innovations	9.9	9.9	9.9	9.9
3.2.5 License and patent revenues from abroad	0.06	0.06	0.1	0.28

Figure 4.2. EIS/IUS for Macedonia for the period 2010-2013 (EIS/IUS Reports)

As mentioned earlier in the paper, new units at universities for strengthening the business role have just been established and their expected impact could be discussed after a certain period. The same case is with new laboratories. Without a real use of these infrastructural units and equipment for satisfying the needs of SMEs, the collaboration with industry will remain limited to isolated best practices whose impact on the national economy is on a smaller scale. Therefore, *enhancing the business role of Macedonian universities is a remaining challenge for the future*. In that direction, several of the

activities (in depth trainings of different topics provided by the university staff for targeted industrial sectors; trainings for cluster organizations supported by university guidance, etc.).

## 5. RECOMMENDATIONS ON FUTURE NIS DEVELOPMENT

*Hard-working and committed Government* is a strong precondition for development and growth of the effective NIS, especially in post-socialist countries, such as the Republic of Macedonia, due to the inherited dominance of this sphere over the other two in the triple

helix constellation. Thus, one of the priorities of the Government should be to significantly *increase R&D investments as a part of GDP to 1% up to 2020*. Also, the part of the business sector investment in R&D must be seriously increased. Nevertheless, learning from the advanced societies and giving more autonomy to universities will enhance their business role and initiate demand for their services by the industry, which results in *attracting investments for innovation* from the industrial sector. The business role of universities could also be encouraged by *unconditional support from the top management* (Rectors, Deans, and Heads of the institutes). Additional advice from other Western Balkan Countries examined is that educational curricula should be constantly improved due to detected inapplicability to industrial, and especially to SMEs' needs (Huggins & Strakova 2012). Recently, Polenakovik, Penaluna & Penaluna (2014) presented a methodology for *closing the gap between current competences of graduates, and skills needed on the labour market* that included activities/measures that should be taken on different levels (macro, mezzo, micro, sub-micro) by different institutions/actors.

The FITD that was launched recently *should foster and financially support innovative activities and industry collaboration with research institutions*. The foreseen programmes are: co-financing grants to support start-ups, spin-offs and innovation activities (up to €30,000 and up to 85% of the project), co-financing grants and conditional loans for innovation commercialization (up to €100,000 and up to 70% of the project), co-financing grants for technology transfer (up to €200,000 and up to 50% of the project), and technical assistance through business-technology accelerators (up to €500,000 and up to 75% of the project). It is very early to speculate, but it seems that these financial resources might not fully satisfy the real industrial needs. However, the challenges for

this institution are determining the domestic champions in each area and supporting them with sufficient financial resources. In addition, the role of the government will be *to find additional funds to support FITD*, while private funds (private investors, venture funds, business angels, hedge funds, etc.) should also find their interest to match the state FITD.

Developing an *objective set of indicators* for assessing the progress and impact of the plans and activities related to the NIS is a must for all three spheres. The evaluation of the established innovation infrastructure will give invaluable feedback to its further improvement. Also, the *coordination of the institutions* is crucial for avoiding the duplication of work and for unlocking the real power of synergy between the innovation actors.

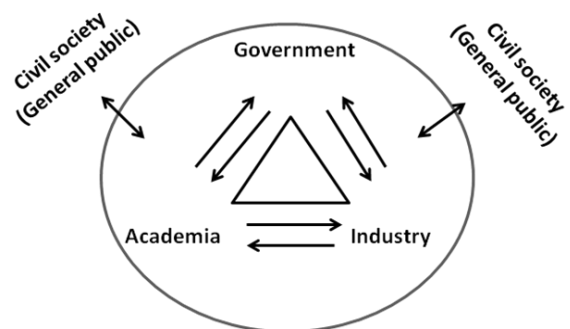


Figure 5.1. Quadruple helix for further development of the Macedonian NIS

Eventually, the last challenge is leveraging the triple helix to *quadruple helix by adding the civil society as the fourth collaborator* (Polenakovik 2014), which transforms the innovation system into democratic and socially accountable through encouraging feedback from the key stakeholders to the proposed decisions and strategies (Figure 5.1).

**REFERENCES**

1. Bartlett, W. (2008). *Europe's Troubled Region: Economic development, institutional reform and social welfare in*

- the Western Balkans*. London: Routledge.
2. Bartlett, W. (2010). A Response to Carolyn Kadas and Ivan Rajic's Comments on Europe's Troubled Region: Economic development, institutional reform and social welfare in the Western Balkans. *Southeastern Europe*. (34), pp. 240-243.
  3. Cviic, C. & Sanfey, P. (2010). *In Search of the Balkan Recovery: The Political and Economic Reemergence of South-Eastern Europe*. New York: Columbia University Press.
  4. Etzkowitz, H. (2006). The new visible hand: an assisted linear model of science and innovation policy. *Science and Public Policy*. (33), pp. 310-320.
  5. Etzkowitz, H. & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research Policy*. (29), pp. 109-123.
  6. Freeman, C. (1995). The 'National System of Innovation' in historical perspective. *Cambridge Journal of Economics*. (19), pp. 5-24.
  7. Freeman, C. (2002). Continental, national and sub-national innovation systems – complementarity and economic growth. *Research Policy*. (31), pp. 191-211.
  8. Grossman, G.M. & Helpman, E. (1991). *Innovation and Growth in the Global Economy*. MIT Press, Cambridge, MA.
  9. Hu, Y.S. (1992). Global or transnational corporations are national firms with international operations. *Californian Management Review*. (34), pp. 107-126.
  10. Huggins, R. & Strakova, L. (2012). Knowledge-based Economic Development in Emerging Regions: Policy Issues and Implications in the Balkan Peninsula. *Regional Studies*. 46(7), pp. 961-975.
  11. *Innovation Strategy of the Republic of Macedonia for 2012-2020* [Online]. Available from: <http://www.seecel.hr/UserDocsImages/Documents/InnovationStrategy%20EN%20version.pdf> [Accessed: 1 October 2014]
  12. Kadas, C. (2010). Debate. Bartlett, W., Europe's Troubled Region: Economic development, institutional reform and social welfare in the Western Balkans (London: 2008: Routledge). A Comment. *Southeastern Europe*. (34), pp. 223-230.
  13. Machacova, J. & Dall, E. (Eds.) (2008). *Innovation Infrastructures in the Western Balkan Countries*. Information Office of the Steering Platform on Research for Western Balkan Countries [Online]. Available from: <http://www.socinnovationlab.org/resources/Western%20Balkans/InnovationInfrastructuresinWBCsee-science.euReportversion2.pdf> [Accessed: 29 August 2014]
  14. Ohmae, K. (1990). *The Borderless World*. Harper, New York.
  15. Patel, P. (1995). Localised production of technology for global markets. *Cambridge Journal of Economics*. (19), pp. 141-153.
  16. Polenakovik, R. & Pinto, R. (2010). The national innovation system and its relations to small enterprises: the case of the Republic of Macedonia. *World Journal of Science, Technology and Sustainable Development*. 7(1), pp. 91-107.

17. Polenakovik, R., Penaluna, A. & Penaluna, K. (2014). Closing the gap between labour market needs and students/graduates competences and skills, in Fiti, T. and Polenakovik, R. (eds.), *How to increase employment of students and graduates?* Conference Proceedings, MANU and NCDIEL print, Skopje, 14 March 2014 (closing event for the project "Building capacities for better employability" funded by the UK Embassy in the Republic of Macedonia), pp. 27 – 38.
18. Polenakovik, R. (2014). Building an Innovation Society – Case of the Republic of Macedonia, presentation on the occasion of *UNCTAD Multi-year Expert Meeting on Investment, Innovation and Entrepreneurship for Productive Capacity-building and Sustainable Development*. Palais des Nations, Geneva, Wednesday 19th to Friday 21st March 2014.
19. Porter, M. (1990). *The Competitive Advantage of the Nations*. Free Press, Macmillan, New York.
20. Romer, P. (1986). Increasing returns and long-run growth. *Journal of Political Economy*. (94), pp. 1002-1037.
21. SEE Project FINNO (2014). Internal project report.
22. Todtling, F. & Trippel, M. (2005). One size fits all? Towards a differential regional innovation policy approach. *Research Policy*. 34, pp. 1203-1219.
23. Uvalic, M. (2012). Transition in South-East Europe: Understanding economic development and institutional change, in Gerard, R. (ed.), *Economies in Transition: The Long Run View*. Basingstoke: Palgrave Macmillan, pp. 364-399.
24. World Bank (2013). Western Balkans Regional R&D Strategy for Innovation. *Country Paper Series – Former Yugoslav Republic of Macedonia* [Online]. Available from: <http://www.worldbank.org/content/dam/Worldbank/document/eca/Western-Balkans-R&D-Macedonia.pdf> [Accessed: 14 August 2014]
25. World Bank (2014). *World Bank Group – FYR Macedonia Partnership Country Program Snapshot, April 2014* [Online]. Available from: <http://www.worldbank.org/content/dam/Worldbank/document/eca/Macedonia-Snapshot.pdf> [Accessed: 14 August 2014]