

MACEDONIAN NATIONAL INNOVATION SYSTEM – STATES, CHALLENGES AND PERSPECTIVES

The key segments of Macedonian National Innovation System: business sector, research sector, technology transfer system and in its institutional policy framework are analysed in the paper. The results of the performed analyses point the numerous weaknesses in its key segments, particularly detected in the domain of financial and human resources, intellectual property rights, implementation of the key strategic documents and efficiency of the institutions. This paper results in a series of recommendations for innovation policy intervention that can be considered for the National Innovation System improvement.

JEL: O38; O32; O52

Introduction

Traditional economic theory has argued that in the long run, companies strive to maintain a stability, primarily by achieving optimal size and profits optimisation. Practice shows that companies that do better today are more likely to do better tomorrow, i.e. to achieve higher sales, higher profits and productivity growth. Probably the different success of the business is mainly related to their different capacities and capabilities for acquiring, creating and implementing knowledge, i.e. for developing and introducing innovations.

If we consider that the innovation drives changes, creates new opportunities, new products and services, and creates new markets, it becomes clear that today the challenge for any enterprise is to compete by introducing innovation.

In recent decades, the issues related to research and development, creation and transfer of knowledge and introduction of innovations have become an area of special interest where numerous studies and empirical analyses have been conducted. Additionally, many literature findings explicitly state that innovations are not only important for individual enterprises, but for economies as a whole, as they enable the building of competitive knowledge-based economies, which accelerates the economic growth and improves

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competitiveness of national economies to the global market. Hence it becomes clear that one of the key priorities for every market economy, that wants to boost its economic growth, should be strengthening the competitiveness of the business sector – through knowledge and innovation.

Within the paper, a particular meaning is given to the concept of National Innovation Systems (NIS). This concept is generally accepted as one of the most comprehensive systemic approaches that give insight into the innovative and economic performance of a country. In recent years, the concept of NIS, become a tool for analysing country profiles in terms of innovation, as well as a guide for policy formulation.

1. Literature review

The concept of “National Innovation System”, developed in the 1980s, is closely related to the British economist Chris Freeman, the Swedish scientist Bengt Ake Lundvall and the American economist Richard Nelson.

According to the theoretical basis of the concept, economic growth, as well as competitiveness and innovativeness of the countries are largely determined by the quality of usage of available research and development resources (Cvetanović i dr., 2017).

By applying a holistic view of innovation, rather than focusing on individual aspects of the innovation process, the concept of national innovation system emphasises the importance of interaction between participants in the innovation process and considers the ways in which those processes are shaped by the influence of numerous social, institutional and political factors (Fagerberg and Verspagen, 2009).

Freeman defines the national innovation system as “... the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies” (Freeman, 1987).

Lundvall, similar to Freeman, emphasises the importance of interaction and collaboration in the processes of production, diffusion and use of new and economically useful knowledge (Lundvall, 1992).

According to Nelson, national innovation systems are “... a set of institutions whose interactions determine the innovative performance ... of national firms” (Nelson, 1993).

Unlike Freeman and Lundvall, whose theories for the concept of national innovation system are focused to the role of technology, in Nelson’s theories, the focus is put on research and development activities that take place within individual national innovation systems (Nelson, 1993).

In general, according to the authors’ opinion, the concept of NIS and its effectiveness is the result of the quality of the integrative process of research organisations, universities, and companies applying new technologies and knowledge in the production process (Freeman, 1987; Lundvall, 1992; Nelson, 1993).

Furthermore, in the opinion of a group of authors led by Freeman and Malerba, each country has a national innovation system, but some of them are efficient and others are not so efficient, which is largely determined by the degree of their development (Freeman, 1987; Malerba, 2000).

According to another group of authors, the definition of a national innovation system implies the existence of quality institutions. Only if the institutions part of the NIS are developed in a satisfactory extent, it makes sense to discuss the existence of the innovation system (Smith, 1997).

Therefore, it could be concluded that the performance and functionality of the individual national innovation systems are largely determined by the degree of their development and the quality of institutions.

According to the Law on innovation activity of the Republic of North Macedonia, NIS is defined as a set of organisations, institutions and the relations between them in the function of generating, disseminating and applying the results of scientific research and technological improvements in the country².

Innovation systems theory defines “systems“ in terms of a number of “actors“ and stresses that the relationships between them and system performance is often determined by the weakest link in the chain. This means that policy interventions should focus on the weaknesses. Systems theory also suggests that individual policy instruments applied in isolation are unlikely to have a high impact on overall system performance. The policy implication is that there is a need for a broad range of policy instruments, rather than a focus on only one aspect (Polenakovik and Pinto, 2010).

At the same time, many authors highlight the importance of the National innovation systems for gaining insight into the economic and innovative performances of the countries, because the NIS are one of the most comprehensive systemic approaches (Freeman 1995; Porter 1990; Patel, 1995). This insight is essential for policy-makers to develop a legal framework for enhancing the innovation performance, which is the main pillar of the knowledge-based economies (Polenakovik et al., 2014).

Within the national innovation systems, there are interacting groups of actors defined in terms of the public and private sectors and their roles as ‘knowledge creators’ or ‘knowledge users’ (Guy and Nauwelaers, 2003).

Each sector is also characterised by a dominant issues, such as:

- Social and Human Capital (The supply of and demand for qualified human resources).
- Research Capacity (The knowledge base).
- Technology and Innovation Performance (The ability to innovate).
- Absorptive Capacity (The capacity of markets to absorb and diffuse innovations).

² "Official Gazette of the Republic of Macedonia" No. 79/2013, 137/2013, 41/2014, 44/2015 and 6/2016.

The concept of NIS is, thus, a tool for analysing country specificities in the innovation process in a globalised economy, as well as a guide for policy formulation. It highlights interactions and interfaces between various actors and the workings of the system as a whole, rather than the performance of its individual components (OECD, 1999).

Having in mind those facts the concept of national innovation system nowadays is a kind of template for enhancing cooperation between science and industry and a model on which the development policies of European Union countries are based.

2. Methodology

For the purposes of the study, a combination of several data collection methods was used. In order to review the current status of the Macedonian NIS, its key segments (business sector, research sector, technology transfer system and institutional policy framework) and the relations between them, extensive desk review and research were conducted. The analysis is predominantly based on secondary data, i.e. data already published by the institutions responsible for the creation and implementation of the innovation policies. These documents cover: Prepared and adopted national and regional strategies (National Innovation strategy for 2012 – 2020, Strategy for Regional Development of the Republic of Macedonia 2009 – 2019, Entrepreneurial Learning Strategy 2014 – 2020, Regional Innovation Strategies for eight Planning Regions for the period 2016 – 2018, Competitiveness Strategy 2016 – 2020 and others); Laws (Law on Innovation Activity, Law on Higher Education, etc.); Development programs and action plans; National reports as well as reports from other relevant organisations on the progress of policy implementation and measures in the area of innovation and competitiveness; Reports from international organisations – the Global Economic Forum, European Commission, etc. and statistical data from the State Statistical Office and Eurostat.

Additionally, over 10 representatives (entrepreneurs and managers) of the Macedonian business sector were interviewed in order to take into consideration the key challenges connected with their innovation and R&D activities.

Research in the paper is based on new and relevant literature in the field of innovation and entrepreneurship.

Analysed quantitative indicators are further supported by qualitative analysis and by summarised results part of my doctoral thesis titled “Creating policies for promoting the innovation capability of the Macedonian business sector”.

3. Macedonian national innovation system – current states

In this part of the paper Macedonian national innovation system is analysed through its four integral segments: business sector, research sector, technology transfer system and institutional policy framework.

3.1. Business sector

Within the business sector of North Macedonia, today operate 75 914 active business entities (Table 1).

Table 1

Number of active business entities in North Macedonia, according to the number of employees

Year	Total	0 ¹⁾	1-9	10-19	20-49	50-249	250 +
1990	7 234	/	/	/	/	/	/
1999	109 378	/	/	/	/	/	/
2010	75 497	10 756	59 276	2 483	1 568	1 211	203
2015	70 139	7 329	56 261	3 032	1 947	1 339	231
2018	72 315	8 221	57 184	3 142	2 129	1 399	240
2019	75 914	7 565	61 265	3 211	2 237	1 404	232

Source: SSO, 1999, 2020.

1) Including business entities with an unascertained number of persons employed

Micro-enterprises, small and medium-sized enterprises create almost 99.7 % of the total business population in the country, while the smallest share in the Macedonian business community, of only 0.3 %, has large enterprises with over 250 employees (SSO, 2020).

In terms of value-added and employment, SMEs in North Macedonia play a large role in the nonfinancial business economy³. In, 2017, SMEs generated roughly three out of every four jobs (74.2 %) and nearly two-thirds (63.4 %) of total value added in North Macedonia, which is considerably above the respective EU averages of 66.5 % and 56.3 % (European Commission, 2019). From the other side, SMEs in North Macedonia have low productivity. Annual SME productivity in North Macedonia, measured as value-added per person employed, is only EUR 9 360, in stark contrast to the almost five times greater average of EUR 43 604 achieved by EU SMEs (European Commission, 2019).

In terms of sectoral distribution, the largest share in the structure is given to the sectors Wholesale and retail trade; repair of motor vehicles and motorcycles and Manufacturing. These two sectors, in 2019, account for 30.5 % and 11.0 % of the overall economic structure, respectively (SSO, 2020). Sectors from the trade and sectors from the industry have the highest impact on the country's GDP creation. Enterprises from these two sectors in 2018 accounted for 19.6 % and 18.5 % of the GDP, respectively (SSO, 2019a). Manufacturing accounts for 19 % of the total employment in the country and at the same time, it is a sector dominated by medium-sized and large enterprises – over 30 % of the medium-sized and large enterprises operate in this sector.

The average number of active business entities per 1 000 population in North Macedonia in 2108 was 35, which is a relatively solid number, although still not a high enough average,

³ The data cover the 'non-financial business economy', which includes industry, construction, trade, and services (NACE Rev. 2 sections B to J, L, M and N), but not enterprises in agriculture, forestry and fisheries and the largely non-market service sectors such as education and health.

having in mind that some studies in the USA and Great Britain suggest that for a well-functioning of a market economy there should be around 50–60 SMEs per 1 000 population (Brada and Fiti, 2006).

According to official statistics, in North Macedonia, the share of innovative enterprises in total enterprises in the period 2012 – 2014 is 36.0 %, and in the period 2014 – 2016 the share is 37.4 % (DZS, 2016, 2018). According to this indicator North Macedonia, in 2016, lags behind almost all countries in the region: Slovenia (39.8 %), Croatia (48.0 %), Serbia (40.5 %) etc., except Bulgaria (27.2 %). These differences are even more pronounced and are higher than 10 percentage points if the share of innovative Macedonian firms is compared to the EU-28 average which in the period 2014 – 2016 is 50.6 % (Eurostat, 2019).

3.2. Research sector

The key research institutions in North Macedonia are the Macedonian Academy of Sciences and Arts (MANU), higher education institutions (universities – faculties and research institutes), R&D departments within the enterprises and other research institutes that are not part of the universities.

Macedonian Academy of Sciences and Arts, established in 1967, in principle, is the primary national institution to promote the development of science, research, innovation and new technologies, both in the country and internationally. The scientific activity of the Academy takes place in six departments⁴ and eight research centres⁵.

On the other hand, despite its wide mandate, MANU has a relatively limited research capacity (Josimovski, 2011). This situation arises from the fact that the Academy is not institutionally organised. On the contrary, MANU has a relatively small number of research centres with a limited number of researchers, managed by academicians. Today, MANU has 32 academics, 6 correspondent members and 34 full-time scholars (including 17 scholars with scientific titles and 17 scholars with research titles), involved in the scientific activities of the Academy, as well as, a large number of external collaborators (university professors, junior researchers, volunteers etc.), usually engaged in the realisation of international projects.

State contribution to the budget of the Academy is about 65 % – 67 %, while the other part of the budget is consist of funds from self-financing activities, international projects, grants and donations. Although in the past few years the situation in terms of strengthening the research capacity of the Academy and increasing of the share of public budget allocations

⁴ Department of Linguistics and Literary Science, Department of Social Science, Department of Medical Science, Department of Technical Science, Department of Natural, Mathematical and Biotechnological Science and Department of Arts.

⁵ Research Center for Energy and Sustainable Development, Research Center for Genetic Engineering and Biotechnology „Georgi D. Efremov“, Research Center for Areal Linguistics “Božidar Vidoeski”, Research Center for Computer Science and Information Technologies, Lexicographical Center, Research Center for Cultural Heritage, Research Center for Environment and Materials and Center for Strategic Research “Ksente Bogoev”.

for research activities has been improved, lack of funding, relatively outdated equipment, unattractive salaries of researchers and low mobility of the employees, are still the key limiting factors of the research activity of MANU.

In the period 2016 – 2019, members of the Academy, have published 740 papers in total, out of which 338 in international journals (237 of them are published in journals with impact factor) and 402 in national journals and proceedings (16 of them are published in journals with impact factor).

Besides MANU, research activities in Macedonian NIS are carried out within the higher education institutions. The higher education system in North Macedonia consists of six state universities⁶, 10 private universities⁷ and one public-private non-profit higher education institution⁸. In the segment of the private higher education system, in addition to the universities, there are also several private faculties, institutes and colleges (MoES, 2017).

Universities in North Macedonia are mainly focused on education. However, there is evidence for engagement of universities in research activities, predominantly represented by state universities, which show a tendency for higher R&D capacity than private ones.

State University Ss. Cyril and Methodius (UKIM), with its 23 faculties and 60 laboratories, half of which are dedicated to biotechnology research, is a leader in the scientific and research activity within the higher education system in the country.

Other higher education institutions, public and private, are primarily focused on education. Consulting and training services are another important part of their activities, while basic and applied research is less performed. The insufficient coordination between the faculties, redundant equipment and facilities, unattractive salaries and limited employment opportunities for academic staff, etc., are ongoing problems of the higher education institutions in the country.

Recent research of MANU related to higher education and science in North Macedonia points to serious problems in this field. The basic problems stressed in the study are (Kambovski, 2016; MANU, 2017): the absence of a consistent and scientifically-based vision, ie strategy for development of higher education and science; the breakdown of the three core activities that define the contemporary vision of a “third-generation university” – education, research and innovation; weak effects of the Bologna Process, especially in the area of improving the quality of the education and research activity of the universities; hypertrophied university network – 24 universities with over 130 faculties and 600 study

⁶ Ss. Cyril and Methodius University of Skopje, St. Clement of Ohrid University of Bitola, Goce Delčev University of Štip, University of Tetova, University of Information Science and Technology “St. Paul The Apostle” in Ohrid and “Mother Teresa” University in Skopje.

⁷ First Private European University “Republic of Macedonia”- Ckonje, FON University - Skopje, New York University Skopje, University American College Skopje, MIT University Skopje, University of Audiovisual Arts ESRA Paris-Skopje - New York, University of Tourism and Management Skopje, International University of Struga, International Balkan University Skopje and International Vision University - Gostivar.

⁸ South East European University in Tetovo.

programs and the establishment of numerous dispersed centres; commercialisation of higher education; marginalisation of scientific and research activity in public universities; the evident discrepancy of higher education with the needs of the labour market; low investments in education and particularly in research and development; absence of a well-designed financing system of higher education, etc.

This situation determines the existence of a serious gap between the knowledge and skills provided by the education system and the demands of the labour market. That results with very low efficiency of the higher education system in the Western Balkan countries, as well as in North Macedonia. "... Efficiency is only 13 %, which means that out of 100 graduates only 13 without special problems can find employment appropriate to their qualifications, and get engaged in the labour market" (MANU, 2017, p. 64).

3.3. Technology transfer system

The technology transfer system comprises the research sector, business sector and institutional infrastructure, which supports and enables technology and knowledge transfer from research institutions to industry.

As is the case with most of the Western Balkan countries, in North Macedonia also "cooperation between public research institutions and industry is mainly conducted on an ad hoc basis, driven by occasional opportunities and short-term goals" (World Bank, 2013, p. 11). This is actually the main reason why improving of the technology transfer process, until now, remains one of the key challenges of the country.

In North Macedonia, from the early transition years has been started the process of establishing institutions to support SMEs, entrepreneurship and technology, knowledge and know-how transfer.

In the mid-1990s, in the country were established five Regional Enterprises Support Centers, three Enterprise Support Agencies (ESAs), one Regional Agency for Economic Development-PREDA (Today Foundation for Sustainable Economic Development – PREDA Plus) and eight business incubators.

Within the technology transfer infrastructure, several technology transfer centres have been established in the country, located at universities or individual faculties. Financially supported by TEMPUS and GTZ programmes the technology transfer centres/offices were 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. In addition to these, the centre of excellence – CIRKO-MES CE and Business Start-up Center (BSC) were founded in 2005 and 2006 respectively. Both centres are still active and are established at the Faculty of Mechanical Engineering – Skopje.

Another important segment of the technology transfer system of North Macedonia is the Center for Entrepreneurship and Executive Development (CEED), established in 2007, as part of the international network of entrepreneurship centres operating in Southeast Europe. Significant specificity of the Center is the CEED Business Angels Club (CEED BA Club),

founded in November 2013, as one of the first clubs of its kind in Macedonia (<http://ceed-macedonia.org/>).

The establishment of the Technological Industrial Development Zones (TIDZ) is an important step of the country towards improving the conditions for technology and knowledge transfer and further increasing of the innovation capacity of the economy. With the establishment of the first Technological Industrial Development Zone (TIDZ 1), located near Skopje Airport (Bunardzik), there were attracted the two leading Greenfield investors – Johnson Controls and Johnson Matthey, as well as, Van Hall, Aptive, Kemet, Protek Group and others. FDI “opened new jobs and brought sophisticated technology in the country” (Богдановска, 2017). Limited cooperation of domestic enterprises with FDI is a serious challenge and should be significantly improved.

Furthermore, one of the key institutions within the technology transfer system of the country is the Fund for Innovation and Technology Development (FITD), established as a public institution in 2013, with financial support and technical assistance by the World Bank. Acting through its key support instruments⁹, FITD by the beginning of 2020, has provided support to 314 micro, small and medium-sized enterprises, with a total value of the projects of € 57 million, and has supported 54 schools with more than 500 students directly involved, as well as more than 30 partner organisations. Successful piloting of the instruments for supporting technology extension and business-technology accelerators programmed in the ERP 2018-2020, part of the measures of the third pillar of the Economic Growth Plan, resulted with establishing of three business accelerators: Business Accelerator “UKIM”, “SEAVUS” Accelerator and “X Factor” Accelerator (see more at: <http://www.fitr.mk/>).

The “UKIM” Accelerator is an integral component of the new National Technological Transfer Office and it is located at the Faculty of Electrical Engineering and Information Technologies (FEEIT) in Skopje, within the Center for Technology Transfer and Innovation (INOFEIT). INNOFEIT is a place where the faculty staff, students and company representatives can interact, network and transfer technologies and innovations. “UKIM” Accelerator is already active, and several start-up businesses have started operating within it and INNOFEIT from the previous period has experience in supporting collaboration with the industry.

3.4. Institutional policy framework

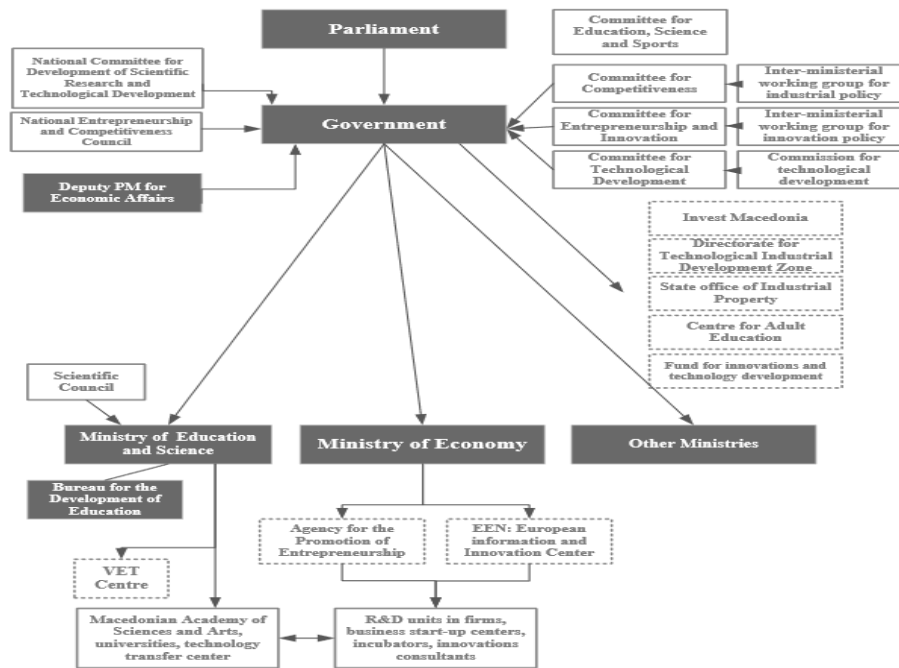
The institutional policy framework in the National innovation system of North Macedonia is relatively complex and, besides the government with its ministries, as the highest executive body responsible for innovation and R&D policy-making, includes a large

⁹ Co-financed Grants for Newly Established Enterprises: Start-up and Spin-off; Co-financed Grants and Conditional Loans for Commercialization of Innovations; Co-financed Grants for Technology Extension and Co-financed Grants for the Establishment, Operations and Investments of Business and Technological Accelerators.

number of agencies, committees, boards and other bodies and institutions in charge of their implementation, shown in Figure 1.

Figure 1

Governance structure of the national innovation system



Source: National Study, 2017

Within Macedonia NIS there are two key institutions responsible for policy-making in the area of innovation and competitiveness: Ministry of Education and Science and Ministry of Economy. Cabinet of the Deputy Prime Minister for Economic Affairs, Macedonian Academy of Sciences and Arts and National Entrepreneurship and Competitiveness Council are also one of the key policy-makers in this area.

The key institutions for the implementation of innovation and R&D policies in North Macedonia are: Agency for Promotion of Entrepreneurship, Fund for Innovation and Technology Development, State Office for Industrial Property, Agency for Foreign Investment and Export Promotion, Directorate for Technological Industrial Development Zones etc.

At the regional level, there are eight Regional Agencies (five SME Development Funds and three Enterprise Support Agencies) covering 7 of the 8 planning regions. These Regional Agencies are providing expert and technical assistance designed to strengthen the capacity of SMEs.

Through UNDP project in 2014 within the Centers for Development Support of Planning Regions were established Business Support Centers. The main aim of these centres is to provide consulting services for SMEs.

4. Key strategic documents within Macedonian NIS

In North Macedonia in the past period and especially in the period after 2008, has been started the process of intensive reforms, mainly aimed to improve the business climate for increasing the innovation capacity of the business sector, strengthening the role of SMEs in the economy, attracting FDI, fostering R&D in the country and boosting private sector competitiveness. Within this process, there have been made significant improvements in legislation and numerous documents (strategies, laws and legal solutions, action plans, programs and measures) have been adopted at the same time.

In the area of innovation was made legal framework that enabled the establishment of the Fund for innovation and technology development, as a central institution in the national innovation system in terms of business innovation support.

At the same time, the Law on promoting technological development (2008) and the Law on Innovation Activity (2013) were adopted, and there were made amendments to the Law on Research Activity and the Law on Higher Education.

In the last period were adopted numerous strategic documents, such as: National Innovation strategy for 2012 – 2020, Strategy for Regional Development 2009 – 2019, Entrepreneurial Learning Strategy 2014 – 2020, Regional Innovation Strategies for eight Planning Regions for the period 2016 – 2018, Competitiveness Strategy 2016 – 2020, Industrial Strategy 2018 – 2027, National Small and Medium-sized Enterprises Strategy 2018 – 2023 etc.

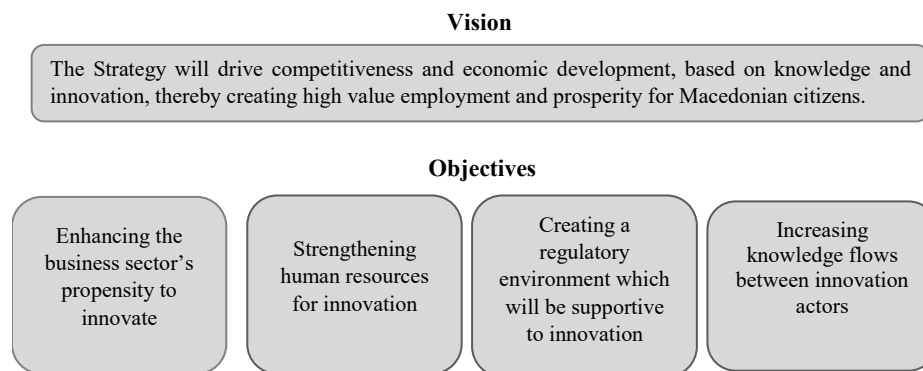
4.1. National Innovation Strategy (2012 – 2020)

One of the key strategic documents within the Macedonian national innovation system is the National innovation strategy (2012 – 2020) adopted in 2012. The document articulates a vision and four strategic objectives (Figure 2), with the intention, that by 2020, North Macedonia should have an effective national innovation system, created by all stakeholders, and open to the world.

The key actor in the implementation of the strategy is the Ministry of Education and Science (MES). Until now, MES, has developed three Action plans (Action plan 2013 – 2015, Action plan 2016 – 2018 and Action plan 2018 – 2020).

Figure 2

National Innovation Strategy (2012 – 2020): vision and strategic objectives



Source: *National Innovation Strategy 2012 – 2020*

Last Action plan 2018-2020, developed with the support of the World Bank Skills Development and Innovation Support Project Office, contains numerous measures related to creating an innovation support infrastructure, trainings, grants, awareness-raising, new models of support etc.

Key outputs of the implementation of measures related to this strategy, in terms of innovation support infrastructure development, are founding of the Fund for Innovations and Technology Development, as an active implementer of the innovation policy in the country and the (new) National Technological Transfer Office.

5. Innovation policy in North Macedonia – overview of the Plan for Economic Growth

Innovation policy in Macedonia consists of three main segments:

- Policies for attracting FDI in the Technological Industrial Development Zones (TIDZs), started in the period after 2006;
- Fund for Innovation and Technology Development (FITD), founded in December 2013 as a state institution, with the financial assistance from the World Bank; and
- Plan for Economic Growth, launched in 2018.

The Plan for Economic Growth from 2018, as the latest segment of the national innovation policy, designed by the government to provide a complete and integrated system to support innovation in the business sector, is briefly elaborated below.

The basic objectives of the Plan are shown in Figure 3.

Figure 3



Source: Government of Republic of North Macedonia, 2018

The Plan for Economic Growth contains three pillars:

The first pillar includes support for: creation of new jobs, capital investments and revenue growth, establishment of technological development and research departments, cooperation with suppliers, purchasing assets from enterprises with difficulties and stimulation of investment projects of significant economic interest to RNM;

The second pillar includes support for: improving the competitiveness of companies in new markets and conquering new markets and increasing the sales of the companies in new markets; and

The third pillar includes support for: gazelles, micro and small domestic enterprises, as well as start-ups, innovation, professional training and practice of newly employed young people and the creation of conditions and the preparation of legal basis for the development of venture capital in the country.

The strengths of the Plan for Economic Growth are reflected in the fact that the Plan is an attempt to integrate all significant segments of the innovation policy that have been applied in the country after 2006 – foreign direct investment, innovation support through the new institution (FITD), activities related to establishing links between foreign companies and domestic firms, encouraging the process of establishing research sectors in companies, supporting the entrepreneurship and the fast-growing SMEs, focusing on the measures intended to improve the innovation performance of the Macedonian business sector, etc.

Generally, there are several issues (weaknesses) of the Plan for Economic Growth:

- the complexity of the procedures for determining the business entities that will have access to the funds provided for in this plan, both in the pre-selection and in the final selection phase of the companies, and in the period following the implementation of the support;
- the funds under the first and second pillar of the Plan for Economic Growth are granted ex-post, in the form of subsidies to already implemented activities, while the funds provided for under the third pillar of the Plan, which are under the competence of FITD, are awarded in the form of grants before the implementation of the investment begins;
- the available assets (budget) to support the companies are modest – just over EUR 50 million annually (for 2018) for economic development and around EUR 16 million for the implementation of active policies on the labour market;
- this type of innovation policy belongs to the group of horizontal innovation (industrial) policies, which means that its measures apply to all business entities in the economy.¹⁰ Since the structure of the Macedonian economy is dominated by the traditional sectors, it is expected that a significant part of the funds for support will end up in business entities from these sectors. It brings the danger of reproducing the unfavourable structure of the Macedonian economy;
- the absence of a solution for monitoring the effects of the implementation of the support measures offered by the Plan for Economic Growth, which will enable assessment of the economic effects of the measures – increasing the innovativeness, productivity and competitiveness of the Macedonian business sector.

6. Main challenges of the Macedonian national innovation system

Key challenges facing the Macedonian national innovation system are identified in the following areas: financial resources, human capital, Intellectual Property rights, implementation of the key strategic documents and efficiency of the institutions.

6.1. Financial resources

This part of the analysis gives an overview related to R&D activities in the country, based on the relevant indicators, such as: R&D expenditure as a percentage of GDP (also known as a R&D intensity) and structure of the R&D expenditure by sectors (source of funds). Analysed data has been compared with the trends in selected neighbouring countries and with the EU average.

¹⁰ The plan defines that the support measures do not apply to public enterprises, enterprises with licensed businesses, law firms, audit firms, accounting bureaus, enterprises – users of agricultural subsidy, enterprises – users of concession and banks, insurance companies and funds, which is basically understandable.

In the analysed years (in period 2007-2018) in North Macedonia the percentage of GDP devoted to the R&D has been increased from 0,17 % of GDP in 2007 to 0,44 % of GDP in 2015 and 0,37% of GDP in 2018. Although in the analysed period this percentage is mostly increasing, it is still very low compared with the countries from the region such as Bulgaria 0,75 %, Croatia 0,97 %, Serbia 0,92 % etc., and especially compared with the EU-28 average (2,12 %), shown in Table 2.

Table 2
Gross domestic expenditure on R&D (% of GDP), for selected countries

	2007	2008	2009	2010	2015	2016	2017	2018
EU-28	1,77	1,83	1,93	1,92	2,04	2,04	2,06	2,12
Bulgaria	0,43	0,45	0,49	0,56	0,96	0,78	0,75	0,75
Croatia	0,79	0,88	0,84	0,74	0,84	0,86	0,86	0,97
Romania	0,51	0,55	0,44	0,46	0,49	0,48	0,5	0,51
Slovenia	1,42	1,63	1,82	2,06	2,2	2,01	1,86	1,95
Serbia	:	:	0,82	0,70	0,81	0,84	0,87	0,92
North Macedonia	0,17	0,23	0,20	0,22	0,44	0,44	0,35	0,37
Montenegro	:	:	:	:	0,37	0,32	0,35	0,36

Source: Eurostat, 2019.

Besides the low level of investments in R&D, of greater concern is the structure of R&D expenditure by sectors and especially the low level of investment in R&D by the business sector. The R&D expenditures are primarily in high education (58.01%) and 30.57% are coming from the business sector. In all others mentioned countries, except Montenegro (14.47%) the business sector invests significantly more in R&D (Table 3).

Table 3
Structure of expenditure on R&D by sectors for selected countries, in 2018

	Business sector	Government Sector	High education	Non-profit organisations
EU-28	66,71	10,74	21,78	0,76
Bulgaria	71,91	22,06	5,45	0,58
Croatia	48,03	19,93	32,04	:
Slovenia	74,2	13,55	11,92	0,33
Serbia	39,1	28,17	32,72	0,01
Montenegro	14,47	44,29	38,98	2,26
North Macedonia	30,57	9,82	58,01	1,61

Source: Eurostat, 2019.

Another significant limiting factor of the innovativeness of the Macedonian business sector, in the area of financial resources, is the difficult access of enterprises to funds for supporting of innovation and R&D activities. Access to funds is particularly difficult for small and medium-sized enterprises, and especially for micro-enterprises and start-ups. This situation mainly stems from the restrictiveness of banks in financing innovation projects. Commercial banks in the country mainly prefer traditional loans. The absence of

developed venture capital in the country is also a limiting factor of innovation activity of the Macedonian business sector.

6.2. Human capital

In the analysis, the human capital involved in R&D is also taken in consideration. As a relevant indicators are analysed the share of researchers involved in R&D in total employment (FTE)¹¹, researchers in R&D (per million people) and the distribution of researchers by sectors. According to the Eurostat definition R&D researcher “is a person that can be employed in the public or the private sector – including academia, to create new knowledge, products, processes and methods, as well as to manage the projects concerned” (Eurostat, 2013).

The FTE index in North Macedonia with a value of 0.21 ranks country at the last position between analysed countries. The index is also significantly lower than the EU average (0.90). In the country, in 2017, the share of the researchers (FTE) in the business sector, is 21.5%. This indicator is significantly lower than the EU average (51.1%) and it is also much below the indicator of Slovenia (61.8%) and Bulgaria (43.4%). North Macedonia especially marks a significant lag in terms of the number of researchers in R&D per million people (Table 4).

Table 4
Share of researchers involved in R&D in total employment (FTE), researchers in R&D (per million people) and the distribution of researchers by sectors, in selected countries, in 2017

	Full-Time Equivalents (FTE)	Researchers in R&D (per million people) ¹¹	Percentage of researchers – full-time equivalent in			
			Business sector	Government sector	High education	Non-profit organisations
EU-28	0.90	3 939	51,1	10,3	37,7	0,9
Bulgaria	0.49	2 130	43,4	30,7	25,3	0,6
Croatia	0.49	1 865	21,3	23,0	55,6	:
Slovenia	0.99	4 468	61,8	16,2	21,7	0,3
Serbia	0.55	2 079	10,6	20,6	68,8	0,0
North Macedonia	0.21	729	21,5	12,5	63,4	2,6

Source: Eurostat, 2019; World Bank ¹¹, 2019

Besides the modest research community of only 729 registered researchers in R&D per million people in 2017, in the same year in the country are identified only 49 research units, within the business entities included in the sample of R&D survey of SSO (World Bank, 2019; SSO, 2019b).

¹¹ FTE Index – Ratio of the number of researches and total employment (FTE).

6.3. Intellectual Property rights

One of the main indicators for the innovation activity and economic performance of the businesses are the results in the domain of intellectual property rights. The main institution in North Macedonia responsible for the Intellectual Property (IP) protection is the State Office of Industrial Property (SOIP). In recent years, the capacity of the SOIP has been significantly enhanced by intensifying the participation of the staff at international seminars, improving its technical equipment, providing access to certain international databases, etc. (SOIP, 2016). The SOIP is promoting creativity and innovation through initiatives such as the International Intellectual Property day, the Patent of the Year, local exhibition of inventions, participation in the international exhibition of ideas, inventions and new products etc.

Analysed data in the selected years shows some improvement in the domain of the intellectual property rights in the country (patent applications, trademark applications and industrial design applications), shown in Table 5. This trend is mostly in accordance with the general trend in Western *Balkan* countries.

Table 5

Intellectual Property rights, in selected years

	2005	2011	2015	2018
Total number of patent applications	436	405	719	1094
National	53	37	31	32
Foreign	383	368	688	1062
Total number of trademark applications	1050	1391	1354	1322
National	433	944	815	843
Foreign	617	537	539	474
Total number of industrial design applications	60	61	388	227
National	47	45	21	33
Foreign	13	16	367	194

Source: SOIP, 2006, 2012, 2016, 2019.

The difference in the domain of patent applications and trademark applications may be a sign that despite the limited capacity for technological innovation, companies in North Macedonia do compete to design new products and new ways to commercialise them (OECD, 2011, p. 2). Another problem in the country in the field of patents and trademarks is the dominant share of foreign applicants before the domestic applicants as well as the fact that the domestic patents are awarded to individual inventors.

Furthermore, one of the most frequently cited criticisms that are mostly coming from international institutions, concerns the process of examining patent applications by SOIP. Namely, the State Office of Industrial Property does not conduct a substantive examination of patent applications. Instead, the validity of the registrations of the invention is estimated only at the stage of investigation of possible legal violations, which creates legal uncertainty over the patent rights (OECD, 2013).

6.4. Implementation of the strategic documents

One of the key weaknesses of the national innovation system is related to the inefficiency in the implementation of the key strategic documents. Although most of the strategies adopted in the past period (National Innovation Strategy 2012-2020, Competitiveness Strategy 2016-2020, Industrial Strategy 2018-2027, National Small and Medium-sized Enterprises Strategy 2018-2023 etc.) are documents with high quality, their huge number often creates confusion among policy-makers and implementers. The confusion is heightened by the fact that there are numerous institutions in the field, often with the same or similar competencies, making their coordination process considerably difficult.

For example, in the 2018 work programmes of the institutions, part of the Macedonian NIS, are identified 28 national support measures, relevant for innovation and technology development in the private sector. The large number of – 28 measures and the different responsible stakeholders make it very difficult for the private sector to understand which support is available to them. In 2018, EUR 23.18 million had been awarded for the purpose of support to innovation and technology development and SMEs. Most of the funds (97 %) were allocated through open calls by Fund for Innovation and Technology Development. The remaining part of the funds was allocated through the Ministry of Economy and the Agency for Entrepreneurship Support (FITD, 2019).

6.5. Efficiency of the institutions

The modern economic literature, in the recent years, is increasingly pointing to the importance of institutions, their quality, their capacity and their credibility to the sustainability of economic growth (Acemoglu and Robinson, 2012; Petreski, 2004; Fiti, 2019).

According to Nobel laureate Douglass North, the existence and development of the organisations are strongly influenced by institutions and, conversely, organisations influence the development of the institutions. This further means that if there are strong and efficient institutions, there will be strong and efficient organisations (North, 2005).

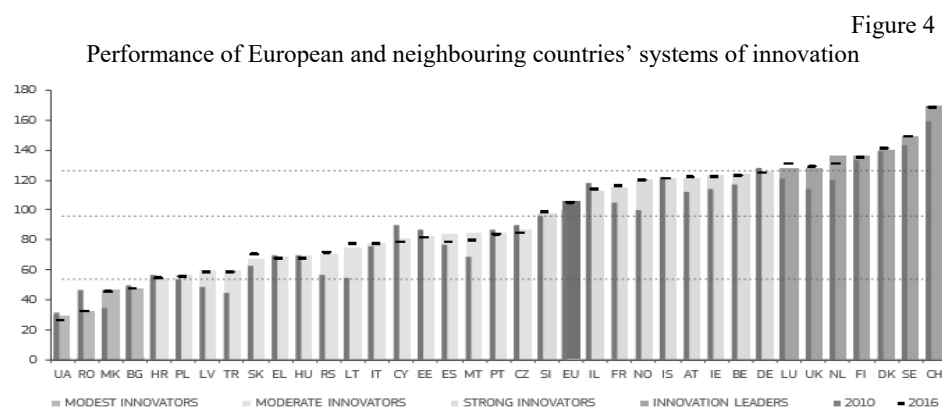
Despite the great importance of the institutions for the economic performance of the countries, it is a fact that North Macedonia is a country with weak, inefficient and non-credible institutions. “Macedonia has serious problems with the quality of institutions and the quality of governance” (MANU, 2017, pp. 87-88).

Important documents that perform qualitative analysis and evaluation of institutions in the country, their efficiency, quality and credibility are the annual reports of the European Commission (EC) on the progress of the Republic of North Macedonia in the process of EU accession. Almost all annual reports of the EC state that in North Macedonia there is a weak institutional capacity for law enforcement, fight against corruption, regulation and business agreements and that the judicial system is strongly influenced by political interests (European Commission, 2018, 2019).

7. Assessment of the innovativeness and competitiveness of the Macedonian business sector according to international reports

Numerous challenges facing Macedonian NIS that were detected in analyses, result with modest innovativeness and low level of competitiveness of the Macedonian economy.

According to the relevant Report of EC¹² – European innovation scoreboard 2019, the North Macedonia Summary innovation index has a value of 43.4. With the innovation performance below 50% of EU average, North Macedonia falls in the group of modest innovators (Figure 4).



Another relevant report that ranks countries annually in terms of competitiveness performance, is the Global Competitiveness Report of the World Economic Forum. According to the last Global Competitiveness Report from 2019, North Macedonia with Global competitiveness index of 57.3, is ranked on 82th place among 141 countries. In terms of this competitiveness indicator, North Macedonia in the analysed year has lower performance than all countries from the Region included in the research: Slovenia (70.2 / 35.), Bulgaria (64.9 / 49.), Romania (64.4 / 51.), Greece (62.6 / 59.), Serbia (60.9 / 72.), Croatia (61.9 / 63.), Montenegro (60.8 / 73.) and Albania (57.6 / 81.) (World Economic Forum, 2019).

Conclusions and recommendations

Performed analyses of the innovation system of the Republic of North Macedonia clearly points on the existence of numerous weaknesses in its key segments: business sector, research sector, technology transfer system and in its institutional policy framework. This

¹² The European innovation scoreboard provides a comparative analysis of innovation performance in EU countries, other European countries, and regional neighbours.

situation is expected, especially having in mind the fact that the weaknesses in one segment automatically spill over into the other segments of the system and limit its efficiency. The main challenges of the Macedonian NIS are detected in the domain of financial resources, human capital, intellectual property rights, in the process of implementation of the key strategic documents and efficiency of the institutions.

As a mostly important segments of the innovation system that can be denoted as typically entrepreneurial approaches, are identified the following:

Increment of the gross R&D expenditures, especially R&D expenditures of the business sector – for the achievement of this goal it is necessary: the government to treat those budget allocations as non-discretionary government spending; the dynamic of R&D expenditures growth should be higher than the GDP growth at medium term; for achieving this goal, unproductive government spending should be reduced. Increment in the usage of foreign scientific project funds (particularly the European funds) also should be achieved.

Improvement of the enterprises' access to funds for supporting of innovation activities and R&D – this measure includes: the well-capitalised, stable and liquid banking sector to facilitate the SMEs access to funds through the introduction of new banking products (credit lines) intended for supporting of innovative projects; preparation of high-quality project proposals by business sector; recapitalisation of the Development Bank of North Macedonia; increment of the available funds of FITD and affirmation of alternative sources of finance for business – venture capital funds and business angels, factoring, leasing, etc.

Harmonisation of the Macedonian formal education system according to the labour market requirements – for the achievement of this goal radical reform in the education system should be undertaken at all levels and dual education system should be implemented.

Continuing education of the employees in the business sector – the process of continuing education of the employees is of a high importance for the improvement of the innovation activities and of their productivity. Besides straightening of the management awareness for the benefits of the knowledge improvement and employee's skills, in the same time is necessary government subsidies and incentives to be established for enterprises that are investing in continuing education of their employees.

Increment of the entrepreneurial awareness for the importance and benefits of introducing of innovation – this presents a common measure of innovation policies among developed countries and it is implemented through organising seminars, round tables, media campaigns, affirmation of successful entrepreneurs, etc.

Straighten the cooperation of domestic enterprises with FDI – the low level of cooperation between domestic enterprises and FDI in the country is leading to a reduction of the positive impact of the FDI in the Macedonian economy. The support should be in the form of: tax and custom incentive for the domestic subcontracting enterprises that will be included as a part from the international value-added chain of foreign companies (in the import of machinery, technology, raw materials, etc.); subsidising of the costs intended for the training of their employees for the usage of the new technologies and also some forms

of financial incentives should be established for the FDI that will start cooperation with the domestic enterprises.

Increment of the competitive pressure in the Macedonian economy – a large number of studies have confirmed that competitive pressure in the economy has a key role in the improvement of investments and innovativeness in the economy. This is a wide range measure and assumes changes in the key segments of the business climate, particularly in those with the highest importance for the competitiveness of the enterprises: protection of copyrights, including the industrial property rights, rising contracts efficiency, enhancing the efficiency of regulatory authorities, fighting against corruption with a focus on the corruption in public procurement.

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