

# Chapter 13

## Report on ICT in Education in the Republic of North Macedonia



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### 13.1 Overview of the Country

#### 13.1.1 Geography

North Macedonia is a country situated in Southeastern Europe with geographic coordinates 41° 50' N 22° 00' E, bordering Serbia and Kosovo to the north, Bulgaria to the east, Greece to the south, and Albania to the west. The country is a major transportation corridor from Western and Central Europe to Southern Europe and the Aegean Sea. North Macedonia is a landlocked country but has three major natural lakes: Lake Ohrid, Lake Prespa, and Lake Dojran. It has a surface area of 25,713 km<sup>2</sup> with water area of 857 km<sup>2</sup>, while its land area is 24,856 km<sup>2</sup>.

#### 13.1.2 The Political System

The political system of North Macedonia consists of three branches: Legislative, Executive, and Judicial. The Constitution is the highest law of the country.<sup>1</sup> The political institutions are constituted by the will of its citizens by secret ballot at direct and general elections. Its political system of parliamentary democracy was established with the Constitution of 1991, which stipulates the basic principles of democracy and guarantees democratic civil freedom.<sup>2</sup> Local government functions

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<sup>1</sup>Republic of Macedonia Constitution 2019.

<sup>2</sup>Democracy Index (2016).

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are divided between 78 municipalities. The capital, Skopje, is governed as a group of ten municipalities collectively referred to as “the City of Skopje”. Municipalities in North Macedonia are units of local self-government.

### ***13.1.3 Population***

According to the latest population estimates (as at 31.12.2017) (source: State Statistical Office (SSO)<sup>3</sup>), the Republic of North Macedonia has 2,075,301 inhabitants, and regarding the percentage distribution, 50.1% are men, while 49.9% are women. The population density is 83 inhabitants per km<sup>2</sup>. The Skopje Region is the most densely populated, while the Vardar region is the least densely populated.

### ***13.1.4 The Status Quo of Society***

North Macedonia is firmly committed to the processes of European Integration and ultimately of accession to the European Union. The country concluded the Stabilization and Association Agreement in 2001 which came into force in 2004 and the EU candidate status was awarded in December 2005. The National Programme for the Adoption of the Acquis (NPAA) was adopted in 2006 and it is revised and updated every year with activities deriving from the progress reports of the European Commission, as well as with short-term and mid-term priorities from the Accession Partnership Agreement which was adopted by EU Council of Ministers in 2008.

From historical and cultural aspects, throughout the millennia, North Macedonia marks a significant and rich civilization and cultural development in a material and spiritual respect. From an archeological point of view, it is one of the most attractive destinations with authentic history and culture, many archeological sites, fortresses, and towers since the time of the Roman, Byzantine, and Ottoman Empires. On the territory of North Macedonia there are about 35 smaller and bigger cities with their own history and culture, where the majority of the population lives. In the larger places, the country’s industrial capacities and state administrative institutions are predominantly located.

Almost the entire territory of North Macedonia intertwines eastern and western civilization, different cultures intertwine with their own distinctive feature and so they create a kaleidoscope of history and culture, tradition, customs, architecture, food, mostly marked by the Middle Eastern and Mediterranean influences. This reality is a functional unity of opposites and a sustainable system of development, cooperation, and co-existence among all ethnic groups on the territory of North Macedonia, mainly with Orthodox Christian religion, the second place belongs to the inhabitants of the

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<sup>3</sup>State Statistical Office (2018a).

**Table 13.1** Gross domestic product (State Statistic Office 2018)

Year	2016	2017
GDP at current prices (EUR) (million)	9657	10,014
GDP annual growth rate (%)	2.8	0.2
GDP per capita (EUR)	4659	4827

Islamic religion and there are also Catholics, Protestants, atheists, and members of other religions.

The National Strategy for Development of Culture in Republic of North Macedonia 2018–2022<sup>4</sup> has announced its main cultural priorities based on access to culture (freedom of creativity, equality, universal good) and most important principles to enable accessibility, inclusiveness, cultural democracy, and participation in cultural processes.

### 13.1.5 Current Situation of Economic Development

Republic of North Macedonia has achieved relatively stable growth over the last 15 years elevated its status from lower-middle in 2000 to upper-middle income economy. Among 188 countries, North Macedonia ranked 82nd in 2017<sup>5</sup> and is in the group of the countries with high human development, according to UNDP Human Development Report.

Country's gross domestic product in 2016 was EUR 9657 million or EUR 4659 per capita (Table 13.1) (State Statistic Office 2018). The real growth of GDP for 2016 was 2.8% (World Bank 2018). In the past ten years, the efforts toward maintaining macro-economic stability in the face of the global recession and the slowdown in the Eurozone resulted in the GDP growth, the GDP growth rate was the highest in 2007 (6.5%) and the lowest in 2012, when GDP shrank by 0.5%.

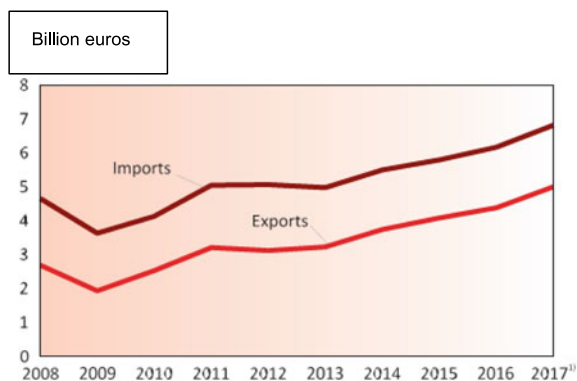
The inflation measured by the Consumer Price Index (CPI) in the last ten years has remained relatively stable, ranging from 8.3% in 2008 to –0.8% (deflation) in 2009. The penultimate three years have seen a negative inflation rate, while in 2017 the rate was 1.4%.

The increase in CPI by 1.4% in 2017, in comparison with the previous year, is a result of the higher indices in the groups: communication by 8.5%, alcoholic beverages, tobacco by 6.3%, transport by 5.5%, restaurants and hotels by 3.8%, clothing and footwear, recreation and culture by 1.0%, furnishings, household equipment and routine maintenance of the house by 0.5%, food and non-alcoholic beverages by 0.3%, while a decrease was registered in the groups: health and miscellaneous goods and services by 0.6%, education by 0.3%, housing, water, electricity, gas and other fuels by 0.2%.

<sup>4</sup>National Strategy for Development of Culture in Republic of North Macedonia (2018–2022).

<sup>5</sup>State Statistical Office (2018a).

**Fig. 13.1** Exports and imports of goods



The upward trend in import coverage by export that started in 2010 continued in 2017, as is presented on Fig. 13.1, based on the statistical data (State Statistical Office 2018a) and Mak Stat database.

In 2017, exports accounted for 42.3% of the trade volume, an increase of 4.3% compared to 2010. The share of imports in the trade volume has decreased continuously, reaching 57.7% in 2017. Compared to 2010, the share of imports in the volume of trade in 2017 decreased by 4.3%. Total imports and exports by products in 2017 are shown in the Fig. 13.2, provided by State Statistical office.

In 2017, according to the data provided by State Statistical office, from total export, the Republic of Macedonia exported 81.1% to EU28 countries, 11.7% to the Western Balkan countries, 0.7% to the EFTA countries, and 6.5% to other countries. From export to EU28, the most amounts go to Germany (57.9%), from export to the EFTA countries to Switzerland (92.8%), from export to the Western Balkan Countries to Serbia (37.4%) and from export to other countries to Turkey (23.9%) and China (17.1%), as shown in Fig. 13.3.

In 2017, according to State Statistical office, as shown in Fig. 13.3, of the EU-28 countries, North Macedonia imported the most from Germany (18.7%), of the Western Balkan Countries from Serbia (74.8%), and of other countries from China (21.6%) and Turkey (17.9%).

On the export side (Fig. 13.3), micro enterprises accounted for 38.9% of the value of external trade in the trade sector. Large enterprises generated 75.6% of the value of external trade in the industry sector. On the import side, small enterprises accounted for 28.7% of the value of external trade in the trade sector. Large enterprises generated 69.1% of the value of external trade in the industry sector (Fig. 13.4).

According to the data of SSO,<sup>6</sup> the number of active business entities in the North Macedonia in 2017 was 71,419, and compared to 2016 it decreased by 0.1%. The sections with the highest share in the structure of business entities are: wholesale and retail trade; repair of motor vehicles and motorcycles with 23,337 entities or 32.7% and manufacturing with 7885 entities or 11.0%, whereas the least represented were

<sup>6</sup>State Statistical office (2018c), State Statistical office and UN (2017).

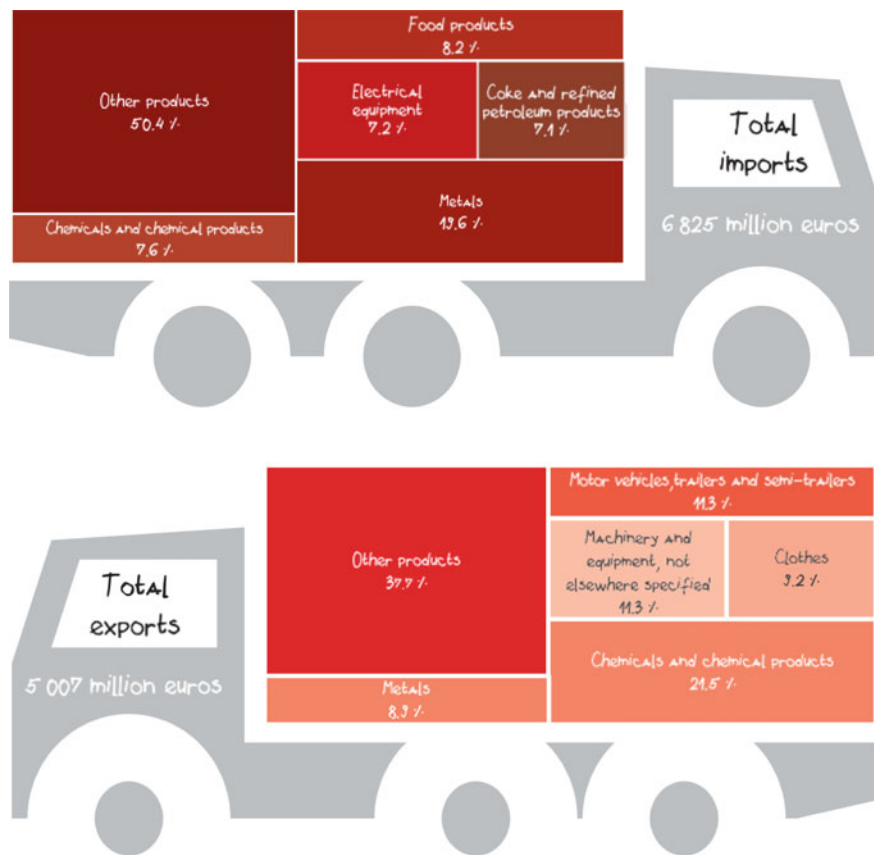


Fig. 13.2 Exports and imports by products, 2017

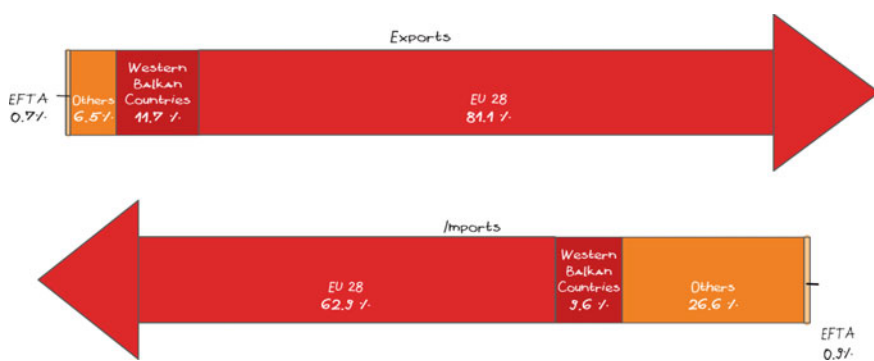
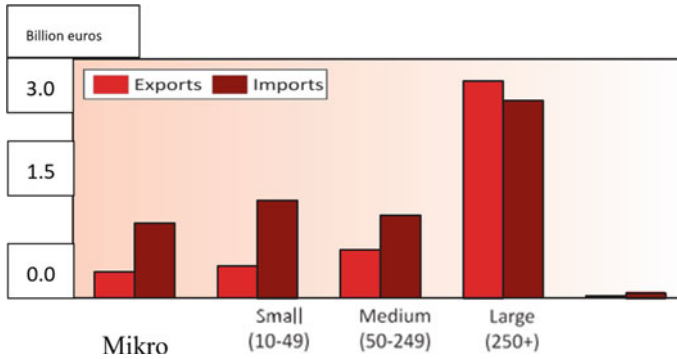


Fig. 13.3 External trade by economic groups of countries, 2017



**Fig. 13.4** External trade by sectors of activity and by employment size class, 2017 (State Statistic Office 2017)

**Table 13.2** Basic structural business indicators<sup>a</sup>

	2016	2017
Enterprises	55,469	55,203
Persons employed	378,737	385,728
Turnover, in million denars	1,121,017	1,192,284
Value added, in million denars	248,289	260,285
Personnel costs, in million denars	118,377	126,371
Gross operating surplus, in mil denars	129,911	133,915

<sup>a</sup>Gross Domestic Product (2017)

the sections: electricity, gas, steam, and air conditioning supply with 172 entities or 0.2% and mining and quarrying with 201 entities or 0.3%.

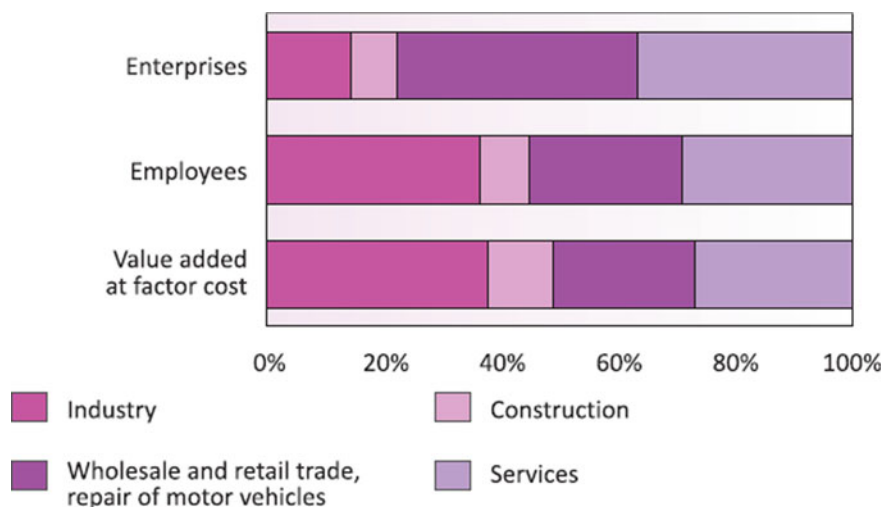
Of the total number of active business entities (71,419), 8258 (12%) were registered in industry. Of the 8258 business entities registered in industry, 6712 had less than 10 employees (1–9), as part of micro segment.

The divisions—manufacturing of machinery and equipment (13.0%), manufacturing of food products (11.0%), electricity, gas, steam, and air conditioning supply (10.4%), and manufacturing of wearing apparel (9.0%) had the largest shares in the structure of industrial production in 2017.

According to the basic structural business indicators, shown in the Table 13.2, business entities in last year generated 6.4% more turnover and 4.8% more value added than in previous year (State Statistical Office 2017, 2019).

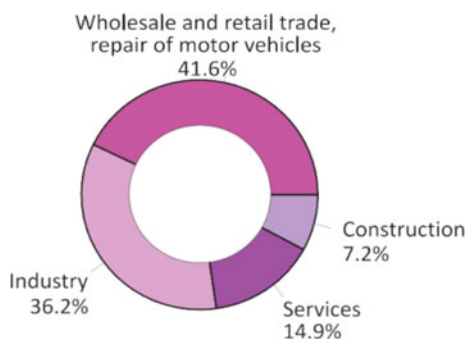
According to Industry review,<sup>7</sup> the highest share in the total value added was registered in the manufacturing sector (26.6%) and the trade sector (23.5%). According to enterprise size, the biggest was the contribution of medium and large enterprises from the manufacturing sector (20.7%) and micro and small enterprises from the trade sector (11.1%), shown in Fig. 13.5.

<sup>7</sup>State Statistic Office and MakStat (2018).



**Fig. 13.5** Basic structural business indicators by activity sector, 2017 (State Statistic Office and MakStat 2018)

**Fig. 13.6** Structure of turnover, 2017 (State Statistical office 2019)



As shown in Fig. 13.6, more than two thirds of the total turnover was generated in trade and industry (77.8%). The share of capital goods in last year increased mostly as a result of the newly opened enterprises in the Technological Industrial Development Zones.<sup>8</sup>

### 13.1.6 The Relationship with China under the “17 + 1”

The relations between the Republic of North Macedonia and the People’s Republic of China are developing in the spirit of friendship, mutual understanding and respect

<sup>8</sup>Agency for Foreign Investment (2019).

for the sovereignty, territorial integrity, and equality of these two countries. Republic of North Macedonia and PR China have well developed bilateral economic and cultural relations. At present, these relations are on the highest possible level. The good bilateral contractual situation is a precondition for establishing and widening of the overall bilateral cooperation.

The development of the relationship between China and CEE countries is in accordance with the principles of China's foreign policy, and China treats each country equally in Europe, nevertheless the size of the country. "17 + 1" Cooperation shows that China develops relations with West European countries, but also has the interests to develop relations with CEE countries as well. Actually "17 + 1" Cooperation is a beneficial complement to the general China-EU relations. People in CEE countries are getting to know more about China, explore further opportunity with China, and stimulate the trade and investment with China.

Based on the previous successful cooperation between the Republic of North Macedonia and the PR China, as a country member in the "17 + 1" Cooperation, the North Macedonia, makes steps in the part of trade and investment promotion, development of infrastructure, scientific and technological cooperation, as well as cultural and educational cooperation. There is a need to underline the opening of the coordinative Centre for cultural cooperation between the countries of the "17 + 1" Process in Skopje in March 2018. In this context, the commitments to reaffirming the central role of culture in improving mutual understanding and cultural dialog as an important factor for further cooperation is the main role of the Centre for cultural cooperation of the "17 + 1" in Skopje, capital city of the North Macedonia. Furthermore, through the Centre are successfully completed fifth Symposium of Think Tanks of "17 + 1" Process, which was held in October 2018 in the Republic of North Macedonia and was organized by MANU (Macedonian Academy of Sciences and Arts) and the Ministry of Foreign Affairs. Next activity is the preparation of the upcoming meeting of ministers of culture at the "17 + 1" Process which will be held in the first half of 2019 in the Republic of North Macedonia.

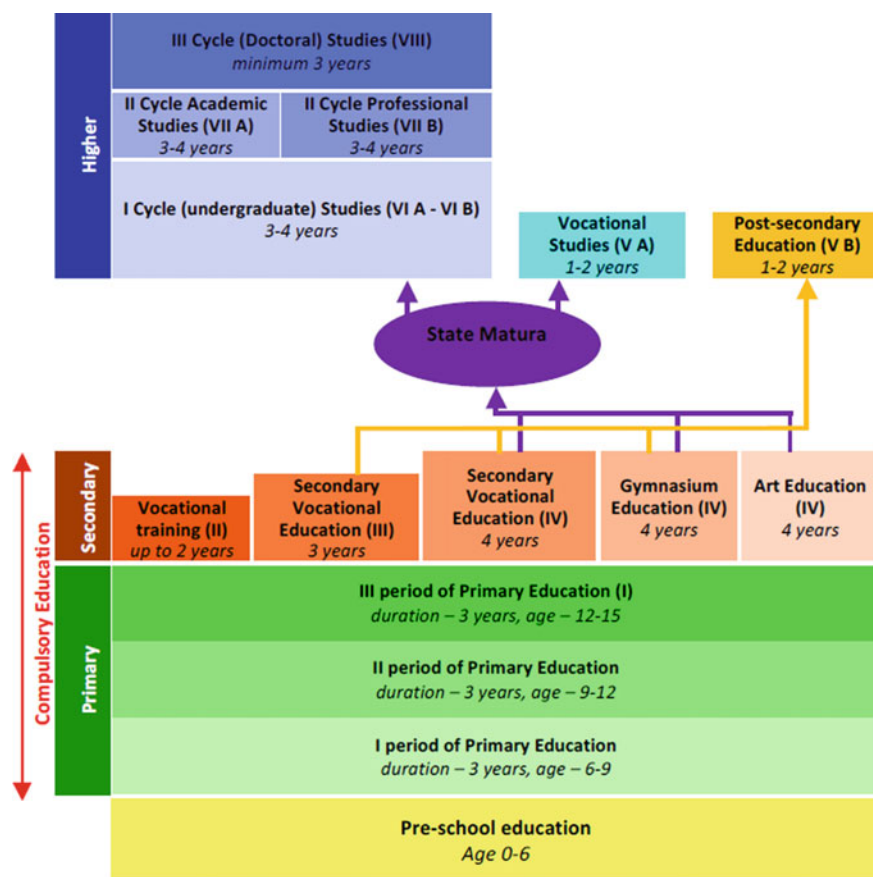
## **13.2 Overview of the Educational Development**

### ***13.2.1 Education System***

The education system of the North Macedonia comprises a mix of pre-school, primary (6–14 years), secondary (15–17/18 years), and higher education. Figure 13.7 represents the structure of the education system.

In 2017, there were 33,286 children up to 6 years old enrolled in 99 public and private pre-school institutions as kindergartens (State Statistical office 2018a). The number of children in kindergartens, centers for early childhood development in 2017 grew by 2.6% in comparison with 2016.





**Fig. 13.7** Structure of the educational system according to MQF (Ministry of Education and Sciences 2018)

Primary education lasts for nine years and is compulsory and free for all pupils (6–14 years old). There are 347 primary schools in the country (around 1100 including satellite schools) (Ministry of Education and Sciences 2018). In 2017, there were 192,448 pupils in primary schools (State Statistical office 2018a).

The secondary education is also compulsory and free, and is divided into four streams: general secondary education (gymnasium), secondary vocational education, art schools, and education for pupils with special educational needs. Secondary vocational education may be of 3- or 4-year duration. At the end of 3-year vocational education the students take a final exam, without a right for university entrance. Graduates of the 4-year secondary education are allowed to choose between the final exams and state Matura or school Matura depending on whether they wish to continue education. Among existing 124 secondary schools, 108 are public and 16 are private (Ministry of Education and Sciences, 2018).

**Table 13.3** Number of graduates (first, second, and third cycle) by scientific field

	2016	2017
Total	10,465	10,731
Natural sciences and mathematics	513	498
Technical-technological sciences	1572	1657
Medical sciences	962	900
Biotechnical sciences	368	373
Social sciences	5795	5971
Humanities	1255	1332

Higher Education is implemented at 3 levels: undergraduate, master, and doctoral studies. There are 6 functional public universities, 1 private–public university and 9 private universities, and 2 high vocational schools. In 2016/17, the 122 faculties within the universities had 61,488 enrolled students (first, second, and third cycle) and in 2017/2018, 60,010 enrolled students in the three cycles.

According to the data from the State Statistic Office,<sup>9</sup> graduated students (first, second, third cycle) in 2016/2017 were 10,465 and 10,731 graduates in 2017/2018. The total number of the graduated students (first, second, third cycle) in 2017 was 204% higher compared to 1992.<sup>10</sup> In 2017, 79.6% of the total numbers of graduates were students who had graduated from undergraduate studies (Table 13.3).

### 13.2.2 Educational Institutions

In the Ministry of Education and Science (MES), the Department of Primary and Secondary Education (4 units) and the Department of Higher Education (3 units) are responsible for the corresponding levels of education. The Department for European Union (3 units) is responsible for negotiation and integration into the community, coordination of projects and donors' support, as well as for the implementation, coordination, monitoring, and evaluation of the relevant IPA Components.<sup>11</sup> Due to the specification of vocational education and training and adult education system structure in the country, no individual unit is responsible for these sectors within the MES, coordination of this sector is a responsibility of the Unit for Secondary Education.

There are a number of public institutions responsible for different aspects of education. The Bureau for Development of Education (BDE) is a body of the state administration subordinated to the MES, assigned with performing expert tasks of significance to the development and promotion of education in the country.<sup>12</sup> Other

<sup>9</sup>State Statistical office (2018c).

<sup>10</sup>State Statistical Office (2018b).

<sup>11</sup>Ministry of the Education and Science of the Republic North Macedonia (2019).

<sup>12</sup>Ministry of Education and Sciences (2018).

bodies within MES and institutions connected to the education system are: Vocational Education and Training Centre, Centre for Adult Education, National Examinations Centre, State Education Inspectorate, and Pedagogical Service.

The main legal act for the sector is the Law on Higher Education. Version from 2008, it has provisions on harmonization of the country's higher education with the Bologna process and the European credit transfer system, as well as establishes legal base for status of the teaching staff and student's mobility. From May 2018, the new Law on Higher Education is in the power. A Law on Scientific Research regulates relations in the sphere of scientific research and international cooperation, with regard to transfer of knowledge, research, training, and application. In 2013, a Fund on Innovations and Technological Development (FITD)<sup>13</sup> responsible for coordination and strengthening of activities in the field of innovation was established according to the Law on Innovative Activities. In 2015, the Fund on Innovations and Technological Development started using the instruments for providing co-financing grants for: (1) the newly established start-up and spin-of trading associations, (2) commercialization of innovations, (3) transfer of technologies, and (4) establishment, operation, and investment in business technology accelerators.

Providing and assessing quality assurance in higher education, according to the Law on Higher Education, is a responsibility of the Board for Accreditation and Evaluation of Higher Education (BAEHE) established in 2011, which consists of 23 members. The Board is responsible for approval and recognition of higher education institutions and study programs, assessment of higher education provision quality, management, financing, academic, and other activities.

In different spheres of higher education are open questions,<sup>14</sup> such as: difficulties with issuance of the diploma supplement, lack of distance learning opportunities due to insufficient legal framework and low development of online learning platforms, actual non-existence of a tripartite cooperation between the state, academy, and businesses. The level of research funding remains unsatisfactory which results particularly in improper infrastructure of scientific research centers at the universities; access to global scientific data bases is limited and minor; there is no appropriate mechanism for commercialization of innovative solutions.

In 2014, the Republic of North Macedonia joined "Horizon 2020" with other four Western Balkans countries and became an associate member with equal participation in all segments of a seven-year EU program for research and innovation that allows for mobility of prominent scientists, strengthens national research systems, and assists countries to integrate.

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<sup>13</sup>Fund on Innovations and Technological Development of the Republic North Macedonia 2019.

<sup>14</sup>Ministry of Education and Sciences (2018).

### ***13.2.3 Teachers' Professional Development***

Upon conducting the policy and practice analysis of the teacher professional and career development in the Republic of North Macedonia, based on the recommendations from the analysis made by relevant institutions, the working groups consisted of representatives from the Ministry of Education and Science, the Bureau for Development of Education, the Vocational Education and Training Centre, the State Education Inspectorate, the National Examination Centre, the Syndicate for Education, Science and Culture, representatives from the teacher training faculties and faculties that educate student support staff and practitioners from schools, with the support from USAID, in cooperation with the foundation for educational and cultural initiatives step by step, developed the following documents for professional and career development of education staff in schools:

- Teacher core professional competences and standards
- Student support staff core professional competences and standards
- Professional competences for primary and secondary school directors
- Manual on performance monitoring and professional development planning for teachers and student support staff in primary and secondary schools
- Guideline on the manner and form of providing mentoring support to novice teachers and novice student support staff in primary and secondary schools

## **13.3 New Progress of ICT in Education**

As part of the education process “computerization and digitization of education” has been intensively developed in the period after 2002, when the first donation from China was received and enabled a certain degree of mass use of ICT at primary and secondary schools in 2005, the relevant institutions and expert working groups were established and started the implementation of the National Program on Education Development the Draft Program on ICT Development in Education (2005–2015),<sup>15</sup> the National Policy on Information Society and the National Strategy on Information Society Development (2005–2015),<sup>16</sup> and lastly National Strategy for ICT from 2015,<sup>17</sup> which encompass the process of computerization and digitization of education in Republic of North Macedonia.

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<sup>15</sup>National Strategy for Information Society Development of Republic of Macedonia: Action Plan (2005–2015).

<sup>16</sup>National Policy on Information Society and the National Strategy on Information Society Development (2005–2015).

<sup>17</sup>National Strategy for ICT (2015–2018).

### **13.3.1 Infrastructure**

#### **13.3.1.1 Campus Network Access**

As mentioned in the introduction, Republic of North Macedonia is a developing SEE country recognized with strong commitment to ICT as a driver of national growth. The measurement of the degree for development of the Information Society, through monitoring core indicators as a continuous process, in North Macedonia is done by the State Statistical Office, which, since 2005, has been conducting the yearly statistical surveys by type of ICT users. The core indicators of measuring and monitoring are: equipment with certain ICT (e.g. computers, access, and type of the Internet connection), level and purpose of ICT usage, digital literacy, benefits and obstacles while using ICT by different type of enterprises, households, individuals, and the public sector.

According to the data of SSO, in the first quarter of 2018, levels of key ICT indicators in the country are: (1) Households with internet access at home are 79.3% and the participation of households with fixed broadband connection in the total number of households is 70.4% in 2018; (2) 79.2% of the total population aged 15–74 use the Internet, and 68.7% use the Internet every day where a mobile phone or a smart phone is the most used device for access to the Internet, by 81% of Internet users and mostly among persons aged 15–24 (91.8%). 74.9% of the people used computers, laptops, smartphones, tablets, or other portable devices at work.

According to Gavrilovska Lj and Atanasovski V,<sup>18</sup> North Macedonia boasts an impressive broadband penetration rate on a national level with 100% company Internet connectivity. The latest figures from Economic Development Program developed by the Ministry of Finance (MOF) of the country, have shown that access to fast NGA network coverage for 78% households and access to ultra-fast NGA network coverage is 43.8%.<sup>19</sup> Moreover, the Internet access in schools and WiFi-based public Internet access is already rolled out with very high percentage of national coverage including remote areas. Macedonian schools offer one web-enabled computer for every 1.2 children. University students and academics can freely access to knowledge and research resources via the academic network—MARNET (Macedonian Academic Research Network).

About UKIM,<sup>20</sup> there were several projects to build up the campus networking infrastructure. The first project dated prior to 2000, when the University network was built as part of MARNET. There are 4 campuses in the capital town of Skopje and they were connected by optical lines and the institutions located on various distributed sites with high-speed wireless networks. The major improvements were done with GEANT European gigabit network-related projects in recent years. Eduroam was established 15 years ago and is functioning as an interoperable infrastructure that allows the students and professors access to Internet wherever they are.

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<sup>18</sup>Gavrilovska and Atanasovski (2013).

<sup>19</sup>Ministry of Finance of Republic of Macedonia (2019–2021).

<sup>20</sup>Ss. Cyril and Methodius University (2019).

Primary and secondary schools were included in computer networks more than ten years ago, by providing computing and networking infrastructures at each elementary and secondary school.

There is no computer literacy problem in North Macedonia. Most of population uses computers and smartphone operating systems without any problems. Probably a small percentage of older population over 65 is not using the relevant technology.

### **13.3.1.2 Computer–Student Ratio**

Installation of 100,000 computers at all primary and secondary schools throughout the country was made in a period of 6 years, around 2008–2014, in frame of the project of the Government of the Republic of North Macedonia “Computer for Every Child,” implemented in coordination with the Ministry of Information Society (MIS) and Ministry of Education and Science (MES). At the universities, there are computer labs; at the biggest University Ss. Cyril and Methodius more than 3000 computers were installed. This is not relevant issue anymore, since most of the students use their own laptops.

## **13.3.2 Educational Resources**

Having in mind that for more than a decade different projects were focusing on preparation of digital teaching/learning materials for Macedonian schools, there are several investigations made in order to see how the digital materials have changed the educational process and the approach of teachers (Atanasova-Jankulovska and Mitevski 2016; Pop-Angelova and Zdravev 2013).

### **13.3.2.1 Digital Educational Resources**

Related to digital educational resources (DER), case of UKIM is that they started publishing textbooks in electronic version in the last 10 years. Also, a large number of DER cases at different faculty/university in the country have been implemented with digital contents distributed directly through professor-student line. At other educational levels, the most essential content for all elementary and secondary schools can be found online. During few years, testing has been realized electronically at the end of each semester in schools, realized by officials from the MOE. From 2010 there was a big initiative to translate the most university books in Macedonian language and more than 1000 books are available in this form.

The research (Vitanova et al. 2016) is done in order to ensure valid and reliable assessment of the extent and nature of ICT knowledge and skills of teachers in primary schools in R.N. Macedonia, as well as to identify the factors of teachers’ views affecting the development of ICT competences, conducted in primary schools in the

Republic of North Macedonia. Research has found that the basic ICT applications which are used by 94% of the teachers are online and text editor. The application navigation in operating system was used by 90%, email by 89%, and multimedia presentations by 81%. Then, spreadsheets was used by 79%, and blogs was used by only 10% of the respondents. The lowest percentage of respondents—4% are using databases for the purposes of teaching.

### 13.3.2.2 Open Educational Resources

In the case of the education system in the Republic of North Macedonia, open education resources (OER) are public resources for teaching, learning, and research, available under copyright licenses that enable free use by other persons. OER project usually starts “from zero” and the relevant projects are implemented by the teaching staff and in some cases students have initiated and enhanced OER projects.<sup>21</sup> Most OER projects are prone to the use of copyright licenses Creative Commons<sup>22</sup> or GNU Freed Documentation.<sup>23</sup> At different faculty/university, there are developed and used OER through Moodle Platform, Microsoft Office 365 Platform, or other in-house developed e-learning platforms.

In the country, the legislative framework that regulates open educational resources (OER) was developed according to national legislative (law on primary education, law on secondary education, law on higher education, law on adult education, law on e-Governance, law on free access to public information, “Concept on Nine-Year Primary Education,” national strategies on developing education and e-contents, as well as other laws and regulations that regulate education and information society development). Numbers of different educational and scientific online archives are developed as results of projects implemented by state institutions and by other local, private, foreign, and international entities that work in the field of education, science, international cooperation, and ICT. OER gains importance given that North Macedonia is a developing country and requires higher rate of utilization of open resources and free educational tools and contents. From the aspect of different developed OER, it includes: (1) educational contents: curricula, courses, teaching digital contents, manuals, workbooks, teaching plans, modules, tests, video materials, (2) educational digital databases, (3) education tools: these include software to support the development, use, preparation of educational contents, as well as tools aimed to generate contents and create online communities in the field of education; (4) copyrights: creation of copyright licenses that would promote open publication of educational materials, and (5) open and free courses and training.

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<sup>21</sup>E-Macedonia Publication (2012), Gusev et al. (2016).

<sup>22</sup>Creative Commons Global Summit (2019).

<sup>23</sup>GNU Free Documentation License (2019).

### 13.3.3 *Learning and Teaching*

The usage of ICT in education gives possibilities of introducing new technologies in classes that are widening and changing every day. One important finding that reappears is that transition from traditional teaching and learning into electronic will succeed with continuing implementation of appropriate methods and techniques (according to World Economy Forum<sup>24</sup>). This is also supported by an OECD finding (Hermans and Tondeur 2016) that crucial improvements were not visible in the countries that have made huge investments in ICT in schools, but first recommendation internationally is that together with introducing new technologies in schools, changes in approaches and practices should be introduced. Another recommendation emerging from several researches is that teachers should be adequately prepared with continuously built capacities in order to establish and maintain the quality results from implementation of ICT in schools, reasons of large number of training organized for teachers from primary and secondary schools in the country. Also, teachers should lead not only the implementation, but also the creation of digital educational materials in schools. This recommendation is on the level of demand in the country, not achieved yet.

Introducing and using ICT to support teaching and learning is time consuming for teachers, both as they attempt to shift pedagogical practices and strategies and when such strategies are used regularly. Successful teacher professional development models can be divided into three phases: (1) Pre-service, focusing initial preparation on pedagogy skills and use of various teaching tools (including ICT); (2) In-service, including structured, face-to-face, and distance learning opportunities, building upon pre-service training and directly relevant to teacher needs; and (3) On-going formal and informal pedagogical and technical support enabled for teachers by ICTs.

According to OECD—Students, Computers, and Learning: Making the Connection, they have identified three main stages for ICT to be highly valued and regarded by the teachers: integration, enhancement, and complementary. Those three main stages are recognized from MES and MIS in the country, and followed through design of teachers' trainings. Integration approach is about implementing right use of ICT in particular subject area with review of curriculum and related ICT resources and appropriate software skills in order to improve students' achievement. Enhancement approach is about using ICT to give great emphasis on the topic introduced. Complementary approach is when the ICT is used to aid and support the students' learning. This approach allows students to be more organized and efficient in which they can obtain the notes from computer, submit their works by email from home as long as they meet the deadline, and look for information from various sources provided online to fulfill the task given to them (Hermans and Tondeur 2016; Hussain and Morgan 2015).

The integration of ICT in classroom at all education levels is getting more important as it helps student in enhancing their collaborative learning skills as well as developing transversal skills that stimulate social skills, problem solving, self-reliance,

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<sup>24</sup>World Economic Forum (2015).



responsibility, and the capacity for reflection and initiative. All these elements are core values that students need to achieve in an active teaching and learning environment (Ghani et al. 2014).

### **13.3.3.1 Information Technology-Assisted Teaching**

University provides sufficient technology-assisted learning, especially at engineering areas, where simulation and other learning tools are used in realization of programs. Also, faculties (mainly in technical fields) have academic licenses for using of different software programs relevant to their study programs and courses.

The Republic of North Macedonia has invested a lot of installed hardware and software for education and teacher training. That installment offers environment where IT tools directly assist teaching process. The research (Atanasova-Jankulovska and Mitevski 2016) was aiming to determine the situation in country of usage of databases of digital educational materials (DEM) and to define recommendation for future improvements. DEM, as an organized collection of digital educational materials, its main aim is to provide materials that can facilitate the educational process by using the ICT technologies. Using DEMs in education will provide more information about the progress of students, and will also provide teachers with an opportunity to design own subset of materials that is suitable for them and their students. According to the research, it has found that teachers understand the importance of the professional development and are doing their best to use all available resources, especially with the help of technology, to improve own development. This teachers' attitude towards professional development is important because it also has found that teachers need training on understanding, using, preparing, and updating DEMs. The findings can be generalized for country that continuous capacity building is important for every institution; only part of the interviewed teachers had experience with databases of educational materials; teachers should be adequately prepared to develop, use, and update DEMs; usage of materials in national language is preferred; established practices and attitudes in schools should be targeted and revised in order to have efficient usage of DEMs.

### **13.3.3.2 Courses about Information Technology**

Each faculty offers at least one IT oriented course with content of using Internet and document editing programs. Engineering-oriented faculties offer more courses, including those use simulation tools. Almost all higher education institutions and universities in the country offer an ICT curriculum. The most versatile programs along with dedicated ICT are being offered in the largest and oldest university in the country, Ss. Cyril and Methodius University in Skopje (UKIM). Faculty of Computer Science and Engineering at UKIM realizes plenty of courses with computers, and even mathematical disciplines are offered with IT support. The situation is similar

at other faculties of computer engineering that work in frame of the other public and private universities in the country.

Secondary schools integrate several programming and web design courses besides the essential document editing and Internet use courses.

Primary schools offer one informatics course as an elective course in last year. In the country, it is initiative to adopt that as obligatory course in the programs of one of the last years.

### ***13.3.4 ICT Integration into Practices***

During the previous decade in schools in the Republic of North Macedonia, a lot of hardware has been installed, and teachers have received a lot of capacity building training: computers in schools are installed and connected on the Internet; numerous software applications have been translated and adopted for North Macedonian education; each teacher has received a laptop to facilitate own preparation for work and implementation of teaching activities (Vitanova et al. 2016). In R.N. Macedonia the government has implemented the integration of ICT in learning and teaching process. In addition, it is recognized that teachers' readiness and skills in using ICT are playing essential role in the use of ICT in education. Teachers need sufficient ICT skills to implement the technology and are required to have high confidence level to use it in a classroom setting. For that reason, large numbers of ICT training for teachers are realized. Here is the list of actions in the field of ICT education in North Macedonia<sup>25</sup>:

- Subject "Informatics" became obligatory in primary schools by 2007/2008 school year;
- "Computer for every child" primary education project in Macedonia, initiated by Government and supported by USAID;
- "Technology integration program" with integration of every classroom in primary and secondary education with use of client-server based technology;
- "Macedonia country of computer experts" with opportunity of training for basic computer skills of all citizens;
- "Free internet for all citizens" provided free dial up connections.

#### **13.3.4.1 The Ability for Faculty to Use ICT to Teach**

A lot of educated and specialized personnel have been employed at universities to teach relevant courses. Almost all faculties as university's members are computer centers that coordinate the computer labs and ICT infrastructure. This situation is for all public universities in the country and almost all private universities according

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<sup>25</sup>E-Macedonia Publication (2012), Learning Series in Macedonia's Initiative Computer foEvery Child (2014).

to the rules for accreditation. The public universities have information systems for workflow data management with web based electronic platforms, for organizing and managing all students' data, such as iKnow e-platform of UKIM<sup>26</sup> and other more at other universities. Few universities mainly public have electronic bases of the published resources, up to authority of the teaching and scientific staff, mainly called repositories, such repository of the "Ss. Cyril and Methodius" University in Skopje<sup>27</sup> and repository of the "Goce Delcev" University in Stip.<sup>28</sup>

#### **13.3.4.2 The Ability for Students to Use ICT to Solve Problems**

The abilities of students to use ICT tools to solve problems at all education level in the country are on very good level. Students are using IT technology a lot in their education, especially in browsing and finding more learning resources on Internet. Due to the very successful projects to build a digital infrastructure at elementary schools, the students are well educated and enjoy the fruits of the new technology.

### **13.4 Policy and Strategy of ICT**

#### ***13.4.1 Policies related Educational Informationalization***

Several projects were realized to support use of IT in education, mainly in the period of establishing the Ministry of Information Society and by support of Ministry of Education and Science. The digital initiative was realized early enough to enable a good infrastructure and decrease the computer literacy. The essential educational material was also offered to students as part of their education.

Electronic testing was introduced at elementary and secondary schools to evaluate their knowledge at national level by the Ministry of Education and Science.

All relevant strategies and action plans for education informationalization, as policies frameworks, including the latest one covering the period of 2018–2025 proposes intensive use of IT in education. According to the last National Strategy for ICT,<sup>29</sup> there are projected follow measures for realization of the strategic goal No. 7—Improving formal and informal ICT education, including lifelong learning:

1. Practical training in ICT studies—Finding an instrument for better practical training in ICT studies that will be better in quality. This can be done by establishing direct cooperation between universities and chambers of commerce.

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<sup>26</sup>I-Know Platform of the "Ss. Cyril and Methodius" University in Skopje, <https://is.iknow.ukim.mk>.

<sup>27</sup>Repository of the "Goce Delcev" University in Stip, <https://eprints.ugd.edu.mk/>.

<sup>28</sup>Repository of the "Ss. Cyril and Methodius" University in Skopje, <https://repository.ukim.mk/>.

<sup>29</sup>National Strategy for ICT (2015–2018).

2. Specialized secondary education in the field of ICT—It is necessary to establish a basis for the introduction of specialized secondary education in the field of ICT, through amendments to the law on secondary education. Advanced IT Skills Trainings—continuous implementation of the project “Trainings for advanced ICT skills” in order to increase the number of certificated persons through training for retraining to meet the needs of labor market.
3. Establishment of certification centers in formal education—Higher education institutions will open training centers as an instrument to provide certificates from international vendors (Microsoft, Cisco, Oracle, Adobe, Autodesk, etc.). This activity will also include adaptation of study programs to the faculties, where possible. Competitive advantage of faculties is reflected in well-trained human resources, to provide trainers for offering trainings to students and also to companies.
4. Establishment of alumni networks at the IT faculties—This measure envisages the establishment of alumni database and constant communication with students. The goal of the alumni network will be to inform graduates for additional training, and will also provide information on the achievements of graduates in various fields of their work (as an opportunity for additional training for new students).
5. Enrichment of curricula in elementary schools with ICT subjects—The measure focuses on improving the curriculum in elementary schools dedicated to ICT, following the positive experiences from the education system, from other countries. ICT subjects should be introduced, such as Fundamentals in programming, but mainly through using visual tools.

### ***13.4.2 ICT Financing Resource***

The Government supports all strategies and specified projects with the adopted action plans for sufficient funds. The projects funded mainly by programs of the European Commission have been realized with institutions from different level of education in the country. But the development of the digital society needs more financial resources in order to achieve, on one hand, infrastructure with broadband and digital connectivity and on the other hand, skilled ICT workforce.

Broadband infrastructure and services are fundamental components of today’s digital economy and society. A fast and secure digital connection of high quality is a prerequisite for a modern economy and society. The requirements for high-speed networks are fast evolving and are necessary to absorb increasing data usage of future applications in tomorrow’s digital society—e-government, e-health, e-procurement but also business-related and day-to-day household applications. The European Commission adopted a strategy on Connectivity for a European Gigabit Society (EGS)<sup>30</sup> on 14 September 2016. According to World Bank (World Bank ICT 2019), the Western Balkans region has significantly lower broadband penetration rates and the EC recommendations (European Commission 2018) are that Western

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<sup>30</sup>European Commission (2016).

Balkan governments are responsible for identifying suitable digital (broadband) infrastructure projects in order to be in step with EGS.

Developing digital society depends on availability of skilled ICT workforce for service providers, as well as service users. Analysis of the ICT staff across all public institutions in North Macedonia is currently being conducted, focusing on the retention of ICT workforce and ICT skills demand. Activities are planned to inform and educate the citizens for the use of e-Services (National Portal for e-Services) and public awareness raising activities in the field of cyber security (National Cyber Security Strategy). For example, under the EU code week initiative, students and lecturers are stimulated to engage with programming and innovation activities, as an extra-curricular activity. A significant number of projects within the umbrella of EU code week will continue as long-term projects. Also another example, all 10–14-year old students in the public school system will be engaged within the “21st century schools programme in Western Balkans,” for building their digital skills and employment prospects. The program will allow them to learn in a fun and innovative way by having access to free micro-bit pocket-sized, code-able computers in ICT classes and other subjects, helping them build their skills and confidence in computer literacy and coding.

## References

- Agency for Foreign Investment. (2019). <http://www.investinmacedonia.com/>. Accessed March 6, 2019.
- Atanasova-Jankulovska, M., & Mitevski, P. (2016). On the usage of databases of educational materials in Macedonian education. *International Journal on Integrating Technology in Education (IJITE)*, 5(4), 13–22.
- Creative Commons Global Summit. (2019). *Creative Commons*. <http://creativecommons.org/>. Accessed 24 Apr 2019.
- Democracy Index. (2016). *The economist intelligence unit*. <https://www.eiu.com>. Accessed March 1, 2019.
- E-Macedonia Publication. (2012). Ministry of Information Services and Administration.
- European Commission. (2016). *Connectivity for a Competitive Digital Single Market—Towards a European Gigabit Society*, SWD 2016.300 final. <https://ec.europa.eu/digital-single-market/en/news/communication-connectivity-competitive-digital-single-market-towards-european-gigabit-society>. Accessed March 25, 2019.
- European Commission. (2018). *Measures in Support of a Digital Agenda for the Western Balkans*, SWD 2018.360 final. [https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/swd\\_measures\\_in\\_support\\_of\\_a\\_digital\\_agenda\\_for\\_the\\_western\\_balkans.pdf](https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/swd_measures_in_support_of_a_digital_agenda_for_the_western_balkans.pdf). Accessed March 25, 2019.
- Fund on Innovations and Technological Development of the Republic North Macedonia. (2019). <http://www.fitr.gov.mk>. Accessed March 11, 2019.
- Gavrilovska, L., Atanasovski, V. (2013). ICT standards in South Eastern Europe (SEE) education: Macedonian Case. *Journal of ICT Standardization*, 1, 1–18.
- Ghani, M. F. A., Ran, N. Y., & Tengyue, Z. (2014). ICT integration in education: Incorporation for teaching & learning improvement. *Journal of Educational Technology (MOJET)*, 2(2), 24–46.
- GNU Free Documentation License. (2019). *GUN operating system*. <http://www.gnu.org/licenses/fdl.html>. Accessed April 24, 2019.

- Gross Domestic Product. (2017). *State Statistic Office* (p. 58). ISBN 978-608-227-311-2.
- Gusev, M., Ristov, S., & Armenski, G. (2016). Technologies for Interactive learning and assessment content development. *International Journal of Distance Education Technologies (IJDET)*, 14(1), 22–43.
- Hermans, R., & Tondeur, J. (2016). The impact of primary school teachers' educational beliefs on the classroom use of computers. *Computers & Education*, 51(4), 1499–1509.
- Hussain, A. J., & Morgan, S. (2015). How does ICT affect teachings and learning within school education. *Developments in E-systems Engineering (DeSE)*, 32(4), 250–254.
- I-Know Platform of the “Ss. Cyril and Methodius”. University in Skopje, <https://is.iknow.ukim.mk>.
- Learning Series in Macedonia's Initiative Computer for Every Child. (2014). *Intel success story*. Ss. Cyril and Methodius University. (2019). <http://www.ukim.edu.mk/en>.
- Ministry of Education and Sciences. (2018). *Strategy for Education*. <http://www.mon.gov.mk>. Accessed March 10, 2019.
- Ministry of the Education and Science of the Republic North Macedonia. <http://www.mon.gov.mk>. Accessed 10 Mar 2019.
- Monthly Statistical Bulletin, No.1.2.19.01. (2019). *State Statistical office*. ISBN: 1857-7504, p. 72.
- National Policy on Information Society and the National Strategy on Information Society Development. (2005–2015). Government of Republic of Macedonia. [http://www.mio.gov.mk/sites/default/files/pbl\\_files/documents/strategies/Strategija\\_i\\_Akcionen\\_Plan.pdf](http://www.mio.gov.mk/sites/default/files/pbl_files/documents/strategies/Strategija_i_Akcionen_Plan.pdf). Accessed March 11, 2019.
- National Strategy for Development of Culture in Republic of North Macedonia. (2018–2022). [https://drive.google.com/file/d/1gfzA76RBOTS1\\_A00fNn62n352E3nr8kB/view](https://drive.google.com/file/d/1gfzA76RBOTS1_A00fNn62n352E3nr8kB/view). Accessed April 24, 2019.
- National Strategy for ICT. (2015–2018). Government of Republic of Macedonia. (2019). [http://www.mio.gov.mk/sites/default/files/pbl\\_files/documents/strategies/Kratkorocna%20IKT%20Strategija\\_avgust2015.pdf](http://www.mio.gov.mk/sites/default/files/pbl_files/documents/strategies/Kratkorocna%20IKT%20Strategija_avgust2015.pdf). Accessed March 11, 2019.
- National Strategy for Information Society Development of Republic of Macedonia: Action Plan. (2005–2015). Government of Republic of Macedonia. [http://www.merc.org.mk/Files/Write/Documents/03488/mk/Decentralizacija\\_MON\\_Nacionalna-strategija-za-obrazovanieto-2005-2015.pdf](http://www.merc.org.mk/Files/Write/Documents/03488/mk/Decentralizacija_MON_Nacionalna-strategija-za-obrazovanieto-2005-2015.pdf). Accessed March 11, 2019.
- OECD. (2015). *Students, computers and learning: making the connection*. PISA OECD Publishing. <http://dx.doi.org/10.1787/9789264239555-en>. Accessed 22 Mar 2019.
- Pop-Angelova, N., Zdravev, Z. (2013). Implementation of ICT in teaching process: case analysis. In: Davcev (Ed.), *Proceedings of the 2nd Conference of ICT and Innovation*, Ohrid, Macedonia. Republic of Macedonia Constitution. (2019). <https://www.wipo.int/edocs/lexdocs/laws/en/mk/mk014en.pdf>. Accessed March 1, 2019.
- Repository of the “Goce Delcev” University in Stip. <https://eprints.ugd.edu.mk/>.
- Repository of the “Ss. Cyril and Methodius”. University in Skopje, <https://repository.ukim.mk/>.
- State Statistic Office and MakStat. (2018). Statistical Review: Industry. (p. 63). ISBN: 1857-5234.
- State Statistical Office. (2018a). *Statistical Yearbook*. ISSN: 187-6761, p. 687. [http://www.stat.gov.mk/PrikaziPublikacija\\_1\\_en.aspx?rbr=735](http://www.stat.gov.mk/PrikaziPublikacija_1_en.aspx?rbr=735). Accessed March 2, 2019.
- State Statistical Office. (2018b). *Macedonia in Figures* (p. 80). ISSN: 187–6761.
- State Statistical office. (2018c). *Mac Stat Selections*. ISSN: 978-608-227-313-6, p. 68. [http://www.stat.gov.mk/PrikaziPublikacija\\_1\\_en.aspx?rbr=751](http://www.stat.gov.mk/PrikaziPublikacija_1_en.aspx?rbr=751). Accessed March 5, 2019.
- State Statistical Office of Republic of North Macedonia. (2018). *Usage of Information and Communication Technologies in Households and by Individuals*. <http://www.stat.gov.mk/pdf/2018/8.1.18.29.pdf>. Accessed March 15, 2019.
- State Statistical office and UN. (2017). *Unit Value Indices for the Exported and Imported Goods in the Republic of Macedonia* (p. 49). ISBN: 978-608-227-211-5. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/>. Accessed March 6, 2019.
- Structural Reforms, Ministry of Finance of Republic of Macedonia. (2019–2021). *Economic Reform Program, Draft Chapter*. Access: <https://finance.gov.mk/files/Draft%20ERP%202019%20EN.pdf>.

- Vitanova, V., Atanasova-Pachemska, T., et al. (2016). Factors affecting the development of ICT competencies of teachers in primary schools. *Procedia—Social and Behavioural Sciences*, 191, 1087–1094.
- World Bank. (2018). *World development Indicators*. <http://databank.worldbank.org/data/reports.aspx?source=2&country=MKD&series=&period>. Accessed March 2, 2019.
- World Bank ICT Development. (2019). <https://data.worldbank.org/indicator/IT.NET.BBND.P2>. Accessed March 25, 2019.
- World Economic Forum. (2015). Does technology in schools improve education? <https://agenda.weforum.org/2015/09/does-technology-in-schools-improve-education/>. Accessed March 22, 2019.