

*Review*  
(accepted December 14, 2014)

# BASIC DIRECTIONS OF TECHNOLOGY DEVELOPMENT IN TERM OF GLOBALIZATION: REVIEW OF MACEDONIA

Marija Merdzhanovska<sup>1</sup>

## Abstract

There are many types of econometric models used in predicting the inflation rate, but in this study we used a the paper explores the possibilities of technology development in terms of globalization. In the beginning the characteristics of globalization are analyzed. These questions are looking for answers which are the basic directions for technology development which influence the choice of business strategy. The basic technology paradigms in terms of globalization, which dictate the technology development, are analyzed there: knowledge, innovations, renewable resources of energy and information and telecommunication technology. All these categories are presented through the case of the Republic of Macedonia. The goal of the paper is to show that with bigger education, innovations, renewable energy and information technology, Republic Macedonia can survive at the global world market.

**Keywords:** Globalization, technology development, technology paradigms, competition, Republic of Macedonia.

*Jel Classification:* O3

## INTRODUCTION

If we had to choose just one term which symbolizes the spirit of today's time, it certainly would be the term "globalization". Globalization is a process that in today's world gradually abolishes restrictions on the flow of material goods, services, people and ideas between different countries and parts of the world. Companies are becoming global, act at global market and need to survive in conditions of global competition.

The term "globalization" is widely used to describe the growing internationalization of production, growth factors, the financial market and the market of goods and services.

The most characteristic features of globalization are (OECD 2005, 16–18):

---

<sup>1</sup> **Marija Merdzhanovska**, PhD, Ss. Cyril and Methodius University, Faculty of Economics in Skopje, Macedonia.

- Reducing trade restrictions. In fact, there are no boundaries to act, businesses are global and operate in the global market;
- External direct investment become a major factor in the process of industrial restructuring and the development of global industries;
- Major role in the economic internationalization have transnational firms. They have the largest share in cross-border trade;
- The international spread of technology comes to simultaneous shortening of the production cycle of technological innovation;
- Matching global competition in the markets between numerous new competitors from around the world;
- Reduce time and distance in international transactions and reduce transaction costs;
- Matching larger number of regional free deals.

Major technological paradigms in the time of globalization are knowledge, innovation and renewable energy. Also, new information technologies as a foundation of development are reviewed.

In such conditions of action acting, every economic sector "suffers" major changes. In the process of adaptation to the global economy, the economic sector is increasingly focusing on the use of intangible non-material factors of growth. This orientation implies priority of renewable resources in the areas of their production, distribution and use.

## **1. THE BASIC TECHNOLOGY PARADYGMS IN TERM OF GLOBALISATION**

In the past the competition was reached achieved primarily by the price factor. In today's conditions of globalization lasting competitiveness can be ensured only with knowledge, innovation and renewable energy sources. Technological, social and economic changes dictate the development of society. For solving technological problems defined models or types of forms are used, which are called technological paradigms (Popovska 2002, 63–65). Any level of scientific and technological progress is characterized by determined technological paradigms. Below we will focus on the basic technological paradigms: knowledge, innovation and renewable energy.

### **1.1. Knowledge**

In the conditions of globalization, the importance of knowledge grows. Countries that have more knowledge are more successful in the global market and can survive longer in the global competition. The need for interdisciplinary knowledge from several areas, knowledge of foreign languages and computers grows. Also, knowledge is not given once and for all, but it needs to be renewed and upgraded.

Goel, Koryukin, Bhatia and Agarwal state that knowledge is a fundamental resource in the competitive society (2004, 7). In the early years of the 21st century, the developed economies are based on the results of the development of microelectronics, biotechnology, new materials, scientific industry, telecommunications, computers, numerically controlled tools and robots. Drucker believes that this is a time of transformation when learning and knowledge management receive greater importance

in increasing values (1997).

Modern economies are based directly on the production, distribution and use of knowledge and information. It reflects the trend of investing in high-technologies, high-tech industries and increasing the number of employees with high job skills and higher educational level. The number of employees with higher education level grows. Science explores ways of incorporating more direct knowledge and technology in their theories and models. "The new theory of development" reflects an attempt to understand the role of knowledge and technology in achieving growth and development. From that perspective, the key are investments in research and development, education, learning and the new management structure (Barrell, Mason, and O'Mahony 2000, 33).

Leading world economies are dependent on the production, distribution and use of knowledge more than ever before. They are innovative societies that are based on the conversion of knowledge into new products, processes, systems management, organization and more. Less developed countries should also recognize the importance of knowledge and innovation (OECD 1996, 9–34). To facilitate the economic analysis, a distinction is drawn between different knowledge types that are important in the knowledge economy (Jensen, Johnson, and Lorenz 2007, 682–690): know- what, know- why, know- how and know- who. Know-what - a knowledge which refers to facts. Data on law and medicine belong to this category. Know-why — refers to scientific knowledge of the principles and laws of nature. The creation and reproduction of this knowledge is typically organized in specialized organizations like universities and research laboratories. Know-how -refers to the ability or capacity to do something. Know-who - includes information about who you know and who knows how to do it. It also includes information on special social relationships which permit certain knowledge of experts to be used effectively. According to Houghton and Sheehan (2000, 9–11) knowledge is related to economy, education, knowledge networks, employment and government policies.

**Table 1.** The review of the education of the working population in Republic of Macedonia for period from 2009 to 2013<sup>2</sup>

Year	Total number of working population	Population with high degree	% from total with High education	with Master degree	% from total with Master degree	with Doctor degree	% from total with Doctor degree
2009	919 026	124 425	13,5	412	0,04	119	0,012
2010	925 613	141 779	15,3	479	0,052	157	0,017
2011	936 256	158 618	16,9	1 097	0,12	197	0,021
2012	941 019	173 243	18,4	1 468	0,15	145	0,015
2013	953 780	172 099	18,5	1 558	0,16	219	0,023

The Republic of Macedonia has defined a strategy for knowledge-based society. The following will give an overview of the educational process in the country. The Macedonian Government has defined a strategy for learning in line with global trends for increasing knowledge. A large percentage of young people with university education are able to write and speak in English and also have a solid knowledge of a second foreign language, which is represented by the 6th grade of primary school. The Ministry of Education conducts its Program for development and promotion of formal education

<sup>2</sup> Source: State Statistics Bureau 2013, T20

through multiple projects.<sup>3</sup> From the Table 1, the review of the educational structure of the working population in Macedonia for period from 2009 to 2013, (The Report of State Statistics Bureau of Republic of Macedonia 2013), it can be seen and concluded that the Republic of Macedonia has a high percentage of highly educated staff with a tendency to increase. In fact, about 24 percent of the working population in Macedonia is with higher education, as well as completed post graduate and doctoral degree.

Macedonia has several higher education institutions offering education to young people. But problems arise when intellectuals who speak two or more foreign languages should be included in the processes at work. Although gaining a solid education, they hardly come to employment. They often accept work that does not require the knowledge behind their diploma. Often we do not expect the new employee to provide critical thinking on current activities.

Large is the percentage of outflow of highly educated workforce from Macedonia. The Ministry of Education and Science is working on formulating a strategy to prevent the outflow of highly educated personnel. The biggest loss for one country is when its own youth, after completing university education leaves the country. It is a challenge also faced by other countries in development. Many of the young people have studied at state universities, which means that the state invested in their education.

Worldwide, according to the indicators of the quality of educational system, the Republic of Macedonia is on 70<sup>th</sup> place from 148 countries in the world for the period 2013–2014 in global competitiveness (World Economic Forum 2013–2014, 261). It is well ranked for quality education in the field of mathematics and natural sciences, the 51<sup>th</sup> place. This ratio ranges from 1 to 7. For the quality of science in management, the Republic of Macedonia ranks on the 99<sup>th</sup> position.

## 1.2. Innovations

In terms of globalization, technological innovations are an important factor that dictates the development of a country. Innovations allow greater competitiveness of the countries. From a theoretical perspective, a contribution to the innovation theory gave the American economist Joseph Schumpeter in 1912 in recognition of the importance of innovation and entrepreneurship in economic activities in the companies. In recent decades the understanding of innovation is deepened and expanded.

The competitive environment and the innovativeness of the organization affect innovations. Competitive environment includes the consumer, the product and technology in a given branch. Generally, “Innovative organization” means openness of the organization for changes.

The process of adoption of innovations is called diffusion. Diffusion of innovations depends on four main elements arising from the definition of E. Rogers (1995, 10–24) that “diffusion is a process that communicates innovation through certain channels among members of a particular society in a given time period”. The diffusion depends on the following basic elements:

---

<sup>3</sup> Project: „E-matura“; Project: „Parents advice – parents school“; Project: „Informed parent (E-dnevnik)“; Project: “Digital checking of knowledge”; Project: Energy efficient schools”; Project: “Skillful and competent”; Project: “Macedonian Talents”; Project: “Learning with computers”; Project: “Macedonia on Wikipedia.”

- nature of innovation,
- channels of communication,
- time and
- social entities that are involved in the innovation process.

Ideas for innovation can come from many sources: from the production, trade etc. This means that the process requires communication with different companies, laboratories, research centers, with consumers, with the market. There are interactive relationships among science, engineering, product development, production and marketing. Economic Learning and innovation of an economy is directly dependent on the development of interactions in this system (Popovska 2000, 193–196).

In reality, the findings in Silicon Valley in 1970 are examples of powerful innovations that drive national, regional and global development. Innovative capacity generally becomes an important indicator of sustainable development and economic vitality both at national and at regional level.<sup>4</sup>

Innovations have a strong effect on world growth because they improve the employee productivity, create jobs and ensure sustainable economic development (Pham 2010, 7–10).

Government of Macedonia encourages innovation and entrepreneurship in small and medium enterprises in the country and for this purpose has established the Agency for Support of Entrepreneurship ([http://www.apprm.gov.mk/webdata/dokumenti/APPRM\\_PROFIL.pdf](http://www.apprm.gov.mk/webdata/dokumenti/APPRM_PROFIL.pdf)). Government has adopted a "Program for development of entrepreneurship, innovation and competitiveness of small and medium enterprises in Macedonia in 2012" which envisages funding for the development of entrepreneurship, innovation and competitiveness of enterprises (Sluzben vesnik RM 2012. no. 12 from 26.01.2012). Also, the Government has defined strategy for intellectual property protection. Intellectual property includes patents, marks, samples, licenses. Protection of intellectual property for one country is very important, because a large part of trade rests precisely on the protection of intellectual property (Strategy for intellectual property of Republic of Macedonia 2009–2012, 9).

In the following part the overview of patents in the country as one of the indicators for innovation is presented. The State Office of Industrial Property of the Republic of Macedonia in 2011 filled out 405 patent applications, of which 37 domestic and 368 foreign. The number of patent applications filled out in 2011 compared to 2010 increased by 11.3%.

Worldwide, according to the Global Competitiveness Report of the "World Economic Forum", which was conducted in 148 countries around the world for the period 2013 to 2014 (WEF 2013–2014, 15), the Republic of Macedonia is on the 73th place with a 4,14 ratio.<sup>5</sup> The first, second, third, fourth, fifth and sixth place respectively occupy Switzerland, Singapore, Finland, Germany, USA, and Sweden.

In the Table 2, the separate criteria for innovation and the place of ranking of Republic of Macedonia is presented.

---

<sup>4</sup> *Measuring innovation*. 2009. Training workshop on science technology and innovation indicators, Cairo, Egypt, 28–30 September: 3.

<sup>5</sup> This ratio vary from 1 to 7.

**Table 2.** The criteria for innovation and place of ranking of Republic of Macedonia<sup>6</sup>

Innovation Criteria	Place of Ranking of Republic of Macedonia
Capacity for innovation	94
Quality of education and research institutions	86
Funds for R&D	91
Collaboration of Universities and industry in R&D	81
Government support of innovation	81
Availability of scientists and engineers	92
Number of patent applications	72

According to the presented criteria for innovations the Republic of Macedonia is ranked on the 86th place with a ratio 3,09 (from possible maximum 7) from 148 monitored countries (WEF 2013–2014, 22).

The first, second, third, fourth and fifth place for innovations respectively belong to Switzerland, Finland, Japan, Germany and Sweden.

### 1.3. Transition from non renewable to renewable energy sources

The energy reserves in the world are limited and there is a lack of energy. Also, the harmful emissions from the combustion of fuels are above the limits (Kirtley 2010, 2). The needs for energy are becoming bigger and the prices of liquid fuels are increasing (Momoh 2007, 223). The countries all over the world are oriented to bigger usage of renewable energy resources for electricity production (Antchev 2010, 1–6). The renewable energy resources reduce the greenhouse gas emission and are a factor that increasingly dictates the development of a country. International Energy Agency (IEA, 2004a) defines the renewable energy as energy that comes from nature and is continually renewed.

**Table 3.** Main reasons why the renewable resources are an important strategic source of primary energy<sup>7</sup>

Reason	Effects
Energetic	As host sources, they reduce the import dependence and reserve choice of energy
Social	They contribute for opening new working places
Economic	They reserve bigger competitiveness on the host and foreign markets and become an important factor for regional development
Industrial	With generation from renewable sources, possibilities for export to world markets increase
Environmental	Reducing the CO2 emissions and environmental risk

In the Table 3 are shown the main reasons why the renewable resources are an important strategic source of primary energy.

The renewable sources of energy can be grouped in the following three categories:

- Renewable non-fossil sources: solar, wind, geothermal, tidal power (inflow and outflow);
- The energy of biomass and landfill gases;

<sup>6</sup> World Economic Forum 2013–2014, 261.

<sup>7</sup> IEA PUBLICATIONS 2004, 115.

- Canal gases and biogas.

Like all countries in the world, and European countries are taking actions for transition to renewable energy sources. The Commission of the European Union supports the strategy in the energy sector in the White Paper, in the chapter "Energy for the Future: Renewable sources of energy."

Its purpose is to increase the share of renewable energy sources in total consumption of primary energy by 15% in 2015 (Commission of the European Communities 2006, 3–4).

With directive 96/92/EC of the European Parliament, the Member States of the European Union defined that protection of enterprises should be ensured as a priority in the use of electricity from renewable sources.

Many states have adopted action plans in which defined the purposes of achieving the state share of energy from renewable sources - in trade, production of electricity, heating and cooling by 2020, in line with the Kyoto protocol. The goals, according to the resolution of 20/20/20 Kyoto Protocol, 2020 are (United Nations 2012/6, 11):

- share of renewable energy in total energy consumption to be 20%,
- greenhouse gases in terms of the parameters for 1990 to be reduced by 20% and
- energy consumption to be reduced by 20% compared to the predictions, energy efficiency.

The share of renewable energy in the total primary energy consumption in Macedonia is very low. The principal renewable sources that can be used in the country are: water, wind, sun, geothermal energy and biomass. For wind and geothermal energy there is a lack of systematic analysis on the capacity of resources, which is one of the reasons for their poor exploitation.

We can conclude that each country should strive to transition from non-renewable to renewable energy sources for getting greater energy independence, greater competitiveness, and reducing greenhouse gases. To increase the share of renewable energy sources in the total percentage of electricity generation, each state should have a defined strategy for the production of energy from renewable sources and policies for implementation of the strategy. The implementation process of connecting energy sources to the distribution network also requires special attention.

## **2. INFORMATION TECHNOLOGIES: THE NEW BASE FOR DEVELOPMENT**

In terms of globalization, information technologies and the Internet are major drivers of research, innovation, growth and social change. Technological advances, especially in the field of information technology, telecommunications and transport, affect the characteristics of globalization. Information and communication technologies are changing the way of communication, collaboration and trading of companies. Their exploitation allows integration of the factors of production, production systems, markets, services and companies. In these conditions of action, with the application of these technologies, more information are available, it is much easier and faster to travel and carry various products in different locations. Simple, the criteria for space, time and quality are very different from before. Everything is faster, closer and possible. In

the literature their integrative character is often expressed through the phrase: "The world is becoming a global village."

In terms of globalization, IT technologies have a strategic role in the development of the organization on its path to organizational success. IT technologies spread through diffusion and use of information technologies - computers, software and networks - by businesses and households. Data from the OECD (Organization for Economic Cooperation and Development) show that the use of personal computers doubled in the last decade of the last century. About 37% of the United States population has computers, compared with 24% of the residents of the UK and 12% in Japan (OECD 1996, 34). Many studies show that most of the developed countries are characterized by external computer connection and satellite services. The last decade of the last century is rightly called the age of the Internet. Betz believes that the Internet changed the business environment and highlights the importance of IT in the enterprise strategies (2003, 6).

Compared to internet coverage in the region, it can be noticed that the coverage in the Republic of Macedonia is at a satisfactory level with 61,2% in December 2013 (<http://www.internetworldstats.com/stats4.htm#europe>). The European average is 68%. From another Balkan countries, Kosovo has coverage of 76,6%, Serbia has 57%, Slovenia has 72,7%, Bulgaria has 53,1%, Croatia has 70,9% and Albania has 61,1% internet coverage. Macedonia has a better coverage than the following countries: Greece, Italy, Ukraine, Montenegro, Turkey etc. From the presented data, the continual development of ICT in Macedonia is evident.

The government of Macedonia has adopted a national strategy in the field of ICT which combines basic strategic directions for the development of information and communication technology at both central and local level.

## CONCLUSION

The demand for employees with higher education increases. The importance of knowledge is greater than ever. Because of that, states and companies must work to increase their knowledge base and educational systems. Also, individuals should try to upgrade their education and skills.

Like everywhere in the world, in Macedonia there is a need for greater education and stimulation of the learning process. Macedonia has quality educational institutions. In order to bridge the gap between supply and demand for higher education, we need more cooperation with enterprises and adaptation of educational programs to the needs of industry and institutions.

Innovation is the key for development. States should work to increase the innovation bases of states and enterprises to increase its facilities by stimulating innovative activities.

An important aspect of strengthening the competitiveness of a country is increasing the energy production from renewable sources. With the production of electricity from renewable sources the energy independence of states is increased, harmful gas emissions are reduced and new opportunities to export energy are opening up.

Macedonia has defined a strategy for renewable energy and incentive mechanisms for energy production from renewable energy sources. There are incentive mechanisms for these producers and special tariffs for purchase of electricity generated from



renewable sources, but it seems the procedures for obtaining permits for construction of such facilities are still very complicated.

The last decade of the last century is rightly called the era of the Internet. The Internet changes the entire business environment and highlights the importance of IT in the enterprise strategies. The Government of the Republic of Macedonia has adopted a national strategy in the field of ICT which presents the main strategic directions of development of information and communication technology at both central and local level.

Sustaining a long-term competitive advantage is only possible with employees who have proper knowledge about the changes in the 21st century.

## REFERENCES

- Antchev, Mihail Hristov. 2010. *Technologies for Electrical Power Conversation, Efficiency and Distribution: Methods and processes*. Hershey, PA: Engineering Science Reference.
- Barrell, Ray, Geoff Mason, and Mary O'Mahony, eds. 2000. *Productivity, Innovation, and Economic Performance*. Cambridge: Cambridge University Press.
- Betz, Frederick. 2003. *Executive Strategy: Strategic Management and Information Technology*. John Wiley and Sons.
- Commission of the European Communities. 2006. *Renewable Energy Road Map, Renewable energies in the 21st century: Building a more sustainable future*. European Parliament resolution of 14 December: 3–4.
- Drucker, Peter F. 1997. Implications of the Present. *Harvard business review*, vol.75.
- Framework Convention on Climate Change. 2012/6. United Nations CC/ERT: 11.
- Goel, Vinod, K., Ekaterina Koryukin, Mohini Bhatia, and Priyanka Agarwal. 2004. *Innovation Systems: World Bank Support of Science and Technology Development*. World Bank working paper no. 32. Washington, DC: World Bank.
- Houghton, John, and Peter Sheehan. 2000. *A Primer on the Knowledge Economy*. Melbourne City MC: Centre for Strategic Economic Studies, Victoria University.
- IEA PUBLICATIONS. 2004. 15, 75739 PARIS Cedex, STEDI:115.
- Internet World Statistic Report.
- Jensen, Morten Berg, Bjorn Johnson, Edward Lorenz, and Bengt Ake Lundvall. 2007. Forms of knowledge and modes of innovation. *Research Policy* 36 (5): 680–693.
- Kirtley, James L. 2010. *Electric Power Principle*. Chichester, UK: Wiley and Sons.
- Momoh, James A. 2007. *Electric power distribution, automation, protection and control*. New York: CRC Press; Taylor and Francis Group.
- OECD. 1996. *Knowledge based economy*. Paris: 9–34.
- OECD. 2005. *Handbook on Economic Globalization Indicators*. Paris: OECD.
- Pham, Nam D. 2010. *The Impact of Innovation and the Role of Intellectual Property Rights on U.S. Productivity, Competitiveness, Jobs, Wages, and Export*. NDP Consulting.
- Popovska, Zlatka. 2000. *Politika na Tehnoloskiot Razvoj*. Ekonomski Fakultet Skopje: 193–196.
- . 2012. *Ekonomski Rast i Razvoj*. *Jugoreklam Skopje*: 63–65.
- Rogers, Everet M. 1995. *Diffusion of Innovation*. 3rd ed. New York: The Free Press.
- Sluzben vesnik na RM. 2012. no. 12 from 26.01.2012.
- State Statistics Bureau. 2013. Statistic review Nr.2.4.12.03 716. Skopje. T.05.
- Strategy for intellectual property of Republic of Macedonia. 2009–2012. Government of Republic of Macedonia.
- United Nations. 2012/6. *Framework Convention on Climate Change*, CC/ERT: 11.
- WEF (World Economic Forum). 2013–2014. *The Global Competitiveness Report*: 261.
- WEF (World Economic Forum). 2013–2014. *The Global Competitiveness Report*: 15–22.