AICEI PROCEEDINGS

INDEX QUALITY AIR (IQA), EDUCATION AND SCIENCE IN THE WESTERN BALKAN COUNTRIES AND THEIR EU PERSPECTIVE

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ABSTRACT: Climate change is considered to be the biggest global problem at the beginning of the 21st century, and the negative impacts of anthropogenic and climate change on human health are greatly attracting the attention of the World Health Organization (WHO), as well as the activities of EU commissions to reduce environmental pollution and protect human health. In addition to the global greenhouse gas problem due to the predominant impact of CO_2 and NO_2 emissions, air quality due to a number of other pollutants: SO_2, NOx, Ozone, Methane, Benzene, PM_{10}, etc. created by industry, is most commonly measured by the Air Quality Index (IQA). The correlation between IQA and Gross Domestic Product – GDP (nominal) per capita has been identified as a reliable indicator of the standard of living of people in a country. It is also an indisputable fact that the economy of a country depends to a large extent on the quality of education, and above all on university education and science, as a basis for scientific innovation and progress of the country. The Western Balkans (WB) countries have been facing economic problems for a long period of time and have put the ruling elites in education – especially university and science, in the second palace. This situation puts this country in an unequal position with respect to the developed world. The consequences of such a situation are subsidies to foreign investors who install obsolete and trivial IQA-enhancing technologies in WB, which is contrary to the environmental requirements of WHO and the EU. These facts put the WB countries in an inferior position and hamper their path to European integration and EU membership.

KEYWORDS: *IQA, GDP (nominal) per capita, Western Balkans (WB), EU integration*

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INTRODUCTION

At the beginning of the 21st century, the phenomenon of global warming due to greenhouse gases has attracted the particular attention of all humanity on the planet. In the last 150 years, the atmospheric CO_2 content has been steadily increasing from 280 (ppm) to 400 (pmm), causing the global average temperature to increase by almost 0.70C (Kumar and Muhuri, 2019). In addition to the increase in global temperature, due to the increased concentration of CO_2 (Wang et al., 2019; Munir et al., 2020) in the atmosphere, toxic substances are increasingly emitted, such as SO_2, NOx, PM_{10}, Benzene, Ozone, Methane,... as well as heavy metals Hg, As, Cd, Pb, Ni, Cu, etc. which seriously endangers human health and obviously increases mortality (Pope et al., 2007). In order to protect human health, the World Health Organization (WHO), as well as the EU authorities, take a number of measures to reduce the emission of pollutants into the atmosphere and to protect human health, which is binding on all countries in the world (WHO, 2006, 2019; EC, 2000; EU, 2008).

Worldwide, with few exceptions, real-time air quality measurement, expressed through the Air Quality Index (IQA), is conducted to draw people's attention to their health hazards, and to competent authorities to take action on the emission of harmful substances into the atmosphere (Guerreiro et al., 2014; Živković and Djordjević, 2020). Often, in poorly developed countries, episodes of extremely high concentrations of pollutants in ambient air occur without any sanction by state authorities against broadcasters, especially if they are foreign investors (Arsić et al., 2011; Djordjević et al., 2013; Živković and Djordjević, 2020).

Human capital has a predominant effect on economic growth and changes in GDP growth (nominal) per capita (Rindermann and Becker, 2018) which is used as a measure of a nation's economic growth and a measure of the well-being of people in the national economy (Alesina et al., 2005), as well as a measure of the quality of education and scientific output (Park et al., 2019).

Education in general, especially university one, and science are one of the most significant factors for the development of each country's economy, the level of GDP (nominal) per capita and its position in the world (Živković and Panić, 2020). The level of university education and science determines the level of the country's economy GDP (nominal) per capita (Dananica and Belasku, 2008; Dragoescu, 2015), as well as the level of environmental protection, which also means the size of IQA as an indicator of the quality of the air breathed by its citizens (Hencher, 2020).

Environmental protection (water, air, and land) has recently become a focus of WHO (WHO, 2006, 2019), as well as a number of EU bodies, which through directives oblige especially potential members to fully comply with environmental requirements, where air protection has a place. The level of environmental protection in a country depends on the level of knowledge acquired and the scientific results obtained, which are implemented in the development of the whole society. The EU perspective of WB countries depends, among other things, on the quality of the outputs of education and science, as well as the level of environmental protection.

THE STUDY AREA

The areas covered in this paper are the WB countries: Serbia, Montenegro, Albania, Bosnia and Herzegovina, Northern Macedonia, and Kosovo* (*According to UN resolution 1244, a status has not been defined yet), which are on their way to European integration (only Serbia and Montenegro are in the negoti-

ation process). EU integrations require candidate countries to fulfil a number of EU standards, including environmental standards in the fields of water, land, and air protection. IQA, which is determined in real-time in numerous countries of the world, in all EU countries and in WB countries (except Albania), was taken as a benchmark for consideration.

The position of WB countries in relation to IQA will be considered in terms of GDP (nominal) per capita level, an education level (PISA test and ARWU list), and science level (ranking 239 countries according to scientific results in the period 1996–2018).

DISCUSSION OF RESULTS

It is often argued in underdeveloped countries that an increase in the economy and standard of living results in an increase in air pollution (an increase in IQA) (Kumar and Muhuri, 2019; Munir et al., 2020), which is not true. It is a fact that in many countries special attention is paid to the development of economies with reduced CO_2 emissions (Wang et al., 2019) and to the protection of their own natural resources (Mora, 2019). Also, incorporating the environmental impact on the economy and the development of a healthy system provides a perspective for the development of an ecological economy (Hensher, 2020).

Gross domestic product – GDP (nominal) per capita determines the degree of development of a country, while the purchasing power parity (PPP) term is one of the most commonly used to measure the purchasing power of a population, which determines the level of well-being of people in the national economy (Park et al., 2019). Developed countries, with high GDP (nominal) per capita, pay special attention to education and human health, which creates the conditions for modern technologies that ensure a healthy environment and high environmental standards.

WB countries are constantly in an economic crisis, so the ruling elites are putting aside the development of education, science, and environmental conditions, which, because of their low level of knowledge in all fields, puts them in a vassal relationship with developed countries. In this way, WB countries are forced to, in the process of attracting foreign investment, adopt outdated technologies that pollute land, water, and air, with additional subsidies and inappropriate treatment of domestic labor by a foreign investor (Živković and Panić, 2020). In the EU accession process, all WB countries must first, for example, bring their air quality standards in line with EU directives (EU, 2008). The current situation of IQA in WB countries by GDP (nominal) per capita, relative to other countries, according to the results of the International Monetary Fund (IMF) for 2019, *(https://en.wikipedia.org/wiki/List_of_Countries_by_GDP(PPP)_per-capita)* is shown in Figure 1.

< 50 (good): *1 – Lithuania; 2 – Estonia; 3 – Portugal; 4 – Finland; 5 – Sweden*;

50–100 (moderately good): *1 – Bulgaria; 2 – Russia; 3 – Slovenia; 4 – Spain; 5 – France; 6 – Sweden; 7 – Denmark; 8 – Norway; 9 – Luxembourg*;

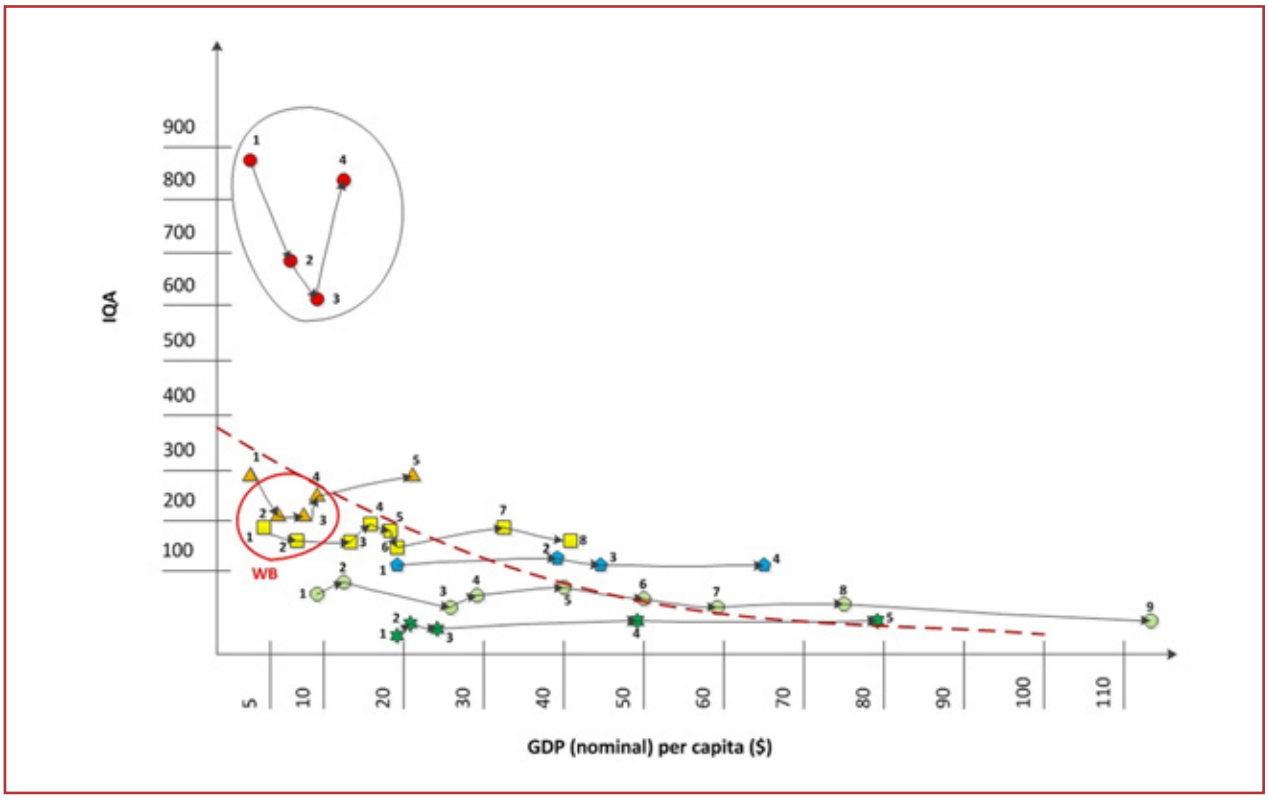
100–150 (unhealthy for the sensitive ones): *1 – Greece; 2 – Japan; 4 – Canada ; 5 – USA*;

150–200 (unhealthy): *1 – Kosovo*; 2 – Northern Macedonia; 3 – Croatia; 4 – Poland; 5 – Hungary; 6 – Slovakia; 7 – Italy; 8 – England*;

200–300 (very unhealthy): *1 – Ukraine; 2 – Bosnia & Herzegovina; 3 – Serbia; 4 – Montenegro; 5 – Czech Republic*;

> 300 (dangerous): *1– India; 2 – Turkey; 3 – China; 3– Mexico*

Figure 1.
IQA dependence on GDP (nominal) per capita



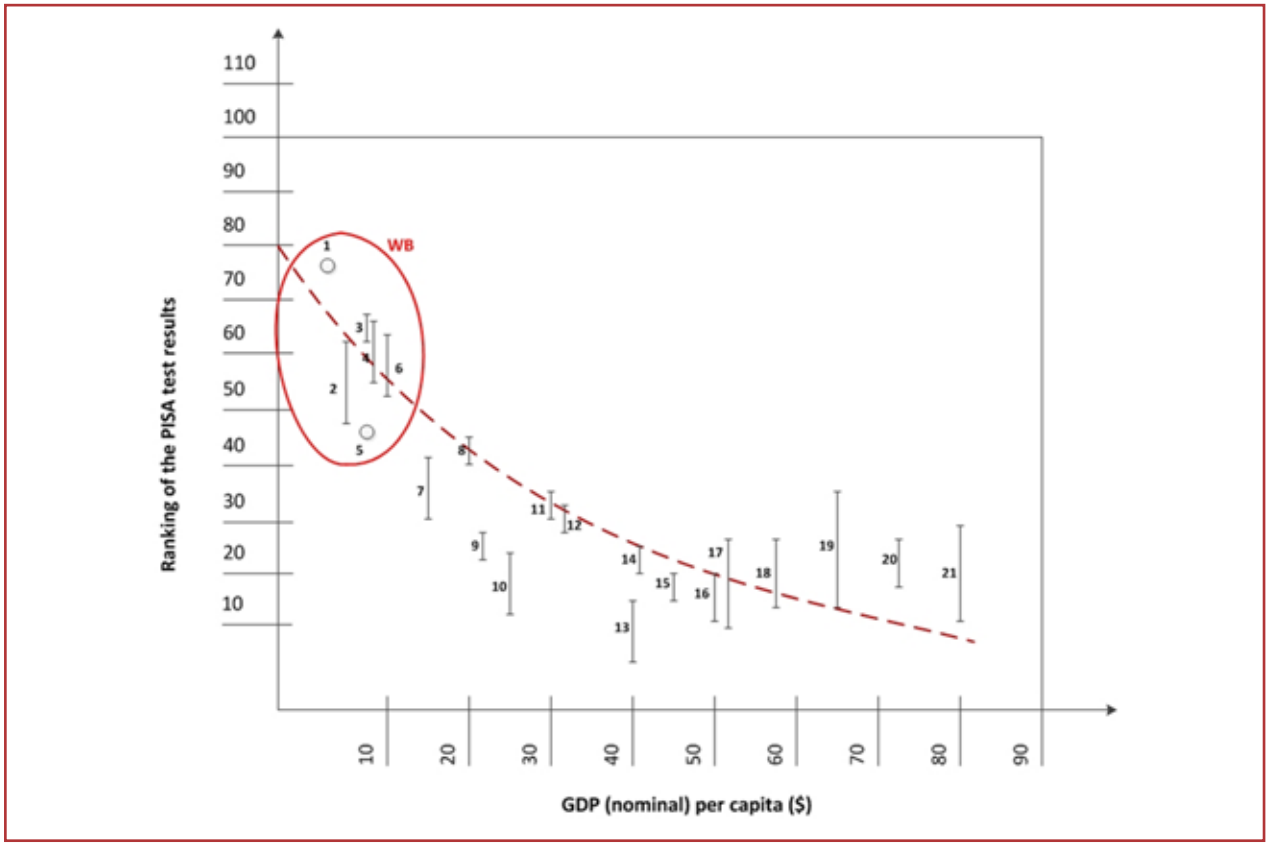
Measurement results obtained in the period from 10 to 20 January 2020 shown in Figure 1 indicate that an IQA size of over 200 (very unhealthy) in the WB countries is in Serbia, B&H, and Montenegro, and that with a ratio of 150–200 (unhealthy) is in Kosovo* and N. Macedonia, where the size of GDP (nominal) per capita is less than $ 10. In Albania, IQA is not measured. The cities of Belgrade and Sarajevo have repeatedly been among the ten most polluted cities in the world. IQAs with values less than 100 (moderately good and good) are in countries with a GDP (nominal) per capita value above $ 40 (Spain, France, Germany, Denmark, Norway, Sweden, Netherland, Luxembourg,...) where the developed industries exist.

The level of air pollution, measured by the size of IQA, depends on the size of GDP (nominal) per capita, that is, on the level of standards in a given country, which is a consequence of the level of knowledge gained through the education system at all levels and the science whose results directly affect the development of the economy (Bak, 2018), i.e. the level of industry in a given country on which the emission of puppy components into ambient air depends.

The Organization for Economic Cooperation and Development (OECD) organizes the so-called PISA (Programs for International Student Assessment) test worldwide every three years starting in 2000. At the last testing in 2018, all WB countries participated (Serbia and B&H for the first time), and the results achieved in three categories: Mathematics, Science and Reading, for twenty countries with different GDP (nominal) per capita, *(https://en.wikipedia.org/wiki/Programme_for_International_Student_Assessment)* are shown in Figure 2.

Figure 2.

Results of the 2018 PISA test, depending on the country's GDP (nominal) per capita



1 – Kosovo; 2 – Albania; 3 – B&H; 4 – N. Macedonia; 5 – Montenegro; 6 – Serbia; 7 – Croatia; 8 – Greece;*

9 – Czech Republic; 10 – Slovenia; 11 – Spain, 12 – Italy; 13 – Japan; 14 – France; 15 – Germany;

16 – Sweden; 17 – Netherland; 18 – Denmark; 19 – USA; 20 – Norway; 21 – Switzerland

The obtained results indicate that every third fifteen years old in Serbia is functionally illiterate and in B&H every other, while in other WB countries the situation is less favorable. This situation, as a result of the PISA test, indicates a very poor input for university education, from which academics are also created, which greatly impedes the quality of university education and science outputs, with a very low level of allocation to these areas (less than 1% of GDP). In Figure 3, the results of the rankings of science levels in 239 countries for the period 1996–2018 are presented, depending on GDP (nominal) per capita *(https://www.scimagojr.com/journalrank.php?country=IL)*.

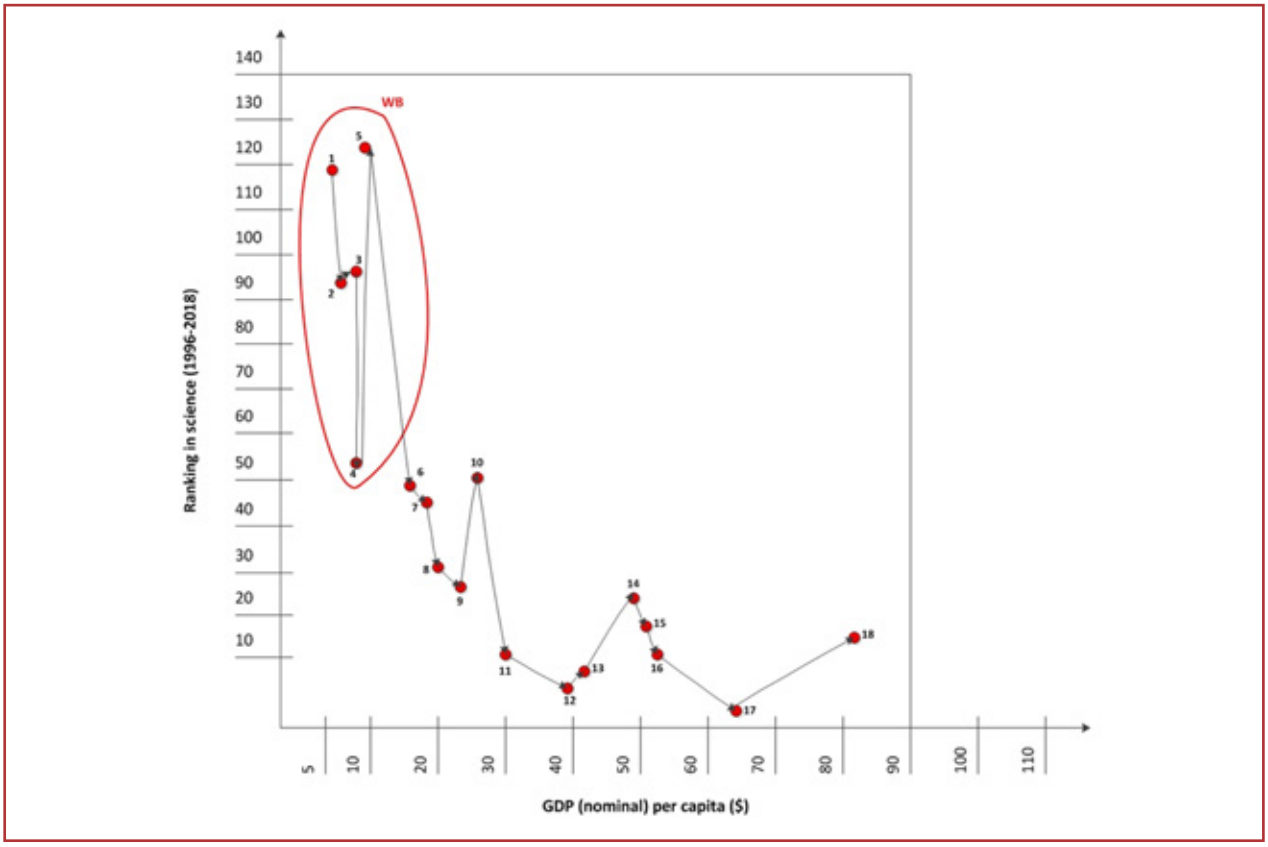
1 – Albania; 2 – B&H; 3 – N. Macedonia; 4 – Serbia; 5 – Montenegro; 6 – Croatia; 7 – Slovakia; 8 – Greece;

9 – Czech Republic; 10 – Slovenia; 11 – Spain; 12 – Japan; 13 – France; 14 – Finska; 15 – Sweden;

16 – Netherland; 17 – USA; 18 – Switzerland (Kosovo not ranked)*

As in the case of PISA testing, the worst-ranked countries in science rankings are those with low GDP (nominal) per capita of less than $ 10, and the best-ranked countries are those with values of this indicator above $ 40, in which modern technologies are being developed that provide low IQA values.

Figure 3.
Dependence of rank in science (1996–2018) on the size of GDP (nominal) per capita



In Figure 4, the relationship between the results of the PISA test and the rank in science is shown (from Figures 2 and 3), which clearly shows a direct linear correlation between the two indicators of quality of education (at all levels) and science. Undoubtedly, it is seen that investing in the development of education at all levels, especially university education, directly results in science, which is the starting point for all elements of society and as such contributes to the growth of GDP (nominal) per capita in every country, which directly affects development of all sections of society, including environmental standards, in order to preserve human health.

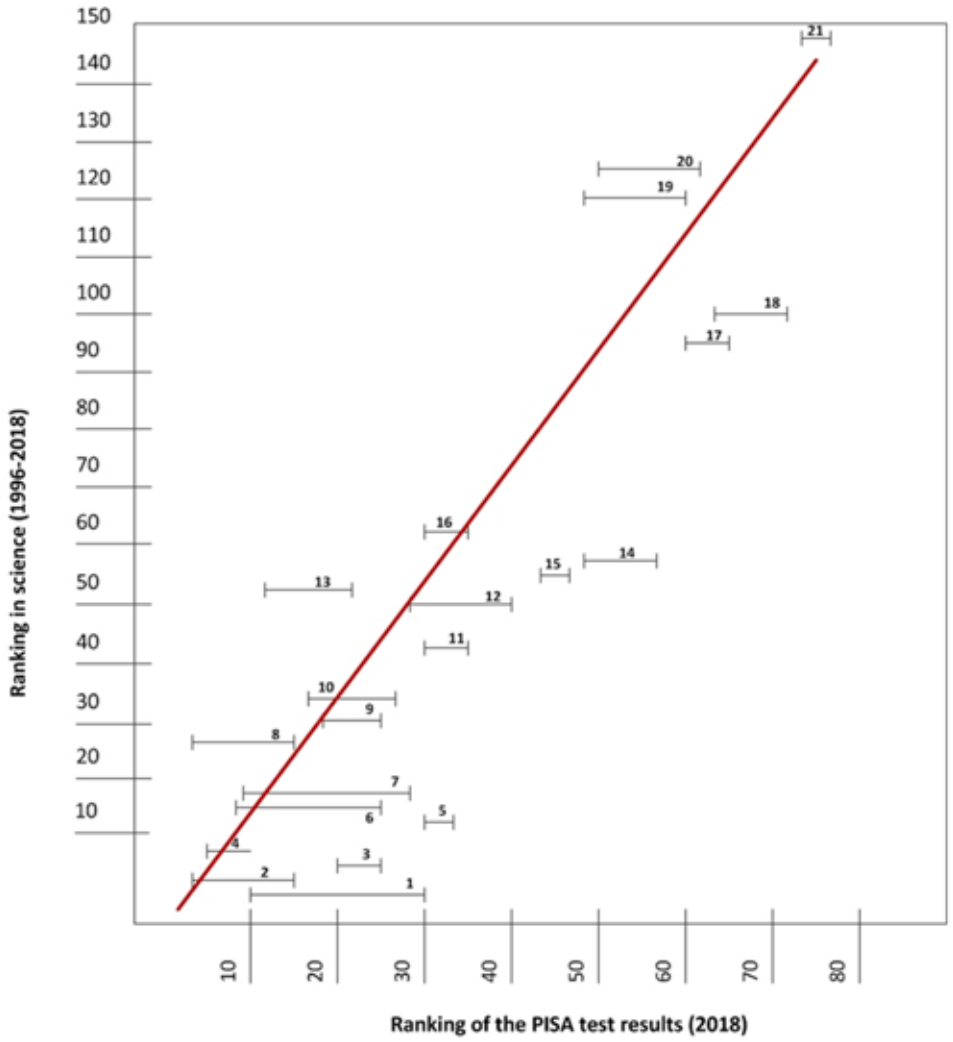
1 – USA; 2 – Japan; 3 – France; 4 – Canada; 5 – Russia; 6 – Netherland; 7 – Switzerland; 8 – Finland;

9 – Sweden; 10 – Norway; 11 – Hungary; 12 – Slovakia; 13 – Slovenia; 14 – Bulgaria; 15 – Serbia;

16 – Lithuania; 17 – B&H; 18 – N. Macedonia; 19 – Albania; 20 – Montenegro; 21 – Dominican Republic (Kosovo is not ranked in the science rankings)*

University education is an activity in which developed countries are recognized in the world, which is why every year universities are ranked according to various lists (Jakobs, 2010; Daraio et al., 2015). The most popular among them is the Shanghai List or Academic Ranking of World Universities (ARWU), which includes the top 500 universities, which is about 2% of the total number of universities in the world (Docampo, 2013; Živković et al., 2017a).

Figure 4.
Dependence of science results (1996–2018) on PISA test results (2018)



Each year, the ARWU list of the top 500 universities for a given year is published based on the results achieved according to the defined criteria in the previous year. *(http://shanghairanking.com/ARWU2019.html)*. Also, a list of 501–1000 universities in the world is published, among which the candidates for the top 500 are recognized. The results obtained for 2019 for WB countries are shown in Table 1.

Table 1
WB universities ranked among the top 1000 in the Shanghai list for 2019

Number	Country	Number of universities	Name of the university	Rank
1	Serbia	2	University of Belgrade University of Novi Sad	401–500 901–1000

The results obtained indicate that, from the WB group of countries, only the University of Belgrade (UB) is on the ARWU list, between 401–500 places, and the University of Novi Sad at 901–1000. UB has been in the top 500 on the ARWU list since 2012. Universities from other WB countries are not ranked among the top 1000 in the world so far, according to the ARWU list criteria, which are as follows: (a) the number of graduates who are winners of the Nobel Prize and Medal in scientific fields (Alumni); quality of the faculty; (b) the number of employees who won the Nobel Prize or Medals in scientific fields (Award); (c) number of highly cited scientists from 21 scientific fields (HiCi); (d) results of scientific research: number of papers published in the journals Nature and Science (N&S); (e) number of papers published in SCIe and SSCI journals; (f) par capita academic performance of a institution (Docampo, 2013; Živković et al., 2017a, 2017b).

In the WB countries, for some time, there is always some form of economic crisis, which results in a small investment in the development of education and science. This attitude towards education and science leads these countries to lag more behind the developed world in all elements of development, which is why they do not have an equal relationship with them in all forms of business negotiation. The results shown in Figures 1–3 and in Table 1 clearly indicate that the GDP (nominal) per capita level in the WB countries is the lowest in Europe, which affects the low level of education output at all levels of learning, as well as the scientific results achieved in for a longer period of time.

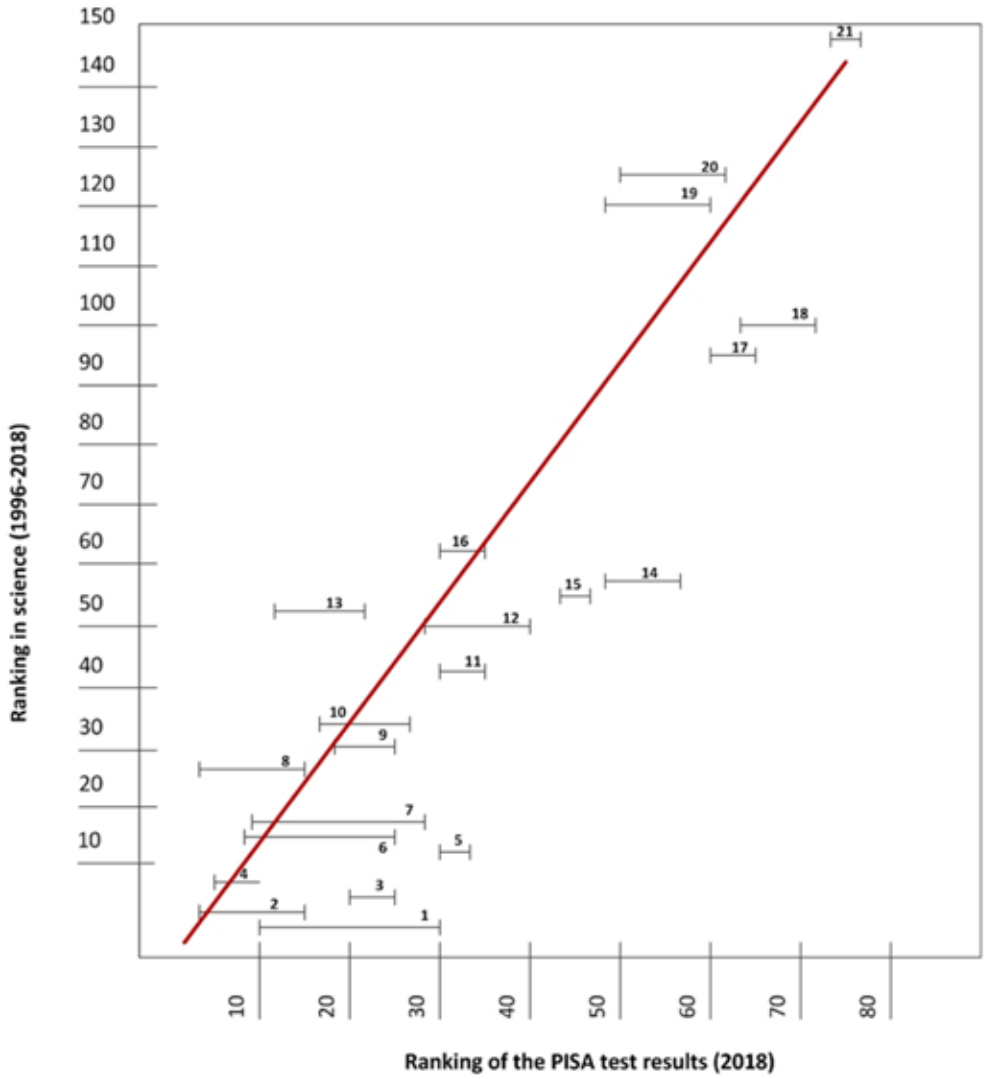
One gets the impression that the ruling elites in the WB countries are not interested in the development of science and education as well as the quality of the environment – foreign investors are being alienated from natural and ore resources, water and forests, allowing the removal of dirty technologies, etc., and their activities are aimed only at the goal of staying in power. In such circumstances, EU integration of the WB countries is hampered by the substantial failure to meet EU standards in the prescribed areas. The new negotiation format for EU integration of the WB countries will require the prior achievement of the EU level in certain areas (environmental protection, agriculture, forestry, transport,...), which requires a radical shift in the WB countries towards education and science as a starting point for all other achievements and achievements of EU standards (Barro, 2013; Bak, 2018).

Democracy Perception Index (DPI) ranked 167 countries for 2019 by Economist Intelligence Unit (EIU) *(https://en.wikipedia.org/wiki/Democracy_Index)*, and Corruption Perception Index (CPI) ranked 180 countries annually by Trasparency International (TI) *(https://en.wikipedia.org/wiki/Corruption_Perceptions_Index)*. WB countries have not taken a promising position in them. In the ranking of corruption perceptions, WB countries ranked in the range of 52–106 places and in the perception of democracy ranked in the range of 62–101 places in the world rankings with ratings in Serbia (Flawed democracy) and in other countries in the WB (Hybrid Regime). Figure 5 shows the Democracy Perception Index dependence on GDP (nominal) per capita and the Coruption Perception Index dependency on GDP (nominal) per capita function is shown in Figure 6.

1 – Ukraine; 2 – Albania; 3 – B&H; 4 – N. Macedonia; 5 – Serbia; 6 – Montenegro; 7 – Croatia; 8 – Greece;

9 – Slovenia; 10 – Spain; 11 – Japan; 12 – France; 13 – Germany; 14 – Netherland; 15 – Denmark; 16 – USA; 17 – Norway; 18 – Switzerland; 19 – Luxembourg (Kosovo is not ranked)*

Figure 5.
The Democracy Perception Index dependence on GDP (nominal) per capita



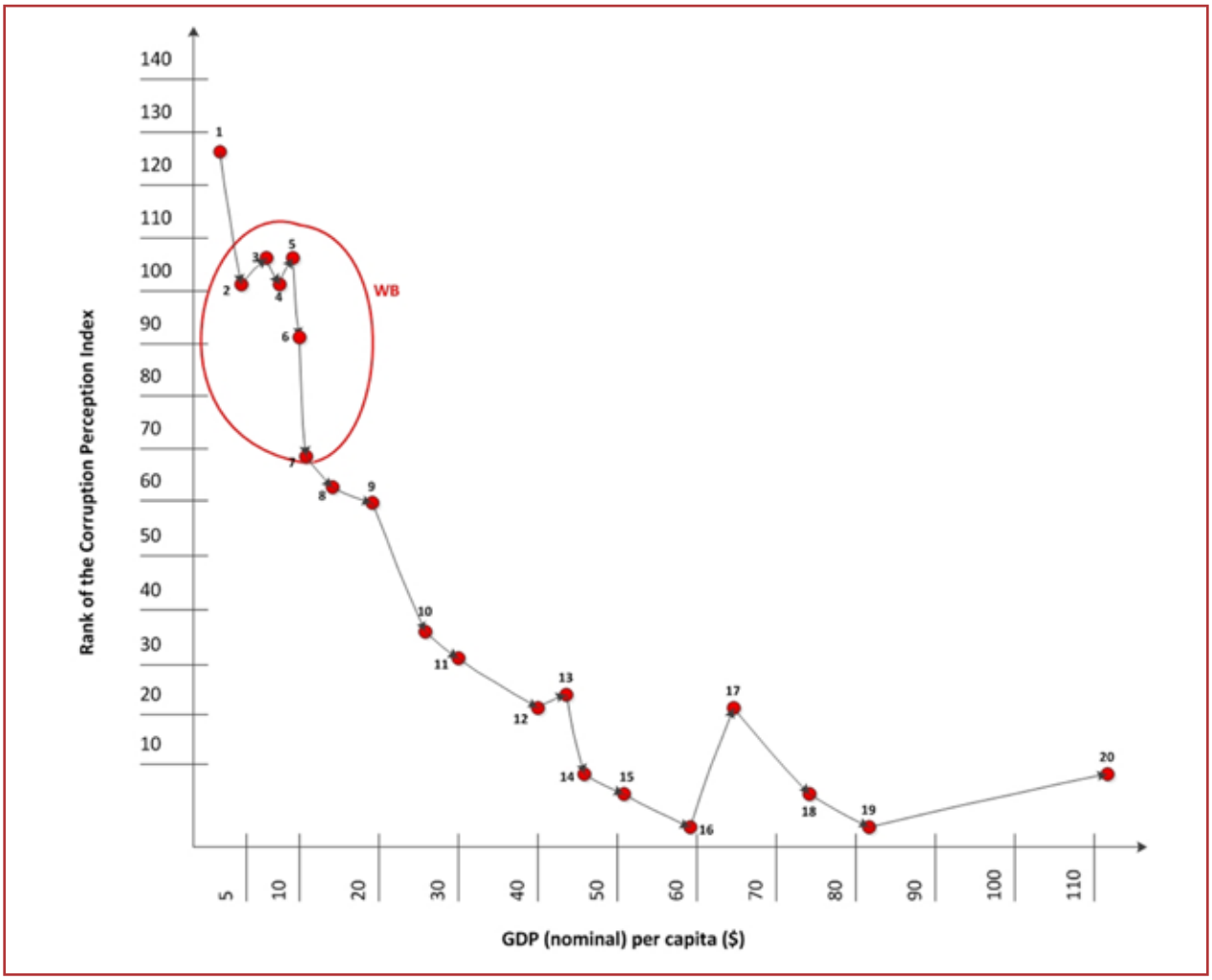
1 – Ukraine; 2 – Kosovo; 3 – Albania; 4 – B&H; 5 – N. Macedonia; 6 – Serbia; 7 – Montenegro; 8 – Croatia

9 – Greece; 10 – Slovenia; 11 – Spain; 12 – Japan; 13 – France; 14 – Germany; 15 – Netherland;

16 – Denmark; 17 – USA; 18 – Norway; 19 – Switzerland; 20 – Luxembourg

The results shown in Figures 5 and 6 indicate that with the increase of poverty (decrease of GDP (nominal) per capita), corruption increases and democracy decreases. Obviously, WB countries have the lowest GDP (nominal) per capita (< $ 10), relative to all countries in Europe. As the poorest region in Europe, the WB is often distinguished for its great corruption and formal democracy. The ruling elites are preoccupied with staying in power at any cost, and everything else is out of focus. The development of education and science that can only increase GDP per capita (Rinderman and Becker, 2018), leading to higher standards of people and more secure EU integration, is also not the focus of their interest.

Figure 6.
The Corruption Perception Index dependence on GDP (nominal) per capita



CONCLUSION

If the ruling elites in the WB countries have a sincere desire and commitment to EU integration, a radical shift is needed in the formulation of internal development policies in the coming period, where the first priority will be the development of education and science with at least 3.5% GDP allocated (EU recommendation) with the application of EU standards in these areas.

Foreign investors must be required to strictly comply with the legislation of the country they came to and EU standards in the field of occupational safety and environmental protection. Only an increase in GDP (nominal) per capita can stem the brain drain from WB countries, without which these countries have no future prospects. If this does not happen, then only the ruling elites and their followers will remain in these countries.

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