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The evaluation of interdependence between economic development and scientific and technological progress in the context of globalization (European countries and Ukraine are chosen as examples)

Summary: Today,the research of globalization is becoming more and more popular because we are living in the era of not only the total companies integration, but also countries integration that can't be separated, since it is not economically effective to create **a** closed cycle of «production-consumption».Technologies develop quickly and give an opportunity to use global networks, which allows us, on the one hand, to give quick information about all products, to compare itwith the other goods, to find substitutes with lower prices and higher quality, if it is necessary, and without much difficulty to buy goods from any part of the world. On the other hand, companies have the opportunity to give customers information about their products by using the global network and as **a** result, decreasing their costs. The globalization processes are irreversible, so corporations and governments must adapt to the trends that arise in different areas and try to use the advantage of the globalization processes. Accordingly, today, the quick development of the economic environment needs to be used in the production process are not only traditional factors of

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production but scientific and technical achievement.

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Problem statement. Globalization reflects the intensive development of the internationalization of manufacturing which is based on complicated, expanded and strengthened foreign economic relations. Global economic interdependence has a great influence on individual national economies. The biggest economical effect results in the firm interdependence on the basis of mutual relations between economically equal partners (for example, economic cooperation between developed countries). On the other hand, there are a large group of low-income countrieswhich share in the world gross national product (GNP) is decreasing. Therefore, globalization increasingly stimulates dividing states, depending on their level of development, the possibility of using international financial means.There are a lot of indicators which help us to assess the level of different countries' development and to compare it. However, it is generally considered to assess the level of countries' development concerning the following indicators:GNI, GNIper capita, GDP, GDP per capita, GDP PPP. In addition, accordingto the criteria which are established by the World Bank, the country gets into one of the four groups depending on the income level (The World Bank, 2019). In addition to these indicators, there are many global indexes and ratings which help us to understand the level of countries' development in different directions. These indexes are integrated indicators that allow anyone, regardless of education and place in society, not being a professional in the field of finance, politics, or economy, to understand what the development level of different countries is. There are many indicators which are used for calculation of different indexes: indicators of the level of economic development, social, scientific and technical development of the country; indicators of different levels of education quality, medicine, social support for unprotected groups of people; indicators of democracy and freedom development level; indicators of military development level; indicators of life safety and others. There are a lot of indexes and there issome interdependence between these indexes (country's places in the ranking) and the country's level of economic development, which is determined by the size of GDP and GDP per capita. Therefore, the main aim of this research is the de-

termination of the interdependence between GDP per capita and elements of international indexes that describe the level of innovation, scientific and technological development. We base our research on analyzing GDP per capita because such an approach will provide us with more objective information, as we compare countries that are absolutely different in size, population, history of development, culture, political and socio-economic structure.

Analysis of recent research and publications. The basis for the research were the scientific papers of the following authors: AssaJa., BoniniA., CalderonC., Danninger S., Dutta S., HsuYu-Ch., KovacevicM., Lanvin B., LengfelderCh., RiveraC., TapiaH., Schwab K., Sorenson O., YasserA., Wunsch-Vincent S. etc. Further research is needed on the interconnection and interdependence between GDP per capita and such indexes as Human Development Index, Global Innovation Index, and The Global Competitiveness Index and specific components of these indexes which shows the level of innovation, scientific and technical development. The choice of these components was determined by the dynamic development of the economic environment which needs to use in the production process not only traditional factors of production but also scientific and technological. And human capital is beginning more and more associated with knowledge, innovation, talent, which increases its value.

The aim of the research. The aim of the research is to determine the interdependence between GDP per capita and elements of international indexes that describe the level of innovation, scientific and technological development, as well as substantiation of necessity to increase the expenditure in this area.

Research results. As it was mentioned earlier, in accordance with the classification of the World Bank, countriesaredivided into four groups depending on the income level[5]. Therefore, for our research, we choose 2 countries from each of the four World Bank groups. In addition, during the research, we paid particular attention to the level of expenditures for R&D for these countries and some other countries with a higher level of development. R&D investment includes R&D expenditures for basic research, applied research, and experimental development[6]. Such an investigation made it possible to find some interdependence betweenthe level of economic development and spending GDP on research and development. However, there are some exceptions to

[5] *The World Bank.* World Bank Country and Lending Groups. 2019. Retrieved from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

[6] *Global R&D funding Forecast*, A Supplement to R&D Magazine. 2018. Retrieved from https://digital.rdmag.com/resear-handdevelopment/2018_global_r_d_funding_forecast?pg=1#pg1

the rule. For example, Finland, Sweden, despite of the high level of economic development has a dynamics (tendency) to reduce the expenditures for research. In general, Spain during the last 5 years did not have a lot of expenditures in this area. It might be because expenditures for research havea long-term impact and can be returned after a long period of time. But some countries, for example, Turkey has increased expenditures for research and innovation over the last three years. This research is based on R&D forecasts for each country on economic forecasts and science and technology (S&T) survey data performed by the International Monetary Fund (IMF), the World Bank, the Organization for Economic Cooperation and Development (OECD), and the U.S. Central Intelligence Agency, along with multiple reader surveys performed by the editors of R&D Magazine[7, 8]. Expenditures for R & D include investing in the development of advanced technologies, new consumer products, alternative, ecology clean sources of energy, artificial intelligence, pharmaceuticals for treatingserious illnesses, new software and technologies for protecting the environment, etc.The largest share has the United States and China. It is predictable because this research estimates the percentage of spending on R&D from the country's GDP. Conclusion: the most developed countries invest a lot of expenditures in research and development[9]. Nevertheless, some countries don't spend a lotonresearch and development but keep top positions in international development. In this research, we try to find interdependence between GDP per capita and elements of international indexes that describe the level of innovation, scientific and technological development. Below, in the article, we present the results of our research.

For the research, the following countries were chosen: Switzerland, Singapore, Bulgaria, Turkey, Moldova, Armenia, Tajikistan, Nepal and Ukraine. According to the World Bank classification, we have chosen two countries from each of the four groups and Ukraine was taken separately. Based on the analysis, we identify the interconnections and correlation of GDP per capita

[7] Basco, S., Mestieri, M. *The world income distribution: the effects of international unbundling of production*. Journal of economic grows, 49, issue 2: pp.189 – 221. Retrieved fromhttps://link.springer.com/article/10.1007/s10887-019-09164-4

[8] BranstetterLee G., GlennonB.J., Bradford Jensen.*The IT Revolution and the Globalization of R&D. Innovation policy and the Econimy*. 2019. Volume 19, pp. 11-14. Retrieved fromhttps://www.journals.uchicago.edu/doi/abs/10.1086/699931

[9] Jan-Michael Ross, Jan H. Fisch, Varga E. *Unlocking the value of real options: How firm specific learning conditions affect R&D investments under uncertainty*. Strategic Entrepreneurship Journal, 2017, 12, issue 3, pp. **335-353**. doi: https://doi.org/10.1002/sej.1275

and the degree of innovation, science and technology development. For better understanding ofchosen indexes (The human development index, the Global Innovation Index and the Global Competitiveness Index) and their components, we will describe(analyze) them in some words.

The Human Development Index(HDI) is a statistic composite index of life expectancy, education and per capita income indicators, which are used to rank countries into four tiers of human development. It is 1 when GNI per capita is $75,000 and 0 when GNI per capita is $100; Life Expectancy: it is 1 when Life expectancy at birth is 85 and 0 when Life expectancy at birth is 20; Education[10].

The Global Innovation Index consists of 80 different indicators that describe the innovative development of countries around the world in detail, which are at different levels of economic development. It includes the sum of two groups of indicators: availability of resources and conditions for innovation (InnovationInput) and achieved practical results of innovation (Innovation Output). The Global Innovation Index is a ratio of costs and effects that allows evaluating innovation development in different countries. In the framework of this research, from the Innovation Input group has been selected: human capital and research which includes: education (expenditure on education, % GDP, government funding/pupil, secondary, % GDP/cap; school life expectancy, years; PISA scales in reading, maths& science; pupil-teacher ratio, secondary); tertiary education (tertiary enrolment, % gross; graduates in science & engineering, %; tertiary inbound mobility, %); Research & development (R&D) (Researchers, FTE/mn pop.; Gross expenditure on R&D, % GDP; Global R&D companies, top 3, mn US$; QS university ranking, average score top 3)(DuttaS., 2013 -2018, LanvinB., 2013 -2018, Wunsch-VincentS., 2013 -2018, MarcRysman, 2017, ScottSchuh, 2017). From the Innovation Outputgroup has been selected: knowledge creation (patents by origin/bn PPP$ GDP; patents by origin/bn PPP$ GDP; utility models by origin/bn PPP$ GDP; utility models by origin/bn PPP$ GDP; citable documents H index); knowledge imp (growth rate of PPP$ GDP/worker, %; new businesses/th pop. 15–64; computer software spending, % GDP; ISO 9001 quality certificates/bn PPP$ GDP; high- & medium-high-tech manufactures, %); knowledge diffusion (intellectual property receipts, % total trade; high-tech net exports, % total trade; ICT services exports, % total tr; FDI net outflows, % GDP)[11].

[10] *United nationals development program.* Human development report, Human Development data 1990 – 2017.Retrieved from http://www.hdr.undp.org/en/data

[11] Dutta S., Lanvin B., Wunsch-Vincent S.*The Global Innovation Index.* Geneva, Switzerland,

The Global Competitiveness Index has been measuring the factors that drive long-term growth and prosperity for over four decades, helping policymakers identify challenges to be addressed and strengths to build on when designing the economic growth strategies for their countries. For the research was selected the components of the Global Competitiveness Index, which are related to innovative development, scientific and technological progress (Availability of latest technologies, Quality of the education system, Innovation and sophistication factors: Capacity for innovation, Quality of scientific research institutions, Company spending on R&D, University-industry collaboration in R&D; Gov't procurement of advanced tech product; Availability of scientists and engineers; PCT patents, applications/million pop)[12].

Furthermore, based on a chosen countries (Switzerland (CH), Singapore (SG), Bulgaria (BG), Turkey (TR), Moldova (MD), Armenia (AM), Tajikistan (TJ), Nepal (NP) and Ukraine (UA)) and selecting global indexes and their parts (Human development index, Global Innovation Index and The Global Competitiveness Index) correlation and regression analysis of GDP per capita and selected indexes (subindexes) was conducted.

As a result, we found for each country indicators that have the biggest impact on GDP per capita and built dependence between indicator growth and changing of GDP per capita (see Table 1). We research them for each country selected. The result of this analysis was finding indicators that have the biggest impact on GDP per capita. The data for the last 6 years have been researched.

Also, as a result of the analysis, indicators, which have the same effect on GDP per capita for the two selected countries, which are in the same group, according to the classification of countries by the level of income, defined by the World Bank, were highlighted. The values of the correlation coefficients for these indicators are highlighted in green. The next step was to determine the indicators for each selected country that have the biggest impact on GDP per capita (in grey) and build up (the graphic) the dependence between the growth of this indicator and the change in GDP per capita. We will analyze them separately for each country.

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by the WorldIntellectual Property Organization (WIPO), 10th edition, 2017, pp. 183–311. Retrieved from https://www.wipo.int/edocs/pubdocs/en/wipo_ pub_ gii_2017.pdf

[12)] Schwab K.*The Global Competitiveness Report 2017–2018*, Committed to improving the state of the world, The World economic forum, 2019, pp. 1–35. Retrieved from http://www3.weforum.org/docs/GCR2017-2018/05FullReport/ TheGlobalCompetitivenessReport2017–2018.pdf

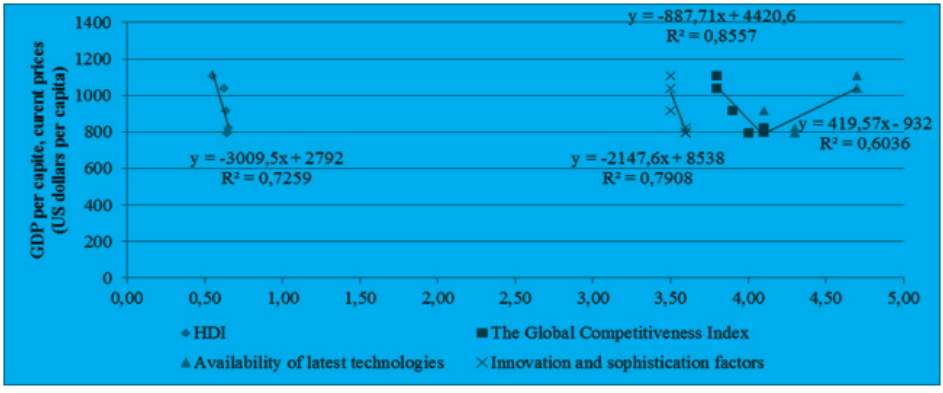
Tab. 1. Correlation analysis of GDP per capita and global indexes (sub-indexes)

Indicator/Country	UA	NP	TJ	AM	MD	TR	BG	CH	SG
GDP (current US$)	1	1	1	1	1	1	1	1	1
HDI	0,4	-0,3	-0,9	-0,2	0,5	-0,9	0,2	-0,5	0,3
The Global Innovation Index	0,1	-0,4	-0,4	-0,5	-0,1	-0,7	0,3	-0,6	0,3
Knowlage and technology outputs	-0,8	0,2	0,5	-0,9	-0,8	0,3	0,0	-0,5	-0,1
Human capital and research	-0,0	0,1	-0,7	0,1	0,0	-0,5	-0,1	-0,9	0,7
The Global Competitiveness Index	-0,2	-0,2	-0,9	0,5	-0,9	0,8	0,1	-0,5	0,5
Availability of latest technologies	0,6	0,4	0,8	0,9	0,1	0,8	-0,3	-0,4	-0,6
Quality of the education system	0,1	-0,1	-0,9	0,9	0,1	0,8	0,7	-0,5	0,8
Innovation and sophistication factors	0,1	-0,5	-0,9	-0,3	-0,9	0,6	0,8	-0,5	0,6
Capacity for innovation	0,1	-0,2	-0,9	0,4	0,5	-0,8	0,7	-0,5	0,3
Quality of scientific research institutions	0,2	0,1	-0,7	0,5	0,5	0,1	0,8	-0,5	0,8
Company spending on R&D	-0,1	0,4	0,2	0,6	-0,3	-0,1	0,8	-0,4	0,4
University-industry collaboration in R&D	0,9	0,2	-0,5	0,5	-0,9	0,5	0,8	-0,4	-0,8
Gov't procurement of advanced tech product	0,9	0,2	0,9	0,3	-0,9	0,6	0,8	-0,4	-0,5
Availability of scientists and engineers	0,9	-0,2	-0,7	0,5	-0,5	0,9	0,8	-0,4	0,7
PCT patents, applications/ million pop.*	-0,4	-	-	-0,5	-0,3	-0,8	-0,4	-0,6	0,8

Source: Compiled by the authors

For Low-income countries (< 995) the indicator of Research and development expenditures (% of GDP) is not researched[13, 14]. This fact shows that countries with very low levels of development do not spend money in this direction, or the percentage of expenditures for research and innovation is so small that international organizations do not take them into calculating total expenditure on research and development. The confirmation of this fact, according to our research, is the absence of an impact on GDP per capita in Nepal of any of the selected indicators. The second selected country from this group was Tajikistan.

Fig. 1. Analysis of the impact of HDI, Availability of latest technologies, The Global Competitiveness Index, Innovation and sophistication factors on GDP per capita for the period 2013-2018 (Tajikistan)



Source: Compiled by the authors

For this country (fig. 1), there is an inverse dependence between GDP per capita and HDI, the Global Competitiveness Index and Innovation and sophistication factors. These indexes show life expectancy, education and income

[13] *The World Bank.* World Bank Country and Lending Groups. 2019. Retrieved from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

[14] *Global R&D funding Forecast,* A Supplement to R&D Magazine. 2018. Retrieved from https://digital.rdmag.com/resear-handdevelopment/2018_global_r_d_funding_forecast?pg=1#pg1

level of the population; the ability of countries to provide high levels of prosperity to their citizens; the level of supporting the factors that have the greatest impact on the level of a country's innovation development. At first, these indicators grew very slowly, and the second, indicators of these indexes are characterized by the country's expenditures on the development of these areas. The positive return of the country's expenditures for R&D can be expected only in the long-term period of time if the resources will be used rationally in the country and will be provided by effective administration. At the same time, the availability of the latest technologies has a direct impact on GDP per capita,because it shows the results of R&D politics and the availability of technology in the country.

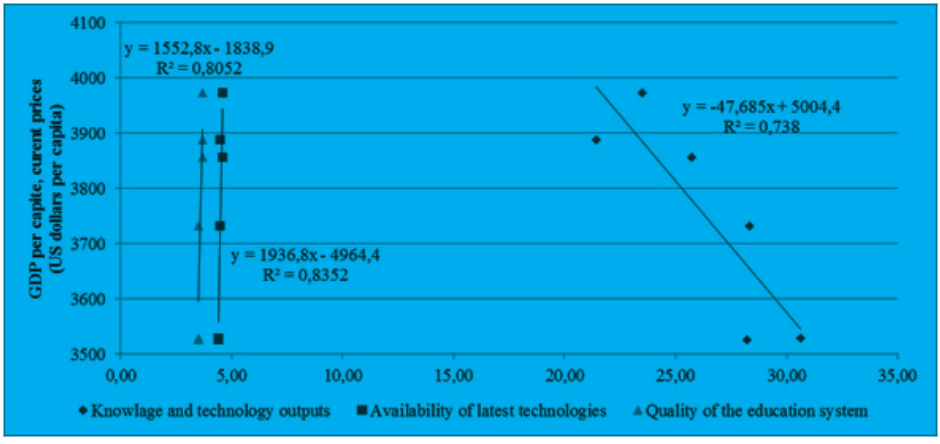
From the Lower-middle income countries (996 - 3,895), which includes Ukraine, for research were selected Armenia and Moldova.

The growth of the sub-index Knowledge and technology outputs has inverse dependence to GDP per capita in Ukraine(fig. 2). This sub-index is included in the Innovation Output Indicator Group. It consists of indicators like the number of published articles, patents, citations in scientific journals, getting international quality certificates. In other words, this sub-index includes indicators that show some results of R&D and it is difficult to assess them in monetary form. In addition, this sub-index includes indicators that show the effect of innovation in monetary form. This is, for example, the cost of software, the growth of GDP per capita due to technical progress. However, the inverse dependence can be explained that the positive return of the country's expenditures for R&D can be expected only in the long--term period of time. In addition, it is difficult to assess in monetary form all components which are included in this sub-index. Also, in Ukraine, we have a deficit of technical staff and workers professions, who agree to work for the offered salary in the market. In addition, in Ukraine there are some disproportions in the higher education system. Most universities of Ukraine prepare graduates of the humanities professions, while the market needs technical professions.

Concerning three other researching indicators that have an impact on GDP per capita in Ukraine, we see a direct dependence between them. The gained result confirms the importance for Ukraine in cooperation among universities, research institutions and business; the creation of demand for innovative products by the government. For the development of production in the country and as a result GDP growth, we should pay attention for the commercialization of scientific ideas, the private investment in the develop-

ment of laboratory research, which should be on a university base and receive government support. It is very important to prepare engineers, scientists and other technical stafffor the development of scientific and technological progress and the creation of innovative products. It will increase the cooperation between business and the scientific sector and will have a positive impact on GDP per capita growth in the country.

Fig. 2. Analysis of the impact of Knowledge and technology outputs,Gov't procurement of advanced tech product,Availability of scientists and engineerson GDP per capita for the period 2013-2018 (Ukraine)



Source: Compiled by the authors

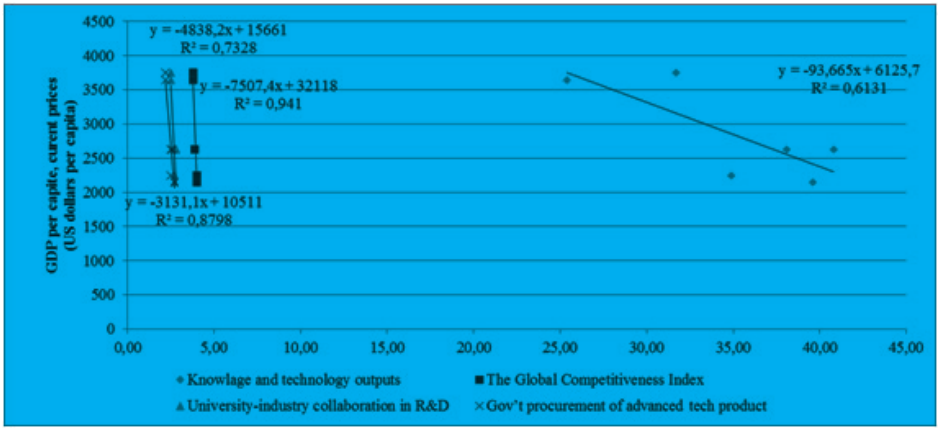
Availability of the latest technologies, Quality of education hasa directly dependence of system to GDP per capita in Armenia (fig. 3). We can see such research results because it is a qualitative indicator that shows how the education system corresponds to the needs of a competitive economy. Knowledge and technology outputs haveinverse dependence on GDP per capita it can be explained in the same wayas for Ukraine.

As for Moldova(fig. 4), which like Ukraine and Armenia included in the Lower-middle income countries (996-3.895), it has inverse dependence to GDP per capita according to the indicators which have the most impact on GDP per capita.

This dependence for that group of Lower-middle income countries (996-3895) can be explained by Hight expenditure for improving the living

standards of the population, financing scientific, technical and innovation development, investment in science and education, and increasing the level of public procurement of innovative products[15, 16]. But, as we told earlier, the return of the country's expenditures for R&D can be expected only in the long-term period of time.

Fig. 3. Analysis of the impact of Knowledge and technology outputs, Availability of scientists and engineers, Quality of the education system on GDP per capita for the period 2013-2018 (Armenia)

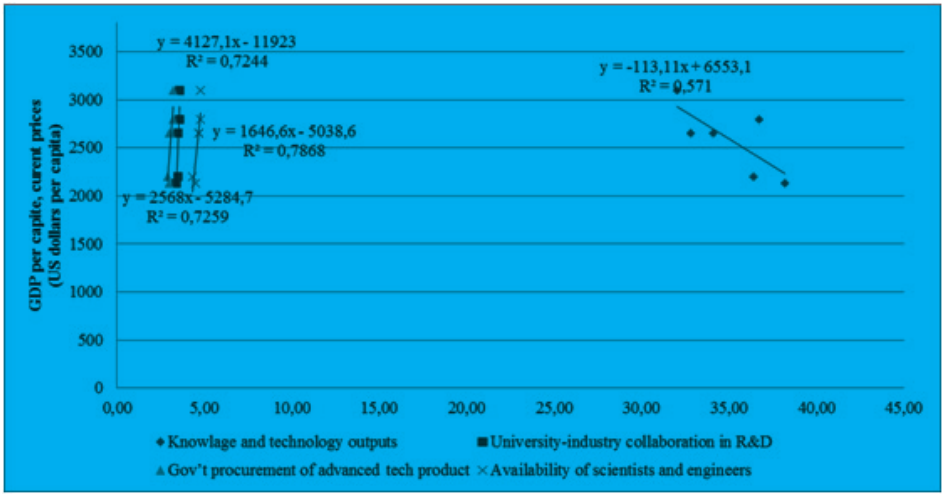


Source: Compiled by the authors

[15] *The World Bank*. World Bank Country and Lending Groups. 2019. Retrieved from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and- lending-groups

[16] *Global R&D funding Forecast*, A Supplement to R&D Magazine. 2018. Retrieved from https://digital.rdmag.com/resear-handdevelopment/2018_global_r_d_funding_forecast?pg=1#pg1

Fig. 4. Analysis of the impact of Knowledge and technology outputs, University-industry collaboration in R&D, The Global Competitiveness Index, Gov't procurement of advanced tech product on GDP per capita for the period 2013-2018 (Moldova)

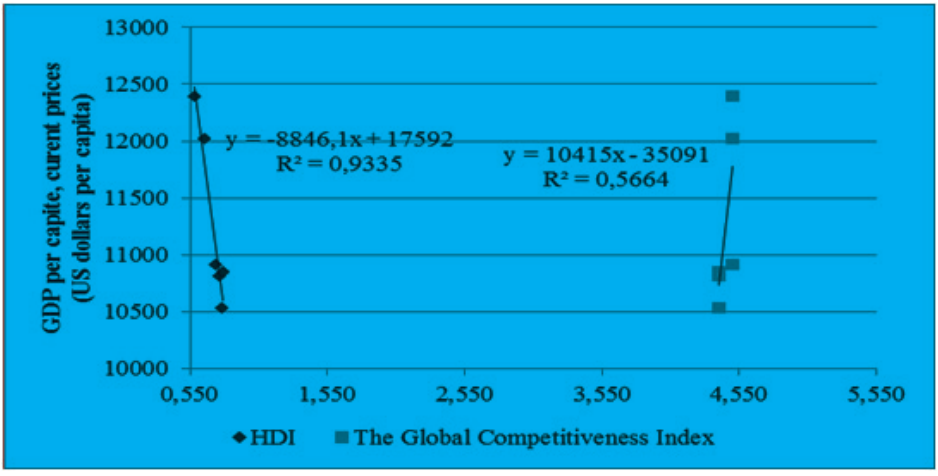


Source: Compiled by the authors

From the Upper-middle income countries (3,896 – 12,055), for research were selected Turkey and Bulgaria.

HDI and The Global Innovation Index has inverse dependence to GDP per capita in Turkey (fig. 5).

Fig. 5. Analysis of the impact of HDI, The Global Innovation Index on GDP per capita for the period 2013-2018 (Turkey)



Source: Compiled by the authors

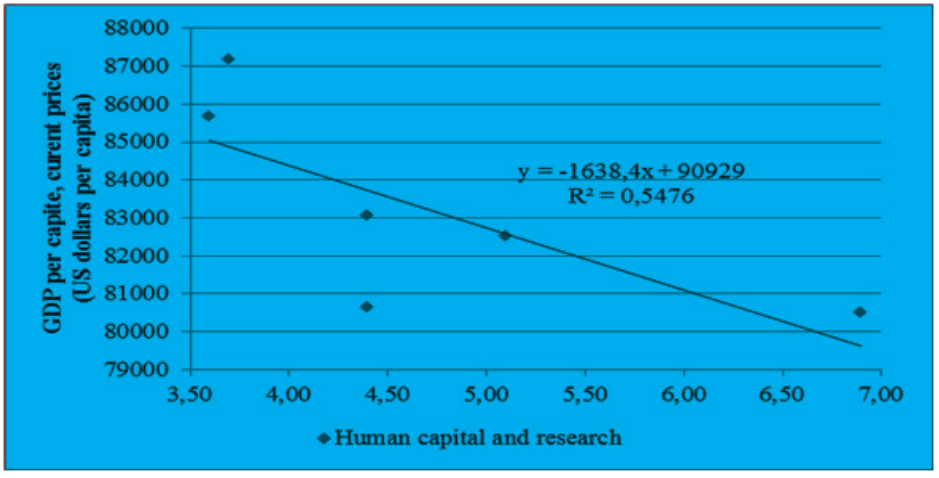
This can be explained, at first, by the fact that one of the indicators which are included inHDI is GDP per capita, and for Turkey, it is increasing; secondly, increasing the level of education, quality of life, developing an innovative component of the economy need an expenditure, therefore, HDI and The Global Innovation Index growth needs expenditures for this area. But, as it was said earlier, the return of the country's expenditures for R&D can be expected only in the long-term period of time.

However, we can see the direct dependence between the Global Competitiveness Index and Availability of scientists and engineers and GDP per capita in Turkey, it shows that the competitiveness of the country is increasing. So, the expenditures on the socio-economic development of the country which are included in this index are effective.

Regarding Bulgaria(fig. 6), GDP per capita has been an increase over the last 4 years. We can see the direct dependence between GDP per capita and indicators that have the biggest impact on GDP per capita in the country. This dependence can be explained by the fact that the greatest impact on GDP per capita in this country have those indicators that show the quality of education, the level of cooperation between universities research institutions and

businesses, creation of demand for innovative products by the government, preparing scientists and other technical staff[17].

Fig. 6. Analysis of the impact of Quality of scientific research institutions, Gov't procurement of advanced tech product, Availability of scientists and engineers on GDP per capita for the period 2013-2018 (Bulgaria)



Source: Compiled by the authors

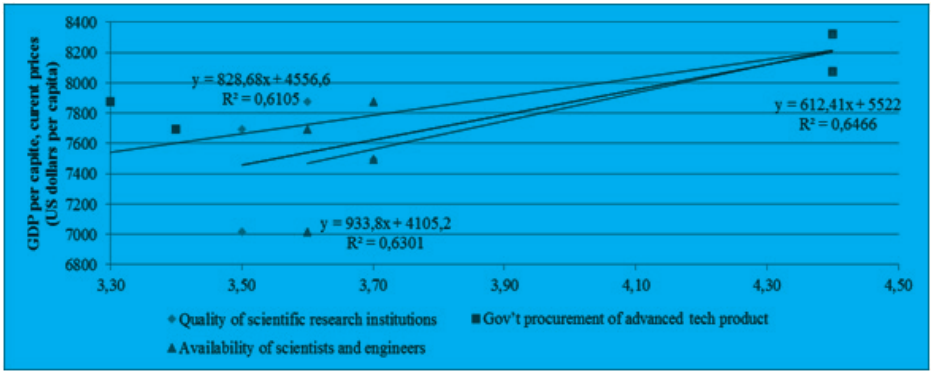
The greatest influence is the qualitative indicators, which show the result of previously implemented measures and invested money. This dependence is the result of previous effective innovation and investment policy in the country, which shows the needs of government and private investment in education, science, development of innovation, scientific and technological progress.From the High-income countries (> 12,055), for research were selected Switzerland and Singapore.

Human capital and research has the largest impact on GDP per capita for Switzerland(fig. 7), but the dependence between them is inverse. This dependence can be explained by the fact that the greatest impact on GDP per capita

[17] Dutta S., Lanvin B., Wunsch-Vincent S.*The Global Innovation Index.* Geneva, Switzerland, by the WorldIntellectual Property Organization (WIPO), 10th edition, 2017, pp. 183–311. Retrieved from https://www.wipo.int/edocs/pubdocs/en/wipo_ pub_ gii_2017.pdf

in this country has Human capital and research indicator which includes sub--indexes that describe expenditure for education, R & D, and sub-indexes that describe qualitative components, for example, the percentage of students who receive education on technical and engineering faculties.

Fig. 7. Analysis of the impact of Human capital and research on GDP per capita for the period 2013-2018 (Switzerland)



Source: Compiled by the authors

The country is home to large multinationals that are often leaders in their sector, as well as a dense network of SMEs with a reputation for quality and innovation. In addition to research excellence, an intense collaboration between the academic and business worlds yields innovative products with commercial applications[18, 19].

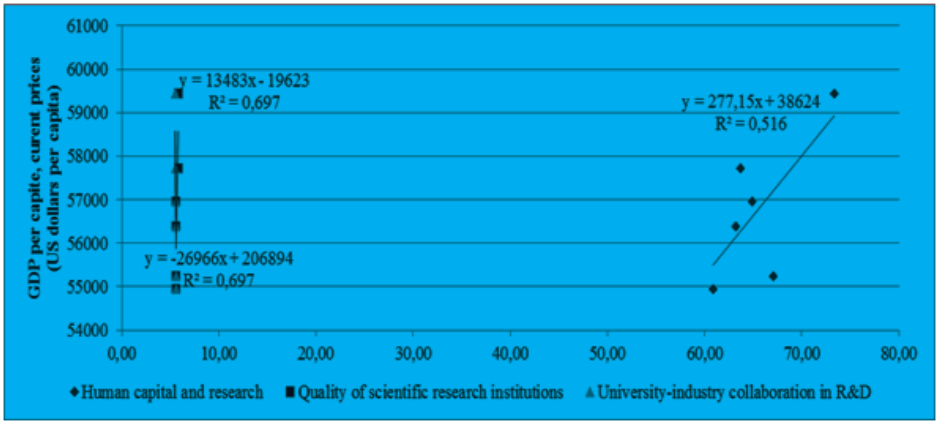
The impact of the sub-index Human capital and research on GDP per capita for Singapore can be explained the same as for Switzerland (fig. 8). But, direct dependence might indicate that the return from investment in education, science and innovation more than expenditure. The direct dependence between GDP per capita and Quality of scientific research institutions and PCT patents, applications / million pop., can be explained, on the one hand,

[18] *United nationals development program.* Human development report, Human Development data 1990 – 2017.Retrieved from http://www.hdr.undp.org/en/data

[19] Dutta S., Lanvin B., Wunsch-Vincent S.*The Global Innovation Index.* Geneva, Switzerland, by the WorldIntellectual Property Organization (WIPO), 10th edition, 2017, pp. 183–311. Retrieved from https://www.wipo.int/edocs/pubdocs/en/wipo_ pub_ gii_2017.pdf

by the fact that these indicators are qualitative and don't have cost aspects, but on the other hand, it has an impact on the level of socio-economic development of the country. Singapore is a regional innovation house, but in order to become a global powerhouse, it will need to improve its ecosystem further: Skills, Business dynamism and Innovation capability.

Fig. 8. Analysis of the impact of Human capital and research, Quality of scientific research institutions on GDP per capita for the period 2013-2018 (Singapore)



Source: Compiled by the authors

According to the research, we can tell that very important for any country is developing the area of innovation, research and development, education and human capital in the context of globalization. Based on the criteria are determined by the World Bank, we can tell that all countries in the High-income countries (> 12,055) and Upper-middle income countries (3,896 – 12,055) have powerful innovative potential. However, there are some countries with a high level of development, that did not have a large expenditure for the development of this area during the analyzed period of time. It might be connected with the long-term return on such expenditures that were made in previous periods. For research was selected next countries: Switzerland, Singapore, Bulgaria, Turkey, Moldova, Armenia, Tajikistan, Nepal and Ukraine. According to the World Bank classification, we take two countries from each of the

four groups and separately Ukraine. In this research, we tried to find interdependence between GDP per capita and elements of international indexes that describe the level of innovation, scientific and technological development.

Conclusion. The conducted research showed, that countries with very low levels of development do not spend money on R & D, or the percentage of expenditures for research and innovation is so small that international organizations do not take them into calculating total expenditure on research and development.

For Lower-middle income countries (996 – 3.895), which include Ukraine, in most cases, we can see the inverse direct dependence between GDP per capita and indexes or sub-indices that describe the level of scientific and technological development. At first, the inverse dependence can be explained that the positive return onthe country's expenditures for R&D can be expected only in the long-term period of time. Secondly, such countries, as a rule, have some disproportions in expenditure on education or do not have enough investment to R & D. The results for Lower-middle income countries confirm the importance of cooperation between universities, research institutions and business; the creation of demand for innovative products by the government.

For Upper-middle income countries (3,896 – 12,055) in the most cases we can see the direct dependence between GDP per capita and indicators which describe the quality of education, the level of cooperation between universities research institutions and businesses, creation of demand for innovative products by the government, preparing scientists and other technical staff. The greatest influence has the qualitative indicators, which show the result of previously implemented measures and invested money. This dependence is the result of effective innovation and investment policy in the country during the previous periods, which shows the necessity of further government and private support and financial investment in education and science, and development of innovation, scientific and technological progress.

High-income countries (> 12,055) have a high-level R & D. If compared High-income countries (> 12,055) with countries from other groups, it has the biggest share of R & D expenditures. From all researched indicators, the biggest impact on GDP per capita has Human capital and research sub-index. It includes sub-indexes which describe expenditure for education, R & D, and sub-indexes which describe qualitative components, such as the percentage of students who receive education on technical and engineering faculties. Therefore, our conclusions about this group of countries and their characteristics

from the point of view of innovation and research component of development are confirmed.

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