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THE IMPACT OF THE DEVELOPMENT OF MANUFACTURING ON ECONOMIC GROWTH: THE EXPERIENCE OF UZBEKISTAN

The article is devoted to the assessment of the impact of the development of manufacturing on economic growth in developing countries, in particular, the Republic of Uzbekistan. Conclusions for Uzbekistan take into account the peculiarities of the implementation of the Program for Localization of the Production of Finished Products, Components and Materials. To perform the estimates, a regression model was constructed to determine the impact of the factors of sustainable economic growth on per capita GDP (in US dollars of 2010), which indicator is used in the model as a dependent variable characterizing sustainable development. Factors of economic growth are substantiated with the use of well-known theoretical approaches and empirical data. The article presents a cross-country analysis of economic growth indicators in developing countries, which allowed to form a sufficient sample of data for estimates. The article evaluates the impact of the diversification factor on economic growth indicators, analyzes the relationship between the indicators of processing industry development and economic growth. The connection between the volatility of economic growth and the development of the processing industry is demonstrated, as well as a comparative analysis of different types of economic diversification in the developing countries selected for this study. Using correlation and regression analysis, the impact on economic growth of such factors as R&D expenditures, human capital, trade openness, the share of manufacturing in GDP, and employment in industry was analyzed in detail. Based on the author's study of the impact of these factors on economic growth, the recommendations have been developed for developing countries, including Uzbekistan.

Keywords: *factors of economic growth, manufacturing industry, economic diversification, R&D expenditures, human capital, trade openness*

The coronavirus pandemic has slowed economic growth in the entire world. According to OECD forecasts, in 2020 the world GDP growth rate is expected to decrease (Fig. 1). In many developing countries, there is a reduction in output, consumption, and income, which creates economic tensions.

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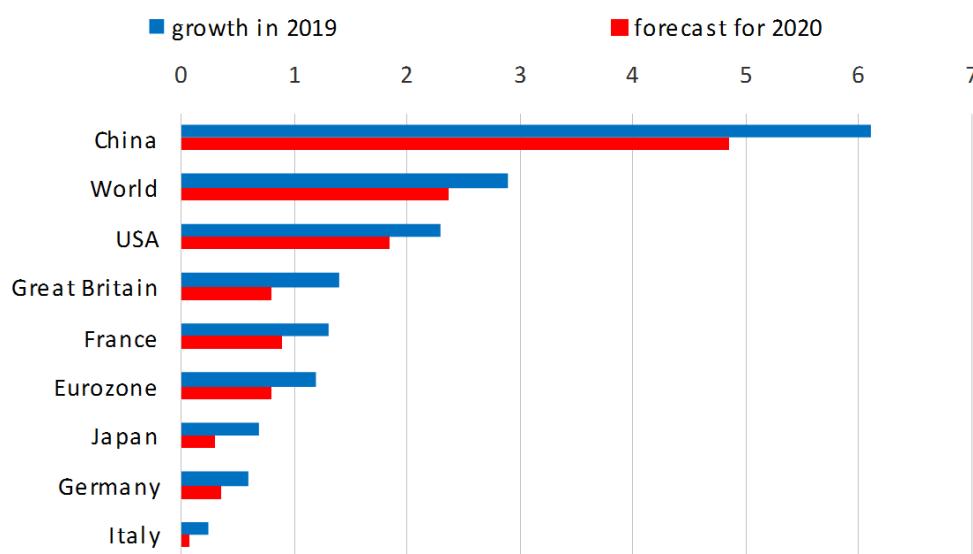


Fig. 1. Annual GDP growth in 2019 and 2020, %

Source: OECD.

However, in Uzbekistan it is planned to ensure a GDP growth rate of 2.2% in 2020. The resolution of August 29, 2020 "On measures to restore economic growth in 2020-2021 and on the continuation of systemic structural reforms in the sectors of economy" presents a program, consisting of two stages. In the first stage, it is planned to stabilize and restore economic growth, and in the second one - to continue systemic reforms.

Thus, in 2020, at the stage of stabilization and restoration of growth, the growth rate of industry in Uzbekistan was planned to increase to 3.4%, and to reduce the decrease in the rate of exports to -5.7%. Experts note that countries with developed industry and exports will benefit from the recovery of demand.

It is important for Uzbekistan to ensure the development of the industrial sector. In many national economies, a key position in this sector is occupied by the manufacturing that ensures sustainable economic growth.

As industry produces about 27% of GDP and provides 22% of total employment, it comprises a major part of the world economy.

According to the World Bank², the share of manufacturing in GDP has averaged about 21% in countries with above-average incomes over the past twenty years, 16% worldwide, and 13.7% in Uzbekistan. The dynamics shows that in Uzbekistan there is a growth in the share of the manufacturing industry: from 10.8% in 2010 to 19.5% in 2019 (Fig. 2). However, the share of high-tech products in the processing industry is quite low.

In the last ten years, the intensification of the manufacturing has become a major factor in the growth of total industrial output in Uzbekistan. In the overall structure of Uzbekistan industry in 2010-2019, its share increased from 73.8 to 79% (Fig. 3).

² World Bank data of 18.08.2020

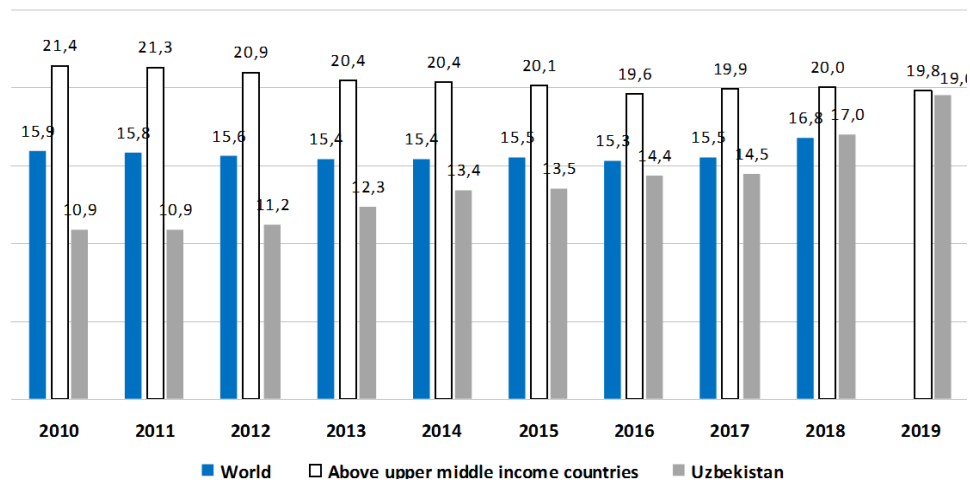


Fig. 2. Change in the share of manufacturing in GDP, %

Source: World Bank data, 2020.

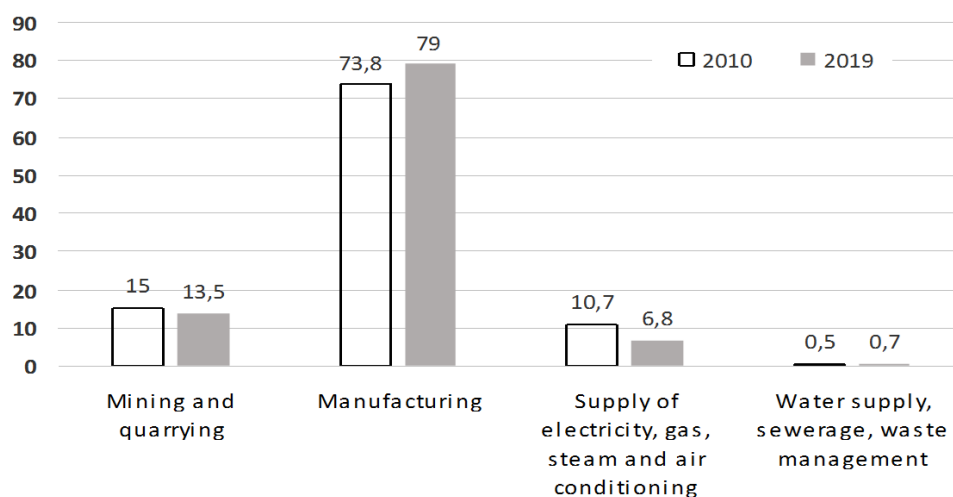


Fig. 3. The structure of industry in Uzbekistan

Source: data of the State Committee of the Republic of Uzbekistan on Statistics.

The survey covered a sample of 50 developing countries from all regions of the world, which are similar to Uzbekistan in terms of development (per capita GDP) and economic structure (share of industry in GDP). Among them are 20 countries in Asia (four - West Asia, four - Central Asia, eight - East and Southeast Asia, and five - South Asia), four countries in Africa, nine - Europe, nine - Latin America and seven North American countries. In addition, eight of the analyzed countries are the former CIS countries (Russia, Azerbaijan, Kyrgyzstan, Uzbekistan, Kazakhstan, Belarus, Ukraine, and Tajikistan) and other transition economies (18 countries), including China and Vietnam.

Below, Fig. 4 shows the first and last ten of these 50 developing countries, which are ranked according to the scale of manufacturing in the structure of their economies for 2000-2019. The average share of manufacturing in GDP in the top ten countries was 22.9%, and in the bottom ten countries was 10.0%.

In the first group, the average estimates of GDP volatility in the ranked population were 2.2 percentage points, and in the second group was much higher than 3.8 percentage points (see Fig. 4). Thus, countries with a high share of manufacturing are on average less volatile in economic growth than those with a low share, in other words, their growth is more inclusive.

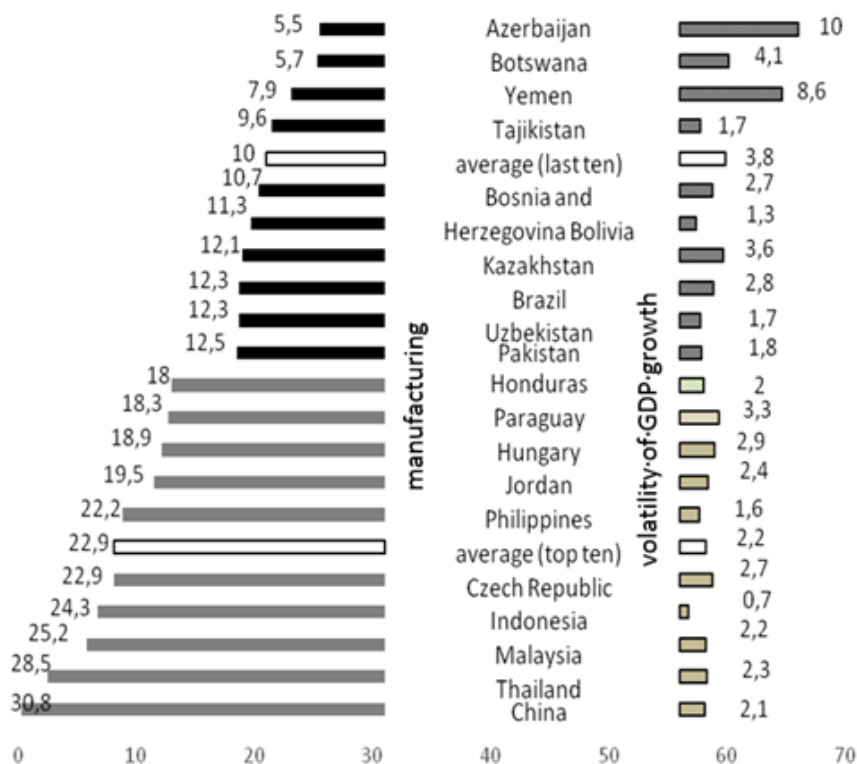


Fig. 4. The ten developing countries³ with the largest and smallest shares of the processing industry in GDP (left) and volatility⁴ of GDP growth (right) on average for 2000-2019

Source: the author's calculations based on World Bank data WDI.

Regarding the share of manufacturing in GDP in 2000-2019, its increase was observed in Jordan (+3.8 gross formation), Bosnia and Herzegovina (+3.1 gross formation), and Yemen (+2.7 gross formation), and reductions - in Tajikistan (-22.5 gross formation), the Dominican Republic (-10.3 gross formation), and Malaysia (- 8.0 gross formation).

The reason for the reduction of the share of manufacturing in the structure of the economy along with the decline in production in these economies is the effect of "premature deindustrialization", which negatively affected economic growth.

The share of jobs in services related to medium-tech industries, such as metallurgy and metalworking industry is much higher than the share of jobs directly

³ Among 50 selected developing countries.

⁴ Volatility is calculated as a standard deviation of GDP growth rates for 2000-2019.

in manufacturing, and the creation of new jobs in the service sector can compensate for their reduction in industry [1]. It is noted that the preconditions for the natural outflow of capital from industry to the services sector are a combination of two factors: if industry achieves 30% of GDP, and gross national product (GNP) per capita - at least 12 thousand dollars. These areas can also significantly contribute to employment growth in related services, especially in business services, which include R&D and consulting services.

The UNIDO report [2] states that investment and accumulation of physical capital are key factors in both manufacturing growth and aggregate growth in developing countries. The development of medium-tech and low-tech industries of these countries is influenced by the consumption of natural and energy resources. Diversification of the economy in favor of the manufacturing allows to achieve high rates and longer periods of growth and reduce volatility, which supports economic growth in the long run.

For developing countries, which seek to sustain economic growth and ensure sustainable job creation, the manufacturing sector provides an opportunity not only to shift the balance of the economy towards higher value-added industries, but also to create a relatively broad base of job with higher labor productivity. In these conditions, there is a steady demand for skilled labor, while the level of employees' income increases, which has a positive effect on such social indicators as human capital and poverty.

From the ecological perspective, companies tend to find efficient ways of the use of resources. As businesspersons strive to maximize profits and minimize costs by introducing innovations into technological processes, this tendency contributes to resource conservation, reduction of environmental pollution and waste recycling.

A review of existing publications on this topic provides an opportunity to draw a number of important conclusions for the purposes of our study. In the work of V. Kondratieva [3], it is noted that the manufacturing becomes a good basis for R&D, stimulates innovation, productivity and growth of welfare.

Examining the conditions of development of the manufacturing, Carlos F. Gomes, Mahmoud M. Yasin, João V. Lisboa [4] note that high-performance organizations tend to pay more attention to product quality and demand orientation than low-productivity ones.

Y. Wei and X. Liu [5] examine the impact of productivity factors such as R&D, exports and foreign direct investment (FDI) in China's manufacturing sector. They identify positive effects from R&D and exports in intersectoral production and positive effects in production for both foreign and local producers in the region.

The article by I. Kalashnikova and Li Jujsjan [6] identifies the conditions, which ensured the effectiveness of the development of Chinese industry, such as tax benefits, investment support for R&D, and encouragement of the use of China's own technologies. China pursues a policy of finding advanced technologies used by international corporations in key cost-effective areas. All technologies used in the production of goods (services) for the needs of the Chinese government must be created in China. This prompted many multinational companies to focus most of

their research and development in China. Generalization of the results of research by Chinese scientists makes it possible to identify the guidelines of the new state strategy for the development of Chinese industry, such as: alternative energy sources, composite materials, information industry, development and exploitation of new technologies, development of intellectual capital, and environmental protection.

In the study by V. Borysova [7], it was demonstrated that innovation-technological and investment factors are able to ensure sustainable growth in the manufacturing sectors.

In view of the above, it can be concluded that the human factor, investment support for R&D, and innovation play an important role in the development of the manufacturing and, as a consequence, in ensuring inclusive economic growth.

Over the past millennium, the world's population has grown 23 times, per capita income - 14 times, and GDP - more than 300 times [8]. Increasing incomes and per capita labor productivity lead to significant changes in the economic and social spheres. The level of development of individual economies is extremely diverse (Fig. 5). At the same time, the coronavirus pandemic is currently having a serious impact on the economy, so maintaining increasing economic growth is becoming an urgent task for all countries of the world, including Uzbekistan.

As you can see, the accelerated rate of GDP per capita is observed in countries such as the United States, Germany, but in the Central African Republic (CAR) growth is not observed at all. Why have some countries become richer than others? What is the reason for their economic growth? To study these questions, economists at different times tried to identify factors that stimulate economic growth.

The experience of developed countries shows that today sustainable economic growth must be based on qualitative positive changes due to innovations aimed at increasing efficiency, growth and improving the quality of life.

The concept of high quality economic growth was first used in World Bank research [9].

The IMF paper [10] is interesting, where a growth model was built and it was found out that, in addition to such factors affecting economic growth as investment, and human capital, an important role is played by structural transformations of the economy that determine long-term growth.

In recent years, Uzbekistan has adopted the necessary programs and continues to take measures to diversify its economy [11, 12]. The share of value added in industry increased from 20%⁵ (2000) to 33% (2019), while in and the agriculture it reduced from 30% (2000) to 26% (2019). Positive changes are observed in the development of the manufacturing, whose share in Uzbekistan's GDP in 2010-2019 almost doubled from 10.6 to 19.6%. However, it should be noted that the effectiveness of measures taken in Uzbekistan is still insufficient, as evidenced by the following World Bank statistics: the share of exports of the country's manufacturing in the exports of goods in 2018 was 34% (in the group of low and middle income countries

⁵ World Bank data, 2020.

- 66%), and the share of high-tech produce in the exports of the manufacturing - 0.5% (in the group of low- and middle-income countries - 22%).

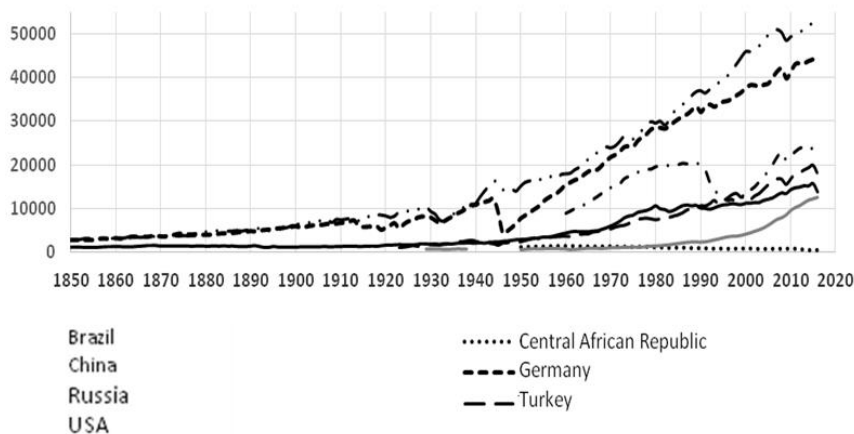


Fig. 5. Differences in the progress of the world economy

Source: Bolt Jutta, Inklaar Robert, De Jong Herman and Van Zanden Jan Luiten. Maddison Project Database, version 2018. *Maddison Project Working Paper*. 2018. Nr. 10. URL: www.ggd.net/maddison

The development of industry in Uzbekistan was also facilitated by the implementation of the Program of localization of the production of finished goods, components and materials. The localization program is approved annually by the Government of Uzbekistan, and it includes projects that are important for the further development of this country's industry based on local raw materials and components. In 2019, under this program 839 projects produced products worth 21.8 trillion, exported localized products worth \$549.4 million, and created 10038 new jobs. Compared to the same period in 2018, in January-December 2019, the number of newly created jobs increased 9.2 times. At the same time, compared to January-December 2018, there is an increase in exports of localized products (Table 1).

Table 1

The main indicators of the Program of localization of the production of finished goods, components and materials in 2018 and 2019

Indicator	2018	2019
Number of projects, <i>units</i>	714	839
Number of enterprises, <i>units</i>	297	340
Output, <i>billion sum</i>	15010	21750
Exports of localized products, <i>million dollars</i>	458	549
New jobs, <i>units</i>	1092	10038

Source: data of the State Committee of the Republic of Uzbekistan on Statistics.

The urgency of further development of the manufacturing for Uzbekistan can be outlined as follows: while maintaining the situation of economic diversification, it is not easy to ensure high and sustainable rates of economic development.

In order to study the degree of influence of diversification on economic growth, a model was studied, in which the influence of factors of sustainable economic growth was determined at the interstate level. In this model, the independent

variables are the average data for 2000-2018, and the dependent variable is the GDP per capita in 2019 for 217 countries. All data are taken from the World Bank database.

In other words, in this model, the author considers GDP per capita (in US dollars of 2010) as dependent variable, i.e. as the indicator that determines the level of a country's economic development, and its place in general classifications used in international statistics and comparative studies. GDP per capita depends on the rate of change in population, which does not always points to the indicator's adequacy. However, a number of studies consider GDP per capita as an indicator of economic development, as exemplified by the work of researchers in the economic department of the OECD, as well as the IMF study "Growth and Structural Reforms: A New Assessments" (2009) ⁶.

The model includes a conditional variable that divides the countries of the world into four groups according to the level of per capita income according to the World Bank methodology (the first group - high income, \$12375 and more; the second group - above average income within \$3996-12375; the third group - income below the average within \$1026-3995; and the fourth group - low income at \$1025 or less).

Table 2

Correlation matrix of GDP per capita and its factors

Indicator	GDP per capita	R&D expenditure	Trade openness	Employment in industry	The share of manufacturing in GDP	Human capital
GDP per capita (log)	1					
R&D expenditure	0,64***	1				
Trade openness	0,33***	0,02	1			
Employment in industry	0,63***	0,23***	0,16**	1		
The share of manufacturing in GDP	0,2**	0,14*	-0,09	0,4***	1	
Human capital	0,88***	0,67***	0,33***	0,57***	0,26***	1

Note: * - 90% significance, ** - 95% significance, *** - 99% significance.

Source: author's calculations based on World Bank data, 2020.

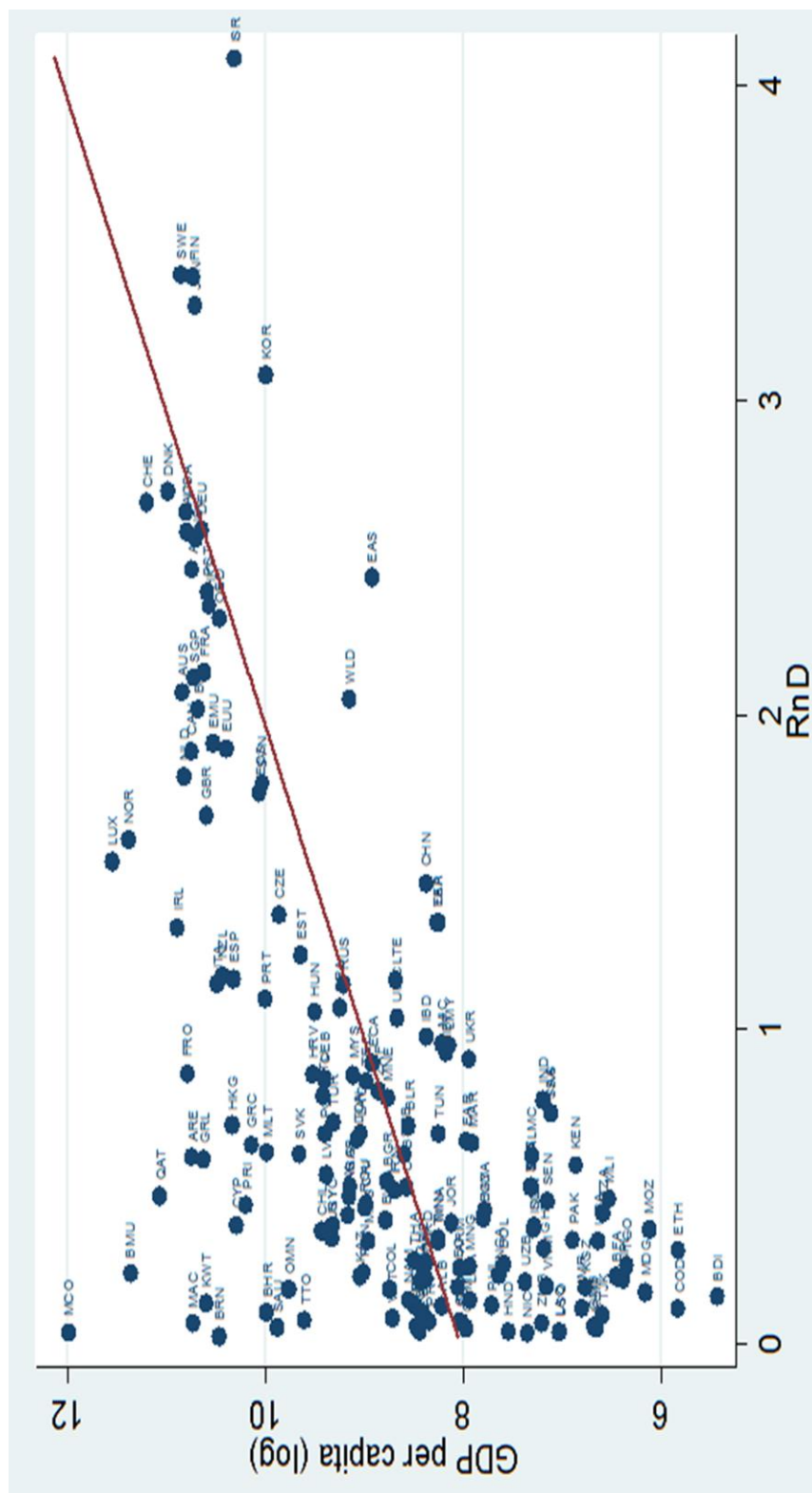
The model's independent variables include human capital, employment in industry, the share of manufacturing in GDP, R&D expenditures, and trade openness.

⁶ Christiansen Lone Engbo, Tressel Thierry, Schindler Martin. Growth and Structural Reforms: A New Assessment. *IMF Working Paper*. December 1, 2009. No. 09/284. URL: <https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Growth-and-Structural-Reforms-A-New-Assessment-23464>

A number of studies consider the impact of the independent variable, R&D expenditure as % to GDP (as a source of innovation) on the economy's sustainable development [13, 14]. In this regard, it is advisable to hypothesize that R&D expenditures are positively related to the dependent variable, such as GDP per capita in this study. In Fig. 6, this hypothesis is confirmed graphically. The correlation coefficient between economic growth and R&D expenditures is positive and equals to 0.64 (Table 2). According to the share of R&D expenditures, countries can be divided into three groups, depending on their expenditures: Group I - countries with a share of R&D expenditures over 3% of GDP, Group II – those with this indicator from 1 to 3%, and Group III - up to 1%. In countries with above-average incomes, R&D expenditures in GDP in 2018 amounted to 1.7%, while in Uzbekistan - about 0.2%. Countries with higher R&D expenditures are mainly East Asian countries, such as Japan (3.2%), and South Korea (4.8%), European countries - such as Sweden (3.3%), Israel (4.9%), Germany (3.1%), Finland (2.8%), and Austria (3.2%), as well as the United States (2.8%) and others. Interestingly, about 80% of total R&D expenditures worldwide are accounted for by United States, China, Japan, and the EU. Thus, our analysis confirms that economic growth is based on the development of R&D.

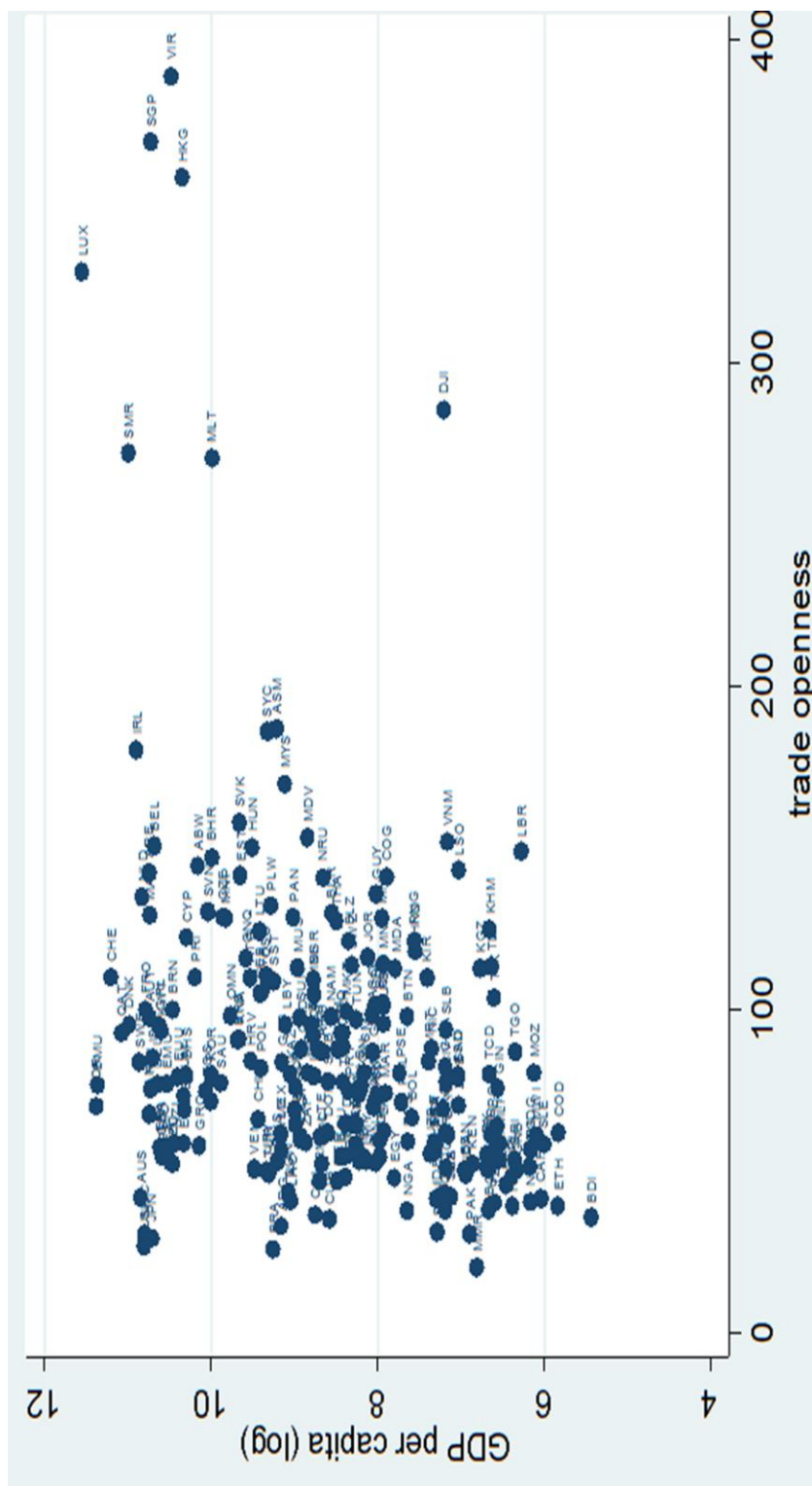
The inclusion in the model of such an independent variable as trade openness is explained by the fact that openness to the outside world leads to greater market competition, which increases productivity and consequently economic growth, and has a positive impact on living standards. Giorgio Barba Navaretti and Marcello Spanò's study "Openness, Growth and Poverty" [15] argues that even if evidence that trade has a positive effect on growth may be questionable from a methodological and other standpoints, there is no evidence to support the alternative scenario and there is no evidence that protectionist measures are conducive to long-term economic growth. On the contrary, a number of studies, in particular in the 1980s and 1990s, convincingly showed that protectionist strategies, such as industrialization to replace imports, are unsustainable in the long run and do not serve as a shortcut to prosperity (for a review on this topic see De Melo and Grether, 2001 [16]).

The impact of foreign trade on economic growth has been examined in empirical studies with an emphasis on the factors influencing these indicators. Among them, important factors that increase economic growth include increased investment, human capital, and technology development. In empirical studies, the use of trade openness indicators does not always clearly indicate the openness of the country's economy. A number of studies, including Frankel & Romer (1999) [17] and Alcalá & Ciccone (2004) [18], show a positive effect of trade openness on economic growth. In our study, the correlation coefficient between GDP per capita and trade openness is significant at 99%, positive and equals to 0.33.



Indicator averaged for 2000–2018

Source: author's calculations based on WDI data.



Indicator averaged for 2000-2018

Source: author's calculations based on WDI data.

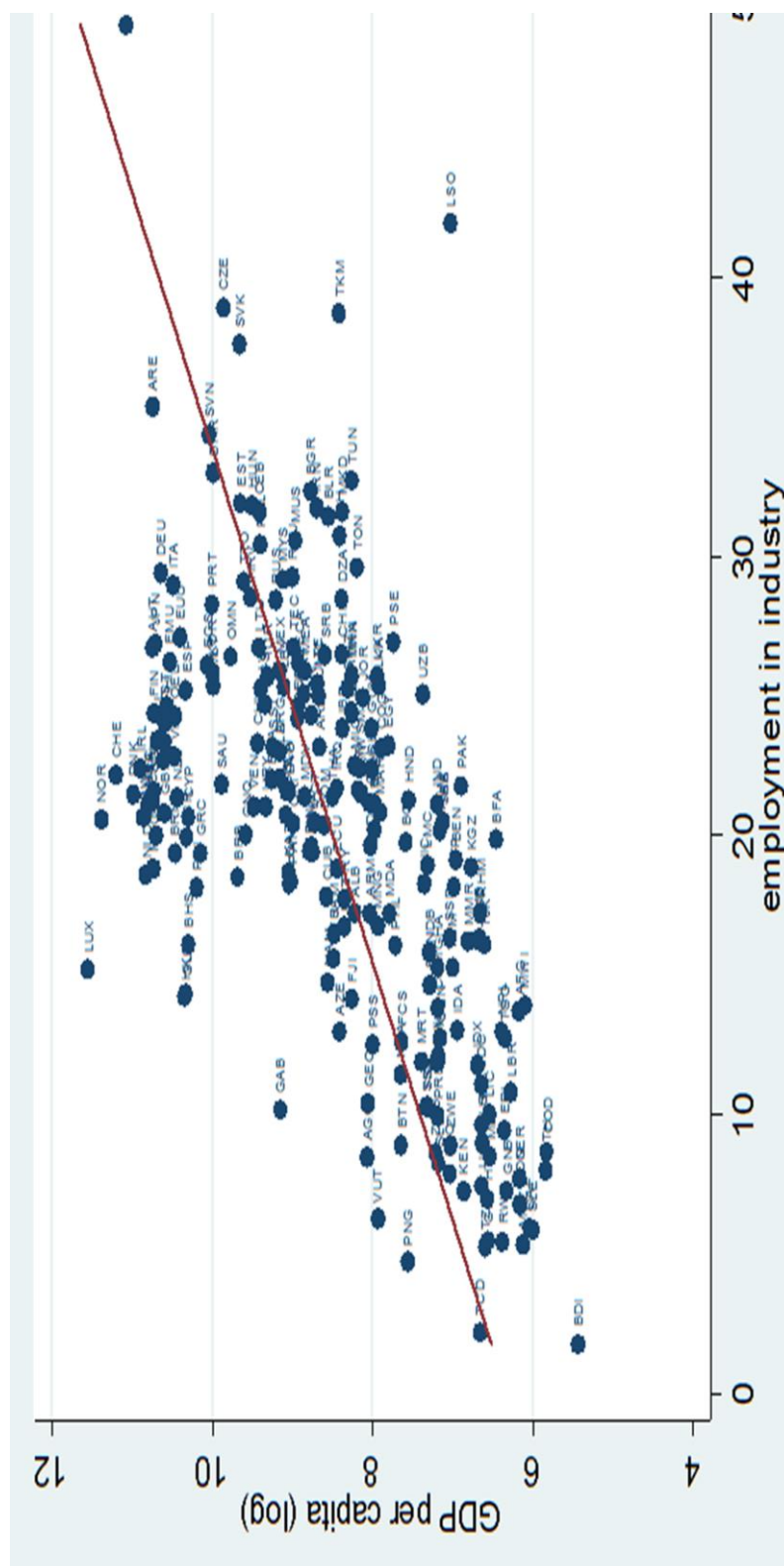


Fig. 6 c. GDP per capita and employment in industry
(% of total employment)

Indicator averaged for 2000–2018

Source: the calculations of the author based on WDI data.

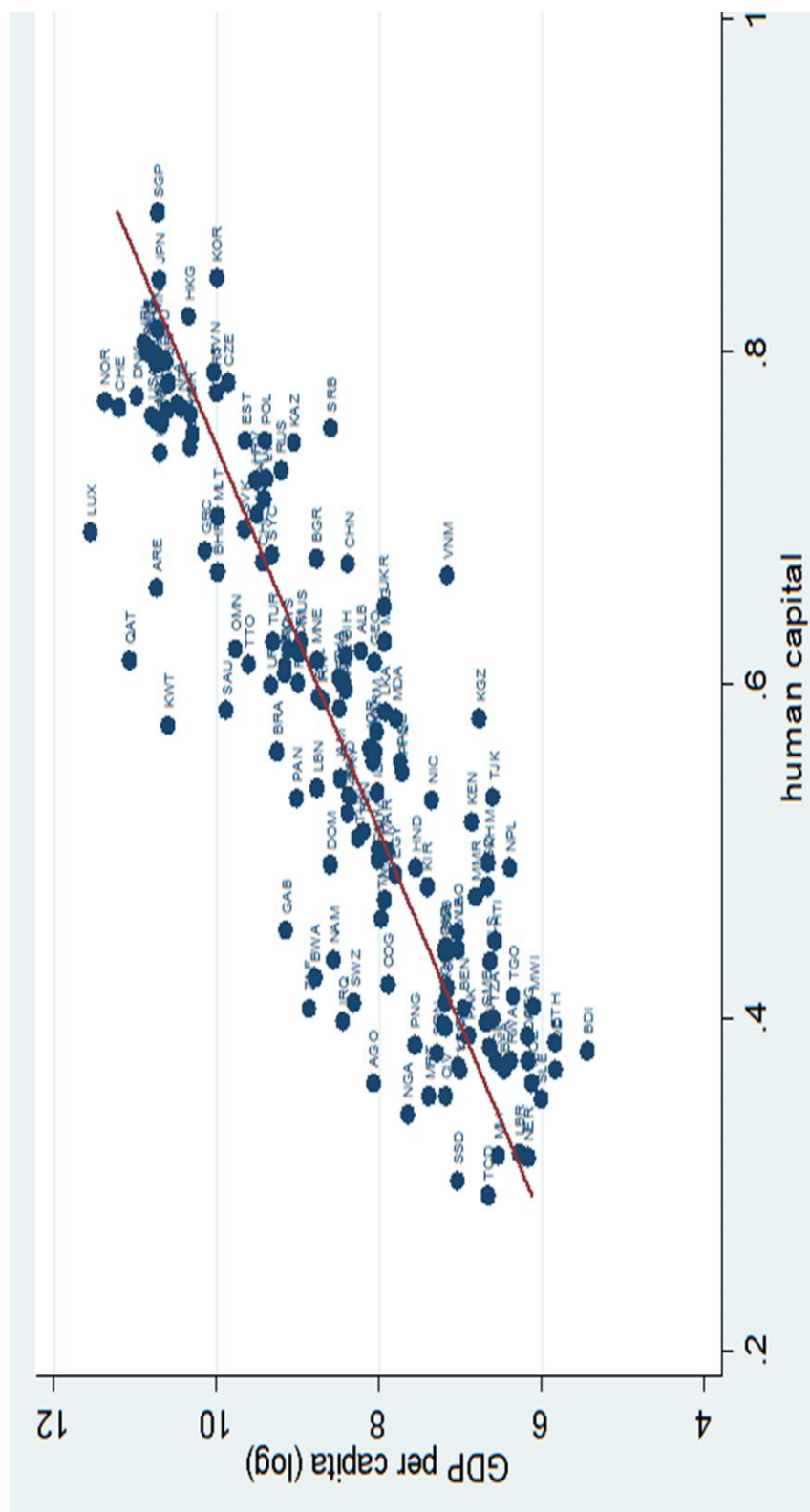


Fig. 6 d. GDP per capita and human capital

Indicator averaged for 2000–2018

Source: author's calculations based on WDI data.

In the well-known Solow model, labor is considered as a factor of economic growth. Indicators that assess the country's labor supply provide information on its economic development. These include such indicators as unemployment, employment in the economy, etc. Our study considers employment in the industrial sector as an independent variable. This factor also contributes to economic growth, as the manufacturing industry creates highly productive employment. As noted in the work of R. Kolosova [19], effective, productive, and decent pay and working conditions can serve not only as a source of income sufficient for decent quality of life, but are also the most important form of the realization of human creativity, which is human development in the fullest sense of the word. Table 2 shows the presence of a significant positive correlation between the dynamics of per capita GDP and industrial employment, which equals 0.63.

Human capital and economic growth are closely linked. N. Zagladin in his work [20] notes that "in the information society the most important condition for ensuring the competitiveness of the economy is human capital, highly qualified professionals capable of producing knowledge, effective management, and marketing. Human capital also includes a wide range of workers capable of to use the so-called high technologies in all spheres of activity both in production and in health care, education, etc." Human capital influences economic growth and can contribute to economic development by expanding people's knowledge and skills. Empirical studies conducted in this area do not provide unambiguous answers, which is attributed to the changing and complex methodology for estimating the value of human capital. Austrian researchers G. Badinger and G. Tondl [21] in their model of economic growth received confirmatory results about the positive relationship between income growth in the EU and capital (physical and human). The correlation analysis conducted in our study confirms a significant relationship: the ratio between human capital and GDP per capita is 0.88.

The model also includes such a variable as the share of manufacturing in GDP. Empirically, a number of works have proven the existence of a significant positive relationship between the growth of the manufacturing sector and GDP [22]. This indicator was analyzed in more detail above.

The current model of economic growth, which is new to previous research, allows to determine the impact of certain factors on economic growth in certain groups of countries (including the conditional variable described above) depending on the degree of economic development and in accordance with the World Bank methodology. In this group breakdown, Uzbekistan belongs to the third group. In addition, the current model allows us to determine the existing potential for economic growth (using this potential, Uzbekistan can move to the second group with incomes above the world average) based on further development.

Analyzing the results of the current regression model, we can draw the following generalized conclusions and recommendations from the experience of world development, which are relevant for Uzbekistan.

Increasing human capital is a major factor in the formation and development of innovation and knowledge, which includes improving the quality of education.

In the model's context, we can conclude that the growth of human capital leads to the growth of household incomes. While in developing countries, economic growth can be

attained due to the growth of traditional factors (number of workers), in developed countries, where population growth rates are negative, economic growth can be attained by improving human capital, and accelerating technological development.

Further development of the manufacturing sector will increase gross value added and help create additional jobs. It should be noted that Uzbekistan needs to increase the output of medium and high-tech products. Emphasis should be placed on the acquisition of resource-saving, and high-tech fixed capital. This will ensure the efficient use of investment. In Uzbekistan, the share of manufacturing imports in total imports of goods was 80% in 2018, which calls for the development of import substitution.

The development of R&D contributes to the growth of output and labor productivity. Experience of the developed countries shows that increased R&D expenditures becomes one of the key factors of economic growth. In Uzbekistan, it is necessary to take care of the further development of R&D, increasing R&D expenditures from 0.13% in 2018 to 0.6% (to the level of such countries as Belarus).

All the above-mentioned factors have a positive impact on economic development, so it is expected that the signs of the coefficients for all variables in the constructed model will be positive. The results of regression of the impact of these factors on GDP per capita are presented in Table 3.

Table 3

Economic growth (GDP per capita) and its factors

Indicator	(1)	(2)	(3)	(4)	(5)
Human capital	8.7***	7.8***	7.4***	6.8***	6.2***
Employment in industry		0.03***	0.02***	0.03***	0.03***
The share of the processing industry in GDP			0.06*	0.03	0.07*
R&D expenditure				0.2*	0.21**
Trade openness					0.003**
Constant	3.7***	3.7***	2.8***	3.3***	2.7***
N	152	148	141	117	117
R ²	0.78	0.80	0.80	0.78	0.79

Note: dependent variable: GDP per capita (log). * P < 0.10, ** p < 0.05, *** p < 0.01.

Source: author's calculations.

This study shows that per capita GDP is influenced by factors such as human capital, industrial employment, the share of manufacturing in GDP, R&D, and trade openness. Therefore, to support further economic growth in developing countries, the following recommendations can be offered:

- further attracting investment in human capital development and ensuring its efficient use, which will help create human resources for innovation and increase the absorption capacity (Cohen and Levintal concept) for the perception of foreign FDI and technology;
- increasing employment by encouraging startups and creating new companies, which will allow the development of industry, including manufacturing;
- increasing investment in R&D and accelerating the commercialization of research projects will promote technological innovation and increase the competitiveness of industry, including the manufacturing sector;

- trade openness (although for developing countries with weak comparative advantages it is a debatable issue), through different channels of technology transfer (and not solely via FDI, which is not the best option), together with the acquisition of advanced fixed capital and licenses (patents), will give an opportunity to strengthen local potential;

- mobilization of existing reserves in order to further diversify the commodity structure of exports through the manufacturing sector. According to the World Bank, the share of manufacturing in exports of goods over the past three years in Uzbekistan was 34%, which is far below the world average (69%);

- further improvement of the quality of state institutions and growth of human capital. In terms of the "rule of law" indicator (which takes values from minus 2.5 to 2.5) in 2019, Uzbekistan has a value of minus 1.04, while Russia - minus 0.72, Ukraine - minus 0.69, Kazakhstan - minus 0.43, and China - minus 0.27. The quality of human capital is closely linked to the quality of state institutions. With low-quality human capital, it is impossible to meet the demand for qualified specialists, increase the efficiency of state regulation, the level of industrialization and export orientation of small business, or create modern large companies integrated into global production networks;

- and diversified attraction of FDI in various manufacturing industries in order to increase industrial potential not only in mining but also in other industries where Uzbekistan has comparative advantage. To do this, following the example of China, it is advisable to classify industries by their priority for foreign investment.

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ВПЛИВ РОЗВИТКУ ПЕРЕРОБНОЇ ПРОМИСЛОВОСТІ НА ЕКОНОМІЧНЕ ЗРОСТАННЯ: ДОСВІД УЗБЕКИСТАНУ

Стаття присвячена оцінці впливу розвитку переробної промисловості на економічне зростання в країнах, що розвиваються, в тому числі у Республіці Узбекистан. Висновки для Узбекистану враховують особливості реалізації Програми локалізації виробництва готової продукції, комплектуючих виробів і матеріалів. Для виконання оцінок побудовано регресійну модель, що дає змогу визначити вплив факторів забезпечення сталого економічного зростання на показник ВВП на душу населення (у доларах США 2010 року), який використовується в моделі як залежна змінна. Фактори економічного зростання обумовлено загально визначеними теоретичними підходами та обґрунтовано емпіричними даними. Проведено міжкраїнний аналіз показників економічного зростання в країнах, що розвиваються, який дав змогу сформулювати достатню для оцінок вибірку даних. У статті оцінюється вплив фактора диверсифікації на показники економічного зростання, проаналізовано зв'язок між показниками розвитку переробної промисловості та економічного зростання.

Продemonстровано зв'язок волатильності економічного зростання і розвитку переробної промисловості, а також проведено порівняльний аналіз різних типів диверсифікації економіки в обраних для цього дослідження країнах, що розвиваються. З використанням кореляційного і регресійного аналізу докладно проаналізовано вплив на економічне зростання таких факторів, як витрати на НДДКР, людський капітал, торгова відкритість, частка переробної промисловості у ВВП, зайнятість у промисловості. На підставі виявленого автором впливу перерахованих факторів на економічне зростання розроблено рекомендації для країн, що розвиваються, в тому числі для Узбекистану.

Ключові слова: фактори економічного зростання, переробна промисловість, диверсифікація економіки, витрати на НДДКР, людський капітал, торгова відкритість

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