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MANAGING ECONOMIC GROWTH ON THE BASIS OF NATIONAL PRODUCT QUALITY IN THE CONDITIONS OF INDUSTRY 4.0

Abstract: *In the conditions of Industry 4.0, quality of economic growth is treated through the prism of its innovational, hi-tech, and marketing characteristics, which are traditionally different in developed and developing countries. Based on the law of the transformation of quantity into quality, the following hypothesis is offered: qualitative characteristics of the national product have to determine its quantitative characteristics – growth rate – and management of economic growth could and should be performed on the basis of quality of the national product in the conditions of Industry 4.0 in view of specifics of developed and developing countries.*

Keywords: *State Management, Economic Growth, Quality of National Product, Industry 4.0.*

1. Introduction

Under the influence of the global financial and economic crises, which led to the necessity for changing the course of socio-economic development, and the influence of technological progress in 2010's, the Fourth industrial revolution started. Thus, one of the most actual tendencies of development of the global economic system is transition to Industry 4.0. Industry 4.0 is considered to be a new technological mode. In this mode, new (breakthrough) digital technologies – AI, the Internet of Things, 3D print, blockchain, cloud technologies, quantum technologies, technologies of virtual and alternate reality, drones, etc. – are used during production of goods and services.

In the conditions of Industry 4.0, quality of economic growth is treated through the prism of new characteristics. One of them is intensity of innovative development of the economy. Foundation on new (breakthrough) digital technologies envisages innovative organization of production, organizational & managerial, and distribution processes. The higher the level of innovative activity in the economic system, the more possibilities for accelerating the rate of economic growth it has.

Another feature is the level of development of hi-tech. One of the most important goals of application of new (breakthrough) digital technologies is starting and developing hi-tech production and exporting hi-tech products. On the one hand, this raises the international statue of the exporting country, as its products are in high demand in the world, and, on the other hand, ensures stable revenues from the export activities. Development of hi-tech production allows creating highly-efficient and high-salaried jobs in the economy, thus stimulating the development of human potential.

The third feature is marketing activity of entrepreneurship. Effectiveness of

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implementing new (breakthrough) digital technologies is largely determined by the demand for products that are manufactured with their usage. Thus, it is necessary to determine the natural (predetermined by objective reasons) potential demand for these products through marketing research, as well as formation of artificial (created by manufacturers and caused by fashion) demand with the help of advertising and PR.

The fourth feature is connected to the share of the processing industry in the sectorial structure of GDP. Industry 4.0 was called so because transition to it was started for development of the real sector of economy, as it ensures its sustainable development, which could not be achieved with foundation on the mining industry with unstable demand and fluctuations of prices for resources in the world markets, on agriculture, which efficiency is depends on uncontrollable geographical factors, and export is complicated by limited life cycle of the products, or service sphere, which causes "financial bubbles" and has become the reason of the recent recession (2008).

The conceptual idea of transition to Industry 4.0 envisages equal opportunities for digital modernization of the economy for all participants of international economic relations. Developed and developing countries participate in the Fourth industrial revolution on equal terms. At the same time, developed and developing countries have different opportunities in the sphere of innovative, hi-tech, and marketing activities and different needs for them.

Based on the law of the transformation of quantity into quality, a following hypothesis is offered: qualitative characteristics of national product have to determine its quantitative characteristics – growth rate. Thus, it is necessary to determine the differences in provision of quality of their national product in the conditions of Industry 4.0 in the interests of developing the most optimal qualitative models of their economic growth, which application will allow reducing disproportions in development of developed and developed countries and ensuring well-balanced development of the modern global economy.

The purpose of this research is to develop a scientific and methodological provision of managing economic growth based on quality of national product in the conditions of Industry 4.0. This goal predetermined the logic and structure of the article. The first part analyzes the qualitative factors of economic growth of developed and developing countries in the conditions of Industry 4.0. The second part is devoted to development of the models of new quality of economic growth of developed and developing countries in the conditions of Industry 4.0. The third part contains author's recommendations for practical implementation of the compiled models in the modern developed and developing countries.

Aim: The purpose of the paper is to substantiate the necessity and to develop recommendations for managing the economic growth on the basis of national product quality in the conditions of Industry 4.0 in developed and developing countries in view of their specifics.

Methodology: An attempt is made to present economic growth as a function of quality of national products, measures with the help of its innovational, hi-tech, and marketing characteristics. Based on open statistical data of the IMF, the World Economic Forum, and the World Bank for 2018, the author performs the regression analysis of dependence of economic growth in developing and developed countries on the quality of their national product. The level of homogeneity of the data selection is assessed with the help of analysis of variation. The author also uses the method of scenario modeling for determining the target innovational, hi-tech, and marketing characteristics of the national product of developed and developing countries in the interests of maximization of its quality and

acceleration of economic growth.

Expected results of the research: It is planned to determine the key factors of quality of national product and their differences in developing and developed countries and to offer the practical recommendations for managing these factors in the interests of maximization of national product and acceleration of economic growth.

2. Literature review

Industry 4.0 is the object of research in a lot of modern works, which focus on its various aspects. Castelo-Branco et al. (2019) emphasize that Industry 4.0 is primarily a new paradigm of development of industrial production, which, though being able to cover other spheres of economy, should be originally approbated and implemented in the processing industry. Developing this thought, Frank et al. (2019a) define Industry 4.0 as a totality of new (breakthrough) digital technologies, which could and should be applied in the processing industry.

Frank et al. (2019b) emphasize the necessity for strong government control over development of Industry 4.0, which is connected to high level of risk due to its essential novelty. Agreeing with them, Gu et al. (2019) note that in the conditions of Industry 4.0 there's a need for high corporate responsibility of companies of the processing industry. Contrary to them, Rajput & Singh (2019) emphasize the advantage of Industry 4.0 as a tool of achieving sustainable development of economy.

Varela et al. (2019) also note the large potential of Industry 4.0 in implementation of the global goals in the sphere of sustainable development. Ardito et al. (2019) think that the concept of Industry 4.0 should cover all chains of added value, going beyond the processing industry. Türkeş et al. (2019) write that Industry 4.0 is new technological and organizational & managerial solutions, which could be used not only by large industrial companies but also by small and medium companies of any sphere – e.g., the service sphere – providing the experience of modern Romania as an example. We think that Industry 4.0 is a new vector of growth and development of the modern socio-economic systems, which potential could be opened only on the basis of knowledge economy (Popkova, 2019; Bogoviz, 2019).

There are a lot of studies also on the topic of treatment, measuring, and management of quality of economic growth. Heng (2018) notes the transition to a new era of economic growth, in which not rate but quality has the important role. A lot of scholars and researchers connect the level and rate of economic growth to quality of the institutional environment. For example, Xu et al. (2019) prove this statement on the basis of cross-country empirical research. Such proofs are also given by Moshiri & Hayati (2017). Abdulahi et al. (2019) write that the resource rent and economic growth are largely predetermined by quality of institutes in the economy. Specifying the notion of institutional environment, Liu et al. (2019) state large influence of quality of state management on economic growth.

Other researchers consider the alternative factors of managing the quality of economic growth. For example, Feriyanto (2019) writes that the level of economic development and the rate of economic growth are largely determined by quality of human development. Srinita (2018) emphasizes the important role of implementing the strategies of marketing mix in supporting high quality of economic growth, which is connected – according to the scholar – to its sustainability. Fan et al. (2016) state that human capital and quality of life have interactive effect on economic growth. Troshkova & Levshina (2018) see the connection between quality of economic growth and innovative activity of entrepreneurship, and Kapuria & Karmaker

(2018) see the connection with sufficiency and effectiveness of its marketing activities.

Other scholars note the necessity for qualitative treatment of economic growth. Within this scientific direction of the modern scientific thought, Long & Ji (2019) state that quality of economic growth could and should be measured through the prism of ecological sustainability and social well-being. Androniceanu et al. (2019) deem it necessary to measure quality of economic growth through quality of population's life. Bravi et al. (2018) define social mission of new (breakthrough) digital technologies as improvement of quality of life.

We think that quality of economic growth is a complex scientific category, which should be measured in the systemic way, envisage full-scale assessment of its causal connections, and be managed in view of the whole complex of the factors in the interests of achieving the top-priority tasks of socio-economic development. When measuring the quality of economic growth in the conditions of Industry 4.0 it is necessary to use the criteria of innovative and marketing activity, balance and sustainability, and optimality of the sectorial structure of GDP with emphasis on the processing industry and, in particular, on hi-tech production. This point of view is described in the works (Popkova et al., 2013; Popkova & Alferova, 2019; Popkova, 2018; Popkova et al., 2018a; Popkova, 2018; Popkova et al., 2018b; Popkova, 2018; Popkova et al., 2018c).

Thus, the performed literature overview on the selected topic showed that the fundamental issues of Industry 4.0 and managing the quality of economic growth are studied in detail in the existing works. At the same time, the scientific & methodological and applied issues of managing economic growth on the basis of quality of national product in the conditions of Industry 4.0 – in particular, the factors of economic growth of developed and developing countries in the conditions of Industry 4.0 – are not studied sufficiently and require further elaboration for filling the existing gap in the system of the modern scientific and economic knowledge.

3. Methodology

In this work, economic growth is treated as a function of quality of national product, which is measured with the help of its innovative, hi-tech, marketing, and sectorial characteristics. Based on the open statistical data of the IMD, the IMF, the World Economic Forum, and the World Bank for 2018, regression and correlation analysis of dependence of economic growth in developed and developing countries on the quality of their national product is performed. The level of homogeneity of the data selection is assessed with the help of the method of analysis of variations. The author also uses the method of scenario modeling, with the help of which the target innovative, hi-tech, marketing, and sectorial characteristics of national product of developed and developing countries are determined for maximizing its quality and accelerating economic growth.

As the most important statistical indicator that shows the level of development of Industry 4.0 in the socio-economic system is the index of global digital competitiveness of economy, calculated by the IMD, it is selected as a criterion of selection of objects for the research. According to this criterion, Top 15 developed countries (first part of the rating, positions 1-15) are selected from the rating of the IMD for 2018 (the rating covers 63 countries) and top 15 developing countries (second part of the rating, positions 27-42; Italy, from the second part of the rating, 41st position, is considered to be a developed country, but here is ignored for avoiding the distortion of the selection).

The research is performed based on the data as of late 2018, which are still significant as of early 2019. The dependent (result) variable is growth rate of GDP in constant

prices according to the version of the International Monetary Fund. Independent variables (factors) are the global innovations index, calculated by Cornell University, INSEAD, and WIPO; indicator of marketing activity of entrepreneurship (11.08 Extent of marketing), calculated by the World Economic Forum within "The Global competitiveness report"; and the volume of hi-tech export and sectorial structure of GDP according to the World Bank. Selections of the data for developed and developing countries are shown in Tables 1-4.

Table 1. Indicators of economic growth and quality of national product of top 15 developed countries of the global rating of digital competitiveness

Position in the global rating of digital competitiveness	Country	Global innovational index, points 0-100	Marketing activity of entrepreneurship, points 0-7	Volume of hi-tech export, USD thousand	Growth rate of GDP, %
		x_{11}	x_{12}	x_{13}	y_1
1	USA	59.81	6.0	110120235.61	2.519
2	Singapore	59.83	5.2	136160944.49	2.555
3	Sweden	63.08	5.5	14973092.21	2.380
4	Denmark	58.39	5.0	7467358.20	1.701
5	Switzerland	68.40	3.7	24159696.00	1.605
6	Norway	52.63	5.2	3590613.20	1.937
7	Finland	59.63	4.2	3571518.72	1.401
8	Canada	52.98	5.0	24220179.63	1.956
9	Netherlands	63.32	5.6	63617214.21	1.840
10	UK	60.13	5.8	68625231.69	1.457
11	Hong Kong	54.62	5.3	141717301.21	2.509
12	Israel	56.79	5.5	7358944.00	2.982
13	Australia	51.98	5.2	4322994.33	2.999
14	South Korea	56.63	4.8	72699710.20	2.835
15	Austria	51.32	5.2	12943326.47	1.300
Direct average		57.97	5.15	46369890.68	2.13
Standard deviation		4.82	0.59	49465474.68	0.59
Coefficient of variation, %		8.32	11.37	106.68	27.47

Source: compiled by the authors based on Cornell University, INSEAD, WIPO (2019), IMD (2019), International Monetary Fund (2019), World Bank (2019), World Economic Forum (2019).

Table 1 shows that in the selection of developed countries the variation of global innovative index (8.32%) and marketing activity of entrepreneurship (11.37%) is moderate. Variation of growth rate is rather high and constitutes 27.47%. Variation of the volume of hi-tech export is very high and constitutes 106.68%. On the whole, the data selection is rather homogeneous, which allows using it for correlation and regression analysis. Table 2 shows that in the selection of developed countries the variation of the share of the service sphere in the structure of GDP is moderate – 12.72%. Variation of the share of agriculture (63.06%), the mining industry (28.66%), and the processing industry (49.69) is rather high. The selection is relatively homogeneous, which allows using it for correlation and regression analysis.

Table 2. Indicators of economic growth and the sectorial structure of national product of Top 15 developed countries of the global rating of digital competitiveness, %.

Position in the global rating of digital competitiveness	Country	Agriculture	Mining industry	Processing industry	Service sphere
		x_{14}	x_{15}	x_{16}	x_{17}
1	USA	1	19	12	77.0
2	Singapore	0	23	18	70.4
3	Sweden	1	22	14	65.2
4	Denmark	1	20	13	65.9
5	Switzerland	1	26	19	71.2
6	Norway	2	30	7	56.8
7	Finland	2	24	15	60.1
8	Canada	1	27	10	65.5
9	Netherlands	2	18	11	70.4
10	UK	1	19	9	70.1
11	Hong Kong	0	7	1	89.5
12	Israel	1	19	12	69,8
13	Australia	3	23	6	67.0
14	South Korea	2	36	28	52,8
15	Austria	1	25	17	62.8
Direct average		1.27	22.53	12.80	67.63
Standard deviation		0.80	6.46	6.36	8.60
Coefficient of variation, %		63.06	28.66	49.69	12.72

Source: compiled by the authors based on IMD (2019), World Bank (2019).

Table 3. Indicators of economic growth and quality of national product of top 15 developing countries of the global rating of digital competitiveness

Position in the global rating of digital competitiveness	Country	Global innovational index, points 0-100	Marketing activity of entrepreneurship, points 0-7	Volume of hi-tech export, USD thousand	Growth rate of GDP, %
		x_{21}	x_{22}	x_{23}	y_2
27	Malaysia	43.16	5.5	41172608.99	4.700
28	Qatar	36.56	5.1	4815.20	2.842
29	Lithuania	43.18	4.7	2160520.24	3.071
30	China	53.06	4.6	504380837.92	6.168
31	Spain	48.68	4.6	15566761.96	2.070
32	Portugal	45.71	4.6	2350793.41	1.454
33	Czech Republic	48.75	4.7	21069666.19	2.152
34	Slovenia	46.87	4.3	1518763.43	1.958
35	Latvia	41.19	4.5	1333535.71	3.293
36	Poland	41.67	4.7	13678247.82	3.232
37	Chile	37.79	5.1	589579.68	2.316
38	Kazakhstan	31.42	4.1	1771744.27	3.406
39	Thailand	38.00	5.1	34720646.34	3.264
40	Russia	37.90	4.5	9174217.41	1.444
42	Saudi Arabia	34.27	4.6	1075441.33	1.314
Direct average		1.27	22.53	12.80	67.63
Standard deviation		0.80	6.46	6.36	8.60
Coefficient of variation, %		63.06	28.66	49.69	12.72

Source: compiled by the authors based on Cornell University, INSEAD, WIPO (2019), IMD (2019), International Monetary Fund (2019), World Bank (2019), World Economic Forum (2019).

Table 3 shows that in the selection of developed countries the variation of growth rate of GDP is moderate – 12.72%. Variation of the global innovative index (63.06%), marketing activity of entrepreneurship (28.66%), and the volume of hi-tech export (49.69%) is rather high. On the whole, the selection is relatively homogeneous, which allows using it for correlation and regression analysis.

Table 4. Indicators of economic growth and the sectorial structure of national product of top 15 developing countries of the global rating of digital competitiveness, %.

Position in the global rating of digital competitiveness	Country	Agriculture	Mining industry	Processing industry	Service sphere
		x_{24}	x_{25}	x_{26}	x_{27}
1	Malaysia	9	39	22	51.0
2	Qatar	0	52	9	47.9
3	Lithuania	3	26	18	60.3
4	China	8	40	29	51.6
5	Spain	3	22	13	66.4
6	Portugal	2	19	12	65.2
7	Czech Republic	2	33	24	54.2
8	Slovenia	2	29	21	56.4
9	Latvia	3	20	11	64.4
10	Poland	2	28	18	58.3
11	Chile	4	30	10	57.6
12	Kazakhstan	4	32	11	57.4
13	Thailand	9	35	27	56.3
14	Russia	4	30	12	56.2
15	Saudi Arabia	3	45	13	52.5
Direct average		3.87	32.00	16.67	57.05
Standard deviation		2.70	9.16	6.55	5.35
Coefficient of variation, %		69.72	28.62	39.32	9.38

Source: compiled by the authors based on IMD (2019), World Bank (2019).

Table 4 shows that in the selection of developed countries the variation of the share of the service sphere in the structure of GDP is moderate – 9.38%. Variation of the share of agriculture (69.72%), the mining industry (28.62%) and the processing industry (39.32) is rather high. On the whole, selection of the data is relatively homogeneous, which allows using it for correlation and regression analysis.

4. Results

4.1. Analysis of qualitative factors of economic growth of developed and developing countries in the conditions of Industry 4.0

The performed regression analysis led to the following results (Figure 1).

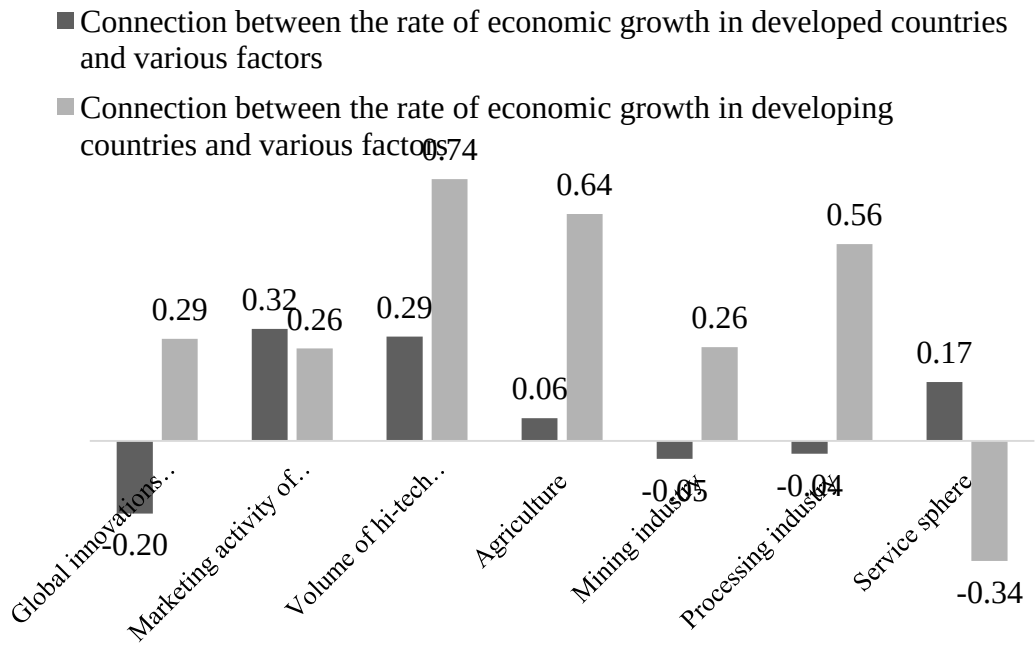

Figure 1. Autocorrelation of growth rate of GDP in developed and developing countries with various factors

As is seen from Figure 1, the highest autocorrelation is observed with growth rate of GDP in developing countries with the volume of hi-tech export (0.74), share of agriculture in structure of GDP (0.64), and share of the processing industry in the structure of GDP (0.56). Autocorrelation of growth rate of GDP of developed countries is the highest with marketing activity of entrepreneurship (0.32), volume of hi-tech export (0.29) and share of the service sphere in the structure of GDP (0.17). Negative autocorrelation (reverse connection) is observed with growth rate of GDP in developed countries with the global innovation index (-0.20), share of the mining industry in the structure of GDP (-0.05), and share of the processing industry in the structure of GDP (-0.04), as well as growth rate of GDP of developing countries with share of the service sphere in the structure of GDP (-0.34).

As could be seen on the basis of the obtained values of autocorrelation, developed and developing countries have their specifics of influence of various qualitative factors of GDP on the rate of its growth. On the whole, autocorrelation of the selected factors with the resulting variables is moderate (does not exceed 0.90). Therefore, the resulting variables are largely predetermined by the influence of other factors, which are not taken into account in this paper. Most probably, these (not considered) factors are of the social nature and cannot be measured statistically.

This does not allow achieving high prevision of regression modeling, but, at the same time allows – with high level of precision – determining the direction and character of the influence of all selected factors on the resulting variables. The obtained models of multiple linear regression have the following form:

- y_1=-4.73-0.04*x_{11}+0.37*x_{12}+0*x_{13}+0.3*x_{14}+0.05*x_{15}+0.04*x_{16}+0.08*x_{17}.
- y_2=4.77-0.07*x_{21}+1.12*x_{22}+0*x_{23}+0.02*x_{24}-0.06*x_{25}+0.03*x_{26}-0.06*x_{27}.

The obtained regression dependencies show that increase of the value of global innovation index by 1 point leads to reduction of growth rate of GDP in developed countries by 0.04%; increase of marketing activity of entrepreneurship by 1 point leads to increase of growth rate of GDP in developed countries by 0.37%; increase of the volume of hi-tech export by USD 1,000 does not change much; increase of the share of agriculture in the structure of GDP by 1% leads to increase of growth rate of GDP in developed countries by 0.3%; increase of the share of the mining industry in the structure of GDP by 1% leads to increase of growth rate of GDP in developed countries by 0.05%; increase of the share of the processing industry in the structure of GDP by 1% leads to increase of growth rate of GDP in developed countries by 0.04%; increase of the share of the service sphere in structure of GDP by 1% leads to increase of growth rate of GDP in developed countries by 0.08.

Increase of the value of the global innovation index by 1 point leads to reduction of growth rate of GDP in developing countries by 0.07%; increase of marketing activity of entrepreneurship by 1 points leads to increase of growth rate of GDP in developing countries by 1.12%; increase of the volume of hi-tech export by USD 1,000 does not lead to any significant changes; increase of the share of agriculture in the structure of GDP by 1% leads to increase of growth rate of GDP in developing countries by 0.02%; increase of the share of the mining industry in the structure of GDP by 1% leads to reduction of growth rate of GDP in developing countries by 0.056; increase of the share of the processing industry in the structure of GDP by 1% leads to increase of growth rate of GDP in developing countries by 0.03%; increase of the share of the service sphere in the structure of GDP by 1% leads to reduction of growth rate of GDP in developing countries by 0.06.

4.2. Modeling of new quality of economic growth in developed and developing countries in the conditions of Industry 4.0

If we put average values of the selected factors for 2018 in the regression equations, we'll have average values of the resulting variables. Let us check:

y_1=-4.73-0.04*57.97+0.37*5.15+0+0.3*1.27+0.05*22.53+0.04*12.80+0.08*67.63=

=2.13.

y_2=4.77-0.07*41.88+1.12*4.74+0+0.02*3.87-0.06*32+0.03*16.67-0.06*57.05=2.85.

The function of scenario modeling in Microsoft Excel is used for determining the target innovative, hi-tech, marketing, and sectorial characteristics of national product in developed and developing countries for maximization of its quality and acceleration of economic growth. Let us set the preferable value of the rate of economic growth as 10% in both values. This will accelerate the growth of the modern global economy and overcome disproportions in its development (or, at least, preserve them at the current level, avoiding the increase), as it will ensure equal growth rate of economy of developed and developing countries. The results are given in Tables 5 and 6 for the categories of countries.

Table 5. Target characteristics of quality of national product in developed countries in the interests of achievement of a 10% rate of its growth.

Variable	Target value	Value in 2018	Growth in absolute expression	Growth, %
x_{11}	56.77	57.97	-1.20	-2.06
x_{12}	16.42 (maximum of 7)	5.15	11.27	218.95
x_{13}	46369890.68	46369890.68	0.00	0.00
x_{14}	11.26	1.27	9.99	788.62
x_{15}	24.02	22.53	1.49	6.60
x_{16}	14.12	12.80	1.32	10.34
x_{17}	69.92	67.63	2.29	3.38
y_1	10.00	2.13	7.87	369.10

Table 5 shows that increase of growth rate of GDP up to 10% (4.69 times) requires achievement of the following qualitative changes in national product of developed countries:

- increase of the share of agriculture by 8.86 times, to 11.26% in the structure of GDP;
- increase of marketing activity of entrepreneurship to the maximum possible level (7 points);
- increase of the share of the processing industry by 10.34%, to 14.12%, in the structure of GDP;
- increase of the share of the mining industry by 6.6%, to 24.02%, in the structure of GDP;
- increase of the share of the service sphere by 3.38%, to 69.62%, in the structure of GDP;
- as is seen, the sum of the shares of structural elements of GDP exceeds 100%, so it is offered to optimize in in the following way: agriculture – 9.43%; mining industry – 20.13%; processing industry – 11.84%; service sphere – 58.60%;
- absence of targeted measures for increase of innovative activity and increase of hi-tech export.

Table 6. Target characteristics of the quality of national product in developed countries for achieving a 10% rate of its growth.

Variable	Target value	Value in 2018	Growth in absolute expression	Growth, %
x_{21}	41.47	41.88	-0.41	-0.97
x_{22}	11.03 (maximum of 7)	4.71	6.32	133.98
x_{23}	43371211.99	43371211.99	0.00	0.00
x_{24}	3.99	3.87	0.13	3.31
x_{25}	31.66	32.00	-0.34	-1.06
x_{26}	16.84	16.67	0.18	1.06
x_{27}	56.73	57.05	-0.32	-0.56
y_2	10.00	2.85	7.15	251.42

Table 6 shows that increase of growth rate of GDP to 10% (by 4.69 times) requires achievement of the following qualitative changes in national product of developing countries:

- increase of marketing activity of entrepreneurship to the maximum possible level (7 points);
- increase of the share of agriculture by 3.31% (to 3.99%) in the structure of GDP;
- increase of the share of the processing industry by 1.06%, to 16.84%, in the structure of GDP;

- as is seen the sum of the shares of structural elements of GDP exceeds 100%, so it is offered to optimize it in the following way: agriculture – 3.66%; mining industry – 28.99%; processing industry – 15.42%; service sphere – 51.93%; absence of targeted measures for increase of innovative activity and increase of hi-tech export.

4.3. Implementation of the models of new quality of economic growth in the conditions of Industry 4.0 in the modern developed and developing countries: policy implications

Results of modeling of the new quality of economic growth in the conditions of Industry 4.0 showed that differences between developed and developing countries are less substantial that is usually considered. This allows creating a universal model of managing economic growth based on quality of national product in the conditions of Industry 4.0, which could and should be used in practice in developed and developing countries (Figure 2).

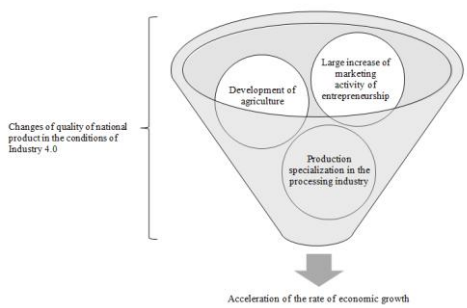

Figure 2. A universal model of managing economic growth on the basis of quality of national product in the conditions of Industry 4.0.

Figure 2 shows that this research offers three perspective tools of managing economic growth on the basis of increase of quality of national product in the conditions of Industry 4.0. Though selection of these tools is similar for the countries from different categories, the totality of measures that should be taken by the government in developed and developing countries is different. 1st tool: significant increase of marketing activity of entrepreneurship. For its stimulation by the government in developed countries, the following measures are offered:

- stimulation of development of export of activities and transnationalization of entrepreneurship, which allows increasing its marketing activity in the world markets;
- support for small and medium entrepreneurship by simplifying the process of registration and doing business and provision of tax, credit, and other preferences that do not limit competition, but support medium entrepreneurship;
- grant support for R&D in the sphere of marketing, which is aimed at development of new perspective marketing directions, methods, and tools;
- formation of regional and national ratings of entrepreneurship according to the criterion of the level of marketing activity;
- stimulation of development of private marketing organizations that conduct marketing research and provide access to their results for interested entrepreneurial structures (including by the commercial basis), which will allow raising marketing activity of small and medium companies with limited marketing budget on the basis of usage of outsource opportunities.

For its stimulation by the government in developing countries, the following measures are offered:

- reduction of customs barriers in the interests of increase of concentration of domestic sectorial markets by means of increase of foreign competition;
- stimulation of marketing of non-profit organizations (e.g., government organizations in the sphere of healthcare and education) on the basis of development of the mechanism of public-private partnership;
- stimulation of marketing activity of large entrepreneurship through strong anti-monopoly policy and, in particular, fighting natural monopolies;
- government support for the integration initiatives in entrepreneurship, which allow strengthening their positions in the target sectorial markets with preservation or increase of the level of their competition – e.g., economic clusters, including international clusters.

2nd tool: development of agriculture. The following measures of government regulation in developed countries are offered:

- implementation of hi-tech projects in the sphere of agriculture, which allow developing effective agricultural production on the territories that were considered unfit for agriculture, on the basis of breakthrough digital technologies of Industry 4.0;
- government tax and credit support for full-scale authomatization of agricultural production;
- increase of export of agricultural products.

The following measures are offered for developing countries:

- development of the ongoing agricultural production and its start on the territories with favorable natural and climatic conditions;
- grant support for R&D in the sphere of agriculture;
- stimulation of innovative activity in agricultural entrepreneurship;
- preservation of foundation on manual labor for ensuring high employment level in agriculture in combination with the programs of digital modernization of agricultural machinery;
- orientation at domestic sales of agricultural products for ensuring national food security.

3rd tool: production specialization in the processing industry. The following measures of government regulation in developed countries are offered:

- stimulation of competition in the infrastructural sphere of Industry 4.0 (transport logistics, telecommunications);
- development of hi-tech processing productions that are oriented at domestic sales of products (satisfaction of the needs of the domestic economy);
- stimulation of mass transition of entrepreneurship to Industry 4.0.

The following measures are offered for developing countries:

- implementation of large investment and innovative projects in the infrastructural sphere (transport logistics, telecommunications) on the basis of the mechanism of public-private partnership;
- standardization of digital modernization of entrepreneurship in the processing industry and control over observation of standards (including ecological standards);
- government orders for wide-scale training of digital personnel by domestic universities and courses of

increase of digital literacy of the population for stimulation of demand for hi-tech products of the processing industry.

Depending on successfulness of the offered measures, economic growth in developed and developing countries could develop according to two alternative scenarios. Transformation of the practice of managing economic growth on the basis of quality of national product under the influence of industrial revolutions and possible future scenarios of this process are presented in Figure 3.

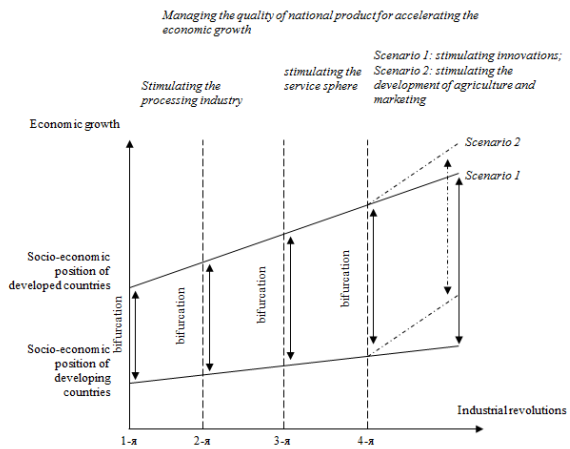

Figure 3. Transformation of the practice of managing economic growth based on quality of national product under the influence of industrial revolutions.

Figure 3 shows that during the First industrial revolution (late 18^{th} – 19^{th} centuries) socio-economic position of developed and developing countries was different. Disproportions in their development grew during the Second (early 20^{th} century) and the Third (second half of the 20^{th} century) industrial revolutions. During the first two industrial revolutions the management of quality of national product for accelerating the rate of economic growth envisages stimulation of the processing industry (industrialization). During the Third industrial revolution, this management envisaged stimulation of development of the service sphere (post-industrialization).

The recent global financial crisis (2008) and new inventions in science and technology started the Fourth industrial revolution, creating bifurcation in the global economy. At present, managing the quality of national product for acceleration of economic growth envisages stimulation of innovations (scenario 1). However, this research showed that increase of the level of innovative activity and the volume of hi-tech export does not accelerate the rate of economic growth, and can even slow it down. That's why in case of managing the quality of national product for acceleration of economic growth according to this scenario, the differentiation of developed and developing countries will be growing.

In case of practical implementation of the offered author's recommendations for managing the quality of national product for accelerating economic growth based on stimulation of development of agriculture and marketing, as well as development of the processing industry, scenario #2 will be realized, which will allow preventing (preserving at the current level) the disproportions in socio-economic position of

developed and developing countries and will create perspectives for its prevention in the future.

5. Conclusion

Thus, the offered hypothesis was proved. It was shown that quality of national product largely determines its quantitative change – growth rate. Characteristics of quality of national product are specified: it is shown that innovative (intensity of innovative development of economy) and hi-tech (level of development of hi-tech) characteristics – contrary to the existing hypothesis – do not have a vivid positive influence on the rate of economic growth and may even have negative influence, which causes its reduction (slowing down economic growth).

The most significant characteristics of quality of national product, which determine its contribution into acceleration of the rate of economic growth, are marketing (marketing activity of entrepreneurship) and sectorial (shares of agriculture and the processing industry in the sectorial structure of GDP). It should be noted that the basic conceptual model of managing economic growth based on quality of national product in the conditions of Industry 4.0 is universal – it fits developed and developing countries.

At the same time, the complexes of measures that are necessary for practical implementation of this model are different. The developed scientific and methodological provision of management of economic growth based on quality of national product in the conditions of Industry 4.0 includes, firstly, large increase of marketing activity entrepreneurship on the basis of stimulation of foreign economic activities in developed countries and on the basis of increase of market concentration in developing countries. Secondly, development of agriculture based on authomatization and increase of export in developed countries and based on creation of additional jobs and domestic sales in developing countries. Thirdly, production specialization in the processing industry based on mass transition of entrepreneurship to Industry 4.0 in developed countries and based on standardization and digital modernization of entrepreneurship in developing countries.

Thus, managing economic growth on the basis of quality of national product in the conditions of Industry 4.0 has its specifics, which differentiates this practice from the previous industrial revolutions. The offered scientific and methodological provision of this management opens the opportunities and perspectives for preventing the increase of the gap in socio-economic position and the rate of economic growth of developed and developing countries and well-balanced development of the global economy.

However, the issue of interest of the modern participants of the international economic relations in increasing the competition between them and leveling their possibilities and level of development remains open. Solutions to these problems may lie in the context of targeted efforts of international organizations (e.g., the UN) on implementation of the global goals of sustainable development, which are brought down to overcoming the disproportions in the global economic system. That's why it is recommended to pay attention to the issues of organization of activities of these organizations for supporting managing economic growth based on quality of national product in the conditions of Industry 4.0.

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