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INNOVATIVE INFRASTRUCTURE DEVELOPMENT PROSPECTS OF SOUTHEAST ASIA COUNTRIES AND UKRAINE IN THE CONTEXT OF THE NEW INDUSTRIAL REVOLUTION

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In the global economy, the foundation of which is increasingly knowledge, the innovation infrastructure becomes the engine of economic growth, it will become the lever that will help transform the economic recovery into long-term growth. The purpose of the article is to analyze the characteristics of the development of the innovation infrastructure of the leading countries of Southeast Asia and to develop recommendations for Ukraine in the context of the new industrial revolution. The article has set and solved the following tasks: to analyze the features of the transformation of the innovation infrastructure in the countries-technological leaders in the conditions of the new industrial revolution both in Southeast Asia and in other developed countries; explore the features of innovation policy and infrastructure of the leading countries of Southeast Asia on the example of Japan, South Korea and China; perform correlation and regression analysis for modeling and forecasting the development of the innovation potential of the countries of Southeast Asia and Ukraine; to assess the prospects for the development of innovation infrastructure in the countries of South-East Asia and to develop recommendations for Ukraine in the conditions of the new industrial revolution. The research methodology includes the processing and study of statistical information, the implementation of trend analysis, the calculation of the model of development of innovative potential by the method of correlation and regression analysis. The results of the trend analysis showed that from Ukraine and the leading countries of Southeast Asia, China has the best prospects for the development of innovative infrastructure. During the correlation-regression analysis, the strongest dependence was revealed when calculating indicators for China between GDP and indicators of the Innovation Infrastructure group. Prospects for the implementation of a new industrial revolution in the leading countries of South-East Asia and Ukraine were identified and recommendations for Ukraine were developed. Conclusions. For the successful development of the innovation infrastructure in Ukraine, the following measures can be applied: attracting investment in R & D and innovation centers; attracting universities to research and development; strengthening environmental policy; concentration of innovation in industry; development of the IT sector.

Key words: innovative infrastructure, the fourth industrial revolution, innovative potential.

The science is replacing capital today, as long ago labor was replaced by capital. More and more attention is being paid to science and new technologies. This is the basis of TNCs' and even state's activities. Innovative infrastructure is a key tool to support the productivity growth needed to meet the growing demand. And to promote the expansion of networks that integrate sustainable production, processing, distribution and consumption. Innovative infrastructure is a set of organizations, enterprises, institutions and their integrations, associations of any form of ownership, providing services to ensure innovation. It can be consulting, marketing, juristic, financial, information and communication, educational and other institutions.

Such outstanding scientists of our time, as Matyushenko I. Yu., Dovgal O. A., Kolesnikova T. V., Mazur A. A., Gagauz I. B., Malyutin D. L., Mindeli L. E., HoleB., Lundvall B., Malerba F., Oh Deog-Seong, Alstrom, D., and others engaged in research of innovative infrastructure, in particular, in research of the characteristics of its development in the countries of Southeast Asia in the new industrial revolution conditions and of the characteristics of the innovation policy of countries-technological leaders.

The purpose of the article is to analyze the features of Southeast Asian countries-leaders innovative infrastructure development and study the prospects of Southeast Asia countries-leaders and Ukraine innovation infrastructure development in the new industrial revolution conditions.

1. Methodological approaches to the analysis of the world countries innovative infrastructure development

The formation of the innovation system is based on forecasts and innovative strategy, which determine the key priority areas of science and technology. In the state innovation policy strategic priorities are an integral part of the national concept of countries

socio-economic development. The innovation strategy of industrialized countries restructuring their economies differs for each country [1].

At the same time, even for countries with economies in transition, including Ukraine, only an innovative strategy determines the path of socio-economic reforms. That said, economic development innovative mechanisms consider national scientific and technical potential using and enhancement, the formation of a quality state innovative strategy and the corresponding innovation infrastructure of developed countries. The state innovation programs and individual projects development and implementation are based on the relevant organizational formations (structures). They provide interaction between the subjects of the innovation process [2]. The study conducted a comparative trend analysis on three indicators: GDP, The Global Competitiveness Index and The Global Innovation Index. The method of correlation regression analysis was chosen to model the innovative infrastructure development. Research of Southeast Asian countries innovative infrastructure development features was carried out in several stages. The diagram shows the sequence of research degrees (Fig. 1.). At the first stage, the essence of the concept of innovative infrastructure, especially its development in the countries-technological leaders in the new industrial revolution context, was determined.

At the second stage, the features of innovation policies models and innovative infrastructures of Japan, South Korea and China in the new industrial revolution context were analyzed. The trend analysis method was used to compare the effectiveness of these models. Three indicators were selected for the trend analysis: GDP of countries (billion US dollars), The Global Competitiveness Index and The Global Innovation Index. Charts with the dynamics of indicators changes were built and forecasting for three years using a linear trend was made on the basis of the trend analysis. In General, the approximation index was quite high, which testified to the high reliability of the forecast.

At the same time, the approximation index was too low in several cases. This meant that the probability of the forecast execution is not available. A trend analysis was also carried out for the three above indicators for Ukraine to compare the models. However, the trend analysis on these three indicators does not consider the presented models sufficiently.

After the trend analysis execution, it was decided to conduct a correlation and regression analysis of the connection between the indicators of the Innovation Infrastructure group and GDP. The indicators of this group are part of 82 indicators, which are calculated to find out the Global Innovation Index of countries. These indicators most fully demonstrate the connection of the GDP of countries with the components of the innovative infrastructure of states. The following indicators were selected for correlation and regression analysis [11]: GDP of countries (billion US dollars); The Information and Communication Technology Access Index (ICT); The Information and Communication Technology Usage Index (ICT); Gross Capital Formation (% of GDP); Environmental Performance Index; The Logistics Performance Index. The study was conducted for four countries: Ukraine, Japan, South Korea and China.

To begin with, the Ukrainian indicators of GDP, The Global Competitiveness Index and The Global Innovation Index for 6 years were compared with the indicators of Southeast Asian leading countries, trend analysis and correlation and regression analysis were calculated for the following 6 selected indicators from the Innovation Infrastructure group, and recommendations for the development of innovative infrastructure were worked out. The next step included the calculation of the correlation between the selected indicators for the three Southeast Asian leaders. For most indicators a strong and medium correlation was determined. After calculating the correlation, the regression between the countries' GDP and other selected indicators was calculated. And the last step was to analyze the results of the study and work out prospects forecast and recommendations for the innovative infrastructure development of South-East Asian leading countries and Ukraine.

2. Southeast Asian leading countries innovative infrastructure development in modern conditions

Japan. Japan was the first in the implementation of the Asian innovation model, proving that the rational use of imported scientific and technological achievements can provide both a significant increase in the national economic potential and will contribute to the output of its complex or in certain areas to the qualitatively highest level of the advanced states of the world. The project of technopolises creation is one of the most important directions of the government to gain a strong position of the technological leader by Japan. The project was worked out by central and local authorities, academic and business circles under the auspices of the ICC of Japan.

The strategy of Japanese technopolises is a strategy of breakthrough into new spheres of activity on the basis of the regional centers network development at the highest technological level. Thus – it is a strategy of intellectualization of the whole Japanese production. In Japan the government lends 50% of the company's R & D expenditures, followed by interest-free return after reaching the profitability of the new product production. Direct budget (government) expenditure on R & D is about 30% of total expenditure on research and development. As a result, the predominant work of an applied nature and the share of search operations is about 8% [2]-[5].

South Korea. The Republic of Korea is a good example of how the competent innovation policy implementation has allowed the country to become

one of the most economically developed countries in a short historical period. The Ministry of Science and Technology, the Korean Institute of Science and Technology and more than 20 government-supported research institutes are developing their own research and technology base. South Korea has chosen a strategy of socio-economic development based on innovation policy as the main factor and conditions for the modernization of the economy.

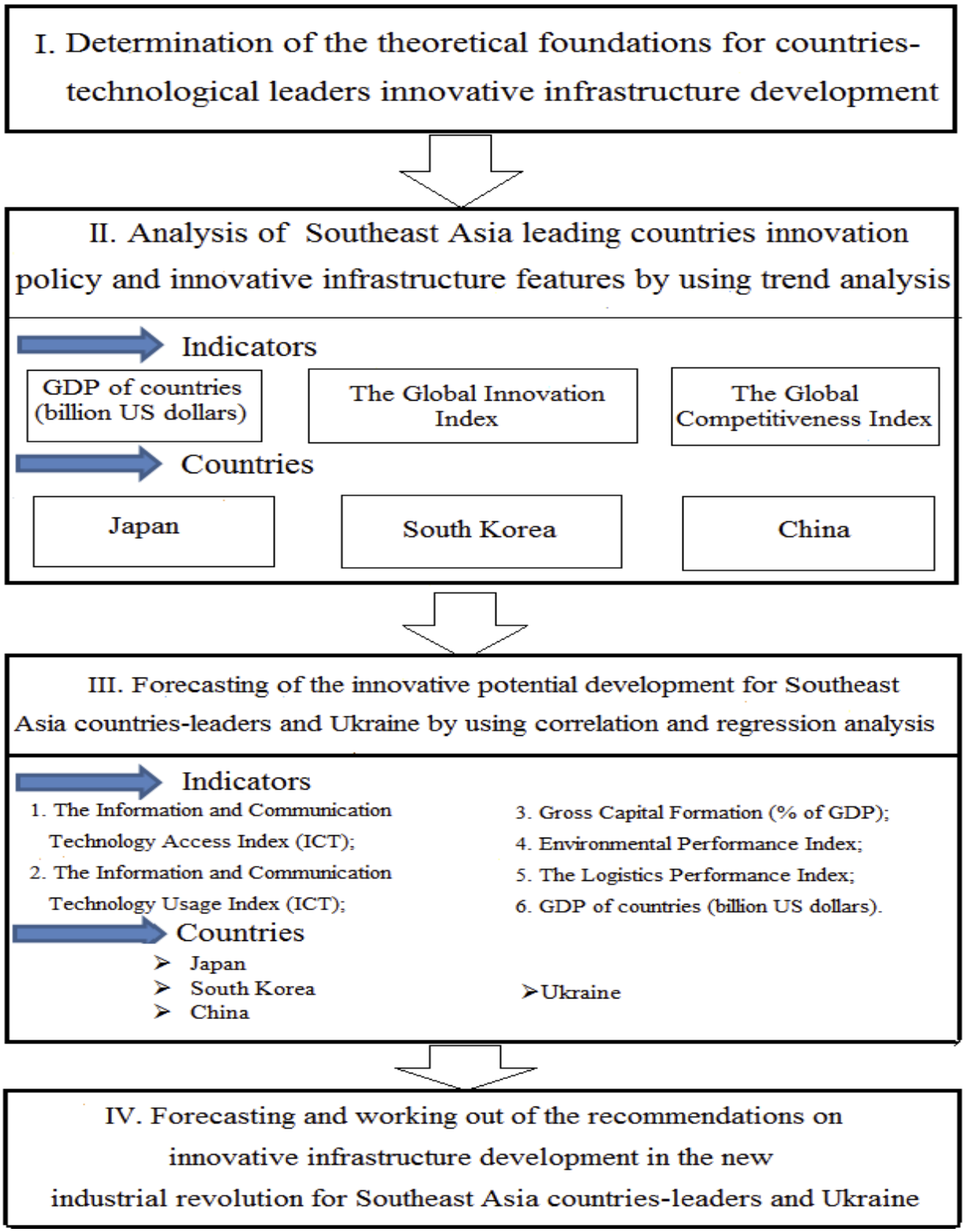

Fig.1.The scheme of Southeast Asia leading countries innovative infrastructure development analysis in the new industrial revolution context

One of the first steps to initialize the creative economy was the creation of Ministry of Science, ICT and Future Planning (MSIP). MSIP released a plan for the creative economy implementation in July 2013, aimed at the installation and adaptation of a new paradigm. The plan describes three goals, six strategies and 24 objectives. Three main objectives include [13]: creation of new jobs and markets through the development of innovations; The Korean Republic formation as a world leader in innovation; creation of a society in which creative thinking is a priority – in contrast to traditional conservative Korean thinking [5, 6].

China. Local governments are driven by a desire to raise the country's ranking of innovative states as resources for the economic growth and social development of their regions at the time when resources such as land are being depleted. In addition, they are caused by the necessity of modernization of goods and services with the aim of preserving the dynamics of export because of decreasing low wages preference and worsening conditions of international trade. China attaches great importance to technoparks.

Most of them were created by the decision of the State Council of China. National and foreign investments in them amount to billions of dollars. On the basis of the accumulated experience, the State Council of China approved a plan for the high technology zones development in March 1991.

The purpose of their creation is the commercialization of national scientific and technological achievements, the development of advanced industries, attracting national and foreign capital in the development of new technologies and materials, the organization of high-tech products industrial production [2, 10, 12].

The graph in figure 2 shows the dynamics of Japan's GDP – significant changes over the past 6 years. Natural disaster influenced at the country's economy. In 2016, GDP growth began, but the volume decreased again in 2017. Trend analysis predicts a further GDP decline in the next 3 years, but the approximation coefficient shows the unreliability of the forecast. Perhaps it is due to the fact that the indicators were at a fairly high level before. The chart of Korea's GDP indicators shows the dynamics of changes in the volume of GDP of the country with their rapid reductions and growth. Over the past 6 years, the country's GDP fell rapidly (in 2014), and then also grew rapidly. The forecast with a high approximation coefficient demonstrates the further growth of Korea's GDP.

The volume of China's GDP has been growing almost all the time, and the approximation coefficient is high (0.94), this indicates a high reliability of the forecast. The trend analysis for Ukraine shows a further decline of Ukraine's GDP over the next 3 years. The approximation index has an average accuracy of 72%. Therefore, we cannot unambiguously assert the unambiguity of this forecast. According to the constructed schedule (Fig. 3.), Japanese Global Innovation Index was distinguished by constant growth for a 6-year period, since the level of being 52.12 in 2012, and to the level of the index 54.72 in 2017. At the same time, the Innovation Index shows some slowdown in the development of the country's innovation sector in this period. This may be due to a technogenic disaster, which occurred due to the disruption of the Fukushima nuclear power plant as a result of natural impact. The trend analysis predicts the further growth of indicators, and hence improvements in the innovation sector, and perhaps the return of Japan's positions returning in the rankings. The coefficient of approximation thus shows very high probability of the forecast.

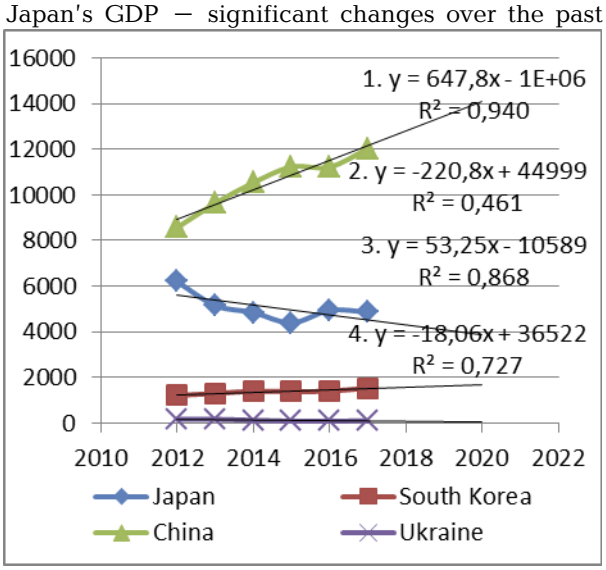

Fig.2. GDP dynamics of Japan, South Korea, China and Ukraine for the period of 2012-2017, trend analysis for the period up to 2021

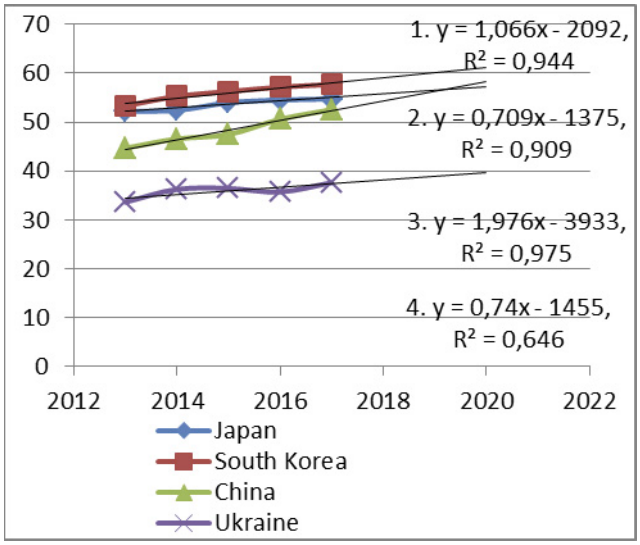

Fig.3. Indicators rates of Japan, South Korea, China and Ukraine in the ranking of The Global Innovation Index for the period of 2012-2017, trend analysis for the period up to 2021

South Korea takes the 11th place in the innovation ranking in 2017, with an index of 57.7 points. It is more than one year ahead of Japan, although it is still a country of a new industrial wave, that is, a country that is developing, unlike highly developed Japan. The pace of innovation development in the country is steadily growing. Trend analysis with a high approximation index shows a high probability that the country will continue to develop rapidly.

Innovative development of China in the last 5 years is characterized by some slowness, but still remains stable.

Forecasting made on the basis of trend analysis shows a tendency to further rapid development of the innovative sphere of the country. A coefficient of approximation allows us to assert the high reliability of the forecast. Ukraine is far from the first place in the innovative development rankings, but the indicators of The Global Innovation Index and its components are growing periodically. Competitiveness indicators (Fig.4.) showed rapid growth in 2013-2014, but development slowed slightly. The prediction has a positive direction, but the approximation coefficient is not high enough to confirm the further growth of indicators. South Korea's Global Competitiveness Index has a steady upward trend. The Global Innovation Index has been constantly changing, occupying a higher and lower position. But the approximation coefficient is too low to make the forecast for this indicator.

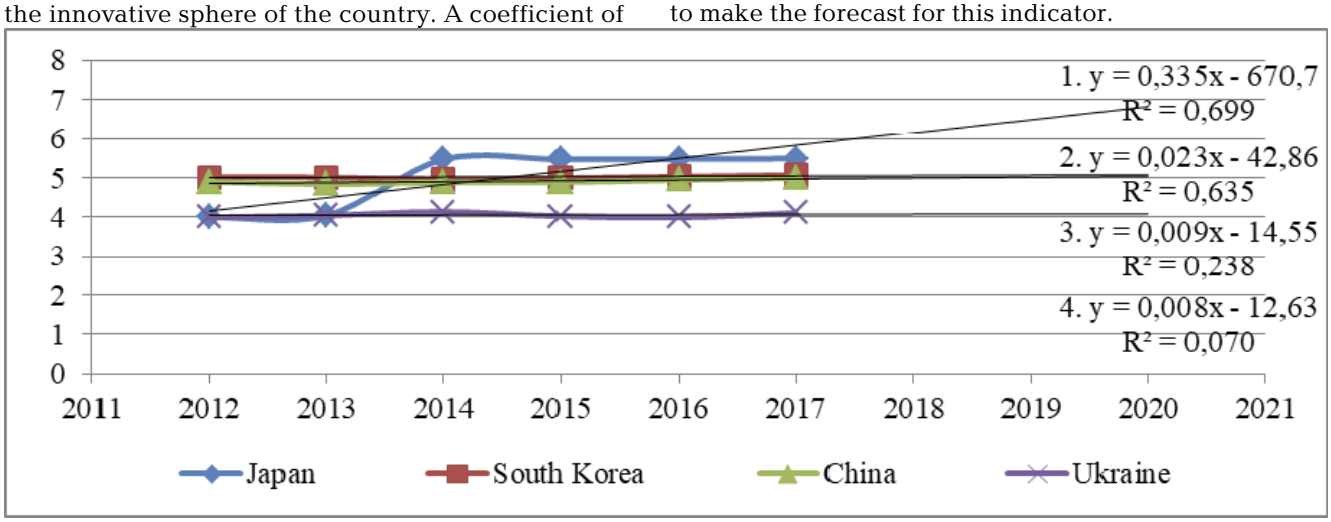

Fig.4. The Global Competitiveness Index indicators dynamics of Japan, South Korea, China and Ukraine for the period of 2012-2017, trend analysis for the period up to 2021

3. Innovative potential development modeling of South-East Asia leading countries and Ukraine

The trend analysis revealed that such indicators as the country's GDP, The Global Innovation Index and The Competitiveness Index demonstrate the level of innovative development of the state and provide an opportunity to make a forecast for several years ahead, based on the dynamics of indicators for a certain period of time. However, The Global Innovation Index most extensively and comprehensively demonstrates the level of innovation policy and innovative infrastructure development, because the indicators included in its composition relate to all areas of development of the state. Based on this, we have selected the indicators of the Innovative Infrastructure group for a more in-depth analysis.

The study was conducted for three South-East Asia countries-leaders (Japan, South Korea and China) and the values selected from the group of indicators, which are used to account Innovative Infrastructure in The Global Innovation Index for the period from 2012 to 2017. The following indicators were selected to conduct the study and to identify the interdependence between the indicators: GDP (billion dollars); The Information and Communication Technology Access Index (ICT); The Information and Communication Technology Usage Index (ICT); Gross Capital Formation (% of GDP); Environmental Performance Index; The Logistics Performance Index [11]. The method of correlation and regression analysis was chosen for the study. With the help of the necessary data, the correlation dependence of the indicators of innovation infrastructure was calculated.

For convenience, the initial data and the results of correlation and regression analysis were collected in tables. Correlation analysis for Ukraine shows quite significant interdependence of GDP and Gross Capital Formation (0.76).

Also, a significant correlation between GDP and Logistics Performance Index was revealed. The Environmental Performance Index and GDP have an inverse connection. From the results of the correlation calculations in the table, it can be concluded that Japan's GDP has a very strong feedback to The ICT Access Index. During the study period, Japan's GDP decreased rapidly between 2013 and 2015, and The ICT Access Index, in turn, increased, which confirms the inverse correlation. There is also an average inverse correlation with Gross Capital Formation.

With the growth of GDP, Gross Capital Formation indicators decreased, and with a decrease in GDP, on the contrary, increased. From the results of the correlation analysis for South Korea presented in the correlation matrix, it is clear that the strongest relationship is established in GDP and The ICT Access Index, as well as The Environmental Performance Index. Based on the initial data, these indicators did change in one direction in one period. The Logistics Performance Index has an average reverse correlation with GDP.

In the baseline table, this indicator has the lowest performance in 6 years with a high level of GDP, indicating an inverse correlation. From the results of the correlation calculation for China it can be seen that the interdependence of GDP and the selected indicators is very high to the direct, and the reverse.

The results of the correlation calculation show a very strong correlation between GDP and the Index of Access to Information and Communication Technologies. There is a very strong connection between GDP and The ICT Usage Index. GDP and The Environmental Performance Index have a high correlation value.

There is also a direct correlation, but of a moderate degree, between GDP and The Logistics Performance Index. The value of Gross Capital Formation has a strong inverse correlation. Correlation analysis for Ukraine shows quite significant interdependence of GDP and Gross Capital Formation (0.76). Also, a significant correlation between GDP and The Logistics Performance Index was revealed. The Index of Environmental Performance and GDP have an inverse relationship. The next step of the study is to calculate the regression between GDP and selected innovative infrastructure indicators. To obtain the necessary results of regression calculation, the pairwise calculation of the parameters was performed at the first stage. Analyzing the results of the regression calculation (Table 3), it can be argued that The ICT Access Index does have a connection with GDP, which was revealed during the correlation analysis.

Table 1

Initial data for the correlation and regression study for Japan, South Korea, China and Ukraine (for the period 2012-2017)

Japan						
Year	GDP of countries (billion US dollars)	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
2012	6203,21	8,26	7,78	22,4	67,43	3,93
2013	5155,72	8,4	7,8	23,3	71,94	3,91
2014	4850,41	8,6	7,89	23,9	72,35	3,91
2015	4394,98	8,85	7,98	23,4	76,34	3,95
2016	4949,27	8,73	8,07	23,1	80,59	3,97
2017	4872,14	8,8	8,15	23	83,06	4,03
South Korea						
Year	GDP of countries (billion US dollars)	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
2012	1222,81	8,91	8,2	29,6	58,31	3,7
2013	1305,61	8,94	8,26	29,3	59	3,72
2014	1411,33	8,98	8,3	29,2	63,79	3,67
2015	1382,76	9	8,42	29,4	68	3,68
2016	1411,04	8,9	8,56	29,7	70,61	3,72
2017	1538,03	8,85	8,71	29,9	73,04	3,61
China						
Year	GDP of countries (billion US dollars)	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
2012	8570,35	4,78	2,68	9	37,02	3,52

2013	9635,03	5,1	2,99	9,3	39,99	3,53
2014	10534,53	5,19	3,54	6,8	43	3,53
2015	11226,19	5,25	3,84	6,7	57,6	3,6
2016	11221,84	5,37	4,63	6,2	65,1	3,66
2017	12014,61	5,58	5,27	6,5	69,45	3,61
Ukraine						
Year	GDP of countries (billion US dollars)	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
2012	175,71	6,01	1,8	19	41,02	2,85
2013	179,57	6,16	2,11	16,9	45,3	2,99
2014	132,34	6,2	2,14	14,2	49,01	2,98
2015	90,94	6,27	2,17	13,6	63,27	2,68
2016	93,26	6,45	2,56	15,2	79,69	2,74
2017	109,32	6,6	3,17	16,1	81,46	2,83

Table 2

Calculation results of correlation between GDP and Innovation Infrastructure group indicators for Japan, South Korea, China and Ukraine

Indicator/ Country	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
Japan	-0,87	-0,59	-0,75	-0,64	-0,25
South Korea	0,88	-0,32	0,41	0,89	-0,73
China	0,97	0,93	-0,88	0,91	0,77
Ukraine	-0,73	-0,58	0,76	-0,83	0,74

According to The ICT Usage Index, we see evidence that the indicators have a very weak link. Regression indicators also show the interdependence of GDP and Gross Capital Formation. The Environmental Performance Index of Japan has a weak link to GDP.

Table 3

Results of the regression calculation between GDP and other selected indicators for Japan

Japan	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
Multiple R	0,87898543	0,5907495	0,75309	0,642649	0,256376
R-square	0,77261539	0,3489849	0,567144	0,412998	0,065728
Normalized R-square	0,71576923	0,1862312	0,45893	0,266247	-0,16784
Standard error	324,213538	548,58778	447,3242	520,9193	657,1843
Observation	6	6	6	6	6
Y-intersection	24697,3974	24301,234	26492,21	10098,98	18574,18
Variable X 1	-2280,37673	-2420,425	-923,994	-66,7865	-3418,54

Table 4

Results of the regression calculation between GDP and other selected indicators for South Korea

South Korea	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
Multiple R	0,736111082	0,580344432	0,76751572	0,83432113	0,742320507
R-square	0,541859525	0,33679966	0,58908038	0,696091747	0,551039734
Normalized R-square	0,427324406	0,170999575	0,486350475	0,620114684	0,438799668
Standard error	29,99459672	36,08827023	28,40678833	24,4295205	29,69256045
Observation	6	6	6	6	6
Y-intersection	994,0040541	241,7365959	-115,0152091	242,585469	-541,0799743
Variable X 1	-137,5135135	-47,9770305	15,48664478	-1,874559594	235,9472669

Table 5

Results of the regression calculation between GDP and other selected indicators for China

China	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
Multiple R	0,96949	0,928954	0,880747	0,913024	0,777275
R-square	0,939911	0,862955	0,775715	0,833614	0,604156
Normalized R-square	0,924888	0,828694	0,719644	0,792017	0,505195
Standard error	342,494	517,2328	661,6901	569,9194	879,0559
Observation	6	6	6	6	6
Y-intersection	-12949,6	6013,871	16529,51	6243,215	-50567,3
Variable X 1	4505,922	1181,67	-808,416	82,46815	17091,21

The results of the regression calculation on the indicators (Table 4) show a stable relationship between the GDP of South Korea and The Environmental Performance Index, this confirms the calculations of the correlation dependence of the indicators. The state policy of Korea is really aimed at equalizing the environmental situation.The calculated regression confirms the results obtained in the analysis of correlation relationships. Multiple R, R-square and the normalized R-squared have high values, and hence the connections between these indicators are also strong.

The regression results between GDP and selected indicators show a strong connection. This is the only one of all the studied countries, the results of correlation and regression analysis calculations for which show a strong dependence on almost all indicators.

Analyzing the results of regression analysis, we see confirmation of the previous correlation analysis. The strongest link has The Environmental Performance Index, as evidenced by the high value of the multiple index of the average relationship between GDP and The Index of Access to ICT, The Index of Logistics Performance and the Gross Capital Formation.

The next step was to calculate the regression for GDP and all selected indicators from the Innovation Infrastructure group and derive the regression equation between GDP and the indicators under study. The calculation results for the studied countries are collected in the table.

Table 6

Results of regression calculation between GDP and other selected indicators for Ukraine

Ukraine	Information and Communication Technology Access Index (ICT)	Information and Communication Technology Usage Index (ICT)	Gross Capital Formation (% of GDP)	Environmental Performance Index	Logistics Performance Index
Multiple R	0,736111082	0,580344432	0,76751572	0,83432113	0,742320507
R-square	0,541859525	0,33679966	0,58908038	0,69609174	0,551039734
Normalized R-square	0,427324406	0,170999575	0,486350475	0,62011468	0,438799668
Standard error	29,99459672	36,08827023	28,40678833	24,4295205	29,69256045
Observation	6	6	6	6	6
Y-intersection	994,0040541	241,7365959	-115,0152091	242,585469	-541,0799743
Variable X 1	-137,5135135	-47,9770305	15,48664478	-1,87455959	235,9472669

Regression equations for each of the studied countries (Japan-1, South Korea-2, China-3, Ukraine-4) will have the following form:

1. $y = -2870{,}875311X_1 + 6257{,}87494X_2 - 422{,}664606X_3 - 99{,}37785086X_4 - 2893{,}364873X_5 + 8770{,}032644$;
2. $y = -1151{,}467496X_1 + 157{,}6070577X_2 - 380{,}106184X_3 + 14{,}13709358X_4 - 794{,}9424177X_5 + 23558{,}10358$;
3. $y = 4177{,}184078X_1 - 1123{,}454738X_2 - 353{,}0317784X_3 + 86{,}00468208X_4 - 7327{,}23085X_5 + 17399{,}51407$;
4. $y = 1039{,}754351X_1 - 230{,}6663691X_2 + 20{,}07912577X_3 - 7{,}578122048X_4 - 42{,}82894121X_5 - 5606{,}600527$,

where: y – GDP of countries (billion US dollars); X_1 – The Information and Communication Technology Access Index (ICT); X_2 – The Information and Communication Technology Usage Index (ICT); X_3 – Gross Capital Formation (% of GDP); X_4 – Environmental Performance Index; X_5 – The Logistics Performance Index.

Table 7

The regression calculation results for Japan, South Korea, China and Ukraine

Regression statistics	Japan	South Korea	China	Ukraine
Multiple R	1	1	1	1
R-square	1	1	1	1
Normalized R-square	65535	65535	65535	65535
Standard error	0	0	0	0
Observation	6	6	6	6
Y-intersection	8770,03264	23558,104	17399,51	-5606,6
Variable X_1	-2870,87531	-1151,467	4177,184	1039,754
Variable X_2	6257,87494	157,60706	-1123,45	-230,666
Variable X_3	-422,664606	-380,1062	-353,032	20,07913
Variable X_4	-99,3778509	14,137094	86,00468	-7,57812
Variable X_5	-2893,36487	-794,9424	-7327,23	-42,8289

The conducted regression analysis between the indicators of GDP of Ukraine and the selected indicators of the Innovation infrastructure group confirms the results of the correlation analysis allow us to draw a conclusion about the relationship between GDP and these indicators. Based on the

results of the study, the following prospects for the implementation of a new industrial revolution in the leading countries of Southeast Asia and Ukraine can be determined.

Table 8

Conclusions of the study

Country / Research methods	Ukraine	Japan	South Korea	China
Trend analysis	Trend analysis was carried out on three indicators			
GDP	Decreasing, the approximation coefficient is medium (0.72)	Decreasing, the approximation coefficient is low (0.46)	Growing, the approximation coefficient is high (0.86)	Growing, the approximation coefficient is high (0.94)
Global Innovation Index	Growing, the approximation coefficient is medium (0.76)	Growing, the approximation coefficient is high (0.9)	Growing, the approximation coefficient is high (0.96)	Growing, the approximation coefficient is high (0.94)
Global Competitiveness Index	Cannot be predicted-the approximation coefficient is insufficient (0.07)	Growing, the approximation coefficient is high (0.9)	Growing, the approximation coefficient is low (0.23)	Growing, the approximation coefficient is high (0.94)
Correlation and regression analysis (between GDP and indicators)*	Straight c1. - 3(0.76) and 5 (0.74) Inverse c. — 1(-0.73), 2 (-0.58), 4(-0.83)	Inverse c. — 1(-0.87), 3(-0.75), 4(-0.64), 2(-0.59), 5 (-0.25)	Direct c. — 1(0.88), 4(0.89), 3(0.41) Inverse c.-5 (-0.73), 2(-0.32)	Direct c. — 1(0.97), 2(0.93), 4(0.91), 5(0.77) Reverse c.-3 (-0.88)
Conclusions	1.Indicators of GDP and the Global Innov. Index have the highest probability of growth forecast 2.The strongest correlation is observed between GDP and 4(0.83), 3 (0.76) and 5 (0.74)	1.The global In. Index has the highest probability of growth forecast 2.The strongest correlation is between GDP and 1(0.87) and 3 (0.75)	1.GDP and Global In. Index have a very high probability of making a rise of 2.The strongest correlation is between GDP and 4(0.89), 1 (0.88) and 5 (0.73)	1.GDP and Global In.Index have a very high probability of making a rise of 2.The strongest correlation of GDP and have 1(0.97), 2(0.93),5(0.77), 3(0.88)
Perspectives	In case of attracting investments to R&D, innovation centers; attracting universities to R&D; strengthening environmental policy; innovation in industry;IT-sector	Program "Innovations 25"; innovations to solve global problems, ICT development-three directions (science and technology, society, human resources)	Programs: "Production of innovations 3.0" and "Creative Economy"; modernization of production, digital innovations, Internet of things, robotics	New 5-year plan; innovations in public and military sector; bio -, nano-technologies, genetic engineering; 3 directions: Internet, ocean, space

*1 — ICT Access Index; 2 — ICT Usage Index; 3 — Gross Capital Formation (% of GDP); 4 — Environmental Performance Index; 5 — Logistics Performance Index

In Japan, the strategy of innovative development until 2025 "Innovation 25" was introduced, which defines three priority areas: science and technology, society, human resources [4]. It was also identified as one of the most important areas of development of information and communication systems to address global environmental and energy problems. There are two programs in South Korea: "Innovation 3.0" and "Creative Economy". They provide for the modernization of production, the introduction of digital innovations in all spheres of life, the development of the Internet of things, robotics [13]. In China, the new five-year plan includes the following main strategic directions of development of the

innovation sector: innovations in the civil and military sector, the development of bio -, nano-technologies, genetic engineering. There three R&D directions of development were elected: the Internet, the ocean, space exploration [10, 12]. Regarding Ukraine: strategic plans for innovation are implemented by the Verkhovna Rada, and medium-term – by the Cabinet of Ministers. Thus, strategic plans for the development of the innovation sector in Ukraine provide for the introduction of innovations in industry, especially in the sectors of metallurgy, engineering, search for alternative energy sources, aviation and space structure, the development of IT and services [1, 5, 6].

ПЕРСПЕКТИВИ РОЗВИТКУ ІННОВАЦІЙНОЇ ІНФРАСТРУКТУРИ КРАЇН ПІВДЕННО-СХІДНОЇ АЗІЇ ТА УКРАЇНИ В УМОВАХ НОВОЇ ПРОМИСЛОВОЇ РЕВОЛЮЦІЇ

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У глобальній економіці, фундаментом якої все частіше є знання, інноваційна інфраструктура стає локомотивом економічного зростання, вона стане тим важелем, який допоможе трансформувати економічний підйом в довготривалий зростання. Метою статті є аналіз особливостей розвитку інноваційної інфраструктури країн-лідерів Південно-Східної Азії і розробка рекомендацій для України в умовах нової промислової революції. У статті поставлено і вирішено наступні завдання: проаналізувати особливості трансформації інноваційної інфраструктури в країнах-технологічних лідерах в умовах нової промислової революції як Південно-Східної Азії, так і в інших розвинених державах; дослідити особливості інноваційної політики та інфраструктури країн-лідерів Південно-Східної Азії на прикладі Японії, Південної Кореї і Китаю; виконати кореляційно-регресійний аналіз для моделювання і прогнозування розвитку інноваційного потенціалу країн Південно-Східної Азії і України; оцінити перспективи розвитку інноваційної інфраструктури в країнах Південно-Східної Азії і розробити рекомендації для України в умовах нової промислової революції. Методика дослідження включає в себе обробку і вивчення статистичної інформації, виконання тренд-аналізу, обчислення моделі розвитку інноваційного потенціалу методом кореляційно-регресивного аналізу. Результати тренд-аналізу показали, що з України і країн-лідерів Південно-Східної Азії, Китай має кращі перспективи розвитку інноваційної інфраструктури. При проведенні кореляційно-регресійного аналізу найсильніша залежність була виявлена при розрахунку показників по Китаю між ВВП і показниками групи Інноваційної інфраструктури. Були визначені перспективи реалізації нової промислової революції в країнах-лідерах Південно-Східної Азії і України та розроблено рекомендації для України. Висновки. Для успішного розвитку інноваційної інфраструктури в Україні можуть бути застосовані наступні заходи: залучення інвестицій в НДДКР і інноваційні центри; залучення університетів до НДДКР; посилення екологічної політики; концентрація інновацій в промисловості; розвитку IT-сектора.

Ключові слова: інноваційна інфраструктура, четверта промислова революція, інноваційний потенціал.

ПЕРСПЕКТИВЫ РАЗВИТИЯ ИННОВАЦИОННОЙ ИНФРАСТРУКТУРЫ СТРАН ЮГО-ВОСТОЧНОЙ АЗИИ И УКРАИНЫ В УСЛОВИЯХ НОВОЙ ПРОМЫШЛЕННОЙ РЕВОЛЮЦИИ

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В глобальной экономике, фундаментом которой все чаще являются знания, инновационная инфраструктура становится локомотивом экономического роста, она станет тем рычагом, который поможет трансформировать экономический подъем в долговременный рост. Целью статьи является анализ особенностей развития инновационной инфраструктуры стран-лидеров Юго-Восточной Азии и разработка рекомендаций для Украины в условиях новой промышленной революции. В статье поставлены и решены следующие задания: проанализировать особенности трансформации инновационной инфраструктуры в странах-технологических лидерах в условиях новой промышленной революции как Юго-Восточной Азии, так и в других развитых государствах; исследовать особенности инновационной политики и инфраструктуры стран-лидеров Юго-Восточной Азии на примере Японии, Южной Кореи и Китая; выполнить корреляционно-регрессионный анализ для моделирования и прогнозирования развития инновационного потенциала стран Юго-Восточной Азии и Украины; оценить перспективы развития инновационной инфраструктуры в странах Юго-Восточной Азии и разработать рекомендации для Украины в условиях новой промышленной революции. Методика исследования включает в себя обработку и изучение статистической информации, выполнение тренд-анализа, вычисления модели развития инновационного потенциала методом корреляционно-регрессивного анализа. Результаты тренд-анализа показали, что из Украины и стран-лидеров Юго-Восточной Азии, Китай имеет лучшие перспективы развития инновационной инфраструктуры. При проведении корреляционно-регрессионного анализа самая сильная зависимость была выявлена при расчете показателей по Китаю между ВВП и показателями группы Инновационной инфраструктуры. Были определены перспективы реализации новой промышленной революции в странах-лидерах Юго-Восточной Азии и Украины и разработаны рекомендации для Украины. Выводы. Для успешного развития инновационной инфраструктуры в Украине могут быть применены следующие меры: привлечение инвестиций в НИОКР и инновационные центры; привлечение университетов к НИОКР; усиление экологической политики; концентрация инноваций в промышленности; развития IT-сектора.

Ключевые слова: инновационная инфраструктура, четвертая промышленная революция, инновационный потенциал.

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