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MODELING UKRAINE ECONOMIC GROWTH BASED WITH KNOWLEDGE FACTORS

Summary: Knowledge intensive economy and influence intellectual property rights objects on GDP growth are analyzed in the article. There are Patents, Trademarks and Industrial Design products include utility models and designs in intellectual property right objects. Process of influence considered by authors using WIPO information. The ratio of US, China, Israel, Ukraine GDP growth and forms of IPR in percentage from level of 1991 year are compared. The USA, China and Israel, in contrast to Ukraine, there are relationship between GDP growth and indicators knowledge intensive economy. Ukrainian's GDP growth does not gain the momentum of influence new factors, as it does in advanced economies. Among the main named problems of Ukrainians knowledge intensive economy is action of complex improve the IPR aided system can significantly change the current situation in the manufacturing sector, improve macroeconomic indicators and thereby reduce the negative impact of other countries on the domestic economy.

Key words: knowledge intensive economy, gross domestic product, intellectual property right objects.

1. INTRODUCTION

According to the basics of economic theory, labor and capital remain the main factors of economic growth [1]. But in today's economies, factors that have not previously been emphasized are gaining influence on GDP growth. Scientists increasingly determine that these factors maybe include knowledge [2]. Knowledge directly does not have quantitative characteristics. Knowledge is a product of human intellectual activity and can be formalized in the form of objects of intellectual property rights (IPR), engineering decisions, technologies, management decisions, etc. [3]. IPR are divided into copyright, patent, trademark, business name. The World Intellectual Property Organization (WIPO) collects information on IPR that are registered as Patents, Trademarks and
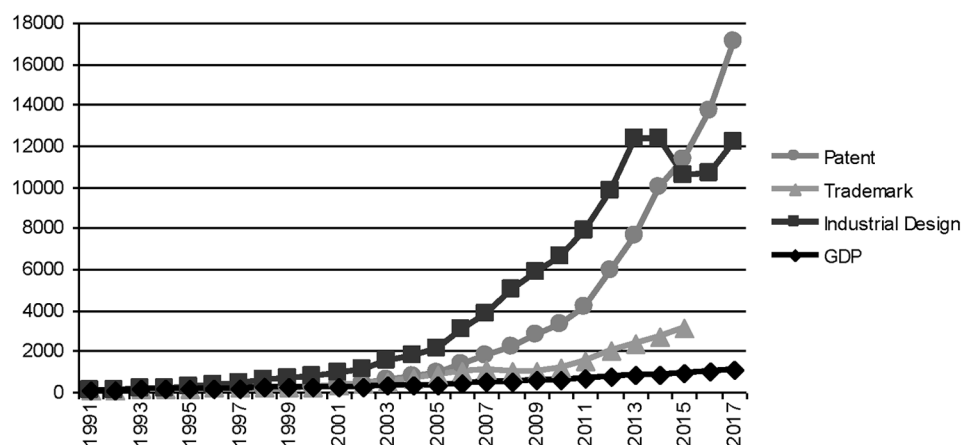
Industrial Design products. Industrial design products include utility models and designs, which in Ukraine are subject to patent law and are also protected by relevant patents. The influence this factors on modeling Ukraine economic growth is needs research.

2. METHODOLOGICAL PART

We can hypothesize that the commercialization of IPR and the use of intellectual labor products contributes to economic development and is a component of new drivers of economic growth. The ratio of GDP growth and the increase in the number of IPR are provides the information about the results of such an impact.

This ratio in percent for China is shown in Fig. 1.

Figure 1. The ratio of China's GDP growth and the forms of IPR in percentage from level of 1991 year

Source: designed by the authors using WIPO [4] information.

The number of patent law objects, namely patents, utility models and industrial designs, has gained the most growth. The number of patents for inventions has increased by 17000% since 1991 and the number of industrial design objects by 12000%, contributing to a 1000% increase in GDP.

These factors are the driving force behind China's GDP growth.

The ratio in percent for USA is shown in Fig. 2.

In the US, there is an increase in all forms of IPR from 350% to 600% from level of 1991 year. Accordingly, GDP growth is slow, but it is of great absolute importance.

Israel's GDP growth relative to 1990 has gained about 300%. Accordingly, the ratio of the growth of IPR and GDP is shown in Fig. 3.

Figure 2. The ratio of US GDP growth and the number forms of IPR in percentage from level of 1991 year
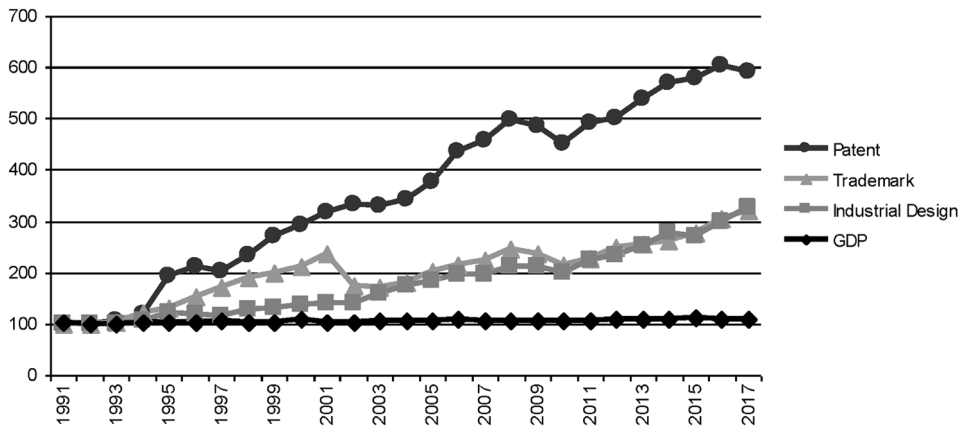
Source: designed by the authors using WIPO [4] information.

Figure 3. The ratio of Israel's GDP growth and the number forms of IPR in percentage from level of 1990 year
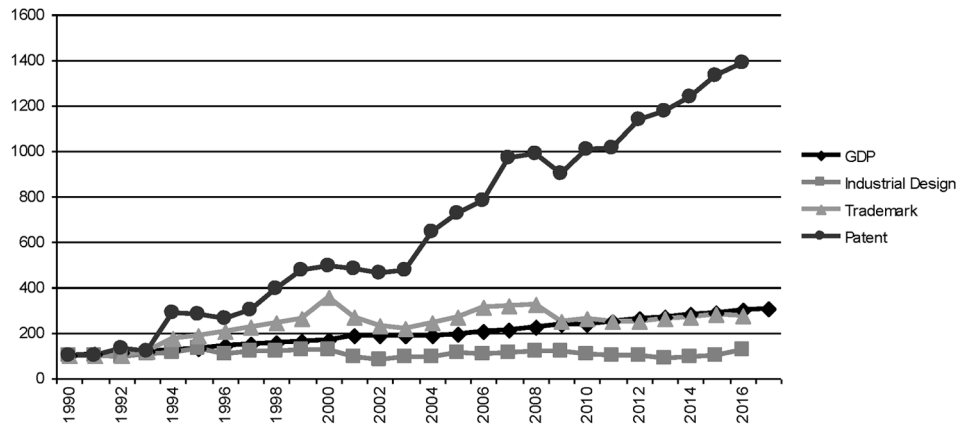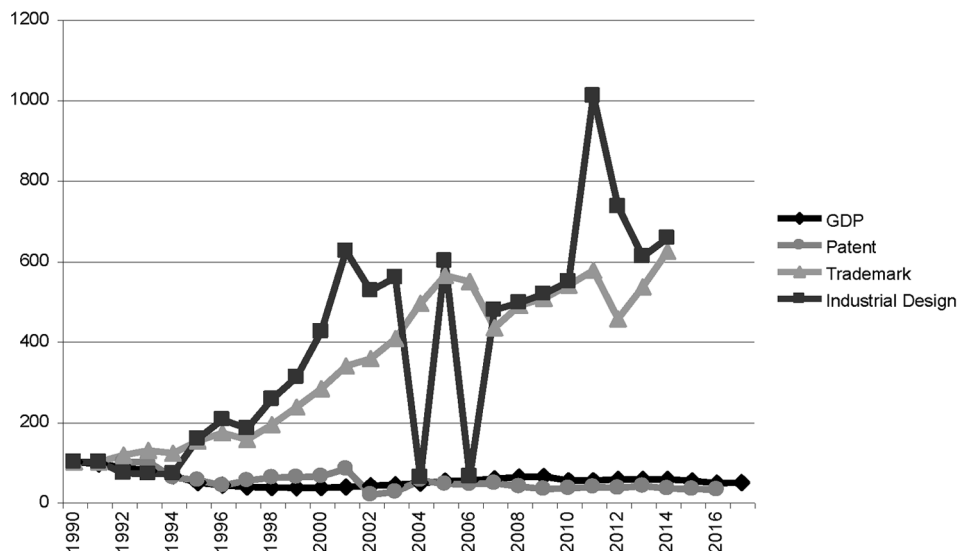

Source: designed by the authors using WIPO [4] information.

The main engine of GDP growth in Israel is a patent for inventions, which have increased by 1400%. The number of trademarks is growing slowly and the number of industrial design objects is practically not growing. Moreover, GDP growth rates exceed the growth rates of industrial design objects.

The ratio in percent for Ukraine is shown in Fig. 4.

Information is given as a percentage relative to 1990. Ukraine has seen an increase in the number of trademarks and industrial design products (industrial designs and utility models). GDP growth and the number of patents on inventions have been slow and even have fallen since 1990.

Figure 4. The ratio of Ukraine GDP growth and the number forms of IPR in percentage from level of 1990 year

Source: built by the authors using WIPO [4] information.

The patents on inventions occupy is the first place in ascension in China, the US and Israel, and public authorities in this countries are actively promoting scientific development, unlike in Ukraine. In the US and China, special attention is also paid to industrial design objects.

Unfortunately, during the years of independence, the society of Ukraine has degraded, both in economic and educational matters. Many post-Soviet countries have been or are still in decline, but Ukraine is almost the most backward country. This low socio-economic situation is caused by population emigration, lack of reform changes, or their lack of effectiveness in branch of education and scientific research, reduced funding for research, and the promotion and protection of intellectual property objects at the state level.

The USA, China and Israel, in contrast to Ukraine, there is a relationship between GDP growth and indicators that can be attributed [5]:
- The volume of completed scientific and scientific-technical works;
- The volume cost investments in innovations;
- The volume cost of acquiring new technologies.

The implementation of research works is accompanied by the creation of IPR, development of design documentation and technological processes.

In Ukraine, during the years of independence, a tendency has emerged that leads to its depletion, lose of scientific personnel, the most educated population, which is the bearer of knowledge. As a consequence, the knowledge complex responsible for the creation of a knowledge society is lost. As a consequence, GDP growth does not gain the momentum of influence new factors, as it does in advanced economies. Therefore, immediate action can significantly change the

current situation in the manufacturing sector, improve macroeconomic indicators and thereby reduce the impact of other countries on the domestic economy. Therefore, only immediate action of complex improve the IPR aided system can significantly change the current situation in the manufacturing sector, improve macroeconomic indicators and thereby reduce the negative impact of other countries on the domestic economy.

At the same time, design documentation, technologies and other intellectual work result shape the knowledge potential of Ukrainian enterprises and need protection of IPR.

The first stage of protection is the formation patents on design documentation and technologies in need of protection.

If the registration system of patents on inventions, industrial design objects and trademarks is sufficiently formalized, then the registration of design documentation and technology for subsequent protection and regulation of commercial circulation procedures needs to be formalized.

Considering existing scientific approaches to determining the importance of knowledge in the context of state formation and the creation of a knowledge society, one should pay attention to the United Nations Development Program (UNDP) – 1980, which annually publishes the Education Level Index (Figure 5). The Education Level Index Ukraine higher than China and keeps upward trend. This forms the potential for the development of the knowledge economy in Ukraine.

Figure 5. Dynamics of the Education Index
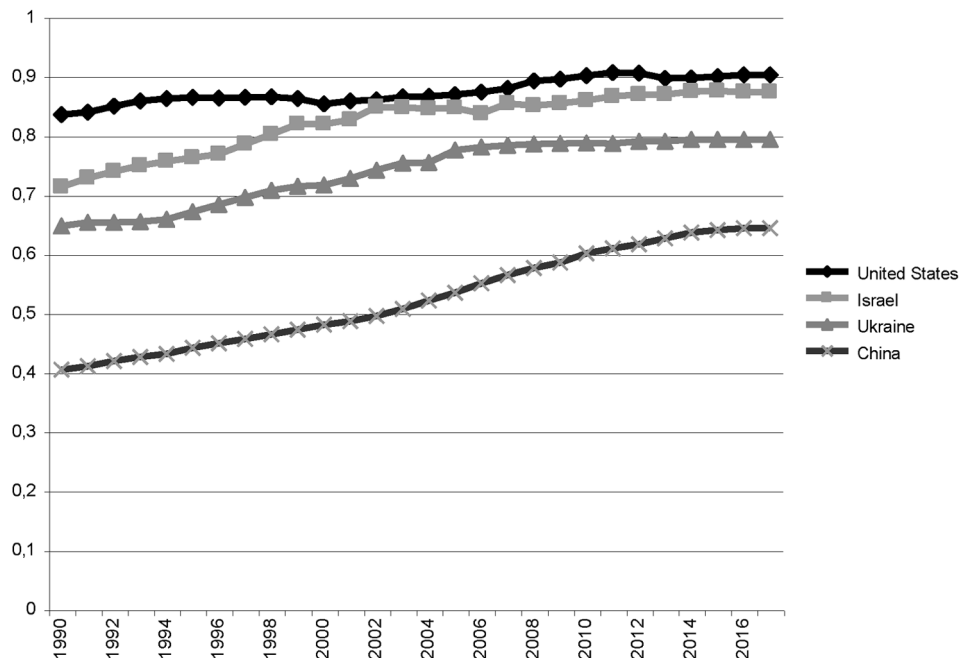
Source: built by the author according to UNDP [6].

The Education Index in the world is a combined indicator of the United Nations Development Program (UNDP). One of its key factors in social development is the Human Development Index. Which was proposed as part of a special series of United Nations (UN) human development reports.

This index measures the achievement of a country in terms of the level of mastery of knowledge of its population by two main indicators:

■ Adult literacy index (weight is 2/3 of the index);
■ Index of the cumulative proportion of students receiving primary, secondary and higher education (weight equals 1/3 of the index).

Based on the above, it is obvious that knowledge occupies a leading position in the state process of building a knowledge society. World economic and political processes are also reflected in this context. Knowledge, unlike any other type of production factor, is a unique factor because it has channels of dissemination, so the influence of the state on knowledge under the «new theory of economic growth» should not be limited to reforming only the education system.

For further research, we will compare the dynamics of Ukrainian's GDP growth and the factors of influence in percentage relative to 1990 (Fig. 6).

Figure 6. Dynamics of Ukrainian's GDP changes and influence factors in percentages relative to 1990
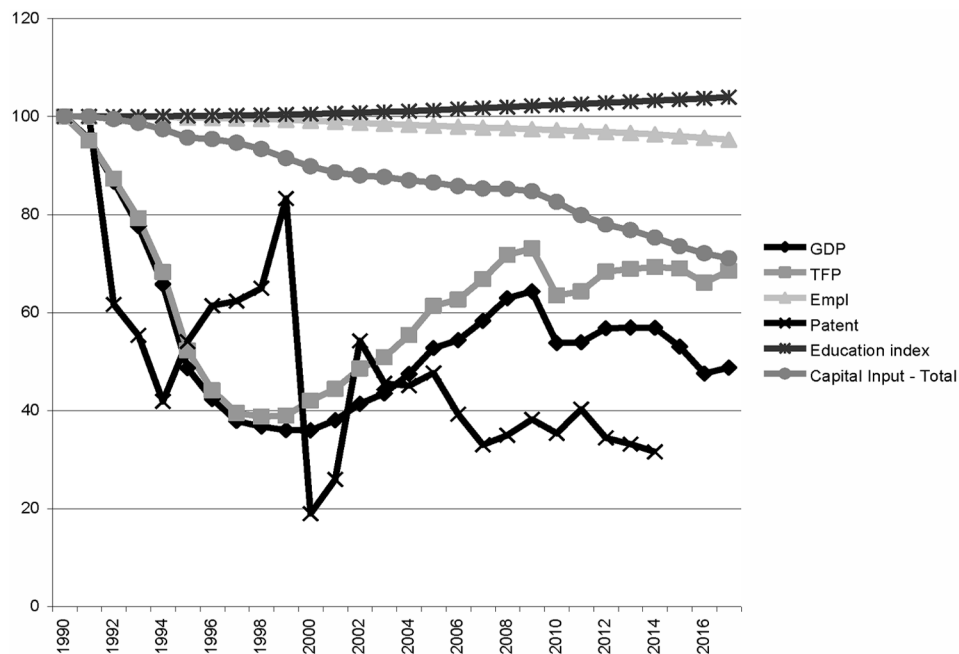
Source: built by the author according to UNDP[1] and information conference-board[2].

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[1] Website of the UNDP Access mode – http://hdr.undp.org/en/data#
[2] Website of the conference-board, https://www.conference-board.org/data/economydatabase/index.cfm?id=27722

Labor resources are replenished at the expense of graduates of schools, colleges, universities, and decreases due to aging, natural mortality and emigration. Capital grows through investment and declines as a result of the physical or moral aging of fixed assets [7].

According to many studies initiated by R. Solow, it has been found that in addition to the main factors, GDP is influenced by others, which have not previously been focused on, which form the deviation of estimated GDP and its actual value.

This deviation was initially referred to as the "Solow residue" or the degree of "our ignorance" of new GDP formation factors. Subsequently, this deviation has become known as total factor productivity (TFP) [8].

Functional analysis shows that changes in the actual value of GDP are most correlated with TFP. The difference between GDP and TFP is easily explained by the dynamics of a declining working population and investment decline. But these factors do not explain the fluctuations in GDP that the TFP repeats. This provides a basis for take hypothesize that exist some other factors affecting TFP.

According to [9], TFP is an additional factor that does not include either the number of employees, nor the capital and investments.

Therefore, we will hypothetically determine that TFP is an integrated factor and its structure includes other factors that are indicators of growth of knowledge level, namely:
- Education Index x_1;
- Patents x_2;
- Trademarks x_3;
- Industrial design products x_4.

In this case, the conceptual TFP model can be represented by an empirical regression formula as follows:

$$TFP = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 \qquad (1)$$

It is possible to determine the coefficients in the regression based on statistical information using Excel's Data Analysis plugin. For the study, the period of beginning of economic growth of Ukraine from 1995 to 2017 was taken. As a result of calculating model parameters for Ukraine according to statistical information for the selected period, the model has the following appearance:

$$TFP = 110,92 - 0,783x_1 + 0,013x_2 + 0,072x_3 - 0,001x_4 \qquad (2)$$

According to the results analysis of regressive statistics the R – square has a value of 0.901257707. That is, in 90% of cases, changes in TFP occur as a result of the influence of certain factors and only less than 10% of the influence is possible on uncertain factors. According to the results of the analysis of Fisher's criterion, the model is significant.

Further analysis determines the significance of the factors according to the student's criterion. The coefficients of t-statistics have the following values:

$t_0 = 0{,}569$; $t_1 = -0{,}4$; $t_2 = 0{,}177$; $t_3 = 5{,}67$; $t_4 = -0{,}268$

The smallest value of the Student's criterion is equal to $t_2 = 0{,}177$. This determines that this variable x_2 can be excluded from the regression. The new model looks like:

$$TFP = 116{,}1 - 0{,}827\ x_1 + 0{,}072\ x_3 - 0{,}0014\ x_4 \qquad (3)$$

After that, the corresponding Student's coefficients acquired the following values:

$t_0 = 0{,}62$; $t_1 = 0{,}44$; $t_3 = 5{,}84$; $t_4 = -0{,}29$

The coefficient $t_4 = -0{,}29$ is the least important. Exclude the fourth factor from the model and get the following equation:

$$TFP = 139{,}32 - 1{,}06x_1 + 0{,}072x_3 \qquad (4)$$

In this model, the Student's coefficient in the variable x_1 is the least important. We also exclude this change and get the model:

$$TFP = 33{,}93 + 0{,}065x_3 \qquad (5)$$

This model is significant by Fisher's test and has significant coefficients by Student's criterion. To compare the graph of the dynamics of changes in the actual TFP and calculated using the model is shown in Fig.7

Figure 7. Dynamics of changes in TFP actual and calculated by the model
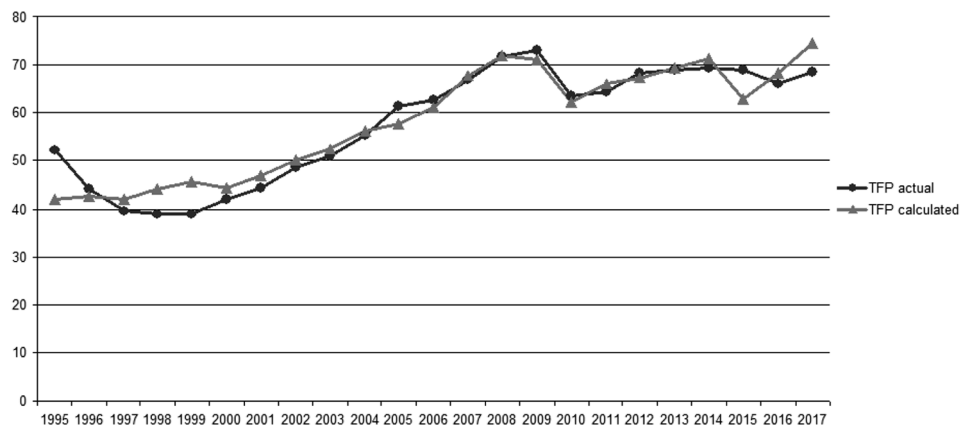
Source: built by the author based on the results of the study.

Thus, the model of TFP construction for Ukraine is currently one-factor and depends on the dynamics of growth in the number of brands. The model can be used for forecasting in the near future. In the future, changes in the influence of other factors that are the result of the use of knowledge are possible.

The study shows that in Ukraine only the number of brands is increasing most dynamically. And even this affects the TFP and, accordingly, GDP. In the future, the dynamic increase of inventions, objects of industrial design can also become a locomotive of economic growth, as it is manifested in economies that are developing dynamically.

The model can be used for forecasting in the near future. Further changes in the influence of other factors that result from the use of knowledge are possible.

The conducted research shows that only the number of trademarks is increasing most dynamically in Ukraine now. And even this affects the TFP and, accordingly, the GDP growth.

Indeed, at the present stage of the economy development of Ukraine there is a dynamic increase in the number of registrations of trademarks, ie new types of products and services and, accordingly, create new businesses environment. There is no significant increase in the number of new patents and industrial design objects. Therefore, their impact on GDP growth is insignificant. But the averment that these factors do not affect economic growth is likely to be wrong.

The experience of developed countries shows a significant impact on economic growth of these factors. It is likely that an increase in the number of patents and industrial design objects will have an even greater impact on economic growth [10]. It is not possible to test this hypothesis at the present stage of Ukraine's economic development. Therefore, it remains only to study the possible impact on the example of other countries [11].

Fore example, in China the number of patents and industrial design objects has a significant impact on economic growth.

The Israeli economy has a synergistic effect of the all factors impact.

To determine the impact of all factors in Ukraine economic growth, it is necessary to create conditions for increasing their number and subsequent commercialization.

3. CONCLUSIONS

Ukraine is only at the beginning of its own development knowledge economy. With the use of knowledge, products of intellectual work of a new quality are created, which have an intangible character [12]. To obtain the effect requires registration of patents, industrial designs and trademarks and their commercialization.

Thus, patents, industrial designs and trademarks are products of intellectual labor. Therefore, improving the conditions of intellectual work will contribute to Ukraine's GDP growth. Moreover, it is possible to obtain a synegetic effect of factors influencing GDP growth, provided the implementation of the intellectual component of human capital.

Following the review, the next suggestions can be made to increase the level of stimulation of the intellectual work and the protection of intellectual property to promote economic growth in Ukraine.

First, for stimulate an increase in the number of patents on inventions, industrial design objects, trademarks and others intellectual results, is necessary to reduced the cost of inventors for registration IPR.

Second, pay only for registration and document processing services.

Third, must be establishing the procedure for design documentation and technology registration as an object of IPR.

Fourth, if the object of IPR is created under the enterprise program, then exclusive property rights are granted to the enterprise.

Fifthly, it is necessary to determine at the legislative level the scope of legal protection of object IPR, what must be protect, what is a violation, how to detect a violation and what the consequences of such a violation are.

Sixth, to must increase the level of knowledge about intellectual property objects in law enforcement systems and judiciary.

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MODELOWANIE WZROSTU GOSPODARCZEGO UKRAINY W OPARCIU O CZYNNIKI WIEDZY

Streszczenie: W artykule przeanalizowano gospodarkę wiedzochłonną i wpływ praw własności intelektualnej na wzrost PKB. Istnieją patenty, znaki towarowe i produkty wzornictwa przemysłowego, w tym wzory użytkowe stanowiące prawa własności intelektualnej. Proces wpływu rozważany był przez autorów wykorzystując informacje WIPO. Porównano wpływ form własności intelektualnej na wzrost PKB w USA, Chinach, Izraelu i Ukrainie w stosunku do 1991 roku. W USA, Chinach i Izraelu, w przeciwieństwie do Ukrainy, istnieje związek między wzrostem PKB a wskaźnikami gospodarki opartej na wiedzy. Wzrost PKB na Ukrainie nie zależy od tych czynników jak to ma miejsce w gospodarkach rozwiniętych. Wśród głównych, wymienionych problemów ukraińskiej gospodarki wiedzochłonnej jest działanie polegające na kompleksowej poprawie systemu wspomaganego prawami własności intelektualnej, który może znacząco zmienić obecną sytuację w sektorze wytwórczym, poprawić wskaźniki makroekonomiczne i tym samym zmniejszyć negatywny wpływ innych krajów na gospodarkę krajową.

Słowa kluczowe: gospodarka wiedzochłonna, produkt krajowy brutto, przedmioty praw własności intelektualnej.

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