

*the intellectual potential, integral index of the level of intellectual potential,
sustainable development*

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MEASURING OF INTELLECTUAL POTENTIAL INFLUENCE ON THE ECONOMY OF UKRAINE

Abstract

Methods of the techno-globalism parameters use in the analysis of the state economy are described in the article. Integrated model of the intellectual potential measurement is presented. The dynamics of the economic development macro indicators is described.

1. INTRODUCTION

The state of economic development of Ukraine is characterized by slow development of the market mechanisms, systemic crisis of the social production and lack of the effective state innovation policy that determines low level of economic development, inefficient use of the intellectual potential of the state and economic subjects.

The use of all factors, which influence the macroeconomic innovation environment formation, are necessary to implement the strategy of economic security and development of Ukraine in conditions of techno-globalism processes' deployment.

These factors include: the use of intellectual potential of Ukraine in all sections: fundamental, sectorial and applied spheres; the effectiveness of innovation processes' state regulation; the knowledge economy foundations' formation in the spheres of education, science, technological and information infrastructures.

New interdisciplinary knowledge, generated by scientific and social institutions, high-quality human capital preparation, provided by the education, additional wealth's creation by the knowledge economy and formation of the integral vector of the society development on this basis, aimed at the life quality

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and safety improvement of all members of the society, became integral components of the knowledge society. The increase of the techno-globalism factors role in the state economic development formation determines the modification necessity of techniques and macro modeling models.

New approaches to the economic growth problem consider multi variation of development and emphasize the increase of not only the scientific knowledge role, but also the volume of society knowledge. It is reflected in the calculation method of the intellectual capital index of the state, which is considered as a composite index with a few components: the human capital index, the process capital index, the market capital index, the reproductive capital index. The state intellectual capital dynamics assessment is required to develop an effective innovation policy. Development indicators of the innovation sector of economy also reflect the structure of intellectual capital and include few groups of indexes, which are evaluated: human resources, new knowledge creation, new knowledge use, innovation financing [1].

Integral ratings, which consider the total effect of the techno-globalism aggregate threats on the sustainable development of the countries of the world, are presented in the sustainable development assessment method (MBC), (Sustainable Development Gauging Matrix, SDGM), which determines aggregate index of the sustainable development through next components: economic, ecological and social dimensions. The knowledge economy parameters are shown in terms of social development indexes. The actual data use of sustainable development indicators and parameters for a specific region aimed at taking deliberate decisions at different management levels is one of the important MBSP implementations [2, 3].

The described methods consider separate components of the knowledge economy and techno-globalism, but don't consider the level of intellectual potential of the state.

The absolute and relative increase in domestic spending on research and development work, capital investment in technical re-equipment of enterprises using own and borrowed funds, is taken place in recent years.

Industrial enterprises should intensify contacts with research institutions and universities for the innovation activity increase. The question of the research and development work assessment in industrial enterprises of Ukraine requires further investigation and improvement aimed at the creation of innovation development management model based on the intellectual potential of the state use.

Fig. 1 shows the dynamics of use of intellectual potential indicators and separate parameters of the state economic development. Comparative data analysis helps to identify discrete trends of dependencies, to determine intervals of high level regression relationships and installation directions of indicators of the stimulants and de stimulants of economic growth.

The research done can be viewed as the initial stage of developing macro modeling using the modified list of techno globalism parameters.

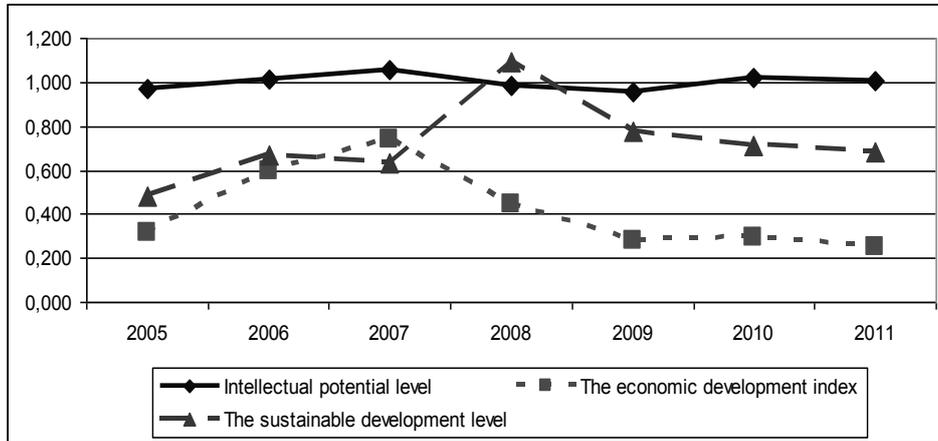


Fig. 1. Comparison of the dynamics of intellectual potential and sustainable development levels [source: own study]

2. PURPOSE OF STUDY

Purpose of this study: to analyze the impact of the intellectual potential integral index on the macro indicators of the economic development of Ukraine.

On the one hand, the modeling process in global economy means the selection of large volume of meaningful units of a certain object, which form together its deepest essence; on the other hand, it means strategy and tactics determination of macro- and micro regulation, aimed to overcome connections which impair existing relationships between the various elements of the system. Thus, adequate economic model reflects both old qualities of the existing before paradigm and some new, which are required by new conditions of the economic development.

Three groups of models are distinguished in scientific literature:

- economic, which include appropriate mechanism and instruments of macroeconomic proportions regulation;
- mathematical, which include modern apparatus of mathematical and fuzzy logic;
- predictive, which allow to predict the growth rates and outcomes of certain changes in the social and economic life of the society using instruments of the mentioned above models [3].

Taking into account the above considerations the integral index measuring the level of intellectual potential is used (1):

$$I_{IP} = \sqrt[3]{I_{OP} \times I_{KP} \times I_{IN}}, \quad (1)$$

where:

I_{IP} – the integral index measuring the level of intellectual potential.

Components' calculations of the intellectual potential level were held using next models of integral indexes:

Tab. 1. Calculation models of the intellectual potential components

Intellectual potential components	Techno-globalism parameters
<p>Education potential level</p> $I_{OP} = \sqrt[4]{\frac{KN}{KNZ} \times \frac{KS}{KVS} \times \frac{OR}{KNZ} \times \frac{RV}{VVP}}$	<p>KN – number of scientists; KNZ – number of scientific institutions; KS – number of students; KVS – number of higher education institution; OR – volume of scientific works done; RV/VVP – proportion of completed scientific and scientific-technical activities in GDP, %.</p>
<p>Cultural potential level</p> $I_{KP} = \sqrt[4]{\frac{KV_T}{KT} \times \frac{KV_K}{KKZ} \times \frac{KV_M}{KM} \times \frac{KP}{KB}}$	<p>KV_T / KT – number of visitors /number of visitors, thousands of people / theatre; KV_K / KKZ – number of visitors / number of concert halls, thousands of people / concert hall; KV_M / KM – number of visitors / number of museums, thousands of people / museum; KP / KB – library fund /number of libraries, thousands of units /1 library.</p>
<p>Innovation potential level</p> $I_{IN} = \sqrt[3]{PVP \times PVIR \times PVPV}$	<p>PVP – proportion of enterprises which implemented innovation, %; $PVIR$ – proportion of enterprises engaged in innovation, %; $PVPV$ – proportion of innovative products sales in industrial sales, %.</p>

Influence level of the chosen parameters of economic development can be measured using appropriate regression models, which allow to set the correlation index value and get access to predictive development models. Adequate economic model reflects both old qualities of existing before paradigm and some new, which are required by new conditions of the economic development [3, 4]. Dependencies between economic development indicators and techno-globalism parameters are presented in Fig. 2, Fig. 3, Fig. 4, Fig. 5.

Tab. 2. Datasets of the intellectual potential components and economic development indexes

Year	Educational potential indicator	Cultural potential indicator	Innovation potential indicator	Integral indicator of the intellectual potential using	Sustainable development index	Economic development index
2001	1,035	1,074	0,970	1,025		
2002	1,023	1,092	0,962	1,025		
2003	1,111	0,673	0,881	0,870		
2004	1,061	1,297	0,960	1,097		
2005	1,036	0,972	0,902	0,969	0,485	0,319
2006	1,016	0,981	1,047	1,014	0,668	0,595
2007	1,058	1,030	1,087	1,058	0,633	0,741
2008	1,054	1,015	0,888	0,983	1,089	0,442
2009	1,015	0,935	0,917	0,955	0,775	0,283
2010	1,013	1,001	1,050	1,021	0,714	0,294
2011	0,967	1,000	1,043	1,003	0,686	0,255

Linear regression equation coefficient $y = 3,6708x - 3,2539$ (Fig. 2) allows to affirm that the increase in the level of intellectual capacity of 0.1 can cause the increase in the index of economic development of 0.367. The coefficient of determination $R^2 = 0,4776$ shows that change in value of the economic development index depends on changes in the level of intellectual capacity at 47.76%.

Regression model $y = 3,6475x - 3,3121$ reflects the dependence of economic development index on one of the components of the integral indicator of intellectual potential, namely the educational potential indicator (Fig. 3). According to this model, it is possible to draw conclusions about a significant impact of the educational potential indicator on change in the economic development index.

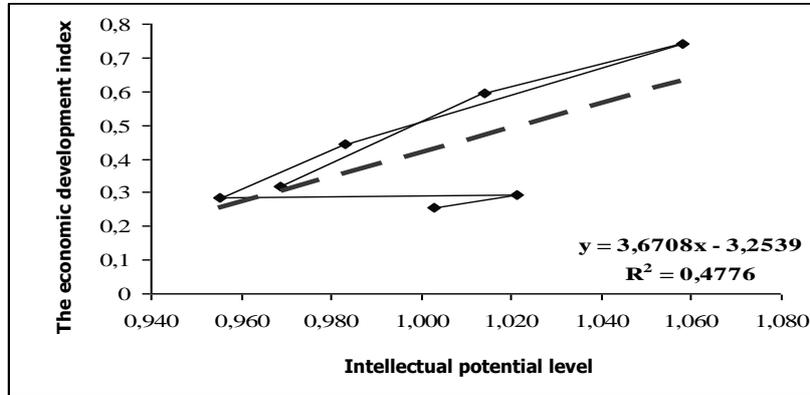


Fig. 2. Influence of indexes of intellectual potential level on the economic development index [source: own study]

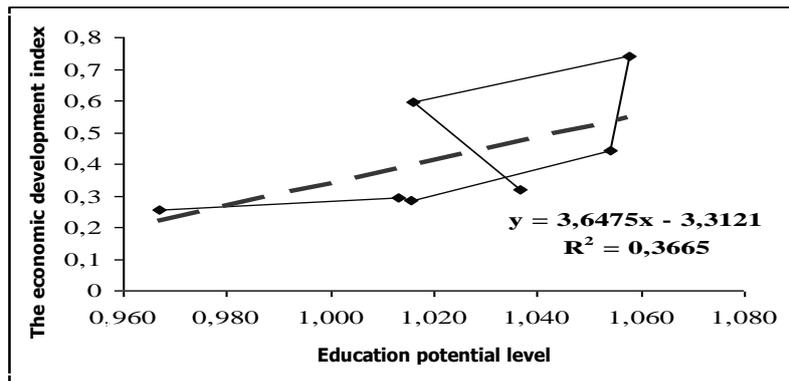


Fig. 3. Influence of indexes of education potential level on the economic development index [source: own study]

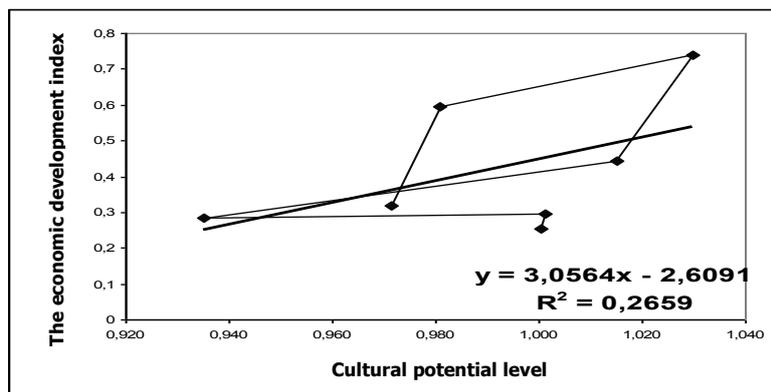


Fig. 4. Influence of indexes of cultural potential level on the economic development index [source: own study]

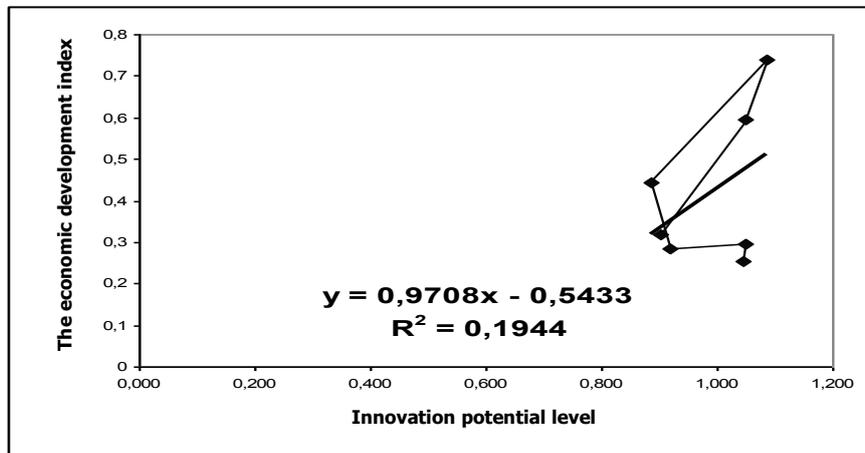


Fig. 5. Influence of indexes of innovative potential level on the economic development index [source: own study]

The values of the coefficient of determination $R^2 = 0,2659$ (Fig. 4) and $R^2 = 0,1944$ (Fig. 5) show that changes or fluctuations in the economic development index by 26.6% depend on changes or fluctuations in the cultural potential indicator and depend on changes in innovative potential indicator by 19,4 %. We can make a conclusion about certain influence of cultural and innovative components of the intellectual potential using level on the economic development.

Regression-correlation analysis of the techno globalism parameters influence on the economic development level makes it possible to assert that the closest relationship is between the amount of expenditure on education and science and the number of implemented innovations. Therefore, increased spending on science and technology fields can be considered as an alternative priority resource of economic transformation. Intellectual investment and spending on basic research show significant but moderate relationship. However, the significance of mentioned factors of the society intellectual potential increase will grow exponentially under the circumstances of the know-how, technology innovation spread in the domestic market.

Research of the influence of intellectual potential index on the economic development of Ukraine allows to suggest that the components of intellectual economy – education potential level (coefficient of determination $R^2 = 0,3665$) are the basis for the overall economic acceleration. Research using regression analysis method allows to suggest that there is the closest relationship between spending on education and science and number of implemented innovations; the level of intellectual potential use influences on the economic development index far more than on the index of sustainable development (coefficients of determination $R^2 = 0,4776$ та $R^2 = 0,0362$ respectively). Thus, the increase in

spending on science, technology and education spheres can be viewed as alternative priority resource of economic transformation. Intellectual investment and spending on fundamental research show significant but at the same time rather modest relationship [4].

3. CONCLUSIONS

The directions of sustainable development of Ukraine in global environment should reflect techno-globalism trends, economic and innovation policies should be based on the analysis and assessment of latest scientific ménage concepts in the context of global ménage dominants according to existing strategic potential of the state. To update the values and goals of sustainable development there is a need to develop innovative approaches that will push the implementation of sustainable development concepts in the coming decades [5].

The research of the influence of the intellectual potential elements on the economic development in Ukraine allows to assert that the components of intellectual economy, scientific and technical progress, the education system, the modernization of the Ukrainian economy, innovation spending and spending on basic research, the development of the intellectual potential of the nation are the basis for the overall acceleration in Ukraine.

The influence of the elements of the intellectual potential of Ukraine on the economy suggest that the basis for the overall acceleration in Ukraine are components of the knowledge economy – NTP, the education system, the modernization of the Ukrainian economy, innovation spending and spending on basic research, the development of the intellectual potential of the nation.

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