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Cultural aspect of innovation strategies' ecologization

Abstract. The article deals with the problem of understanding that further development of the world economy in traditional technological and resource-consuming way is quite problematic due to the environmental limits of economic growth. Our analysis has shown that environmental factors and ecological culture practically are not covered in terms of innovation and are investigated without regarding to economic level. Main environmental characteristics of modern high technologies, especially in space sector, were considered. Functional aspects of culture that directly affect innovation component of economic development and main economic aspects of eco-technological outlook were defined. Based at greening processes and their impact on economic relations, we suggest considering cultural factors of ecological contour of innovations as «soft power». We propose to define environmental and cultural innovations determinants for EU-28. We offer to define environmental levels of innovation culture which is crucial for recognizing economy as resource-efficient. The proposals were realized for Poland and Germany. The start of innovation process' greening is considered as expedient at community level.

Keywords: Innovation Culture; High Technology; JNEL System; Sustainable Development; Greening

JEL Classification: O33; Q28; Z10

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Культурний аспект екологізації стратегій інноваційного розвитку

Анотація. У статті доведено, що подальший інноваційний розвиток світової економіки в традиційному техно-сировинному руслі є проблематичним через екологічні межі економічного зростання. Проведений аналіз показав, що екологічний фактор та екологічна культура практично не розглядаються в інноваційному аспекті та досліджуються безвідносно до економічного рівня. Авторами виділено функціональні аспекти культури, що безпосередньо впливають на інноваційну складову економічного розвитку, та основні економічні аспекти еко-технологічного світогляду. З урахуванням процесів екологізації та їх впливу на економічні відносини запропоновано розглядати культурний фактор в якості екологічного контуру інновацій, що разом із екологічними обмеженнями та заборонами виступають складовими «м'якої сили».

Ключові слова: інноваційна культура; високі технології; інноваційна система; сталий розвиток; екологізація.

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Культурный аспект экологизации стратегий инновационного развития

Аннотация. В статье доказано, что дальнейшее инновационное развитие мировой экономики в традиционном техно-ресурсном русле является проблематичным из-за экологических границ экономического роста. Проведенный анализ показал, что экологический фактор и экологическая культура практически не рассматриваются в инновационном аспекте и исследуются безотносительно к экономическому уровню. Авторами выделены функциональные аспекты культуры, которые оказывают непосредственное влияние на инновационную составляющую экономического развития, и основные экономические аспекты эко-технологического мировоззрения. С учетом процессов экологизации и их влияния на экономические отношения предложено рассматривать культурный фактор в качестве экологического контура инноваций, которые вместе с экологическими ограничениями и запретами выступают составляющими «мягкой силы».

Ключевые слова: инновационная культура; высокие технологии; инновационная система; устойчивое развитие; экологизация.

1. Introduction

Relevance of this article is connected to the fact of significant impact of culture on the economy of a city, region, country, but also the lack of practical tools of using of cultural potential of sustainable development principles realization in different ecological and economic levels.

Specificities of current stage of economic development are largely determined by growing shortage of resources and en-

vironmental problems, which in turn creates high performance requirements of ecological efficiency of new technologies' evaluation. As a result of accumulated ecological and economic problems, international community in general and countries in particular have to deal with another challenge of modernization which requires reengineering of obsolete socio-economic system on environmental basics. Currently, inat various sectoral levels, mainly in scientific and expert researches,

it was concluded the necessity to restructure the existing eco-destructive economic model through the implementation of eco-oriented innovation in high-tech industries. Therefore, the relevance of ecologization of innovation and technology-based sectors is connected with the fundamental importance of environmental factors for economic development.

2. Brief Literature Review

One of classic representatives of contemporary historical science A. Toynbee (Toynbee, 2006) [1] in his researches proved that world civilizations' development is inevitably accompanied by significant influence of external and internal challenges that human communities forced to resort to find new ways to improve social and economic systems. Additionally, scientist stressed that the conservative societies hostile to innovation had dissapered.

The reports «Economy of Culture in Europe» (EU, 2006) [2] and «Creative Economy» (UN, 2008), based on approach of Arnold Toynbee, show that the cultural sector, including the creative industries, provides 5,3% EU GDP and 3,4% of total employment in Europe. However, we note that the obvious economic result do not reflect completely the multiplier effects of a culture factor.

Harrison L., the author of «Who Prospers?», has formulated the main cultural problem of economy in such a way: «Why do some countries and ethnic groups live better than others». In response it has been hypothesized that «... the main difference between ethnic groups are the values and settings, ie culture» [3].

In our research, we will use the definition of culture given by the British philosopher E. Helner which defines culture as a «way of doing things», including business nature actings [4]. Additionally, we underline that the analysis of ecological and innovation aspects of culture in the current economic relations context is based on the principles of innovation ecosystem's concept. The concept of innovation ecosystem has emerged from the interdisciplinary researches and currently is the most comprehensive approach for innovation area analysis. According to Mercan B. and Goktas D. [5], innovation ecosystem should necessarily include the economic agents, the relationship between them and innovation environment that consists of ideas, technologies, rules, social interactions and culture.

According to the «Rainforest» concept [6], innovation ecosystem consists of two parts – «hardware» and «software», where the «hardware» is proposed to consider as innovation infrastructure that was created in some territory; and «software» includes culture of innovation in which the new types of economic behavior and social interactions between people appear, and which promotes the innovation development goals.

In our previous studies [7], it was determined that the model of innovation ecosystem «Rainforest» focuses on the cultural factor that provides innovation economic development and is formed by ecosystem's agents and other «key figures» that unite disparate elements of ecosystem. The socio-economic component of innovation culture is a structure of possible participants of innovation system, their motivation, high level of loyalty and transparent social policy that allows consolidating around some economic interests to effectively achieve some objectives.

Our previous analysis has shown that environmental factors and ecological culture practically were not covered in terms of innovation and investigated without regarding to economic level. The similar results were obtained by Maiale G. et al. (2016) [8] who in their case study come to conclusion that environmental management is not considered by high-tech corporations as a strategic factor that can result potential. Soskin O. and Matviychuk-Soskina N. (2014) [9] consider innovative-informational imperative vectors in the informational society age with ecological context and underline that these processes are under implementation process and in a complicated contrariety to each other, as these factors make the innovation system processes' ecologization relevant and reasonable.

3. The purpose of this article is conceptual analysis of environmental aspects of the culture of innovation and evaluation of its impact on economic relations.

4. Results

In the context of our research, innovation ecosystem can be defined as a set of interacting in development and commercialization of innovations and form of the basis of economic relations through the accumulation of human, financial and other resources in order to optimize and ensure the efficiency of business processes.

Let us examine the main functional aspects of culture that directly affect the innovation component of economic development:

1) Culture of «creator» (inventor, generator of innovation ideas) based on the principles of innovation and technological culture.

Innovation culture is quite multidimensional concept that includes a system of perceptions and economic behavior in environment of not only individuals, but also businesses, organizations, government and society as a whole.

In turn, technological culture is a system of technological views on the world, nature, society and human. We believe that the main economic aspects of eco-technological outlook are the following:

- public economic development is determined by the way of technological impact of humanity on nature-conversion processes, i.e. the level of technological culture of individual and society (which is one of the most important indicators of economic development of society), rational thinking and human creative potential;
- modern economic development requires a holistic perception, based on relationship of biosphere, technosphere, noosphere and production methods;
- selection of production mode depends not only on economic results of joint activities, but also on social, environmental, psychological, ethical and other factors;
- technologies used in social production should not cause harm to environment;
- technological education first of all should ensure the formation of technological view of the world that will allow forming sustainable economic relations between society, nature and technological environment and improve quality of life;
- everyone must be aware of responsibility for economic consequences of his actions to society and environment.

2) Consumption culture. Traditionally, two main patterns of consumption are distinguished: «Western» (high productivity associated with high levels of consumption) and «Eastern» (low labor productivity causes the low consumption and poverty). In this case, innovation technologies of accelerating of ecological and economic development can be differentiated according to the territorial criteria, i.e. «East-West».

3) Organizational culture as a culture of management of financial and economic relations at different hierarchical levels.

4) Social culture as a system of social norms, values and institutions that provides sustainable economic development of society as a social mega-system.

The realities of modern economic development indicate the existence of environmental threats through a policy of innovation implementation. We believe that these problems are particularly actual for high technologies and are the leading factors and catalysts for global economic transformations [10; 11].

For example, the main environmental characteristics of modern high technologies are temperature, pressure and content of hazardous substances (such as mercury) which are growing and approaching the critical level. At the same time, there is an increase of hazardous substances' emissions in environment due to launch of high-power units. There is also the problem of highly toxic products producing within advanced technologies that provide raw materials comprehensive processing.

We also can name the examples of combination of «high» rocket and space technologies with its extremely low efficiency as measured by weight displayed on orbit payload. The starting weight of launch of vehicles «Saturn», according to various sources, was from 2800 to 3000 tonnes. It delivered into orbit 140 tons, so the conditional efficiency of vehicle is approximately 5%. Also, when we divide modern rocket Falcon Heavy load amounting (51 tons) by the weight

of vehicles (1400 tons), then we obtain the efficiency of approximately 3%.

At the same time, environmental threats of using of technologies can be compensated in practice by environmental potential of technologies. For example, the use of space technology allows monitoring of climatic fluctuations and solving many other environmental problems. However, today we can admit the environmental problems of high-tech sector, such as soil and water pollution with dangerous rocket fuel, as well as contamination of circumterrestrial space. In our opinion, these aspects require formation of the space waste international management mechanism, similar to the Kyoto Protocol.

We also note that other high-tech industries are not less environmentally hazardous. Estimation of potential risk of innovation processes to environment also was underlined in Global Risks 2014 Report by the World Economic Forum [12]. Similar studies' results are contained in a report prepared for the Second FAO/WHO Global Forum of Food Safety Regulators (2004), «Emerging Risks Related to the Environment and New Technologies» [13], in which attention is focused on necessity of urgently discussion of potential negative environmental impact of new technologies sector on economic performance. That is why incorporating environmental values into the innovation sector occurs because of the environmental contour of innovations, through which the economic activity of business entities becomes natural appropriate (principle of best available technology with the best environmental characteristics).

As a result of absence of a well-structured system of environmental assessment criteria of economic efficiency of high-tech, mankind face with threat of being on a stage of economic development which is sometimes called «risk society». Such society exists as a post-industrial formation in which economic relations are not confined to redistribution of social product value and achievements of progress, and combined with negative environmental impacts of scientific innovation progress [14; 15]. At the same time, environmental threats in such society have no limits, neither time, nor space, which causes transboundary spreading of the environmental risks on the future generations.

In terms of the ecosystem approach, taken by us as a basic for this study, we underline that traditional developers of technological innovations in energy and energy saving are from the countries with liberal market economy, but not from countries developing by extracting resource rents. Typically, developing countries at government level do not pay adequate attention to environmental aspects of high-tech.

Unlike eco-inefficient countries, EU stands on threshold of the third global scientific and technological revolution that will allow exporting energy-saving technologies and improve the economic position of region in global competitiveness rankings. Innovation processes are the main determinants of EU ecological culture. We propose to define environmental and cultural determinants of innovation for EU-28, which are «resource-innovation development» (stimulating factors) - «resource wasteful innovation development» (disincentive factors): (1) saving natural resources – exploitation of natural resources; (2) food security - food consumption; (3) alternative energy - traditional energy consumption; (4) regeneration - deforestation; (5) environmental protection - environmental pollution; (6) waste management - waste formation. To assess the impact of environmental and cultural factors on innovation development, we use the conditional indicators, which change value from -1 (negative impact on innovation development) to +1 (positive impact on innovation development). Results of ecological and cultural analysis of two EU-states' statistical indicators (2013-2015) are presented in Table 1.

Another example of combination of environmental and economic interests experiences South Korea, which now serves as the only country that officially declared sustainability as a main strategic goal of the national economic development. The new official strategy of Seoul is called «Green growth» that

Tab. 1: Example of environmental and cultural factors of innovation development of Germany and Poland

States	Environmental and cultural factors of innovation development					
	1	2	3	4	5	6
Germany	stimulating factors					
	+0,95	+0,37	+1	+0,19	+0,55	+0,95
	disincentive factors					
	-0,21	-0,82	-1	-1	-1	-0,36
	cumulative environmental and cultural impact on innovation development					
	+0,74	-0,45	0	-0,81	-0,45	+0,59
Poland	stimulating factors					
	+0,44	+0,29	+0,26	+0,38	+0,8	+0,48
	disincentive factors					
	-0,29	-0,98	-0,31	-0,44	-0,43	-0,38
	cumulative environmental and cultural impact on innovation development					
	+0,15	-0,69	-0,05	-0,06	+0,37	+0,1

Source: Authors' estimations

proves that the concern for preservation of natural resources does not prevent the goals of economic development. On the contrary, next after information revolution will be economic leap caused by the development of ecological production.

Given the greening of innovation processes and its impact on economic relations, we note that the innovation culture will acquire the following characteristics:

- stimulating of innovation ideas generating towards the greening of production;
- ecological and economic optimization of innovation processes at the enterprises;
- greening of innovation lifecycle etc.

In the context of Ukraine's integration into the European community, implementation of resource-saving initiatives is an important step in developing a comprehensive concept of relationship of environmental management and economic growth. However, moving of technological innovation sector to ecology-friendly production and reasonable operating conditions may not be desirable for some business groups from the purely pragmatic point of view: because it leads to their profits reduction. This primarily relates to oil business, chemical plants, pharmaceutical corporations etc. At the same time, the revolutionary environmental innovations destroy traditional and stable socio-economic relations in society. That is why the introduction of the environmental innovations is very problematic.

Based on above analysis, we offer to define environmental levels of innovation culture, crucial for recognizing economy as resource-efficient:

- security level: if a person is in environmental conditions that threaten existence, a strategy to overcome the problems will be not «creativity», but «zero growth»;
- sustainability level: involves the prevention of environmental threats with stabilization measures that influence to the environmental problems;
- creativity level: appears as a new hierarchical level of interaction between society and nature, at which a person begins to seek to optimize his environment.

According to the classic definition of Schumpeter, the way to innovations goes through catastrophes [16]. This means that sharp transition to the new level of economic development is possible only through solving new problems and overcoming social challenges. These views of problems of innovation development are formed over the years to current reality, but they find a practical application in contemporary environmental problems context. Therefore, we suggest considering the cultural factors as ecological contour of innovations that both with the environmental restrictions and prohibitions are the components of «soft power». We believe that the start of innovation process' greening is expedient at the community level (or the local level), which is characterized by high level of economic interactions and quick feedback. The accumulation of unresolved environmental problems brings catastrophic consequences for the economy, and so it leads to reorientation of the global economy towards market expansion of environmental goods.

The development of eco-innovation culture requires formation of a new economic strategy for cooperation with local

communities by territorial principle. As part of this strategy, territory is considered as a complex area and as a source of supply of natural resources, and as a source of environmental problems, and also as a source of solving environmental and technological issues involving population. The principle of territoriality will increase the number of participants in innovation process by bringing in various businesses, environmental experts and social groups that live together and interact within the area. This approach improves processes of formation of local community and community activity initiative will stimulate socio-economic development of territory based on environmental innovation.

The decisive characteristics of the local environmental projects focused on the community, are simplicity and compactness. This guarantees to local stakeholders, high degree of awareness about social responsibility requirements in development of technological projects in their territory. The public recognition and support of any technology projects' greening is the key to its effective implementation.

5. Conclusions

The main community objective today is a stable demand for «sustainable» innovations (eco-innovations), which are identical to innovation culture greening process. Although the

primary role of government in regulating of innovation system, we also emphasize the critical role of society in creating of stable demand for innovation products through the desire of communities to innovation activity and innovation behavior. Innovation culture of some particular economic system (environment) is primarily associated with the culture of society of some territorial system as a whole that regardless of entrepreneurs and stakeholders generates steady demand for environmental innovations.

Energy innovations occupy a special place among environmental innovations. Thus, in our research we underlined an objective necessity of transition to energy production lifecycle analysis (or lifecycle costs analysis), which is a set of production and technological processes that deploy consistently based on of rational layout of raw materials and energy, and cover all technological stages of raw materials extraction and processing and final product receiving.

In further studies considering modern international experience and best practices, we expect to develop organizational and economical approach for energy saving through integrated using of resources, which include low-waste and non-waste technologies of raw materials deep processing and recycling.

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