

# AN INNOVATIVE APPROACH TO THE TRANSFORMATION OF ECO-ECONOMIC SPACE OF A REGION BASED ON THE GREEN ECONOMY PRINCIPLES

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## ABSTRACT

*The article proposes an integrated approach to the transformation of eco-economic space of the region based on eco-efficiency tools and management methods, as well as analyzes the impediments that hinder the process of development, implementation, and dissemination of eco-innovation, highlights the areas of innovative activity regulation mechanism on the principles of green economy. The authors propose to assess the impact of innovation on the transformation of eco-economic space of a region based on the dynamic analysis of the main environmental quality index and population health indicator as well as the ecologized human development index. The article presents the insights of statistical indicators of the environment and public health in the constituent entities of the North-West Federal District (NWFED) of the Russian Federation (RF) for the period of 2000-2014, which has shown the nonoccurrence of positive dynamics in efficiency of innovations. The authors carried out calculations of the ecologized human development index in the constituent entities of the NWFED of the RF for the period of 2005-2014, whose trend allows assessing the human development index in the region with due consideration of environmental component, as well as provides the possibility to compare the success in the development of the region under study with other regions of the RF in terms of eco-innovations.*

**Keywords:** Green economy, eco-innovation, transformation of eco-economic space of a region.

**JEL Classifications:** O10, O11, O13, O31

## INTRODUCTION

Currently, the necessity of the transition from traditional economy to a green economy is the most discussed issue in the "nature-society" system development. New eco-innovation approach includes not only nature protection and recovery measures, but also ensures green growth (conservation of natural resources and solution of social problems) that can be achieved through the support and dissemination of technological, economic and socio-cultural innovations.

The problems of development, implementation and dissemination of innovations in contemporary science are discussed within the framework of environmental management and resource conservation. This resulted in the emergence of a concept of eco-innovations which reduce the environmental impact. Eco-innovations include new products, processes and systems, which minimally use natural resources and marginally contribute to hazardous substances emissions. They have specific features, which must be considered when developing the eco-innovative development strategy of the economy. First and foremost, this is the impact of environmental externalities, including greenhouse gas emissions, rising amounts of production and consumption wastes, etc., resulting in a significant climate change that encourages both development of new environmental technologies and their dissemination. Secondly, we should emphasize the dependence of eco-innovations on the specific environmental conditions and the availability of particular resources, a sharp differentiation according to municipalities, agglomerations, regions, climatic zones, as well as their world-spanning nature. Thirdly, we should note the relationship between eco-innovations and the social and institutional innovations process development, the willingness of society to pay for the implementation of eco-innovations, for a better environment.

Today, for the RF, environmental focus of innovative development of economy is especially relevant, given the general inefficient use of natural resources and low level of energy conservation. Despite the large number of normative legal documents produced in recent years, which contain innovative approaches with an emphasis on targeted support of the demand for eco-innovations and their quite consistence with the approaches used in foreign practice, the eco-innovative activity in the country continuous to be in a state of stagnation.

It should be noted that the ecological consequences of any economic activity arise and manifest themselves, first and foremost, in the specific area, where social, economic and ecological processes, as well as production structure and specialization, have unambiguously expressed regional scope. It is greatly influenced by spatial differences of climatic conditions, the uneven distribution of natural resources, the existing population settlement system, and traditions of the economic mode. Therefore, an innovative approach to the positive transformation of regional eco-economic space (conditions and development strategy, content and regulation instruments, and managerial methods) can be implemented with due consideration of each region characteristics.

A decisive role in the innovation processes is plaid by the social component, as a factor accelerating the development, implementation, and dissemination of eco-innovations due to the involvement of employees and the social transformations in the organization to gain competitive advantage as well as ensure environmental safety and favorable living environment.

## **RESEARCH METHODOLOGY AND EVALUATION TECHNIQUE**

An innovative approach to the transformation of eco-economic space of the region on the green economy principles is based on the theoretical provisions of innovative model of economy development (described in the works of Schumpeter (1982), J. Schmookler (1962), D. Mowery and N. Rosenberg (1979) K. Perez (2011), and M. Porter (1993)), as well as the theory of sustainable development (in the works (Dosi 2015; Edler 2007; Sarkar 2013; James 1997; Rennings 2002; Mityakova 2009; Bobylev 2004; Ilin and Anisiforov, N. D.)), in which

economic, social, and environmental aspects are recognized as equal ranking in terms of the development of "society-nature" system, and which define the role and importance of eco-innovations, as well as the need to balance their supply and demand.

Eco-economic space of the region is defined as a system of relations formed by interacting economic and environmental spaces, which defines further living conditions and quality of life of the population in the given region.

Innovation based positive transformation of eco-economic space of a region creates preconditions for transition to its sustainable development on the principles of eco-economic balance, allows predicting the influence of ecosystems on social and economic spaces and reducing the environmental risks of economic activity and the regional environmental conditions.

An innovative approach to the transformation of eco-economic space of a region is implemented based on the following methodological provisions:

- Existing features of eco-innovations, caused by the presence of external effects, whose monetary valuation is not conducted by the market (that reduces incentives to neutralize the negative environmental impacts);
- Specific failures of the market mechanism, associated with the specificities of innovation processes: dependence on traditional technological trajectory, the advantages of companies (the old-timers) operating on the traditional markets; uncertainty of investment in innovation, and attitudinal impediments (resistance of some consumers to innovations);
- The balance between eco-innovations supply and demand based on the green growth principles, providing a high level of environmental safety, energy efficiency and resource conservation as the basis of a positive transformation of the eco-economic space of the region;
- The need for state support and funding of basic research, the creation of institutional conditions providing communications between fundamental research and R&D in the field of innovation.

The study of the development, implementation, and dissemination processes of eco-innovations is carried out in a significant number of articles (Bobylev, S.N., 2004; Gurieva, M.A., 2015; Johnson, M., 2010; Pakhomova, et. al. 2015; Nikolova, et. al. 2015), which analyze the impediments hindering innovations (Table 1).

All noted difficulties in the creation, implementation and dissemination of eco-innovations are interrelated. Therefore, the solution to this problem should be comprehensive. In our view, a comprehensive approach to the effective management of the eco-innovative development of the region should be based on extensive use of the following foreign methods of purposeful and systematic implementation of eco-innovations: the concept of eco-efficiency, cleaner production model; international standards of eco-management and auditing (ISO 14000, EMAS), methods to improve resource productivity based on the MIPS concept, the new systemic ecological design and special labeling of products, providing a high level of ecological safety of production, products and services while strengthening the competitive position of the business.

In consequence of the conducted analysis, practical application of these methods in the RF is limited to those companies which are involved in international projects, or the export-oriented enterprises. Therefore, these practices have no necessary effect on the existing engineering and technological, as well as organizational and managerial approaches in the regional management. The transition of enterprises to innovative management methods in eco-innovative development that gives significant environmental, resource-saving and social effects, are constrained by focusing on the problems of survival in a competitive environment and

economic crisis. In addition, we should note lack of methodological and information base for the implementation of eco-efficient approaches.

<b>TABLE 1</b> IMPEDIMENTS HINDERING THE ECO-INNOVATION DEVELOPMENT, IMPLEMENTATION, AND DISSEMINATION		
No.	Types of impediments	Subject-matter
1.	Economic impediments	<ul style="list-style-type: none"> <li>- market prices, which do not fully reflect manufacturing cost of product or service, for example, health care costs due to air pollution in cities;</li> <li>- low level of demand for eco-innovation on the part of public sector and consumers;</li> <li>- inadequate sophistication of risk and income assessment tools from the implementation of eco-innovations;</li> <li>- increase in costs for investments in eco-technologies because of their perceived risk;</li> <li>- the uncertainty of the start-up investment;</li> <li>- the complexity of transition from traditional technologies to eco-technologies.</li> </ul>
2.	Technological impediments	<ul style="list-style-type: none"> <li>- mismatch of technology with the specified economic requirements and process design standards;</li> <li>- lack of alternative materials that can replace hazardous components;</li> <li>- high level of complexity in the development of eco-innovation based technologies;</li> <li>- low investment activity due to lack of tools to assess profitability of investments in eco-innovations.</li> </ul>
3.	Financial impediments	<ul style="list-style-type: none"> <li>- high studying expenses of eco-technologies;</li> <li>- changing preferences of consumers with regard to eco-products;</li> <li>- lack of analytical methods that determine the balance between costs and benefits from the implementation of eco-innovations;</li> <li>- difficulties in predicting the R&amp;D costs;</li> <li>- lack of investment flexibility due to low profitability;</li> <li>- inefficiency of investments into the environmental modifications for enterprises that have long existed in the market;</li> </ul>
4.	Personnel impediments	<ul style="list-style-type: none"> <li>- lack of highly-qualified personnel in eco-innovation management, monitoring, and implementation;</li> <li>- unwillingness of companies to invest in staff training.</li> </ul>
5.	Impediments in consumer behavior	<ul style="list-style-type: none"> <li>- stable perception of eco-innovations by analogy with the products of technical purpose;</li> <li>- the risk of customers loss due to the price increase caused by the cost component of eco-technologies in the final price of the product.</li> </ul>
6.	Impediments in supply chain	<ul style="list-style-type: none"> <li>- lack of intermediaries capable of accepting responsibility for eco-products marketing and promotion.</li> </ul>
7.	Management impediments	<ul style="list-style-type: none"> <li>- lack of interaction practices between technical staff and experts in the field of resource-saving, environment and natural resources;</li> <li>- difficulties towards implementing eco-innovations into production and management processes;</li> <li>- lack of experience in the management of such changes.</li> </ul>

One important condition of active implementation and dissemination of eco-innovations is improvement of the regional innovation infrastructure institutions. It should be noted that the experience in creation and functioning of technoparks and innovation-industrial zones in Saint-Petersburg, operating for over ten years, shows that the environmental component in their

activity is very small (only environment impact assessment of innovative projects is being conducted). Meanwhile, they could become one of the most effective institutions in the region that would contribute to the positive transformation of innovation-based ecological and economic space.

Best practices have been gained in the establishment of regional environmentally friendly technology innovation centers (TIC). Thus, the CTI for integrated processing and disposal of industrial and solid domestic wastes is established in Saint-Petersburg to solve the eco-innovation development problems («Mechanobr-Tekhnika» Research and Engineering Corporation). Also important is the operational practices of the Northwestern Regional Innovation Center for High Technologies "ARTES" at the Institute of Problems of Electrophysics of the Russian Academy of Sciences. Its activity is focused on priority areas of modern science and technology, i.e. the latest innovative technologies aimed at solving ecology, environmental protection, and waste recycling problems.

In our opinion, an innovative approach to the transformation of eco-economic space of a region based on the green economy principles requires the formation of regulation mechanism when:

- promoting green growth strategy, whose implementation requires consideration of specific features of eco-innovations and related impediments (economic, technological, financial, as well as impediments in human resources, consumer behavior, supply chain, etc.);
- Providing state support of demand for eco-innovations through a system of state orders and purchases;
- Creating of a special leading markets institution to support alternative energy sources;
- Supporting and encouraging private-public partnerships and associations for the solution of eco-innovative problems of regional development;
- Applying a stricter ecological standards for business entities located in the territory of the region to reduce ecological risks;
- Developing network structures as a growth factor in the demand for eco-innovation;
- Applying advanced methods in eco-innovation development, based on the principles of eco-efficiency concept, methods to improve resource productivity (MIPS concept); a new system-based eco-design, special product labeling, etc., by regional business entities;
- Improving the regional innovation infrastructure, which should be focused on extension of eco-innovations penetration and dissemination (technology parks, innovation and industrial zones, innovation and technology innovation centers, science cities, etc.)

The ultimate goal of positive transformation of eco-innovation based eco-economic space of the region is providing favorable conditions of human life. For a first approximation, the assessment of the eco-innovation effect on the transformation of eco-economic space can be carried out based on the dynamic analysis of the key indicators of the environment and the health of the population, as well as based on the trend in ecologized human development index ( $HDI_e$ ), which is calculated using the human development index.

Ecologized human development index was estimated by the formula (Vlasov 2009):

$$HDI_e = 0.3 LI + 0.3 II + 0.1 ENIN$$

where  $HDI_e$  – is the ecologized human development index;

$LI$  – is the longevity index;

$II$  – is the income index;

$ENIN$  – is the environment indicator

$$ENIN = [1 - (3/4 EMI + 1/4 SDI)] UR$$

where *EMI* – is the emissions index;

*SDI* – is the sewage disposal index;

*UR* – is the rate of urbanization: proportion of urban population in total population of the region.

When calculating ecologized human development index ( $HDI_e$ ) we used data on longevity index (LI), education index (EI), and income index (II) retrieved from the reports on human development in the Russian Federation (The report on human development in the Russian Federation, 2014). The ecologized human development index is a measure of eco-innovative development of the region.

## ANALYSIS AND RESULTS

In reliance upon information of Federal State Statistics Service we have performed the analysis of statistical data on the environment and the health of the population in the constituent entities of the North-Western Federal District of the Russian Federation for the period of 2000-2014 (The regions of Russia. Socio-economic indicators), which has showed unfavorable trend. Most of the water and air pollution impacts negatively affect the health of the population (according to the incidence per 1,000 of population; the incidence per 1,000 of population by main disease classes, including primarily neoplasms, as well as diseases of respiratory organs, circulatory, and digestive systems). Morbidity rate per 1,000 of population in the NWFD of the RF is 1.08 times higher than that for the Russian Federation in general. At that, the highest indicators were revealed in the Republic of Karelia, the Komi Republic, and Arkhangelsk Region (by 1.3 times higher comparing to the Russian Federation). Diseases of the respiratory system hold leading position in the structure of primary morbidity of the population. The corresponding indicators (morbidity per 1,000 of population) in the NWFD exceed the indicators for the Russian Federation by 1.2 times. Diseases of the circulatory system in the NWFD are most common in the Komi Republic, Arkhangelsk and Vologda regions, where the incidence per 1,000 of population is higher than average in the NWFD and the Russian Federation. Besides, the NWFD is characterized by unfavorable trends in terms of neoplasms. The highest indicator corresponding to this disease per 1,000 of population is noted in Saint-Petersburg. Table 2 presents the variations in the proper indicators according to main disease classes in the constituent subjects of the NWFD of the RF.

Constituent entities of the North-West Federal District	Variations in indicators by main classes of diseases in the NWFD in 2014 compared to 2010			
	Neoplasms	Respiratory diseases	Circulatory diseases	Digestive system diseases
Russian Federation	1.06	1.04	1.14	1.05
Northwestern Federal District	1.06	1.03	1.01	0.95
Republic of Karelia	1.15	1.06	1.18	1.01
Komi Republic	1.13	1.01	0.95	1.03
Arkhangelsk Region	0.92	1.03	0.85	0.85
Vologda Region	0.86	1.00	0.79	0.92
Kaliningrad Region	1.25	1.06	1.19	0.93
Leningrad Region	1.18	0.97	1.12	1.28
Murmansk Region	1.16	0.98	1.17	1.05
Novgorod Region	1.43	1.05	1.10	0.96
Pskov Region	0.94	1.05	1.43	1.00
Saint-Petersburg	0.99	1.06	0.95	0.92

As shown in Table 2, in the subjects of the NWFD, indicators by main disease classes in general tend to increase. There is just a slight reduction in the incidence of respiratory diseases in the Leningrad and Murmansk regions; circulatory diseases - in the Komi Republic, the Arkhangelsk and Vologda regions, as well as Saint-Petersburg; digestive system diseases - in the Arkhangelsk, Vologda, Kaliningrad, Novgorod regions, and Saint Petersburg.

Constituent entities of the North-West Federal District	Period under review									
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Saint Petersburg	0.805	0.821	0.834	0.851	0.861	0.885	0.868	0.881	0.878	0.868
Komi Republic	0.715	0.723	0.737	0.746	0.752	0.767	0.786	0.796	0.786	0.784
Arkhangelsk Region	0.731	0.739	0.749	0.757	0.759	0.773	0.770	0.805	0.802	0.801
Murmansk Region	0.739	0.753	0.761	0.771	0.773	0.782	0.803	0.814	0.810	0.800
Kaliningrad Region	0.727	0.738	0.757	0.779	0.787	0.806	0.815	0.828	0.815	0.813
Republic of Karelia	0.731	0.749	0.759	0.767	0.769	0.785	0.804	0.812	0.806	0.805
Volgograd Region	0.736	0.742	0.750	0.759	0.763	0.762	0.764	0.783	0.769	0.766
Leningrad Region	0.715	0.72	0.728	0.736	0.745	0.770	0.773	0.789	0.775	0.774
Novgorod Region	0.732	0.745	0.753	0.76	0.768	0.787	0.795	0.808	0.795	0.794
Pskov Region	0.713	0.715	0.723	0.743	0.744	0.763	0.773	0.787	0.773	0.771

Thus, the variations in the main indicators of the environment and public health indicate lack of positive trend in efficiency from implementation of eco-innovations, in spite of the constantly increasing spending from the federal budget for environmental protection. Ecologized human development index for the period of 2005-2014 is presented in Table 3.

The data in Table 3 indicate a decrease in ecologized human development index over the period of 2013-2014 in all constituent entities of the NWFD due to the negative trends of the

environment and public health. We can state that the eco-innovations in the constituent subjects of the NWFD are ineffective and so far do not provide positive transformation of the eco-economic space of the region.

## DISCUSSION

The works dealt with the study of economy innovation problems consider the issues relating to encouragement of innovations supply and demand, the ways ensuring their balance, and efficient state support. These are works of J.A.Schumpeter (1982), J. Schmookler (1962), D. Mowery and N. Rosenberg (1979), M. Porter (1993), N. V. Pakhomova, K.K. Richter, G.B. Malyshkova, Yu.P. Bondarenko (2015), D.G. Rodionov (2016), and Glukhov, V.V., Ilin, I.V., Iliashenko, O.J. (n. d.), Kudryavtseva, T.J., Kuporov, J.J. (2015). In the works devoted to the sustainable development of the economy, based on the innovative approach, all actors of the economy are considered as socio-eco-economic systems, in which economic, social and environmental components are defined as equal ranking in the development of "society-nature" system, and the priority goals are changed towards the integrity of the natural complex, environment, and improvement of the life quality (Dosi 2015; Edler 2007; Sarkar 2013; James 1997; Rennings 2002; Mityakova 2009; Bobylev 2004; Rodionov, et. al. 2014). The strategic management in the region is considered in works of M.F. Zamyatina and A.A. Bashirova, where the authors determine the possibility of forming a development strategy of the region from the perspective of eco-economic balance, and assume the proportion between resource-based environmental capabilities of the region and the needs of regional socio-economic system, which ensures the reproduction of natural, human and produced capital (Zamyatina and Dyakov 2015; Bashirova 2010).

However, the contemporary research works only partially describe an innovative component of the positive transformation of eco-economic space of the region, suggesting the need for proposed integrated approach, which includes setting strategic goals and identifying development areas, creating necessary institutional conditions, forming and implementing the regulatory mechanism of the studied process based on eco-efficient tools and management techniques.

The development of further research can be conducted towards improving the strategic management of sustainable development of the region based on the principles of optimal balance between the needs of public demands, public production, conservation of natural resources, as well as environmental properties and quality.

## CONCLUSION

The obtained results can be practically used in the regional and municipal management, as well as strategy generation of eco-innovative development of the regional economy with allowances made for competitive advantages of the region, its resource peculiarities and economic, environmental, and human potentials.

Estimated ecologized human development index, evidence from constituent entities of the North-West Federal District of the Russian Federation, may be used to evaluate the human potential development in the region, taking into account the environmental component, as well as to compare the success in

advancement of the concerned region with other regions of the Russian Federation with regard to eco-innovations. The results obtained can be used, when developing regional social policy at the state, regional and municipal managerial levels, including the development of ecological culture of the population, government and business representatives in the framework of environmental education and training, as well as assessing health risk from environmental pollution.

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