

Ecologization of production with innovative integration in the system of environmental development

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Abstract — The author studies the essence of environmental development as a factor of social welfare dynamics. The author defines the environmental development as a process directed on the conservation of a favourable environment as a basis of human life which includes the implementation of integrated measures upon the reduction of a negative anthropogenic impact on the nature. The endogenous constituents of the government activities are determined which are directed on the sustainable development. The endogenous constituents of the governmental activity directed on the environmental development are: economic, legal, social and innovative components. The attitude of the actors in the process of the ecologization of the manufacturing with innovative integration is shown. The economic agents within the process of the ecologization of production with innovative integration are presented as donors and recipients. The author emphasizes that the creation of technological platforms at the ecologization of production processes contribute to the development of R&D results. A set of differentiated measures contributing to the ecologization of production with innovative integration in the system of environmental development as a factor of social welfare dynamics is suggested. The specific measures are: development of the ecological literacy of the agents of production process, ecological management in production use, creation and development of environmental infrastructure with innovative integration in an enterprise.

Keywords — *social welfare, environmental development, ecologization of production, innovative integration, ecological security, technological platform, ecological literacy*

I. INTRODUCTION

At the maximization of social welfare as a system category under the conditions of modern economic and social development a special importance has the problem of environmental development. The implementation of the programs for the goal of sustainable development requires a consolidated activity from the part of the state, scientific and research institutions, agents of the entrepreneurial activity and individuals. The development and the implementation of a number of measures in the reduction of a harmful

anthropogenic impact on the environment contribute to the achievement of sustainable development in the system of modern economic, innovative and social interaction.

The ecologization of industry with innovative integration is the element of a sustainable environmental development. The modern conditions of development create the need of an intensive integration of innovative technologies of the environmental development in the process of production. Such integration has a positive ecological effect. It is worth mentioning that together with the positive environmental effect in dependence on the essential features of the integrated innovative technology the presence of a positive economic effect can be found. The positive economic effect consists in the creation of competitive advantages manifested in the improvement of qualitative characteristics of the produced items, expansion of assortment and reduction of production costs. A positive environmental effect consists in the reduction of a negative impact of the production process on the environment.

II. MATERIALS AND METHODS (MODEL)

In the research the complex of the differentiated methods was used including the induction, deduction, analysis and synthesis. At the development of main provisions the system approach was used according to which the definite entity is based on the unification of the interacting elements. By means of the statistical method use the main qualitative indices of the impact on the environment when implementing some types of the economic activity were studied.

The goal of current research is the study of the ecologization of production with the innovative integration in the system of environmental development as a factor of social welfare dynamics.

The goals of research are:

- to study the essence of environmental development as a factor of social welfare dynamics;

- to determine the endogenous components of the governmental activity, directed on the ecological development;

- to reflect the positions of economic agents in the process of ecologization of production with innovative integration;

- to suggest a number of differentiated measures contributing to the ecologization of production with the innovative integration in the system of environmental development as a factor of social welfare dynamics.

III. RESULTS AND DISCUSSION

The environmental development is the process directed on the conservation of a favourable environment as a basis of human life which includes the implementation of measures on the reduction of the anthropogenic impact on natural environment.

The study of ecological development as a basis of the factor of social welfare dynamics is founded on the fact that the environment is the basis for human life, determines its capacity of integration into economic, social, innovative, industrial, political and cultural processes. The indices of human health which are the key elements of all the processes directly depend on the positive or negative dynamics of environmental development. The negative characteristics of environment due to a low environmental development contribute to the reduction of vital functions' quality of a human organism. The positive dynamics of environmental development creates favourable conditions for the growth of social welfare level.

It is worth mentioning that natural processes in the natural environment present an element of national welfare. When using this term we meant the total of the accumulated material values and intangible goods which are the result of the targeted activity of a human and natural process of the environment which ensure as a whole a constant, incessant and sustainable reproduction process [1].

The activity of a government directed on the environmental development as a factor of social welfare dynamics is characterized by the following constituents: economic, legal, social and innovative ones.

The economic constituent of government activity is realized by means of the investment of funds into the implementation of measures on the protection of the environment. Within this constituent the state take measures to the internalization of negative external effects arising in the process of production.

The legal constituent consists in the adoption of normative legal acts directed to the regulation of social relations in the environmental sphere. Also within the normative constituent it is meant to ensure the control function over the adopted legal acts in the environmental sphere.

The social constituent includes the creation of environmental literacy of individuals.

The basis of innovative constituent is formed by the support by the government of R&D in various spheres

ensuring the environmentally sustainable development. A low innovative activity, inefficiency within the innovative process and innovative infrastructure contributes to the growth of need in obtaining the technologies which are external for a territory, for various life spheres of the society, in particular, for environmental sphere. It is worth mentioning that one of the indices of territorial development is the technological activity [2].

TABLE I. TOTAL VOLUMES OF WASTE AND DISCHARGE ACCORDING TO TYPES IN 2017 IN THE RUSSIAN FEDERATION [3]

Type of waste / discharge	Total volume of waste/ discharge	
	Value	Unit measure
Waste of production generated as a result of production and consumption	6 220,6	Million tons
Discharge of polluting emissions into the atmospheric air from stationary sources	17 476,2	Thousand tons
Discharge of waste waters into surface water sources	42 575,74	Million m ³

Source. Made by the author

The appearance of the negative environmental effect in 2017 in the Russian Federation was caused by creation of production and consumption waste, discharge of pollutants into the atmosphere from stationary sources and discharge of waste waters into surface water sources. In Table 1 the total volumes of waste and discharges according to types are shown.

The share of total volume of waste per unit of total volume of waste generation per unit of GDP in 2017 made up 98,3 tons per 1 million rubles [3]. Table 2 reflects the shares of production waste in the total volume of generation of production and consumption waste.

TABLE II. WEIGHTS OF PRODUCTION AND CONSUMPTION WASTE ACCORDING TO TYPES OF ECONOMIC ACTIVITY IN THE TOTAL VOLUME OF PRODUCTION AND CONSUMPTION WASTE GENERATION IN 2017 IN THE RUSSIAN FEDERATION [3]

Economic activity	Weights of production and consumption waste according to types of economic activity in the total volume of generation of production and consumption waste	
	Weight %	Value, million tons
Processing industry	4,4	274,8
Agriculture, forestry, hunting, fishing and fish farming	0,7	41,5
Production of power energy, gas, steam, air conditioning; Water and sanitation, organization of collection and waste treatment, elimination of waste	0,5	30,5

Source. Made by the author

The key sources of discharge of pollutants into the atmospheric air in 2017 in the Russian Federation were the enterprises which present the following economic activities: processing industry; agriculture, forestry, hunting, fishing and fish farming; provision of power energy, gas, steam, air conditioning [3]. Table 3 shows the weights of discharge of pollutants into the atmosphere from stationary sources according to economic activities in the total volume of discharge of pollutants.

TABLE III. WEIGHTS OF EMISSIONS OF POLLUTIONS INTO THE ATMOSPHERE FROM STATIONARY SOURCES ACCORDING TO TYPES OF ECONOMIC ACTIVITIES IN THE TOTAL VOLUME OF POLLUTANTS IN 2017 IN THE RUSSIAN FEDERATION [3]

Economic activity	Weights of emissions of polluting substances into the atmospheric air from stationary sources according to economic activity in the total volume of polluting emissions	
	Weight %	Value, million tons
Processing industry	33,2	5 802,2
Extraction of mineral resources	28,1	4 918,9
Production of power energy, gas, steam, air conditioning	20,3	3 542,6

Source. Made by the author

The analysis of the sectoral structure of emissions of pollutants from stationary sources into the atmospheric air in 2010 and 2017 is presented in Table 4 and it contributes to the dynamics of values.

TABLE IV. COMPARISON OF WEIGHTS OF EMISSIONS OF POLLUTANTS INTO THE ATMOSPHERIC AIR FROM STATIONARY SOURCES ACCORDING TO ECONOMIC ACTIVITIES IN THE TOTAL VOLUME OF DISCHARGES OF POLLUTANTS IN 2010 AND IN 2017 IN THE RUSSIAN FEDERATION [3]

Economic activity	Weights of emissions of polluting substances into the atmospheric air from stationary sources according to economic activity in the total volume of polluting emissions	
	2010	2017
Processing industry	33,6%	33,2%
Extraction of mineral resources	27,2%	28,1%
Production of power energy, gas, steam, air conditioning	22,6%	22,6%

Source. Made by the author

The largest part of waste water discharge into surface water sources was produced by the following economic activities: production of power energy, gas, steam, air conditioning; agriculture, forestry, hunting, fishing and fish farming; processing industry; extraction of mineral resources [3]. In Table 5 the weights of discharge of waste waters into the surface water sources according to types of economic activity in the total volume of waste water discharge are presented.

TABLE V. WEIGHTS OF WASTE WATER DISCHARGE INTO SURFACE WATER SOURCES ACCORDING TO ECONOMIC ACTIVITIES IN THE TOTAL VOLUME OF WASTE WATER DISCHARGE IN 2017 IN THE RUSSIAN FEDERATION [3]

Economic activity	Weights of waste water discharge into surface water sources according to economic activities in the total volume of waste water discharge	
	Weight %	Value in million m ³
Production of power energy, gas, steam, air conditioning	51,6	21 989,53
Agriculture, forestry, hunting, fishing and fish farming	14,1	6 017,8
Processing industry	7	2 996,84
Extraction of mineral resources	3,3	1 407,92

Source. Made by the author

The statistical data mentioned above reflect the necessity of the implementation of a complex of measures for the environmental development which should have a sustainable character.

The Strategy of Environmental Security of the Russian Federation for the period 2025 (further Strategy) considers a low level of development and introduction of environmental technologies as an external factor of reduction of ecological security. For the elimination of such factor the strategy determines the introduction of innovative and environmentally friendly technologies, development of ecologically secure productions as a priority direction [4].

The ecological security is the complex of actions, conditions and processes which directly or indirectly do not lead to vitally significant damages (or threats of such damages) done to the natural environment, individuals and humanity [5].

The total volume of environmental investments in the Russian Federation in 2017 made up 152 995,78 million rubles [3]. In Table 6 the weights of environmental investments according to economic activities in the total volume of environmental investments are presented.

TABLE VI. WEIGHTS OF ENVIRONMENTAL INVESTMENTS ACCORDING TO ECONOMIC ACTIVITIES IN THE TOTAL AMOUNT OF ENVIRONMENTAL INVESTMENTS IN THE RUSSIAN FEDERATION IN 2017 [3]

Economic activity	Weights of environmental investments according to economic activities in the total amount of environmental investments in the Russian Federation in 2017	
	Weight %	Value, million rubles
Processing industry	35,8	54 783,1
Extraction of mineral resources	30,9	47 330,1
Transportation and storage	2,4	3 606,4
Agriculture, forestry, hunting, fishing and fish farming	1,1	1 653,2

Source. Made by the author

During 2012 – 2017 the amount of investments directed to the environmental protection and rational use of natural resources grew from 116 543 million rubles to 152 996 million rubles or by 31% [3]. The comparison of amount of environmental investments according to economic activities in the total amount of environmental investments in the Russian Federation in 2012 and in 2017 is presented in Table 7.

TABLE VII. COMPARISON OF AMOUNTS OF ENVIRONMENTAL INVESTMENTS ACCORDING TO ECONOMIC ACTIVITIES IN THE TOTAL AMOUNT OF ENVIRONMENTAL INVESTMENTS IN 2012 AND IN 2017 IN THE RUSSIAN FEDERATION [3]

Economic activity	Comparison of amounts of environmental investments according to economic activities in the total amount of environmental investments in 2012 and in 2017 in the Russian Federation	
	2012, million rubles	2017, million rubles
Agriculture, forestry, hunting, fishing and fish farming	954,8	1 653,2
Extraction of mineral resources	20 118,5	47 330,1
Processing industry	33 727,1	54 783,1

Source. Made by the author

The presentation of the statistical data in the Republic of Tatarstan within the study of the ecologization of production with the innovative integration in the system of ecological development as a factor of social welfare dynamics contributes to the reflection of the specificity of regional aspect. The total volumes of waste and emissions in the Republic of Tatarstan are presented in Table VIII.

TABLE VIII. TOTAL VOLUME OF WASTE AND DISCHARGE IN 2017 IN THE REPUBLIC OF TATARSTAN [6]

Type of waste/ emissions	Total volume of waste/discharge	
	Value	Measurement unit
Production and consumption waste	4707, 111	Thousand tons
Emissions of polluting emissions into the atmospheric air from stationary sources	285,9	Thousand tons

Source. Made by the author

The industrial quantitative differentiation of the generated production and consumption waste in 2017 in the Republic of Tatarstan reflects the impact of the economic activity which creates a negative environmental effect. In Table 8 the volumes of production and consumption waste according to economic activities in the total volume of production and consumption waste in the Republic of Tatarstan are presented.

TABLE IX. VOLUME OF PRODUCTION AND CONSUMPTION WASTE ACCORDING TO ECONOMIC ACTIVITY IN THE TOTAL VOLUME OF PRODUCTION AND WASTE IN 2017 IN THE REPUBLIC OF TATARSTAN [6]

Economic activity	Volume of production and consumption waste according to economic activity in the total volume of production and waste	
	Value	Measurement unit
Processing industry	1 728, 494	Thousand tons
Agriculture, forestry, hunting, fishing and fish farming	690, 396	Thousand tons
Processing industry	263, 700	Thousand tons

Source. Made by the author

The total volume of investments in the Republic of Tatarstan allocated from the republican budget for the implementation of targeted environmental measures in 2017 made up 846,6 million rubles [6]. The funding of targeted environmental measures from the budget of the Republic of Tatarstan for 2015-2017 is presented in Table 10.

TABLE X. FINANCING OF TARGETED ENVIRONMENTAL MEASURES FROM THE BUDGET OF THE REPUBLIC OF TATARSTAN FOR THE PERIOD 2015-2017. [6]

Year of financing of targeted environmental measures from the budget of the Republic of Tatarstan	Amount of financing of targeted environmental measures from the budget of the Republic of Tatarstan in various years	
	Value	Measurement unit
2015	369389,7	Thousand rubles
2016	557303,2	Thousand rubles
2017	846572,1	Thousand rubles

Source. Made by the author

IV. CONCLUSION

In order to reflect the creation of complex measures directed to the sustainable environmental development under the conditions of modern economic system it is worth mentioning at the regional level that the Republic of Tatarstan has approved the “Industrial strategy of ecological security and development of natural and industrial complex of the Republic of Tatarstan for the period of 2017-2021 and until 2030” (hereafter Industrial Strategy). The Industrial Strategy determines the need in the development of geoinformational technologies. The Republic of Tatarstan has developed and has introduced into operation a trial version of the geo informational system “Ecological map of the Republic of Tatarstan” which contains the information about the condition of environment and natural use in the Republic of Tatarstan [7].

The Republic of Tatarstan has the approved the Governmental Program “Protection of environment, reproduction and use of natural resources of the Republic of Tatarstan for the period 2014 – 2021 (hereafter Program). One of the tasks within the Program which is mentioned is the reduction of the environmental pollution into the Republic of

Tatarstan by production and consumption waste which are expected to be included in the technology of development of the production of goods from salvageable commodities [8].

Together with measures directed to the sustainable development, taken by the state for the improvement of the ecological situation, the economic agents by means of the introduction of resource-saving technologies into the processes of production, influence directly the environment.

The presence of the agents within the process of the ecologization of production with innovative integration is characterized by the position of a donor and a recipient.

At the ecologization of production with innovative integration the economic agents can be presented as donors, creating the supply of the results of the intellectual activity obtained during the R&D in the field of sustainable development. At the same time the R&D can be integrated into the system of the agent's activity or this agent will take part in the financing of the innovative environmental project which is developed in another organization.

The creation of technological platforms at the ecologization of production processes creates the prospects for the development of R&D, introduction of which is connected with ecological and economic development. Under the conditions of the modern economy the creation of technological platforms implies the interaction between the entrepreneurial structures and educational institutions conducting the R&D.

The technological platform is a communicative tool which contributes to the creation of technologies, provision of the resource basis of the research activity, improvement of legislation, regulating the relations in the sphere of innovative development [9].

When making the production environmentally friendly and integrating innovations, the economic agents can be recipients of the process what is characterized by the generation of demand for R&D in the environmental science. The satisfaction of demands in environmental innovative projects which arise in various sectors of the economy depend on the increase of the R&D quality. At the selection of technologies the tendencies of the world development should be taken into account [10].

The ecologization of production together with innovative integration in the system of environmental development as a factor of social welfare development is connected with the necessity of the implementation of a complex of differentiated measures:

- the development of ecological literacy of agents of the production process. The ecological literacy implies a conscious goal setting founded on the comparison of positive and negative ecological effects at the implementation of the activity during the production process. The ecological literacy should be formed continuously during trainings directed on the generation of competences which allow integrating the

economic and environmental efficiency in the system of production;

- the implementation of ecological management in the production process. The key goal of the ecological management in the production process consists in the decision making in the sphere of management based on the environmental literacy;

- creation and development of environmental infrastructure with innovative integration in an enterprise. The improvement of innovative integration in the production should be subordinated to the principle of the highest competitiveness. According to the principle mentioned above the financing of different stages of the creation of ecological infrastructure with innovative integration should be founded when taking into account all the constituents of the competitiveness. The implementation of the principle of the highest competitiveness allows differentiating the projects depending on the high and low economic, environmental and also scientific and technological potential. The growth of environmental infrastructural potential in the production process allows increasing the positive economic and environmental effect.

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