
Assessment of the Socio-Economic Impact of the Implementation of Regional Environmental Programs for Waste Management

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Abstract

The relevance of developing regional environmental programs for waste management, as well as assessing the socio-economic impact of these programs is explained by the importance of solving environmental problems in the modern world. The purpose of the preparation of this article is to justify the importance of developing a scientifically based toolkit that allows assessing the impact of the implementation of environmental programs in the regions, their impact on the quality of life of the local population. The main research methods were descriptive statistics and methods of multivariate statistical analysis, content analysis, factor analysis, data systematization, expert assessments and their coordination, as well as other scientific approaches. The study was presented on the example of the processing of tires and rubber products, as one of the most pressing problems of the number set by the global automotive industry to humanity. The article briefly summarizes the global practice of waste disposal, describes promising technologies for processing tires and other rubber-containing wastes used in the Russian Federation, and substantiates the role of the state in stimulating industrial waste recycling activities. In addition, the article discusses the debatable aspects of assessing the socio-economic effectiveness of investment projects for the disposal of waste and garbage in the Russian Federation, and substantiates the need to take into account the socio-economic consequences of the implementation of regional environmental recycling programs. The materials of the article can be used by public authorities in assessing the socio-economic consequences of the implementation of regional environmental programs for waste management.

Keywords: regional environmental programs, recycling and waste management, recycling

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INTRODUCTION

Any entrepreneurial, industrial activity, one way or another, is associated with the formation of waste (Kevorkova et al. 2018, Zheltukhina et al. 2018). The more active it is, the more waste formats. That is why the introduction of modern methods of processing and disposal of industrial waste is so important in the implementation of national and regional public policy. Recently, the Russian economy is gradually moving away from the environmental strategy used at the end of the 20th and the beginning of the 21st century, and which has caused tremendous damage to the environment, to the understanding that secondary raw

materials resulting from waste processing can be reused in many industries (Bragin et al. 2018, Omarova et al. 2018, Repina et al. 2018).

The results of research of both Russian and foreign experts (Gonopolsky et al. 2005, Klinkov 2014, Galushkin 2015, Kalinina and Barakova 2018, Masalimova et al. 2018), including the authors of this study (Filatov et al. 2018a, 2018b, Vikhrova 2018, Zaitseva et al. 2018) indicate that efficiently organized processing and Disposal of industrial waste can be the key to the economic prosperity of many countries, including Russia. The closed cycle of production and use of its waste stimulates the development of the

economy by reducing the cost of purchasing raw materials. The main part of this sector of the Russian economy is in the oil industry, heavy industry and engineering complex.

Recently, the state authorities of the Russian regions have seriously thought about the need for fundamental changes in the field of environmental management, during which the processing and disposal of industrial waste generated at enterprises will be subject to strict accounting.

Studies on the issues of state regulation of waste management activities based on the implementation of regional environmental programs have long been widespread throughout the world (Clean Production Strategies 2004, Mikhailova and Ustinov 2010). At the same time, the assessment of the socio-economic consequences of the implementation of regional environmental programs for waste management, especially in the unstable economic situation in the country, is still insufficiently studied. For the Russian Federation, which is in a state of protracted economic crisis, as a result of the introduction of political and economic sanctions by a number of countries, it is important to have scientifically based tools to assess the impact of environmental programs in the regions, their impact on the quality of life of the local population.

METHODOLOGICAL FRAMEWORK

The methodological basis of this study was the scientific research of Russian and foreign researchers in the field of recycling of industrial waste, as well as the development of regional environmental programs for the disposal and recycling of various garbage and industrial waste. To carry out this study, the authors of the article used methods of descriptive statistics and methods of multivariate statistical analysis (cluster, correlation and regression analysis).

In addition, within the framework of this study, the methods of content analysis, factor analysis, data systematization, expert assessments and their coordination, as well as other scientific approaches were used, allowing a comprehensive approach to assessing the socio-economic consequences of the implementation of regional environmental recycling programs.

RESULTS AND DISCUSSIONS

Review of the World Practice of Waste Disposal (for Example, Car Tires and Rubber Products)

In many countries of the world, recycling activities are commercially viable, including through the provision of a system of government incentives and benefits (Ryumina 2008, Shuvaev 2011). Many investors are seriously interested in the possibility of investing funds for the construction of enterprises that will process and dispose industrial waste in Russia. It is worth noting that this type of activity is quite specific. The slightest mistake, or defect, can lead to truly irreversible consequences in the form of accidents and environmental pollution (Shamsutdinova and Mustafin 2011). Therefore, the personnel of processing enterprises must have the highest level of qualification. The selection of equipment that has passed the state environmental impact assessment is also very important. It must comply with the specialization of each particular enterprise and be safe during operation.

In this article, we will consider in more detail one of the types of industrial waste - automobile tires and rubber products. In many Russian cities, there is no system for recycling tires and other rubber products, which have exhausted their service life. In practice, most often they are simply thrown into landfills, although it has long been known that tires decompose under natural conditions for more than 100 years (Tire recycling 2018).

In Europe, these issues have been regulated by European Union legislation for more than 10 years. Thus, in the second half of 2006, a ban was introduced on the utilization of tire covers by burning or burying it in the ground. As a result of this decision, many EU countries began to build new enterprises and purchase equipment for processing automobile tires and other rubber products. Such equipment with proper operation can pay off within two to three years.

A study of the global practice of utilization and recycling of automotive industry production, in particular of car tires, showed that there are several promising options. Two of them are considered below:

1. Use in the process of tires' recycling liquid nitrogen. This method was developed at the University of Wisconsin (USA). The use of liquid nitrogen leads to the fact that the tires become brittle, similar to glass, after which they were crushed and used the material obtained in the manufacture of pavement, which has a high coefficient of adhesion with automobile wheels

Table 1. Variants of obtaining various types of waste products from the processing of worn tires of the Moscow region according to the technology of nano-destruction

№	Type of product that can be obtained from used tires using nanodection technology	The average market price of the carbon product, thousand rubles / t.	The expected amount of carbon product produced by the technology of nano-destruction (thousand tons per year)	Cost estimate of the possible commercial volume of the carbon product obtained by the technology of nano-destruction (mln. Rub. Per year.)
1.	Low-grade technical carbon of brand P 803.	More than 60	≥37	2200
2.	Liquid fuel	28	≥65	1800
3.	Chemical raw materials for production of aromatic hydrocarbons (styrene)	60	twice	3500
4.	The bricketed scrap metal	8,8	≥ 12	100
5.	Low-B.T.U. gas	about 18 thousand Gcal and at the price of 1500 rub/Gcal	9	27

and the lowest noise level. At the same time, the cost of raw materials from tires did not exceed the cost of asphalt. The American Transport Bill supported the use of rubber asphalt, which allowed up to 30% of used tires from the US accumulated annually to be used (Recycling is the second life of waste 2018).

2. Recycling of old tires in a special tank in which they are biodegradable using microbes. As a result of this processing, a product that can be used to fertilize fields is obtained. This method was patented at the Colombian University (USA) (Nikulichev 2017).

Another direction of the integrated program of utilization of tires and other rubber-containing materials was the change in approaches in the production of tires themselves. So, the Bridgestone company emphasized that new tires were with reduced levels of harmful materials and were 100% recyclable. Thus, we can conclude that concern for the environment has already reached not only the use of alternative power sources for cars, but also what these sources will drive on the road (Airless tires with internal recycled resin needles 2017).

Promising Technologies for Processing Tires and Other Rubber Waste Used in the Russian Federation

In the Russian market, several companies are engaged in tire processing:

– The South Ural Industrial Company uses the technology of processing tires and plastics into high-quality fuel oil for boiler houses with a capacity of 5 tons per day. raw materials (worn tires);

– The company Novotech conducts the design and construction of factories for the processing of old automobile tires based on the technology of explosion-circulating tire grinding;

– The firms Turbotehmash and Consit-A offer environmentally friendly technological innovative technology for the processing of used tires with the use of low-temperature cooling;

– LLC “Company “Decap” has developed an innovative technology for processing (recycling) worn-out tire covers with metal, textile cord and combined tires with a diameter of up to 2 thousand mm.

One of the leaders in Russian oil production and refining, TATNEFT, currently uses four installations for the processing of used automobile tires in the amount of 1.5 thousand tons per year, and refined products (metal cord, carbon black, liquid solvent) that it receives, are used as secondary raw materials (Tatneft Recycling Production 2018).

In the Russian regions there is a great need in the production of recycling of used tires and other rubber products. So the commodity volume of processing of used tires only by the Moscow region is estimated by experts at 5 billion rubles per year (Rukina and Filatov 2017). However, these are expert and possibly underestimated estimates, as statistics on the entire spectrum of rubber-containing waste in the region are not kept (In Moscow region decided to extract energy from the garbage on an industrial scale 2015).

Calculations show that worn tires make up only half of the volume of all rubber-containing waste to be recycled. If we take into account the volume of all rubber waste, then the total commodity volume will be doubled and will be about 10 billion rubles in a year. Variants of obtaining various types of products as a result of processing waste tires in the Moscow region using the technology of nano-destruction (Arustamov 2018) are presented in **Table 1**.



Fig. 1. The most relevant measures of national and regional environmental programs for the disposal and recycling of waste

The Role of the State in the Promotion of Industrial Waste Recycling

In industrialized countries, there is government funding, laws have been adopted that encourage recycling of industrial waste, various subsidy schemes are implemented. The strategy of the EU countries involves several activities:

- waste prevention;
- utilization and recycling of the materials obtained;
- optimization of final waste treatment;
- regulation of waste transportation;
- carrying out activities for the rehabilitation of the environment;
- educating the population in the spirit of rational consumption;
- inclusion of environmental parameters in product quality standards

All these activities should be based on a modern system of regulations defining the legal and economic bases for waste disposal and recycling activities.

Unlike many European countries, in the Russian Federation the main initiator of the solution of the problem of waste utilization and recycling is often government bodies. One of the priority activities in this area was the development of state integrated environmental programs, both at the national and regional levels, aimed at organizing the collection, temporary storage, processing and development of the market for consumption of waste products.

In general, according to the results of the author’s research ,as well as the study of other studies in this area (Kunakbaeva 2007, Kusraev 2012, Strakhova and Kushnareva 2011) five groups of the most relevant measures of national and regional environmental programs for waste management and recycling can be highlighted (**Fig. 1**).

Discussion Aspects of the Assessment of the Socio-Economic Efficiency of Investment Projects For Waste And Garbage Disposal in the Russian Federation

If we consider this problem in relation to the previously selected object of study – recycling of used tires and rubber products, it should be noted that the most acute issues of disposal and recycling of used tires are in several large cities of the Russian Federation. So

in St. Petersburg now there are no large processors of rubber waste in contrast, for example, from Moscow and the region. Three large enterprises are engaged in such activities in the Moscow region: the Dmitrovsky RTI plant, the Chekhov regeneration plant, and the company "Oris prom." (One of them, Dmitrovsky RTI, was founded in 2012. The capacity of this plant allows simultaneously store about 40,000 tons of tires and process up to 20 tons of tires per hour. The rubber crumb produced by the plant is used in the production of rubber tracks and tiles used for covering sports and children's playgrounds, stadiums. The growth in demand for the plant's products led to a sharp increase in sales - from 93 million rubles. in 2016, up to almost 300 million rubles for 9 months of 2018 (Evgeny Giner became a co-owner of a tire recycling plant 2018).

At the end of 2018, the volume of rubber waste in St. Petersburg and the Leningrad Region was up to 80,000 tons per year. For its processing, the administration of St. Petersburg provided the company Innovatech with a site for the construction of a plant for the processing of rubber waste with a planned capacity of up to 60,000 tons per year. At the same time, Innovatech will apply not traditional mechanical processing to rubber crumb, but its own technology: rubber decays under the influence of superheated steam, the final product is technical carbon which can be used further by production of rubber. The company has already applied it at enterprises in Kaliningrad and the Irkutsk region of the Russian Federation.

However, the implementation of investment projects in the field of industrial waste recycling, including used tires and rubber products, often faces a lack of scientifically based methods for evaluating the effectiveness of such projects, as well as the level of investment risks. The existing system for assessing the economic efficiency of the use in the production of new technologies, inventions and rationalization proposals in the Russian Federation was developed in the late seventies of the last century. Officially approved in 1977, the Methodology for determining the economic efficiency of the use in the national economy of new equipment, inventions and rationalization proposals, in the presence of a number of provisions that have not lost relevance, currently contains those, which use does not take into account the peculiarities of recycling production (Shubov et al. 2018). A modern investor needs to apply special approaches to calculating costs at all stages of the product life cycle, taking risk into account when determining social and economic

efficiency, evaluating prospects and results of state financial support, and other factors.

An integrated approach to the assessment should take into account the following things: compliance with environmental standards; accounting of all positive and negative conditions in the areas of production and operation; comparing the cost of secondary and primary products; provision of social standards, environmental standards (if this condition is not met, projects are rejected); consideration of all associated positive (and negative) quality, social, environmental, external economic conditions in the related areas of production and operation; taking into account the disparity of costs and results at different points in time and, in this connection, bringing them to a single point in time: estimating the costs and results of the project for the entire period of its use; consideration of risk and uncertainty in the calculation of performance indicators at all stages of recycling; multivariate methods of calculating costs and benefits at the stages of the life cycle; comparing the prices of primary and secondary materials.

It is also necessary to take into account that it is very difficult to achieve 90–95% of the actual recycling rate. Taking into account the use of modern technologies, even in developed countries, no more than 60–70% of solid wastes are recycled (30–40% using recovery), and about 30% are incinerated or should be disposed of at landfills (Zakalyukina 2013). In Russia, the level of waste that is recycled still remains at about 30%, and the bulk of the waste is taken to dumps and grounds (Statistics of the Federal Service for Supervision of Natural Resources 2017).

Accounting for the Socio-Economic Consequences of the Implementation of Regional Environmental Programs for Waste Management

In the Russian Federation, since 2018, recycling programs have been launched in all regions of the country. However, this activity faced a number of difficulties and opposition from the public and the local population. At the same time, if in 2018 the main reason for this was mainly due to environmental factors - the local population's dissatisfaction with plans to build a landfill or incinerator, then in 2019 economic factors could become major factors.

The initiated reform of the collection and recycling of waste in the Russian regions is aimed at reducing the burden on the environment and the emergence of a new waste management market, the key actors of which will

be regional operators of the full recycling cycle. These operators will receive payment for waste disposal, which they will be able to use for organizing production for waste disposal.

Operators are given the right to independently determine the rates for waste disposal, and regional and local authorities must approve them. However, there are already quite a few cases of disagreement due to the rates proposed by the operators, which caused the slowdown of reform in most Russian regions. According to the Ministry of Natural Resources and Environment of the Russian Federation, only 16 regions have completely transferred to the new scheme for collecting and recycling garbage. The main reasons for this are unavailability of infrastructure and pain for the population to create a system for recycling.

In the conditions of the ongoing situation of instability in the Russian economy, any measures related to the increase in tariffs cause an open negative reaction. So the first "trash" in 2019 is planned in Tyumen, where on January 20 a protest rally against a 30% increase in tariffs for the export of municipal solid waste should take place.

Thus, it can be concluded that the assessment of the socio-economic consequences of the implementation of regional environmental programs for waste management should be based on the use of multifactor economic and mathematical models that take into account not only the economic but also the social consequences of such programs, and not only in the short-term but also in the long run.

CONCLUSION

As it can be seen from the results of this study, it is necessary to use integrated indicators of the effectiveness of regional environmental programs for waste management, taking into account both the complete movement of waste during disposal, as well as the subsequent use of processed products, as well as the population's readiness for new reforms and technologies.

At the same time, one cannot but agree with the opinion of most researchers in this field - the main way to ensure effective organization of industrial and household waste processing is to expand the resource base and increase the level of recycling (degree of isolation) by involving waste in production cycles.

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