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**WASTE MANAGEMENT AS A COMPONENT OF SUSTAINABLE
DEVELOPMENT OF RUSSIAN REGIONS**



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Abstract

In a modern economy, the main goal of the development of regional systems is the formation of sustainability and at the same time the effectiveness of development. Increased consumption and new production technologies are creating new waste problems. In Russia, the existing waste management system is focused primarily on disposal, therefore, the current management issues are the modernization of the waste processing industry in order to form a sustainable development of regional systems. The authors of the article reviewed the international documents that form the regulatory framework for waste management, assessed the range of existing studies taking into account the requirements of sustainable development. The authors assessed the Russian waste management system. The results of the study allow us to note that more than 80% of waste in the periods 2004-2006 and 2013-2016 was placed in storages owned by enterprises. In other periods, up to 37% of waste was disposed of at landfills; in addition, in 2019, 1/3 of industrial waste was buried in Russia. The average annual rate of increase in waste generation for the period 2003-2019 amounted to 7.06%, the rate of increase in utilization and disposal of waste was 6.86%. At the same time, the share of recycled waste in Russia on average for the period under review is 48.49%. The authors analyzed the waste recycling industry market and proposed recommendations for improving waste management in order to form sustainable development of Russian regions.

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Keywords: Waste management, sustainable development, region



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1. Introduction

In today's world, people consume much more than previous generations, and an increase in consumption leads to an increase in waste. The garbage problem today is a global environmental challenge that requires an immediate solution. In many countries of the world there has long been an awareness of the danger of waste pollution, and there is an active search for the most innovative technological and managerial solutions in the field of waste management.

In the Russian Federation today, the system of household waste management is focused primarily on disposal, which in the future may lead to sad environmental consequences. Landfill disposal contributes to air and groundwater pollution. In the context of a constantly developing economy, the waste processing industry requires modernization and the use of modern approaches. The use of landfill infrastructure should be minimized to avoid serious environmental impacts.

That is why in recent years, among scientific research and solving practical problems in Russia, much attention has been paid to the problem of strategic development of the waste processing industry and recycling management in order to form the sustainable development of regional systems.

2. Problem Statement

The management of the strategic development of the waste processing industry in order to form the sustainable development of regional systems raises a number of problems of both scientific and practical content. Analysis of publications allows us to note that research is not yet systematic and complex in nature, so the topic is interesting and promising for future research.

The research problem is the development of recommendations for improving waste management. To solve it, authors need to answer the following questions:

- what is the category "waste" and what international documents form the regulatory framework for waste management?
- what is the role of waste management in the formation of sustainable development of regional systems?

3. Research Questions

During the study, the authors considered the following questions

3.1. What is “waste” and what international documents form the regulatory framework for waste management?

The definition of "waste" has different aspects and interpretations in different countries. The analysis of legislative aspects in the field of waste management should begin with a review of international agreements and the definition of the concept of “waste”.

The London Convention in 1972 banned the dumping of waste into the sea for the first time, the Basel Convention in 1989 determined the features of control over the restriction of the movement of hazardous waste. In 1993, the concept of “resource recovery” was introduced into European practice, which

includes the reuse, recycling or recovery of energy or other resources from waste. The 2001 Stockholm Convention requires the production and consumption of persistent organic pollutants to be phased out. All of these international agreements have become the basis for national laws on waste.

According to the United Nations guidelines, waste is understood as materials that are not primary products produced for the market, which the manufacturer cannot further use in terms of his own production, transformation or consumption goals and which he wants to get rid of.

The Basel Convention defines waste as any substance or item that is disposed of, intended for disposal, or subject to disposal in accordance with the provisions of national legislation.

The EU Waste Framework Directive defines waste as any substance or item that is thrown away, collected or must be discarded by the owner.

The main law of the Russian Federation that defines the interpretation of terms related to waste management is the Federal Law "On Production and Consumption Waste", adopted in 1998.

3.2. Recycling as a component of sustainable development of regional systems

Waste management and recycling is a means of achieving one of the sustainable development goals - ensuring the transition to sustainable consumption and production patterns (SDG 12). According to the UN, every year 1/3 of all food produced ends up in waste. The current objectives of SDG 12 by 2030 are as follows: to halve the amount of food waste per capita, reduce food losses; reduce the volume of waste by taking measures to prevent their generation, recycling and reuse.

The works of various authors are devoted to the issues of sustainable development of regions and waste management. Studies are being carried out related to the formation of a sustainable environmental policy and the development of a methodology for assessing the efficiency of waste generation in EU regions (Halkos & Petrou, 2018). Developing countries are also the focus of research on sustainable waste management (Waqas, 2019).

In recent years, analysis of management approaches to the processing of municipal solid waste has been carried out in Latin America (Sánchez-Muñoz et al., 2020), Vietnam (Bui et al., 2019).

Research is currently underway on urban waste management in the context of the SARS-COV-2 pandemic using Italian cities as an example (Ragazzi et al., 2020).

Russian authors also conduct research on the formation of methodological aspects of solid waste management (Likhacheva & Sovetov, 2017), assessing their impact on increasing the innovative sustainability of Russian regions (Golova et al., 2017). Russian researchers are developing the organizational, technical and economic foundations for waste management in the context of green architecture and ecological construction (Velichko et al., 2020), assessing the role of environmental innovations in shaping the sustainable development of regional systems (Lyapina et al., 2019), forecasting of waste management processes in the regions of Russia is carried out (Gilmundinov et al., 2020).

4. Purpose of the Study

The aim of the work is to develop recommendations for the modernization of waste management in Russia in order to form sustainable development of regional systems. To achieve the goal, it is necessary

to solve the following tasks: to assess the development of the waste processing industry in the world; to analysis the dynamics of the formation, placement and disposal of waste in Russia for the period 2004-2019; to develop recommendations for the modernization of waste management as part of a strategy for sustainable development of Russian regions.

5. Research Methods

In the process of writing the article at the initial stage, a descriptive review was carried out, the material was selected according to the keywords: waste management, sustainable development, region. Then international documents and Russian legislation regulating waste management issues were studied.

At the next stage, the authors of the article used methods of analytical research, comparative analysis, methods of statistical research.

5.1. Assessment of the current state and development of the waste processing industry in the world

Recently, various industrial enterprises, thermal power plants and road transport have been considered the main sources of pollution. However, in recent years, the accumulation of solid household waste, which inevitably occurs in places of human activity, has become especially acute.

The amount of household waste in our country is about 80 million tons per year. In the United States of America, this figure reaches 280 million tons per year, and in Japan, about 140 million tons of household waste per year. The amount of waste dumped is increasing annually by about 4%, and in some countries by 12%.

Today the garbage recycling industry around the world is in its development stage, in some countries, such as Bulgaria, Croatia and Russia, this business line is in its infancy. This stage is characterized by high costs, few market players and underdeveloped technologies.

The manufacturing industry in Spain, Italy, France, Belgium, Austria is at the growth stage. The aforementioned countries have a developed waste management system, a large number of competitors in the industry and very high costs.

The waste recycling industry in Germany is now in a transition from growth to maturity, at this stage of the industry's life cycle, costs gradually begin to decline, and non-competitive players are eliminated.

As a result of economic development in countries, there is a change in the morphological composition of solid waste (Figure 01).

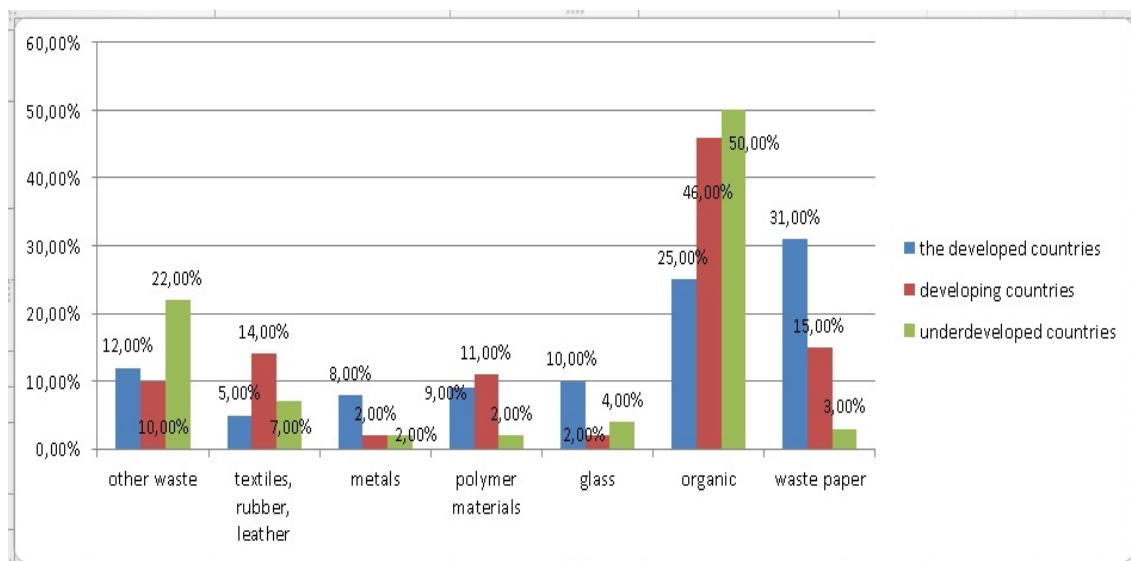


Figure 1. Morphological composition of solid waste in different types of countries of the world according to 2018 data

The higher the development of the country and the standard of living in it, the lower the share of organic waste, while the proportion of waste paper, glass, polymeric materials and metals grows. This trend is due to the fact that in developed countries there is a very large number of various packaging materials, about 30% of household waste is packaging. In 2020 the problem of increasing plastic waste is relevant for all countries of the world.

5.2. Problems and prospects for the development of the waste processing industry

The recycling industry is one of the fastest growing, but not the most profitable. State support makes it interesting for entrepreneurship, because the problem of waste and their recycling is a state problem. Recycling of waste in our country, according to the estimates of various investment companies, could generate income in the amount of 3 to 4.5 billion dollars a year. The global market for household waste is estimated at about \$ 120 billion.

Household waste processing projects are a global trend today. These projects could be of interest to both domestic business and foreign investors. Investments in the Russian waste processing industry are promising. Global trends in production are reduced to the use of secondary raw materials that can be obtained in the processing process.

In 2020 according to the state statistics services, about 300 waste processing plants, 50 waste sorting complexes, 10 waste incineration plants are operating in Russia. This number of waste treatment facilities is very small in order to ensure the recycling of waste in an entire country with such a large population.

Thus, we can conclude that the market is free for new players; each new waste processing enterprise in Russia can have a good return on investment in the future. Moreover, the niche that should be occupied by enterprises engaged in the processing of waste in a full cycle is completely empty. This is due to the fact that most of the projects in Russia are limited only to organizing waste compaction and further stacking at the landfill. Therefore, in our country, the possibility of obtaining proceeds for foreign investors is not realized, since their interest is directly related to the acquisition and reuse of processed raw materials

6. Findings

For the study, we used the data of the Federal State Statistics Service on the disposal of production and consumption waste at facilities owned by Russian enterprises by storage or disposal sites for the period 2004-2019.

Based on the statistical processing of information, Table 01 shows the structure of disposal of production and consumption waste at facilities owned by Russian enterprises by storage or burial places in 2014-2019. It can be noted that more than 80% of waste in the periods of 2004-2006, in 2013-2016 was placed in storage sites and less than 20% in burial places.

Table 1. The structure of production and consumption waste disposal at facilities owned by Russian enterprises, by storage and disposal sites in 2014-2019

Year	Disposal of production and consumption waste at facilities owned by enterprises		Year	Disposal of production and consumption waste at facilities owned by enterprises	
	places of storage, in %	burial places, in %		places of storage, in %	burial places, in %
2004	80,5	19,5	2012	72,4	26,6
2005	80,4	19,6	2013	83,1	16,9
2006	80,1	19,9	2014	82,3	17,7
2007	62,7	37,3	2015	84,7	15,3
2008	74,2	25,8	2016	80,3	19,7
2009	70,7	29,3	2017	74,2	25,8
2010	73,3	26,7	2018	71,2	28,8
2011	74,2	25,8	2019	68,9	31,1

In the period 2007-2013, 2017-2019 buried from 25 to 37% of waste, in 2019 1/3 part of all industrial waste was buried.

In the European Union, an average of 60% of waste is recycled, in the United States of America - more than 40%. In Russia, the bulk of waste is sent to landfill, and less than 10 %.

Based on the data presented in Figure 02, we can conclude that in Russia the number of waste generated over the period 2003-2019 is growing. The share of household waste that is recycled increases at an insignificant rate.

The average annual rate of increase in waste generation for the period 2003-2019 amounted to 7.06%, the rate of increase in utilization and disposal of waste was 6.86%. At the same time, the share of recycled waste in Russia on average for the period under review is 48.49%.

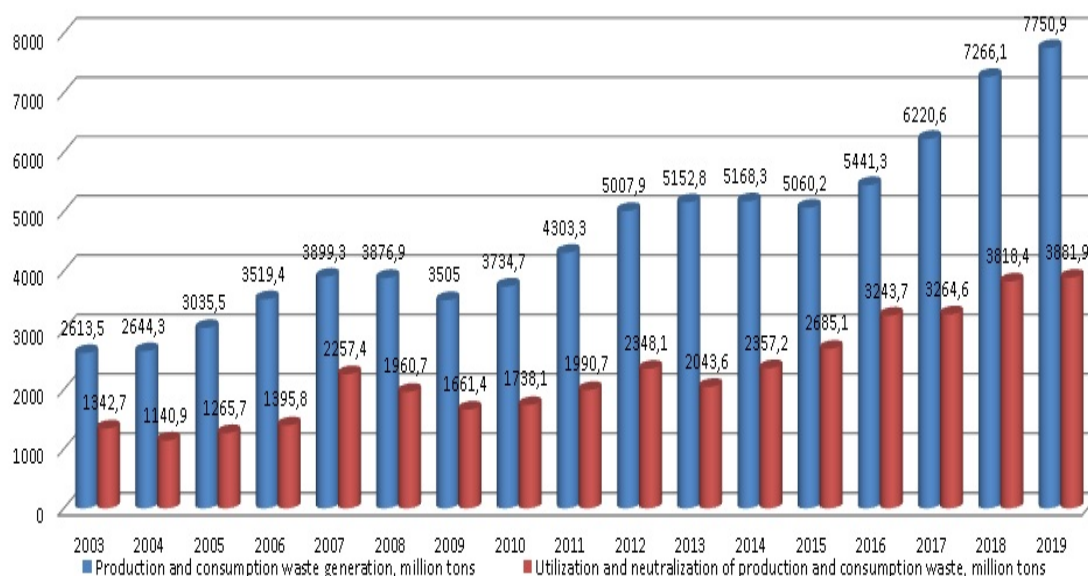


Figure 2. Dynamics of generation and utilization and disposal of production and consumption waste in Russia in 2003-2019

This indicates that the waste management system in Russia is built irrationally and does not fulfill its main purpose - solving the problem of environmental pollution. New technologies in the management of the MSW management system should facilitate the processing of a larger share of the generated household waste

7. Conclusion

To form sustainable development of regional waste management systems in Russia, it is necessary to rely on the following principles:

- reducing the generation of the total volume of waste or minimizing waste in the field of production and consumption;
- ensuring the processing or disposal of waste near the source of their generation;
- development and implementation of waste management standards;
- bans and restrictions on garbage disposal, lack of ecological colonization in the regions;
- provision of extended producer liability based on the principle that the producer pays for pollution and then disposes of the products used by the purchaser at the end of their useful life.

Thus, the successful functioning of the waste processing industry is impossible without government regulation. The promotion of separate collection at the state level can be carried out through the management of the differentiation of the tariff rate for waste disposal, the introduction of an effective system of penalties for violation of the disposal procedure.

The problem of competition between waste transport operators can be eliminated by defining a regional operator. The proposed measures will allow an optimal waste management system and implement a sustainable development strategy in each region of Russia.

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