Artículo de investigación

Tax regulation and attraction of investments in the waste management industry: innovations and technologies

НАЛОГОВОЕ РЕГУЛИРОВАНИЕ И ПРИВЛЕЧЕНИЕ ИНВЕСТИЦИЙ В ОТРАСЛЬ ПЕРЕРАБОТКИ ОТХОДОВ: ИННОВАЦИИ И ТЕХНОЛОГИИ

Regulación fiscal y atracción de inversiones en la industria de gestión de residuos: innovaciones y tecnologías

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Abstract

The rate of waste accumulation in Russia increases every year. The scientific community is constantly looking for new methods of waste management and is forced to solve the emerging environmental and economic problems in this area. The purpose of the article is to analyze the relationship between tax regulation and investment in the waste management industry. The article substantiates the relevance of the introduction of innovative technologies in the field of waste management in the conditions ensuring environmental safety and economic feasibility. The features of tax and investment relations are considered and the application of the investment criterion in determining the environmental tax rate is demonstrated. The priority of an investment project's investment

Аннотация

Скорость накопления отходов в России увеличивается с каждым годом. Научное сообщество постоянно ищет новые методы переработки отходов и вынуждено решать возникающие экологические и экономические проблемы в этой области. Целью статьи является анализ взаимосвязи между налоговым регулированием и инвестициями в отрасль управления отходами. В статье обоснована актуальность внедрения инновационных технологий в области управления отходами в условиях, обеспечивающих экологическую безопасность и экономическую целесообразность. Рассмотрены особенности налоговых и инвестиционных отношений и продемонстрировано применение

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requirements is presented based on the example of the construction of a new municipal solid waste landfill. The experience of investing in waste management in the EU countries is considered. Based on an expert survey, the factors of investment and innovation attractiveness of investing in the waste management industry, as well as the existing innovative waste management technologies in Russia and other countries, are determined.

Keywords: Environmental issues, investment, tax and investment relations, waste, landfill, waste management.

инвестиционного критерия при определении ставки экологического налога. Приоритет инвестиционной потребности инвестиционного проекта представлен на примере строительства новой городской свалки твердых бытовых отходов. Рассмотрен опыт инвестирования в управление отходами в странах ЕС. На основании экспертного опроса определены факторы инвестиционной и инновационной привлекательности инвестиций в отрасль управления отходами, а также существующие инновационные технологии управоения отходами в России и других странах.

Ключевые слова: экологические проблемы, инвестиции, налоговые и инвестиционные отношения, отходы, свалки, управление отходами.

Resumen

La tasa de acumulación de residuos en Rusia aumenta cada año. La comunidad científica busca constantemente nuevos métodos de gestión de residuos y se ve obligada a resolver los problemas ambientales y económicos emergentes en esta área. El propósito del artículo es analizar la relación entre la regulación fiscal y la inversión en la industria de gestión de residuos. El artículo confirma la relevancia de la introducción de tecnologías innovadoras en el campo de la gestión de residuos en las condiciones que garanticen la seguridad ambiental y la viabilidad económica. Se consideran las características de las relaciones fiscales y de inversión y se demuestra la aplicación del criterio de inversión para determinar la tasa impositiva ambiental. La prioridad de los requisitos de inversión de un proyecto de inversión se presenta en base al ejemplo de la construcción de un nuevo vertedero municipal de residuos sólidos. Se considera la experiencia de invertir en la gestión de residuos en los países de la UE. Según una encuesta de expertos, se determinan los factores de inversión y el atractivo de la innovación de invertir en la industria de gestión de residuos, así como las tecnologías innovadoras de gestión de residuos existentes en Rusia y otros países.

Palabras clave: Temas ambientales, inversión, relaciones fiscales y de inversión, residuos, vertederos, gestión de residuos.

Introduction

Recent decades are characterized by high rates of technological progress and rapid economic development and are accompanied by an irresponsible and often predatory attitude of people to nature. As a result, the negative consequences of human impact on the environment have led to a serious complication of the environmental situation on the planet.

Urbanization has created another major problem for cities around the world – the accumulation of large amounts of municipal solid waste (MSW). The vast majority of the incredible number of products that are produced in the modern world are short-term in use and quickly turn into garbage. More than one and a half trillion tons of MSW is formed on the planet every year. Moreover, this figure annually increases at a faster rate (Abdoli, et al., 2016). It is established that the amount of MSW increases by 6% with the growth of the planet's population by 1.5-2% (Singh, et al., 2014). This is due to a change in life and an increase in the living standards of the population.

The problem of waste management is very important for humanity and not only from an environmental point of view. Non-renewable resources, the use of which, is associated with modern waste management technologies, will be

exhausted in the few next centuries. Renewable resources, which may become a permanent source, include MSW (Wilson, et al., 2012).

Tax regulation occupies a special place among the levers of state support for investment activities in the field of waste management. Its main feature is the specific role of the state in this process because it acts as an entity (which turns the rules of conduct into mandatory requirements), an owner of funds (resulting from the actions of participants in investment relations fixed by such orders) and a guarantor of investment.

Despite the obvious relevance of the topic of the impact of tax regulation on attracting investments in the waste management industry for Russia, this problem has not been solved at the level of scientific research.

Literature Review

The following main vectors for the implementation of tax and investment relations have been identified based on the analysis of scientific research conducted in recent years:

1) State tax support for investment (Zee, et al., 2002; Lazaryan and Chernotalova, 2017);
2) Tax incentives and investment promotion (Wong, 2009; Savina, 2015);
3) Tax exemption in the field of investment (Popelysheva and Kostina, 2017; Semenova, and Arapova, 2017).

According to D.M. Kasimova, features of taxation in the field of investment activity, as well as specifics of tax and investment legal relations, can be determined through the following:

1) Special sector of "responsibility" (investment activity) – activities of business entities, state or local government concerning investments;
2) Nature of this activity – complex, consisting of various actions performed at specific stages of investment;
3) Targeted object – investment as property values and other assets (investor contribution) and investment as a set of operations related to the movement of capital (Kasimova, 2015).

A significant number of scientists consider the formation of a modern institutional framework for investing in municipal and industrial waste utilization projects as one of the main prerequisites for efficient waste management, which will lead to the creation of a full-fledged waste management industry (Tuktarov, et al., 2018; Ismagilova, G.V et al., 2012; Vaisman and Pugin, 2015; Pinkovetskaia, 2019).

Research hypothesis: Tax regulation of attracting investments in the waste management industry should be based on the use of the investment criterion in calculating the environmental tax rate. At the same time, the phased distribution of investments is necessary during the implementation of an investment project based on innovative waste management technologies.

Proposed Methodology

General Description

To solve the set goal, the method of analysis of scientific literature was used to justify the use of investment criterion in the calculation of the environmental tax rate, as well as the method of an expert survey – to justify the phased distribution of investments in the implementation of a waste management investment project.

Works of Russian and foreign researchers, peer-reviewed publications of the last decade served as a source of factual and analytical data.

In the online expert survey, employees of regional operators dealing with MSW (22 experts) took part.

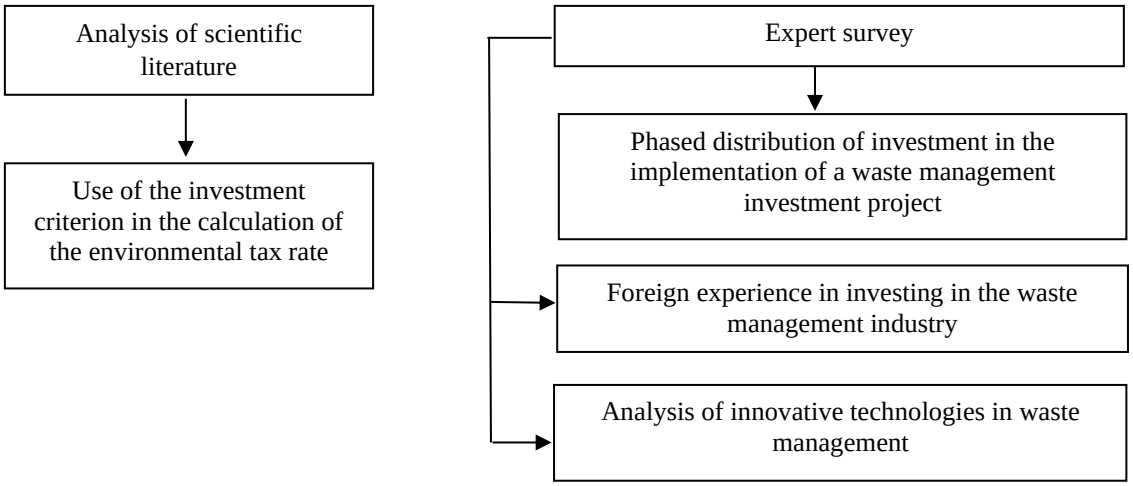
During the discussion of the study results, the experts were asked to characterize the foreign experience of investing in the waste management industry and innovative waste management technologies.

Algorithm

At the first stage of the study, the analysis of scientific literature and the expert survey were carried out, during which the experts substantiated the use of the investment criterion in calculating the environmental tax rate, as well as the phased distribution of investments in the implementation of a waste management investment project.

At the second stage of the study, the expert survey was conducted concerning the stated research problem.

Flow Chart



Result Analysis

Results

The analysis of scientific literature showed that in the case of establishing an environmental tax, the basic decision concerns the tax rate, which determines the effectiveness of the waste management system and its expenditure self-sufficiency.

Theoretically, tax rates are designed to reflect the environmental losses that are caused by a particular product or activity. In other words, these rates are to compensate for the damage associated with such losses and to encourage its reduction. This provision cannot be considered flawless since the purpose of environmental taxes is also to reduce waste, curb the consumption of environmentally harmful goods and, ultimately, change the behavior of both the producer and the consumer.

If the assessment of damage is highly hypothetical, then the methodological approach to the definition of payments may also be different, given that their value is intended to provide financial and economic prerequisites for preventing the occurrence of damage or limiting its manifestation within certain acceptable norms (standards). In this case, the amount of payments is to ensure the creation of a waste management infrastructure and the conduct of operational activities of waste management systems. This allows us to introduce the concept of investment criterion, used to justify the value (rate) of payments. Its essence is associated with the calculation of necessary costs (primarily investment) for the development of the waste management system.

The investment criterion can also be defined as a criterion for covering the costs of waste utilization of final consumption of products or as a criterion for financing organizations involved in waste collection, management and utilization. In terms of the criterion application, the following question arises: what should an environmental payment (tax) be in order to provide the financial basis for the establishment of an appropriate waste management infrastructure within a certain period of time? The answer can be obtained by modeling an appropriate situation and laying the desired amount and technology of collection and management of a particular type of waste. In other words, it is possible to create a clear, transparent calculation scheme based on the experience gained in the implementation of investment projects (both in Russia and in other countries) and, accordingly, on individual (specific) indicators of expenditure – investment and operational (for individual technological operations). A necessary prerequisite is the development of a model and model parameters of the calculation, as well as scenarios as possible variants of the development of the situation (in relation to terms, achievement of certain standards, capacity building rates, etc.).

Table 1 demonstrates one of such calculations based on the example of waste oils. Its scenario provides for a 5-year period of creation of a waste oil collection and regeneration system. The level (norm) of their collection is to reach 30% of their consumption. The functioning of two independent subsystems – collection and regeneration – is taken into account. The cost indicators of waste management systems (investment and operational), which are the basis for the calculation, are determined based on a synthesis of relevant European practices. The

relevant information base was developed, in particular, during the implementation of EU waste directives in Central and Eastern European countries during their accession to the EU (Method of Calculation in the Member States of the Financial Guarantee and Equivalent Insurance pursuant to Art. 6 of Regulation (EC) No 1013/2006 on shipments of waste. A Compilation Document, 2016).

Table 1. An example of forming cost parameters for a waste oil management system.

system development period (years)	oil consumption (thousand tons/year)	rate of collection of waste oil (%)	expected volume of waste oil collection (thousand tons/year)	Waste oil management subsystem	Cost components (euros/t*)	Input of capacities by year and their cost parameters (kt/thousand euros) 1st	2nd	3rd	4th	5th	Total (thousand tons/thousand euros)
5	510	30	≈150	Waste oil collection subsystem	Investment 45	30 thousand tons 1,350	30 thousand tons 1,350	30 thousand tons 1,350	30 thousand tons 1,350	30 thousand tons 1,350	150 thousand tons 6,750
					Operating 58	-	1,740	3,480	5,220	6,960	19,140
				Waste oil regeneration subsystem	Investment 750	30 thousand tons 22,500	30 thousand tons 22,500	30 thousand tons 22,500	30 thousand tons 22,500	30 thousand tons 22,500	150 thousand tons 112,500
					Operating** -	X	X	X	X	X	X

Source: Based on (Method of Calculation in the Member States of the Financial Guarantee and Equivalent Insurance pursuant to Art. 6 of Regulation (EC) No 1013/2006 on shipments of waste. A Compilation Document, 2016). Total: 138,390 thousand euros.
The amount of payment (tax) per 1 ton of oil consumption – 54.3 euros, per 1 kg of oil consumption – 0.054 euros, per 1 liter of oil consumption – 0.048 euros.
*According to the generalized European expert estimates and indicators of Russian developments.
**It is assumed that operating expenses are covered by profit from management. In the future, profit assessment can be a factor in reducing costs.

According to the experts who participated in the survey, in the Russian conditions, there are two possible sources of financing at the local and regional level, through which investments in the waste management industry can be obtained:

1. Financing from local, regional and state budgets;
2. Financing from private sources (public-private partnership).

However, the amount of funding from these sources is unlikely to be sufficient for the simultaneous implementation of a full-fledged waste management project. Therefore, according to the interviewed experts, it is necessary to implement it step by step. Thus, it is necessary to organize the phased distribution of investments including:

1. Provision of equipment and facilities according to the priority needs in the

field of waste management. The most important priority is to ensure environmentally acceptable waste management.

2. Ensuring effective coordination of investments in specific facilities and equipment with other facilities and equipment in order to achieve high effectiveness of each component of the waste management system (according to one of the experts, "investments in equipment for separate collection of recyclable materials should be connected with a plant for processing these materials – and vice versa – because one cannot work without the other").

Accordingly, the experts identified three levels of investment to reflect the priorities of waste management (Kutsuri, et al., 2019; Dyussembekova, et al., 2019; Mustafayeva, et al., 2019):

The first level of priority includes investments that must be made to respond to urgent waste management needs;
The second level of priority investment includes investments that must be made as soon as possible, after the first-level investment;
The third level of priority includes investments that must be made after the first- and second-level investment in order to maximize the benefits of creating a system of MSW management.

Based on expert opinions, Table 2 presents an example of the priority of investment requirements for an investment project for the construction of a new MSW landfill. This table also describes the benefits of each investment.

Table 2. Investment priorities, components and benefits.

Priority level	Investment component	Environmental benefit
First level	New MSW landfill	Hazardous utilization of neutralized MSW poses the main threat to the environment and health. Thus, the construction of a new sanitary landfill is a priority.
	Waste transfer station	With the start of the new sanitary landfill's operation, waste must be transported to it through a new waste transfer station.
	Waste disposal organization	The absence of organized waste collection leads to its illegal dumping, as well as water and soil contamination. Thus, it must be started together with the introduction of the new landfill and waste transfer station.
	Closure of existing landfills	Once the new landfill is operational, all existing landfills must be closed to prevent their long-term periodic use. Appropriate technically prepared closure of these landfills minimizes the environmental risks they pose.
Second level	Recycling facility	In addition to the value of resource recovery, waste management activities reduce landfill waste disposal, considering that some waste elements have a very low level of decomposition.
	Equipment for separate collection of recyclable materials	Recyclable materials are to be brought to the landfill for disposal without separation of recyclable materials at the collection site.
Third level	Batch ground	Due to its degradability, green waste is a significant source of landfill pollution, especially in terms of groundwater, due to contamination of the filtrate and air, through the emission of carbon dioxide and methane. Therefore, its removal from the landfill can significantly reduce environmental risks.
	Landfill for bulky and construction waste	Construction waste usually contains hazardous substances such as asbestos and plaster, which are sources of risks to the environment and health. Its utilization at landfills for safe municipal waste must be prohibited.

Source: Compiled based on the expert survey.

Discussion

When considering the attractiveness of investing in MSW waste management, the experts note that in addition to tax regulation, for example, at the regional level, it depends on the following main factors: high level of concentration of valuable secondary resources in MSW; possibility of placing enterprises for production based on recyclable materials; lack of activity in MSW waste management; lack of an organized market of recyclable materials; absence of competitors engaged in MSW waste management; opportunity to achieve competitive advantages by significantly reducing the cost of production; low cost of labor.

According to the experts, in parallel with waste management, the emphasis should be put on the development and implementation of special mechanisms for the direction of business activities of entities related to waste management. Thus, it is possible to create a complex waste management eco-industry, which includes the following: organization of waste collection and management, specific projects concerning neutralization and utilization of waste, determination of certain directions of the development of the recyclable materials market, justification of specific directions of economic and investment policy, establishment of a computer information system for waste data management, work with the population, etc.

Several experts noted that the issue of strengthening investment activity should be solved in conjunction with the development of the so-called cluster model of MSW management, which refers to the principle of concentration of high-tech industries for the rational management of solid waste located in close proximity to sources of recyclable materials. At the same time, according to one of the respondents, "it is advisable to combine traditional sources of financial resources with new ones, such as venture financing, the main goal of which is financing high-risk projects", including MSW waste management.

Considering the international practice of investing in the waste management industry, the experts name the example of the Nordic Environment Finance Corporation (NEFCO), which participates in a number of projects, including in Russia (The Committee on Environmental Management, State Unitary Enterprise "Krasny Bor Landfill" and NEFCO signed a memorandum of understanding).

The NEFCO is an international financial organization established by five Nordic countries: Denmark, Finland, Iceland, Norway and Sweden. The organization provides investment loans for activities that have a positive environmental impact and are interesting for the Nordic region (Official site NEFCO).

The NEFCO administers numerous funds, the main of which is the NEFCO Investment Fund. The list of areas identified for project financing by the NEFCO Investment Fund includes waste management. The main criteria used in the selection of projects are economic efficiency and positive impact on the environment. Moreover, a project must be of interest to the Nordic countries. Projects that meet the criteria must be based on long-term cooperation through investment in enterprises, creation of joint enterprises or corporate acquisition. Moreover, they must have a Northern European company or institution as a partner. Grants are provided only as an exception as assistance usually includes the financing of a capital fund or medium- and long-term loans and guarantees on market conditions. Loans are provided on market terms. The maximum size of an investment loan is 5 million euros for a project with a payment period of up to 10 years. The maximum grant is one-third of the total cost of the project. When financing capital investments, the share of NEFCO financing does not exceed 50% of the total investment.

Answering questions about investing in existing technological innovations in the field of waste management, the experts note that currently, the most effective way to neutralize MSW is thermal treatment (high-temperature incineration), which reduces the volume of waste by about 10 times. The remains of incineration, no longer containing organic matter, are not capable of spontaneous combustion and decay and do not create epidemiological danger.

At the same time, according to the experts, waste incineration plants of the last generation perform two-stage incineration with a minimum amount of waste of both sorted and unsorted garbage. Neutralization of the prevailing amount of waste is ensured by burning it under special conditions, subsequent absorption of the solid fraction by electrostatic precipitators and scrubbers (wet cleaning systems), catalytic neutralization of gaseous components and final adsorption into solid, monolithic slags that are not harmful for further use.

This is evidenced by the experience of foreign countries, which is currently dominated by thermal method of MSW treatment. In Japan, 82% of garbage is incinerated and only 14% is taken to landfills. These indicators for the US are 81% and 12% and for Denmark – 90% and 9%, respectively (Puna and Santos, 2010).

In Russia, the project of a multipurpose continuous melting unit entitled "Magma" has been developed. In the proposed high-temperature and waste-free technology, incineration of unsorted MSW is carried out in an oxygen atmosphere on the surface of a slag solution superheated to 1,500-1,690°C, which is created based on the mineral component of garbage. The temperature of the gas phase in the unit reaches 1,800-1,900°C. Resulting slag is periodically drained from the furnace. Strong and dense, it does not emit harmful substances and can be used in the production of building materials. Ash captured by the gas cleaning unit is returned by special ejectors to the melting chamber and is completely assimilated by the slag. The disadvantage of this project is the lack of sorting and utilization of MSW.

Another method of processing waste is plasma arc gasification. This method entails the decomposition of MSW into molecules under the action of plasma at a temperature over 1,200°C and the output of ash, solid mineral waste and synthetic gas. From the point of view of environmental safety, it is currently considered one of the most promising methods since this technology allows to economically and safely process waste without special preparation. The fuel extracted with the help of a plasma arc gasifier has a wide range of uses since its composition does not differ from natural gas. Synthetic gas can be liquefied or used to heat residential and industrial premises. It is also possible to generate electricity from it. Another advantage of this utilization method is the ability to process not only new waste but also what has long been "buried" at landfills (Gomez, et al., 2009). According to one expert, "this method of waste management is not cheap, it requires substantial investments. However, landfills in Russia have accumulated a lot of waste, so investments in the production of synthetic fuel from free raw materials will fully pay off in 5 years".

Currently, according to the experts, pre-sorting is becoming widespread. This progressive method significantly reduces the load on waste incineration plants, while ensuring the utilization of over 50% of MSW components. According to the experts, "if city residents sort waste themselves, there is no need for sorting lines".

In countries, where there is no developed waste pre-sorting by city residents, the solution to the waste problem, according to the experts, can be the construction of waste management complexes that can be built next to waste incineration plants and include a sorting line and a landfill for the disposal of a small amount of unusable remains after incineration.

According to the experts, the use of waste management complexes incinerating solid waste using modern technologies and full compliance with environmental requirements are a priority investment in waste management – both in terms of accumulated and newly created solid waste.

Conclusion

The results of the study confirm the hypothesis that tax regulation of attracting investments in the waste management industry must be based on the use of investment criterion in the calculation of the environmental tax rate. It is necessary to gradually allocate investment in the implementation of an environmental project based on innovative waste management technologies.

However, the modern practice of investment support of waste management indicates that projects concerning secondary use of resources have not received a proper distribution, which leads to excessive accumulation of waste. This requires the expansion of the investment corridor to attract investment in the field of waste management.

Moving the focus from incinerators and landfills to the creation of recycling complexes with sorting of solid waste is a progressive global trend. This direction is ecologically safe and economically expedient and can be considered the most perspective for the states with the lacking or underdeveloped infrastructure of MSW sorting, including Russia.

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