

DOI: 10.20542/0131-2227-2023-67-5-100-110 EDN: WNZGYZ

PECULIARITIES, ECOLOGICAL AND ECONOMIC RATIONALE OF INTERNATIONAL WASTE TRADE IN THE RUSSIAN FEDERATION

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Received 21.11.2022. Revised 18.01.2023. Accepted 01.02.2023.

Acknowledgements. This article was prepared as a part of the state assignment by the Karelian Research Centre of RAS “Comprehensive Research and Development of the Fundamentals of Sustainable Development Management of the Northern and Border Zones of Russia in Global Challenges”.

Abstract. Despite the low proportion of recycled waste against the total one generated in the Russian Federation, it is imported into the country specifically for recycling. At the same time some of the generated waste is exported. The purpose of this study is to assess the current waste export and import indicators in Russia and any dialectical and institutional constraints on increasing the rate of waste recycling, which determine the ecological and economic rationale of international waste trade operations. The main sources of data featured reports of the Federal Customs Service and the Federal Service for Supervision of Natural Resources, and the Unified Interdepartmental Statistical Information System and UN Comtrade databases. Econometric methods, cluster analysis of Russian regions, analysis of any regulatory impact and content analysis of laws and regulations were applied and carried out within the study. It is demonstrated that the external waste-related economic operations in the Russian Federation have certain peculiarities against other countries. Their being in place is driven by both dialectical and institutional factors. However, the actors’ opportunistic economic interests rather than the environmental ones and the extent of the country take the lead. Some tools to reduce the transaction costs of transboundary waste movement and to increase the waste management efficiency are proposed. The study is novel in that it analyzes the foreign waste trade transactions of Russia that have not been comprehensively studied before. The theoretical relevance of the research consists in its finding new factors that drive the transboundary waste movement. Recommendations on improving the export and import regulation, reducing the rate of waste generation and increasing the recycling one in Russia, which would both enhance the economic efficiency of companies and provide equitable solution to environmental problems faced by the country, are of practical value.

Keywords: waste export, waste import, transboundary waste movement, international trade, waste disposal, waste recycling, waste management, dependence on imports, economic risks of exporting.

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ОСОБЕННОСТИ И ЭКОЛОГО-ЭКОНОМИЧЕСКАЯ ЦЕЛЕСООБРАЗНОСТЬ ВНЕШНЕЙ ТОРГОВЛИ ОТХОДАМИ В РОССИЙСКОЙ ФЕДЕРАЦИИ

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Статья поступила 21.11.2022. После доработки 18.01.2023. Принята к печати 01.02.2023.

Аннотация. Несмотря на низкую долю утилизации образующихся в РФ отходов, некоторые их виды импортируются в страну для переработки, а другие вывозятся за рубеж. В статье анализируются особенности российских внешнеэкономических операций с отходами, определяются их причины. Показано, что сейчас основную роль играют не экологические, а текущие экономические интересы задей-

ствованных в таких операциях акторов. Рассматриваются возможности сокращения транзакционных издержек по трансграничному перемещению отходов, а также повышения эффективности обращения с ними.

Ключевые слова: экспорт отходов, импорт отходов, трансграничное перемещение отходов, внешнеэкономическая деятельность, утилизация отходов, переработка отходов, обращение с отходами, импортозависимость, экономические риски экспорта.

Благодарность. Статья подготовлена в рамках выполнения государственного задания КарНЦ РАН “Комплексное исследование и разработка основ управления устойчивым развитием северного и приграничного поясов России в контексте глобальных вызовов”.

INTRODUCTION

Waste is a significant aspect of foreign economic activity for all countries. In the 20th century, transboundary movement of waste was primarily associated with the tightening of environmental regulations in developed countries. Waste was exported to developing countries to minimize the negative impact on the environment in developed countries [1], since it was cheaper and easier to export waste than to dispose of it locally [2]. For instance, China, for example, was the largest importer of plastic waste. In 2017, before the country banned the import of 240 types of solid waste, including plastic waste [3], the share of Chinese imports, on a global basis, was 44.94% [source 1]. Moreover, more than 2/3 of imported plastic waste was annually buried or improperly disposed of [3].

In the 1990s, with the spread of the circular economy model in developed countries, waste began to be considered a valuable resource [4]. The capacity of waste management enterprises has grown; in a number of states, the demand for waste has exceeded the volume of its generation. Hence, for example, Swedish companies began to buy waste in Norway.

Currently, the Russian Federation is engaged in both the export and import of waste. At the same time, the presence of legislative acts restricting the transboundary movement of waste, as well as the implementation of a number of environmental programs, is not sufficient to explain the import of waste into the country by redistribution of the environmental burden between developed and developing states. Additionally, the argument that waste import occurs due to a lack of capacity in waste management enterprises is also questionable. What is the reason for foreign economic operations with waste in the Russian Federation, and what are their peculiarities, economic and environmental feasibility? Why is waste both exported and imported simultaneously?

This study aims to assess the current characteristics of waste export and import in Russia,

as well as the institutional restrictions on increasing the level of waste management, which determine the environmental and economic feasibility of foreign trade operations with waste. The relevance of the study is determined by the importance of maintaining a high-quality environment for public health and biodiversity conservation, as well as the need to ensure the competitiveness of Russian business entities.

The main sources of data were the reports of the Federal Customs Service, the Federal Service for Supervision of Natural Resources (Rosprirodnadzor), the database of the Unified Interdepartmental Statistical Information System, and the UN Comtrade. The study utilized econometric methods, cluster analysis of the Russian regions, an analysis of the regulatory impact, and a content analysis of regulatory legal acts.

The foreign economic operations of Russian economic entities with waste that have not been comprehensively studied before, were systematically considered, and their qualitative and quantitative differences from the operations of actors in other countries were determined. The theoretical significance of the study lies in the establishment of new factors determining the transboundary movement of waste, which can be divided into dialectical and institutional ones. The practical value includes recommendations for improving waste export and import regulation in the Russian Federation, along with proposed measures and tools to reduce waste generation and increase waste management, which will enhance economic profitability and address environmental concerns.

LITERATURE REVIEW

Scientific research devoted to the issues of the transboundary movement of waste has been conducted since the 1980s, when the problem of waste export from developed to developing countries received active coverage [1]. Traditional landfills poison the soil and surface waters and emit significant amounts of greenhouse gases. At the same time, they occupy

a significant area and require maintenance costs [5]. Waste management reduces the anthropogenic load on ecosystems and slows down the growth of landfills, meanwhile decreasing the need for primary resources [6, 7]. On the example of plastic waste, it has been confirmed that the export of waste increases its formation and subsequent consumption [8]. Therefore, export, rather than waste management, is a simpler method of ensuring environmental safety [2].

Transboundary movement of waste is sometimes associated with the so-called “out of sight” principle [9]. It is also driven by the lack of capacities for managing the entire volume of waste or its individual types, and the varying costs of disposal in different countries, both financial and transactional. The unwillingness of the local community to have landfills on its territory (the “Not in my backyard” movement) and the lack of space for waste storage also have a significant impact [10].

The tightening of environmental legislation increases the import of waste, mainly to less developed countries [11]. Moreover, the movement of waste from developed to developing countries is considered from the standpoint of both ethics (discrimination against residents of certain countries and violation of their rights) and economics (in some regions, landfills are a significant source of income for the population) [12]. In addition, the factor that increases the volume of foreign trade operations with waste is the presence of a common border and language, and the deterrent factor is the remoteness of the territories [11].

Economic crises that worsen financial conditions and reduce the turnover of activities, primarily of small and medium-sized enterprises being the key actors in the management of many types of waste, can lead to an increase in their imports. In particular, the latter is predicted in Russia in relation to biological and medical waste as a consequence of the *COVID-19* pandemic [2].

Currently, the main international agreement governing the export and import of waste is the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, which establishes the voluntariness and expediency of waste movement as the main regulations (the regulations governing the nonhazardous wastes are defined by the World Trade Organization [13]). In practice, the principles of the Basel Convention are far from being always observed, and this is mainly due to the spread of illegal waste trafficking [11]. Herewith, despite special attention to hazardous waste, its illegal

transboundary movement continues to grow [14]. In general, illegal foreign trade operations with waste are performed with the help of forged documents and are associated with the desire of participants to reduce their costs [15].

While summarizing the review of previous studies, it is worth noting that the environmental and ethical consequences of waste export from developed to developing countries were mainly considered (for example, [9, 16, 17]), as well as illegal transboundary movement (in particular, [15, 18, 19] were devoted to these issues). The main types of waste studied were as follows: plastic [3, 8, 18, 20], electronic [17, 21, 22], and toxic waste [16, 17, 23]. The analysis of the transboundary movement of waste was significantly complicated by the lack of data on many types of waste [12], and the difference in their definitions and classifications in different countries [24]. This study was particularly aimed at the consideration of the import and export of a wide range of waste within one country – the Russian Federation, previously not systematically studied, rather than binary deliveries from one country to another. This would allow identifying the features and causes of domestic foreign trade operations with waste.

METHODS

This study used the data from the Federal Customs Service, the Federal Service for Supervision of Natural Resources (Rosprirodnadzor) and the Unified Interdepartmental Informational Statistical System, as well as the UN Comtrade database. Due to the fact that the primary statistical form No. 2-TP (waste), provided by legal entities and individual entrepreneurs and processed by Rosprirodnadzor, only contained information on the import of waste that was imported with no direct need, information about the volumes of export and import was given in accordance with the data of customs accounting. However, the peculiarity of statistical accounting in the Russian Federation allowed for obtaining quite unique information – the volume of imported waste that had not been managed for at least a year.

This study analyzed six main types of waste:

- plastics, foreign economic activity commodity classification code (TNVED) 3915;
- paper, TNVED4707;
- glass, TNVED7001;
- precious metals, TNVED7112;
- ferrous metals, TNVED7204;

- primary cells, batteries and electric accumulators, parts of equipment or hardware, TNVED8548 (hereinafter referred to as electronic waste).

Econometric methods were used to analyze the data. A hierarchical clustering of regions of the Russian Federation was performed according to the share of recyclable production and consumption waste using the pair-group method with arithmetic averages and squared Euclidean distance; the number of clusters was determined by the similarity index. The Russian and international regulatory legal acts were assessed using the analysis of regulatory impact and content analysis.

RESULTS

Today there is no well-functioning waste management system in Russia. In 2021, 0.05 billion tons of municipal solid waste [source 2], as well as almost 8.45 billion tons of production and consumption waste, were generated. Herewith, only 6.46% and 46.40% of both types of waste, respectively, were utilized (18.88% were recycled) [source 3]. In most regions (more precisely, in 69 regions), on average, only 10.71% of waste was recycled (Fig. 1). Most of the unmanaged waste ended up in landfills, although some of it was exported (the share of exported waste in the total amount of managed waste was 67.11% [sources 3, 4]). Despite such a low

percentage of managed waste, the Russian Federation not only exports it, but also imports it: the share of imported waste was 12.7% of the volume of generated waste [sources 3, 4].

It should be noted that among all types of waste, ferrous scrap made up the largest share (96.8%) in exports by weight (Fig. 2). Metal recycling also exists in Russia, but its price is higher abroad. Among the rest of the waste, paper and plastics were prominent. Although Russian waste paper is more expensive than European paper, Europe appreciates the quality of Russian paper: it has gone through a smaller number of processing cycles, and it has a higher proportion of virgin fiber, which leads to greater production of new paper. The largest importers are Türkiye, the Republic of Belarus, and South Korea. The Russian Federation imports ferrous metals, paper, glass and plastic waste from abroad (Fig. 3). The largest exporters are Kazakhstan, the Republic of Belarus, and Jordan.

When the structure of exports is considered based on its value and not on the weight of waste, the ratio of individual groups of waste will be similar: ferrous metal waste – 97.78%, paper – 1.37%, plastics – 0.36%, etc. The structure of imports for price indicators differs from the one for the physical indicators: precious metals – 48.63%, ferrous metals – 43.38%, plastic – 3.56%, paper – 2.89%, electronics – 0.58%, and glass – 0.96%. This is due to the fact that the cost of imported precious metals

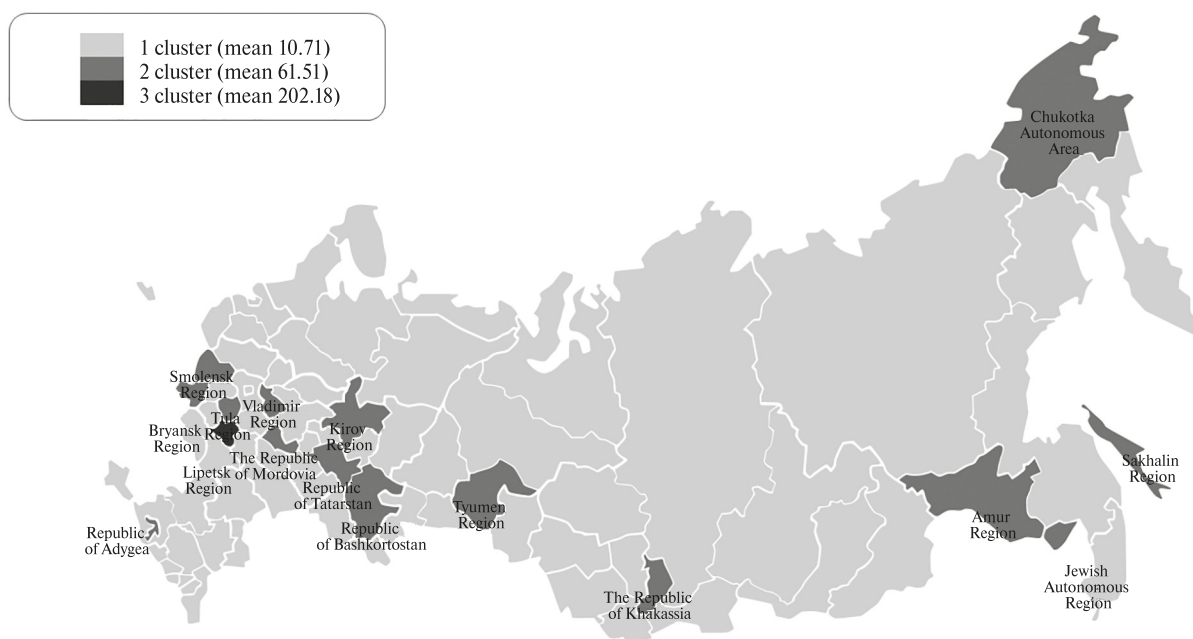


Fig. 1. Clusters by the share of production and consumption waste disposed of for recycling in 2021, %
 Calculated from: [source 3].

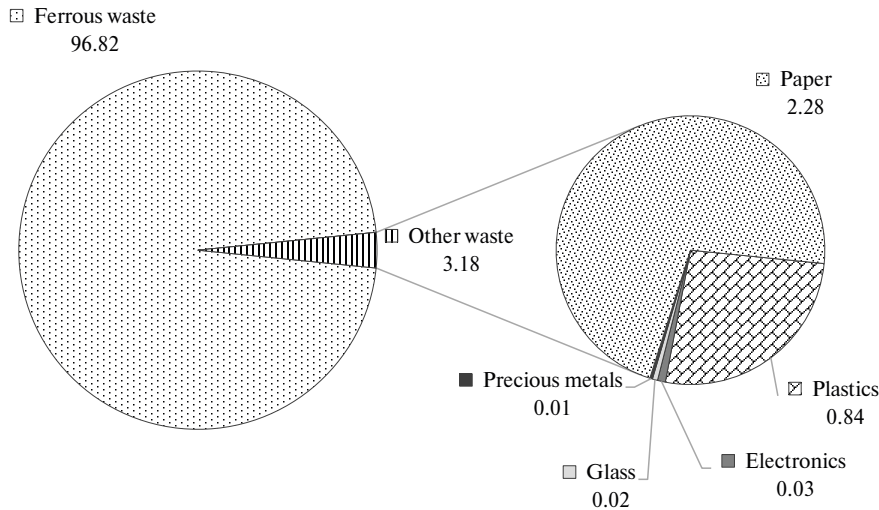


Fig. 2. Share of waste in Russian exports by weight, 2021, %
 Calculated from: [source 4].

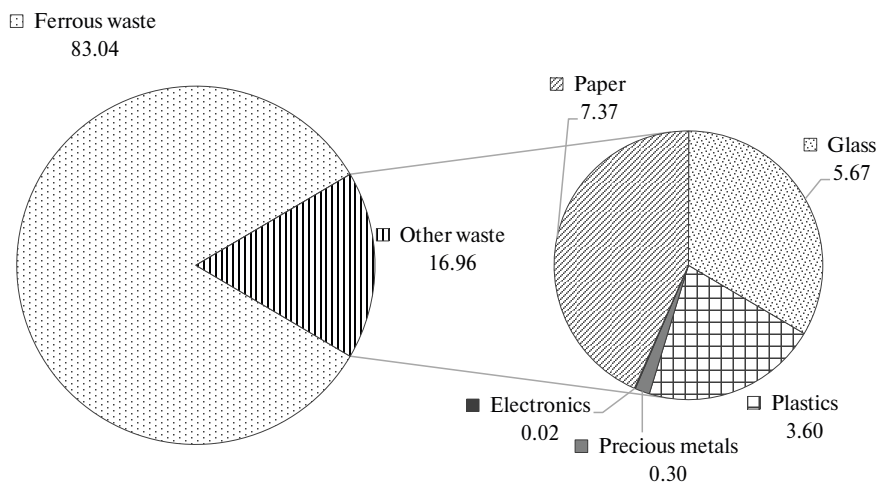


Fig. 3. Share of waste in Russian imports by weight, 2021, %
 Calculated from: [source 4].

and electronics in comparison with those exported is significantly higher (Table 1). At the same time, imported glass and ferrous metals are cheaper than exported ones.

The ratio of exports and imports shows that Russia mainly exports waste of ferrous metals and paper, and imports waste of glass, precious metals, and plastics. In physical indicators, the export of electronic waste exceeds its import; however, due to the lower price of domestic waste in value terms, the ratio is the opposite.

The leaders in the import of waste are the Bryansk and Tver Regions, as well as Moscow. The leaders in the export of waste are the border regions: the

Kaliningrad Region, St. Petersburg (marine border), and the Kamchatka Region (Fig. 4). Imported waste is mostly recycled; however, in 2019–2021, the share of imported waste that was not managed during the year decreased from 0.69% to 0.01% (Table 2).

The export of waste hinders the growth of places for its storage and disposal, but it can be considered economically inefficient: the export of finished products from recycled raw materials would be more profitable, and the recycling itself would reduce the needs of companies for new resources and, accordingly, would reduce the anthropogenic load to the ecosystem. At the same time, the situation whereby existing waste is not recycled in Russia,

Table 1. Excess of exports over imports for various types of waste for 2021, %

Indicator	Plastics	Paper	Glass	Precious metals	Ferrous metals	Electronics
Physical volume	93.05	123.48	1.16	17.16	464.56	709.76
Total value	25.68	121.99	4.42	1.47	578.97	54.67
Average unit price	27.59	98.80	381.97	8.57	124.63	7.70

Calculated from: [source 4].

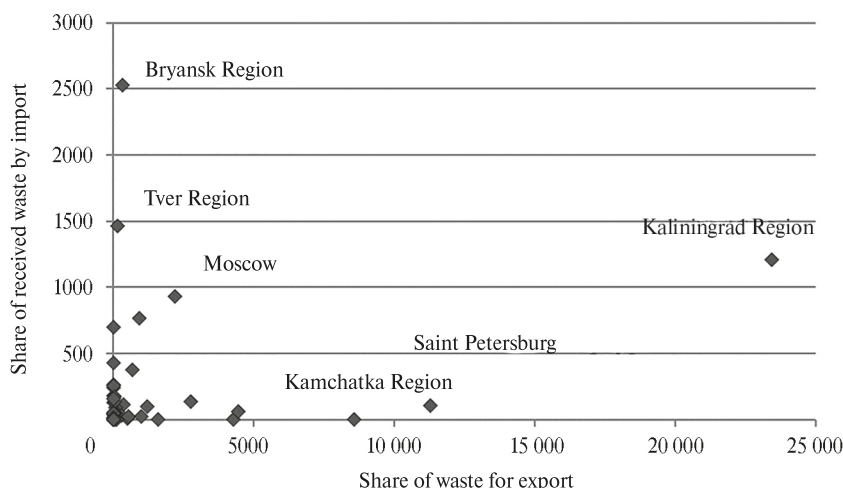


Fig. 4. Distribution of Russian regions by the share of exported and imported waste in the total volume of their generation in 2021, %

Calculated from: [sources 3, 4].

but is purchased abroad for recycling, may seem paradoxical. What are the reasons? First of all, it is the lack of high-quality domestic raw materials due to the following aspects of institutional imperfection.

1. The existing institutions maintain low interest in recycling among business entities and regional operators responsible for the treatment of municipal solid waste. Since 2017, Russian companies are required to dispose of the generated waste or pay an environmental fee within the established norm. At the same time, the increase in standards is performed quite quickly. For example, already in 2020, it was necessary to ensure the recycling of 45% of corrugated paper, cardboard and packaging, and 30% of tires, tire casings, and rubber tubes, as well as other rubber products. While taking into account

the limited number of waste receiving and processing plants, especially in small peripheral regions, the achievement of such indicators is possible only if the producers organize their own waste disposal. At the same time, this requires significant changes in the production and technological process, which is difficult to do in such a short time and requires a sufficiently large volume of investments. In this regard, many companies decide to pay an environmental fee rather than recycle waste, and their partial export allows for reducing the amount of the fee.

With regard to regional operators, it should be noted that their tariff and, consequently, income are determined by the standards for the accumulation of municipal solid waste. Accordingly, the existing institutional system does not contribute to the

Table 2. Estimated share of nonrecycled waste received by import

Indicator	2019	2020	2021
Import by data:			
Federal Customs Service, thousand tons	1 185 198	644 578	1 070 288
Federal Service for Supervision of Natural Resources, thousand tons	823	41	14
Share of imported waste that was not recycled during the year, %	0.69	0.06	0.01

Calculated from: [sources 3, 4].

formation of interest among regional operators in reducing the volume of generated waste or independently transferring it for recycling. At the same time, in recent years, the receipt of proceeds from the sale of secondary resources no longer leads to a decrease in the required gross proceeds of regional operators. Therefore, at least the institutional trap was leveled, leading to the reluctance of operators to transfer waste to processors.

2. Institutional support is provided not only for the labor-intensive process of introducing waste reuse but also for the easier process which implies the production of refuse-derived fuel (RDF) and solid recovered fuel (SRF) from them [25], as well as energy generation as a result of combustion, gasification, and pyrolysis. The reason for this was the inclusion of waste incineration into the processing process to generate energy in 2019. Herewith, the use of waste for energy purposes retains the need for new primary resources, including nonrenewable ones.

It should also be noted that waste incineration does not completely destroy waste [26], and their hazard class increases [27]. Waste incineration results in harmful emissions into the atmosphere (for example, CO₂) [5, 28]. Gasification, when compared with waste incineration, imposes higher requirements on waste, and the difference between the resulting emissions is insignificant [29]. Pyrolysis requires sorted raw materials [30], which, in order to preserve its quality parameters, are better directed not to pyrolysis, but to processing. However, pyrolysis, despite being more environmentally friendly [31], is more energy-intensive [32] and less profitable [31] than gasification.

In general, using RDF fuel is environmentally safe and economically efficient only for the cement industry [33]; therefore, the demand for it is limited. There is an excess of power in the energy system of Russia, and the cost of energy from waste is higher than that of the traditional one. Taking into account the violation of the qualitative characteristics of waste, the economic feasibility of the processes under consideration is absent. Despite this, part of the waste is directed to the production of fuel and energy: for example, waste incineration plants are being built within the framework of the Rostec state corporation, RDF fuel is produced in the Moscow Region, its production is planned, as well as the production of SRF fuel in St. Petersburg. A complex for pyrolysis is being built in the Leningrad Region.

Similar to export, the import of waste is associated with a number of positive and negative consequences.

On the one hand, it is the import of waste that allows overcoming the dialectical contradiction of the transition to sustainable development of territories and a well-functioning system of waste management. It is obvious that the organization of waste collection in the absence and shortage of capacities for its processing has extremely low profitability, and sometimes it is unprofitable. At the same time, processors need raw materials to open new industries, and at the initial stage, imported waste can be used to meet existing needs.

On the other hand, import increases dependence on the external economic and geopolitical situation. At the beginning of 2022, for a number of companies, for example, Kama Plant of Polymer Materials LLC, import restrictions led to significant financial difficulties. Some risks are also associated with the transformation of the environmental policy of the partner countries, which may lead to a decrease in the volume of available raw materials. Kazakhstan, for example, has banned the export of waste paper; in the Republic of Belarus, waste paper processing and the export of resulting products have become a priority. The important issue is that the use of high-quality imported raw materials reduces the interest in organizing waste sorting and collection in Russia. Therefore, the waste of citizens and enterprises continues to end up in landfills.

Importing waste is associated with the risks typical for any import: currency and economic risks, as well as increased transport costs and the cost of final products, etc. There are also environmental risks: imported waste may not be recycled due to changes in plans of the importing company and end up in a landfill. In general, despite the noted negative consequences of waste import, its expediency is due to the need to overcome the dialectical contradiction in the organization of waste collection and processing. It also should be noted that import restrictions can be regarded as covert protectionism, which is prohibited in accordance with the rules of the World Trade Organization.

Ensuring the environmental safety of the territories requires monitoring and regulating the transboundary movement of waste. Existing administrative procedures should be sufficient, but not redundant. At present, in the Russian Federation, a permit for the movement of waste must be obtained for each transaction, and many documents must be provided [source 5], and a fairly large state fee of 325,000 rubles must be paid [source 6]. It would make sense to consider the possibility of issuing integrated

permits for the movement of several batches of waste, as well as to determine the amount of the state fee depending on the type and volume of waste.

It should also be noted that a number of Russian economic entities have already given priority not to the import of waste, but to the organization of its separate collection. As an example, the EcoPartners group of companies could be cited, which in order to provide the necessary raw materials for the Tver Polymers Recycling Plant LLC being part of the group, provides services for the ecologization of production and economic activities within the framework of the EcoTechnologies agency and produces containers for waste collection, presses and reverse vending machines (Rzhev mash plant).

The efforts of individual business entities will be more successful if they are supported at the state and municipal levels. This requires, in particular, the following:

- financial and organizational support for enterprises focused on recycling rather than destruction of waste for the production of fuel and energy;
- creation of processing capacities at the regional level within the framework of ecotechnoparks and industrial clusters;
- stimulation of actors to industrial symbiosis and transfer of waste to those who can use them as raw materials;
- reduction of transaction costs for the supply of waste to processors due to the popularization of auction sites;
- cancellation of the reverse charge VAT for those collecting raw materials [source 6]: although such a measure leads to a decrease in the share of shadow business, waste collectors have additional costs for calculating and paying VAT, and this is a significant problem for one of the key categories of tax payers – individual entrepreneurs on a simplified taxation system, which are exempt from payment of other types of VAT;
- introduction of standards for containers to facilitate their recycling;
- ensuring full coverage of waste disposal in sparsely populated areas;
- decrease in tariffs for waste removal with a decrease in the volume of mixed waste;
- abolition of the tax on personal income upon receipt of funds for all types of delivered secondary

raw materials (now a similar measure is in force in relation to waste paper [source 6]);

- increase in the level of environmental literacy and responsibility of the population.

It can be assumed that the construction of a well-functioning domestic waste management system will lead to a significant reduction in both export and import transactions.

CONCLUSION

Russian import of waste, when compared with similar operations in many developing countries, is characterized by a small level of imported non-recyclable waste that ends up in landfills, and in recent years, its volumes have only been declining. Unlike a number of developed countries, no excess in demand for waste over the volume of its generation is observed within the country. The main reasons for foreign trade operations in the Russian Federation can be considered the contradictions in the formation of the waste management system, as well as the imperfection of the institutional space. A significant role is played not by environmental, but by the economic interests of actors, including those that are not of national economic importance: the implementation of projects having low environmental effect, but bringing significant profits (construction of waste incineration plants, etc.).

As in other foreign trade operations, the spatial extent of the country is of great importance and often determines the economic feasibility of exporting or importing certain products. Thus, Russia not only exports but also imports natural gas. In 2021, due to the purchase of 8.18 billion m³ of gas in Kazakhstan, the Russian regions bordering this country were provided with gas [source 4].

The need to meet the needs of processing enterprises for raw materials in order to support and develop them makes it necessary to regulate the import of waste into the country. Herewith, in order to reduce the transaction costs of market participants, it is worth considering the possibility of issuing integrated permits for the movement of waste and determining the size of the state duty depending on the waste type and volume. At the same time, while taking into account the fact that the import of waste is associated with high risks, slows down the introduction of closed cycles in the Russian economy, and export leads to shortfalls in income for actors, priority should be given to increasing the share of domestic waste sent for processing, in particular, due

to the measures and tools proposed by the authors of the study.

In general, for ecology and the economy, the most preferable option for solving the problem of waste is not to ensure its management but to reduce its overall

level during the processing of that waste that cannot be avoided. Therefore, it is necessary to encourage buyers to exercise conscious consumption, reduce the volume of used packaging by opening stores that sell goods in containers brought by customers, installing water dispensers, etc.

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