PROBLEMS, OPPORTUNITIES, AND DEVELOPMENT PROSPECTS OF WASTE RECYCLING AND LEGAL MANAGEMENT IN UZBEKISTAN.

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Abstract. This research work examines waste recycling, which is one of the most pressing contemporary issues in Uzbekistan, alongside the challenges and opportunities within its legal management. It explores the projects to be implemented for the advancement of the recycling sector and analyzes its future prospects. The article studies the global and local impacts of modern-day waste, its negative consequences, the current state and significance of the waste recycling industry, and the dilemmas and capabilities in the legal regulation of this sector. Furthermore, the study analyzes the norms of national legislation, insights from international experts, and global best practices. Additionally, it highlights various scholarly opinions on enhancing the waste recycling industry in Uzbekistan and introduces original proposals formulated by the authors.

Keywords: waste, recycling, industry, legal management, environmental safety, efficient use of resources, environmental policy.

Introduction

Today, environmental protection and sustainable development have emerged as critical global challenges. Population growth, industrial development, and urbanization processes are driving a sharp increase in the volume of waste generation. Uzbekistan is no exception to these global issues. Consequently, effective waste management, recycling, and the mitigation of their adverse environmental impacts constitute key priorities of state policy. *"According to World Bank data, more than 2.24 billion tons of municipal solid waste are currently generated globally each year, and this figure is projected to reach 3.5 billion tons by 2050. Despite this, only 19–20% of waste is recycled worldwide, while the remainder is landfilled or incinerated, resulting in damage to the atmosphere."*[1] The waste problem is considered not only an environmental issue but also a global economic challenge. *"According to research by the Nations Environment Program, improper assessment of problems causes hundreds of billions of dollars in losses to the global economy annually."*[2]. In Uzbekistan, this issue is also quite serious, with millions of tons of municipal waste being generated in the country, yet a large portion of it is not recycled. The failure to address these problems leads to not only environmental but also economic challenges, as emphasized above.

The objective of this article is to comprehensively analyze the current state of the waste management and recycling system, mitigate the aforementioned issues, identify challenges based on global experience, and develop scientifically grounded proposals and recommendations for the development of this sector under the conditions of Uzbekistan.

[1] World Bank. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. – Washington, DC: World Bank, 2018.
[2] United Nations Environment Programme. *Global Waste Management Outlook*. – Nairobi: UNEP, 2015.

2. The Impact Of The Waste Problem Globally And On Uzbekistan

2.1 Global approaches to the waste problem.

In his message on the occasion of the International Day of Zero Waste, United Nations Secretary-General António Guterres emphasized: "Humanity is generating over 2 billion tons of municipal solid waste annually. Rotten food, plastic bottles, electronics full of chemical substances, and many other items are simply thrown into landfills instead of being recycled, leaving our water, land, and air out of account. As a result of waste decomposition, greenhouse gases are emitted into the atmosphere, which leads to global warming, contamination of water and soil, adverse health impacts, diseases, and even deaths worldwide." Today, there are a number of problems and deficiencies in waste recycling and disposal. In particular, these include a low culture of waste sorting, a lack of infrastructure and financial resources in waste recycling, and several similar issues. *"Not all countries possess sufficient economic and technical capabilities to resolve this problem. 2.7 billion people lack access to such waste collection services. Merely 61–62 percent of this waste is processed at specialized facilities."* [3]

"In Uzbekistan, polymers and plastics account for nearly 50 percent of the generated waste, while the remaining portion consists of organic waste. However, because waste is not segregated at the household level, 60–70 percent of the raw materials arriving at recycling plants end up contaminated, making their processing technically expensive and rendering it virtually impossible."[4] This demonstrates that challenges in waste recycling depend not only on state-led reforms and policies but are also, to some extent, connected to the population. In countries with highly advanced waste recycling industries, such as Japan and Germany, the population's culture of waste sorting is at an equally high level alongside the waste manufacturing industry itself. Specifically, *"In Japan, specific rules have also been developed for the population regarding waste sorting."*[5]. The development of such rules in Uzbekistan would also help increase the culture of waste sorting among the population.

Solid waste disposal is a severe and widespread problem in many developed and developing countries, as well as in urban and rural areas. The generation of solid organic waste is increasing sharply worldwide every year. Domestic or municipal waste typically originates from variable sources encountered across various human activities. A number of studies have shown that municipal solid waste generated in developing countries primarily consists of variable quantities produced by households (55–80%), markets or commercial areas (10–30%), and industries, streets, institutions, as well as many other enterprises. The diversity of such municipal solid waste represents the main obstacle to its sorting and utilization as a material. The sorting and segregation of such waste is one of the most critical and traditional methods, where the stages of municipal solid waste management are essential to provide data on the quality of the segregated fractions for any potential utilization.

[3] Qalampir.uz 2025-yil 29-oktabr. : https://qalampir.uz/uz/news/dunedagi-chik-indilar-%D2%B3azhmi-yiliga-3-5-milliard-tonnaga-yetishi-mumkin-126333

[4] Researchgate.net Nurmetov Ismoil Alimbayevich WASTE MANAGEMENT IN UZBEKISTAN: LEGAL FRAMEWORKS, INVESTMENT PROJECTS AND SOLUTIONS – 2026y.: (PDF) WASTE MANAGEMENT IN UZBEKISTAN: LEGAL FRAMEWORKS, INVESTMENT PROJECTS AND SOLUTIONS

[5] 3d-universal.com **Trash Sorting Rules by Ward in Tokyo (2025 Edition) –** 2025.: Trash Sorting Rules by Ward in Tokyo (2025 Edition) - Study English at 3D ACADEMY, a Language School in Cebu, Philippines

Today, environmental pollution by waste stands as one of the most fundamental ecological challenges on a global scale. In fact, the decomposition of municipal solid waste requires thousands, or even millions, of years. By dumping unsorted waste into a landfill, humans resolve their immediate problem, meaning they rid their homes of waste. Typically, the decomposition period for plastic items can reach up to 1,000 years. Plastic bags frequently used in our daily lives decompose in 100 to 1,000 years, while plastic containers degrade in 450 years or more. Aluminum cans break down over more than 500 years. Currently, this type of waste is widespread across our planet. Aluminum cans are toxic, and harmful substances are released due to the oxidation that occurs during the decomposition process. Glass, on the other hand, is usually a highly convenient material for recycling, as it is manufactured from sand, a natural raw material. New glass can be produced by melting down glass items. Surprisingly, however, if glass is discarded into landfills, it takes a million years to decompose.

2.2 Waste Recycling Industry in Foreign Countries

When it comes to the experience of developed countries, *"Germany ranks 1st in the world for waste recycling with a rate of 68 percent. Out of 52.8 million tons of generated waste, 35.9 million tons are recycled, 31 percent is incinerated for energy production, and only 1 percent is discarded into landfills."*[6] The main reason for Germany achieving this result is that *"since 1991, a system of separate waste collection has been introduced across 6 containers based on type: organic waste, paper, colored glass, plastic, and general waste. Public participation in this regard stands at 82 percent. The ecological awareness of the population and their proactive stance are considerably higher and more remarkable compared to situations in other nations. Since 1991, the 'Der Grüne Punkt' (The Green Dot) system has been in operation—manufacturers pay a fee ranging from 1 to 2 percent of the product's value for packaging recycling. The country also possesses a massive infrastructure, with 98 waste incineration plants, 1,850 waste sorting complexes, and 12,400 waste recycling companies operating in Germany. An investment of 18 billion euros is attracted to the recycling industry annually. 280,000 people are employed in this sector."*[7] The application of substantial fines for non-compliance with established rules in waste recycling, combined with the provision of tax incentives for sorting and the attainment of high recycling rates, helps minimize the amount of waste discarded into landfills and enhances recycling capabilities. As the measures implemented are yielding effective results, the German model is being actively studied by other nations. This information further demonstrates that the development of the waste recycling industry in a country requires not only large-scale infrastructure and capital but also the active participation of the population in waste sorting.

The United Nations is urging bold global action to combat environmental pollution caused by waste, calling for a transition to a circular economy, innovation in manufacturing, the utilization of renewable energy sources, and an increase in extended producer responsibility to transform waste into a valuable resource rather than treating it as a problem.

2.3 Problems in Uzbekistan

[6] Yuz.uz Jahon miqyosidagi muammo: chiqindilar tabiatga yuz yillab zarar yetkazadi https://yuz.uz/uz/news/jahon-miqyosidagi-muammo-chiqindilar-tabiatga-yuz-yillab-zarar-etkazadi

[7] old.eco.uz 2025-yil https://old.ecouz.uz/news-page/view/71

"More than 7 million tons of greenhouse gases are emitted into the atmosphere from landfills, and 43 thousand tons of toxic filtrates seep underground. According to data, out of 7 million tons of municipal solid waste collected in our republic's territories in 2021, 1.8 million tons were recycled, bringing this indicator to 26 percent. Last year, 2.2 million tons or 32.4 percent of 6.8 million tons of municipal solid waste were recycled, while the remaining 4.6 million tons of municipal solid waste were deposited into landfills. According to research, it takes a million years for glass bottles, 450 years for plastic beverage bottles, 80–200 years for aluminum cans, 100 years for power batteries, 50–80 years for rubber boots, 50 years for plastic cups, leather, and tin cans, 30–40 years for nylon fabric, and 25–40 years for leather shoes to decompose and disappear."[8] From this situation, it can be understood that life itself demonstrates how any type of waste discarded onto the ground causes serious harm to the atmosphere, the environment, our soil, water, and certainly to our health. Our state is developing rapidly, the population is growing, and today nearly a thousand types of waste are recorded, with their numbers predicted to increase even further in the future.

Currently, there are many waste-related problems in Uzbekistan, which manifest themselves in the following:

1. **Low recycling rates:** Today, only a very small portion—approximately 5–10%—of the waste generated in our country is recycled. The remaining massive portion is buried in landfills or dumped in unauthorized locations.
2. **Lack of a sorting culture:** A system and habit of segregating waste into categories has not yet been formed among the population. There is a high level of indifference among the public, and they do not pay serious attention to the issue of waste.
3. **The state of landfills:** Most of the existing waste landfills do not meet international sanitary and ecological standards. They cause fires to break out as a result of contaminating underground water and releasing methane gas into the air.
4. **Construction and electronic waste:** As a result of increased construction in recent years, construction waste has risen sharply, yet a system for its disposal is virtually non-existent. Furthermore, there is a lack of collection points for toxic electronic waste, such as batteries and household appliances.

To address these problems, not only citizens but also enterprises and their executives must adopt a more attentive attitude toward our nature, our health, and our atmospheric air.

2.4 Measures being taken and legal frameworks regarding waste-related problems in Uzbekistan

A fair amount of research is being conducted in our country as well regarding this issue, and necessary measures are being taken to improve the situation. As an example of these: *"In the Strategy for the Management of Solid Municipal Waste in the Republic of Uzbekistan for the period of 2019–2028, approved by Resolution No. PP-4291 of the President of the Republic of Uzbekistan dated April 17, 2019, along with the closure and recultivation of 167 landfills with a total area of 1,108.6 hectares, tasks were set to create 54 modernized landfills with a total area of 693.3 hectares on the sites of existing landfills, and to construct 5 landfills with a total area of 80*

[8] https://uza.uz/uz/posts/ekologik-muvozanat-yaxshilanishi-uchun-chiqindilar-samarali-boshqarilishi-zarur-video_684047

hectares."[9] *"However, in foreign countries, optimal solutions have been developed and legal mechanisms have been established in order to reduce the number of landfills. There are 221 waste landfills across the Republic, with areas ranging from 0.5 hectares to 70–80 hectares. The lifespan of most landfills is 20–30 years. Operations at these landfills have been carried out without sufficient attention being paid to waste disposal requirements in a timely manner"*[10]. According to the recently approved Strategy for Municipal Solid Waste Management in the Republic of Uzbekistan, it is planned to optimize the condition of waste landfills. Based on this, the number of landfills in the republic will be reduced, leaving 59 of them. It aims to establish modern landfills by attracting funds from international financial sources, while the remaining landfills will be recultivated and closed in accordance with standards. Global experience shows that once municipal waste landfills are filled, gas extraction pipes are installed in them, and they undergo recultivation. That is, the waste heaps are covered with soil, landscaped by planting trees and plants, and returned to the state land fund.

"Enterprises must reconsider their approach to the products they manufacture, minimize packaging materials that go straight to landfills, and maximize the durability and lifespan of products as much as possible. Consumers, on the other hand, should think seriously about the goods and items they purchase and, whenever possible, submit them for recycling or reuse them. Governments at all levels must develop a circular economy that allows for addressing resource depletion and management issues, as well as invest in modern waste disposal programs that encompass the reuse, recycling, recovery, and prevention of waste generation. At the same time, the global community must unite and work on preparing a legally binding international treaty aimed at ending plastic pollution," said António Guterres, putting forward suggestions that could serve as a solution to the problem.

Through waste recycling, it is possible to both reduce its environmental impact and generate profit. To this end, the Ministry of Ecology, Environmental Protection, and Climate Change, in cooperation with foreign investors, has developed a series of projects.

Another important step has been taken in the field of waste management. In 2025–2027, it is planned to build 8 plants in our country that will generate electricity and produce goods by incinerating municipal waste. In this regard, joint development agreements have been signed between the Ministry of Ecology, Environmental Protection, and Climate Change of the Republic of Uzbekistan, the Ministry of Investments, Industry, and Trade, the Ministry of Energy, and a total of 6 major companies from the People's Republic of China, the United Arab Emirates, and the Republic of Korea.

3. Reforms implemented towards developing the waste recycling industry in Uzbekistan.

The most important issue is raising the ecological culture of the population. Look at the street or any place today. You will see waste left behind by people everywhere. We call our motherland sacred. Why do we not keep it clean and tidy? After all, even our sacred books state, "Cleanliness is part of faith." Why are the mass media and neighborhood activists not sounding

[9] PQ-4291-сон 17.04.2019. 2019-2028-yillar davrida O'zbekiston Respublikasida qattiq maishiy chiqindilar bilan bog'liq ishlarni amalga oshirish strategiyasini tasdiqlash to'g'risida

[10] https://natureandproblems.blogspot.com/2015/06/chiqindilar-muammosi.html

the alarm on this matter? Where are our elders and our public? Of course, such problems cannot be solved through administrative means alone. This can be achieved by cultivating a sense of belonging to mother nature in the hearts of the younger generation. We need to establish an environment and accustom people so that when they see someone littering in the neighborhood or on the streets, they will say, "What you did was wrong." This is the duty and human obligation of all of us," emphasized the President of the Republic of Uzbekistan, Shavkat Mirziyoyev.

"During the meeting held with the President, topical issues in this regard were also discussed. Concerning this, the President's press service emphasized that substantial work is being carried out in our country regarding waste recycling and generating alternative energy sources from them; in particular, within the framework of the 'Sustainable Solid Waste Management' project implemented in cooperation with the Asian Development Bank, it is envisaged to purchase waste collection machinery, waste containers, excavators, and other special transport vehicles, while at the same time, 19 solid municipal waste landfills will be returned to the local government's land reserve based on their recultivation."[11]

"Furthermore, implementing the following measures in the field of municipal waste is included in the programmatic goals of the Ecological Party of Uzbekistan. In particular, the following were strictly established: – increasing the volume of municipal waste recycling to 60 percent, and reaching the amount of industrial waste recycling to 40 percent; – improving the legal mechanism aimed at encouraging public-private partnership principles and the market management system in the field of industrial and municipal waste management; – banning the import of waste into the territory of the country, including any types of hazardous waste from abroad, for the purpose of storage and disposal; – widely introducing technologies for utilizing waste as an energy source. In addition, it was also mentioned that each region in Uzbekistan will have its own specialization in the field of waste recycling. Specifically, it was highlighted that a $270 million construction waste recycling project will be implemented in Tashkent, an $18.5 million electronic waste recycling project in Samarkand, and that fertilizer and energy will be produced from organic waste in neighborhoods."[12]

According to the information from the head of state's press service, more than 2 trillion soums have been allocated to the sector over the last three years, and the Agency for Waste Management and Circular Economy Development was established on the basis of Presidential Decree No. 5 dated 04.01.2024 "On measures to improve the waste management system and reduce its negative impact on the ecological situation." *"1,200 units of new machinery were provided for waste enterprises, and waste collection points were built in neighborhoods. Furthermore, business opportunities were opened up and a favorable business environment was created in the sector, which was previously under state monopoly. In particular, corporate income tax and social tax rates for sanitary cleaning and waste recycling enterprises were set at 1 percent. Machinery and equipment imported from abroad were exempted from import duties. As a result, nearly 200 sanitary cleaning and 290 waste recycling enterprises were opened."*[13]

[11] https://kun.uz/news/2022/02/02/chiqindi-muammosi-boyicha-yangi-choralar-belgilandi

[12] https://www.gazeta.uz/oz/2025/08/15/waste/

[13] PF-5-сон 04.01.2024. Chiqindilarni boshqarish tizimini takomillashtirish va ularning ekologik vaziyatga salbiy ta'sirini kamaytirish bo'yicha chora-tadbirlar to'g'risida

In our country, 14 million tons of municipal waste are generated annually. However, the recycling rate is low. As a result of projects in recent years, this has now reached 5 percent. A quarter of municipal waste consists of paper, plastic, rubber, glass, and textile residues. By recycling them, products worth 1 trillion soums can be obtained. Waste-to-energy generation projects are being supported. Chinese investors are building such plants in 6 regions.

"According to the interview given by the Minister of Ecology, Environmental Protection, and Climate Change, Aziz Abduhakimov, 15 main types of waste requiring special attention were identified during the meeting. Among them, the presence of pharmaceutical and medical waste, organic waste, toxic and radioactive pollution was emphasized. It was noted that these 15 types of waste will be distributed among the regions, and each region will launch an experience focused on waste recycling according to its own specialization; in particular, $270 million in investments will be attracted to recycle construction waste in the city of Tashkent, electronic waste recycling with a total investment of nearly $18.5 million will be established in the Samarkand region, and initially, all regions will cover all types of waste as an experiment, and this reform will later be expanded to other areas"[14]. Furthermore, it has been specified that a modern waste removal system will be introduced at the district level, under which waste will be delivered to waste transfer stations using new machinery and compact equipment, including electric scooters, and sorting operations will be carried out there before the waste is delivered to incineration plants.

According to the minister, it was noted that waste recycling is becoming an economically beneficial sector with a large potential for creating new jobs. It was established that projects will be implemented in every neighborhood to remove organic waste, create fertilizer from it, and generate electricity by obtaining biogas from it.

As stated by Sharifbek Hasanov, the Director of the Agency for Waste Management and Circular Economy Development, the President approved the construction of compost processing plants in remote districts. It was noted that these facilities will process sewage waste into gas and fertilizer for agriculture. Within the framework of this project, it was also mentioned that sewage waste will be removed from excavated pits, with one facility established in each district, to produce compost from the waste, first extracting its gas, then neutralizing the rest, and utilizing it as fertilizer for agriculture. The fact that state bodies are not indifferent to the above-mentioned problems, and that eliminating waste issues and developing their recycling industry is being studied not only at the state policy level but also on an international scale, proves how urgent and impossible to ignore these problems are.

4. Proposals helping and serving as solutions for the waste recycling issue

The problem of waste recycling is not just simple cleaning, but an issue connected with the economy, ecology, medicine, and the social system. Below, we present our proposals developed to eliminate the above-mentioned problems:

- **Deposit system for plastic and glass containers –** When beverage containers and products in plastic packaging are sold, a small additional fee is added to their price, for instance, say 500 or 1,000 soums, and when the container is returned, this amount is refunded to the citizens as an incentive. This is similar to the German model, and this method works very well in Germany, with 90% or more of containers being returned. Waste will decrease, and the ecological literacy level of the population will improve.

[14] Toshkentda qurilish chiqindilarini qayta ishlashga $270 mln investitsiya yo'naltiriladi – Spot

❖ **Production of compost and biogas from organic waste —** this direction is one of the most effective and fast-yielding methods of waste recycling, as 40–50% of total municipal waste is organic (food scraps, leaves, fruit and vegetable waste). The problem is that, under normal circumstances, organic waste is dumped into landfills. There, it decomposes in anoxygenous (oxygen-free) conditions, and as a result, methane gas is formed. This process is called anaerobic decomposition. If we focus on its worst and most harmful aspects, methane is a greenhouse gas 25 times more potent than CO_2, creates odor and harmful bacteria, contaminates groundwater, and is lost (wasted) as energy. If we apply the composting method as a solution, meaning how it works, organic waste decomposes in an environment where oxygen is present and turns into fertilizer. This process is called composting. As a result of applying this, natural fertilizer (which replaces chemical fertilizer) is produced, soil fertility is increased, and the volume of waste is reduced by up to 50 percent.

❖ **Biogas production –** how does this method work? Organic waste is placed in a special closed reactor, decomposes without oxygen, and gas is released. This process is called ***Anaerobic digestion***. As a result, useful chemical gases, biogas (methane), and energy (electricity, heat, gas) are generated, while fertilizer can be obtained from the residual mass. In this regard, we believe that this method will be a highly beneficial proposal for both the atmosphere and the country's economy.

Conclusion

The results of this study show that the issue of waste management and recycling is today a complex problem that possesses not only ecological, but also economic and social significance. The growing volume of waste on a global scale, the placement of most of it in landfills without being recycled, and the resulting damage caused to the environment bring about the necessity of implementing radical reforms in this field. In particular, taking into account that globally only about 20 percent of waste is recycled, while the remaining part poses an ecological hazard, the urgency of this problem becomes even more apparent.

As studied during the research, the waste problem is a serious threat to Uzbekistan as well. Although millions of tons of municipal waste are generated in our country every year, a relatively small part of it is recycled. This leads to the expansion of waste landfills, the release of harmful gases into the atmosphere, and the pollution of land and water resources. Especially, the insufficient formation of a waste sorting culture, the underdeveloped infrastructure, and the inadequacy of financial mechanisms complicate the existing problems even further.

At the same time, the results of the study also showed that there are certain positive shifts in developing this sector in Uzbekistan. Measures taken by the state, such as the adoption of strategic documents, investment projects, the establishment of modern landfills, and the involvement of the private sector in the recycling industry, are laying the foundation for significant changes in the field. In particular, the work being carried out on generating energy from waste, increasing the volume of its recycling, and introducing the principles of a circular economy can be evaluated as a promising direction.

Analysis of foreign experience shows that a comprehensive approach is necessary for effective waste management. In countries such as Germany and Sweden, the establishment of a waste sorting system, the high ecological culture of the population, strict legal mechanisms, and economic incentive tools have been important factors in achieving high results. These experiences can also be applied to the conditions of Uzbekistan in an adapted manner.

The proposals put forward within the framework of the research, in particular the introduction of a deposit system, the production of compost and biogas from organic waste, the development of the recycling industry, and the elevation of the ecological culture of the population, are recognized as practically justified and effective solutions. Especially, the possibility of not only reducing the volume of waste but also creating additional sources of energy and fertilizer through the recycling of organic waste increases the strategic importance of this direction.

In conclusion, improving the waste management system is one of the crucial conditions for ensuring sustainable development in Uzbekistan. To achieve effective results in this field, it is necessary to strengthen cooperation between the state, the private sector, and society, introduce modern technologies, and elevate ecological awareness and culture. Only through a comprehensive and systematic approach is it possible to reduce the waste problem and transform it into an economic resource.

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