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Waste management system in Buryatia (Russia) and ways to reorganise it based on the Asian countries' experience

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Abstract. Waste accumulation leads to pollution of atmospheric air, soil, surface water and groundwater. Russian waste management practice is storage in landfills and dumps, and incineration in specialised plants. Today the percentage of recycling is low. In this article we analyse foreign experience of Asian countries on separate waste collection (China). Introduction of information technologies and encouragement of citizens for separate waste collection - a basis of system of the waste management in the People's Republic of China. The current situation and identified problems in the Republic of Buryatia show the necessity of separate waste collection. We proposed the ways of reorganization of the waste management system, its development directions and also highlighted its socio-economic and environmental effects.

1. Introduction

In the twenty-first century, the waste management system has become a serious problem. According to the Russian Ministry of Natural Resources and Environment (MNRE), there are 8 cubic metres of waste per inhabitant of Buryatia per year. The amount of waste generated in the republic has increased since 2010 by 31,671 million tonnes (or 2.89 times) amounting to 48,397 million tonnes. Only four waste disposal facilities in Buryatia are included in the State Register of Waste Disposal Facilities (SRWDF). The remaining sites have the status of unauthorized ones and continue to operate being not included in the SRWDF, despite the ban since 01 January 2010.

The current waste management system in Buryatia is based on burial and incineration. Of the entire mass of waste, no more than 10% goes to recycling, and the main volume goes to landfill, reducing their lifespan, incurring extra costs, and withdrawal of additional land for landfills.

There is no separate collection of waste from households in Buryatia. Basically, in large municipalities with comfortable housing, the collection of waste as secondary material resources (scrap ferrous and nonferrous metals, polyethylene, paper and cardboard) is organized [1,2]. The current waste situation in the republic requires an urgent solution – using the positive experience of Asian countries on waste sorting. MNRE specialists believes that in Russia it can be implemented faster than it was done in China, which had spent more than 10 years for its introduction [3].



2. Materials and Methods

In this study, we analysed experience of Asian countries (China), and conducted a sociological survey of residents of Buryatia aged 20 to 30 (40 respondents). The aim of this study is to analyse the applicability of waste separation practices used in the PRC to transforming the existing waste management system in Buryatia.

3. Results and Discussion

According to our findings, a culture of waste management needs to be developed amongst the population of the republic before reorganisation can take place (Table 1).

The first step towards the introduction of selective waste collection in China was the legislation of the Regulation on Household Waste Management in July 2003. Waste was divided into several categories with corresponding colour of waste bins on the streets.

Table 1. Results of the social survey of residents of Buryatia.

Question	Answer (%)		
	Yes	No	Do not know / no answer
1. Do you know about selective waste collection in Buryatia?	39	71	-
2. Do you know that waste in Buryatia is partially recycled?	21	63	16
3. Do you know that some of the waste cannot be recycled?	9	13	78
4. Do you use recycled items?	11	86	3
5. How would you like to receive information on sorting, identifying and recycling waste:			
- <i>Media</i>	4		
- <i>Social media</i>	57		
- <i>Mobile applications</i>	39		
6. Are you ready to sort your waste?	61	13	26

Then the PRC authorities introduced fines to deal with unscrupulous residents who put rubbish in one bag. Fines for individuals were up to 200 yuan (30 USD), and for organisations up to 50,000 yuan (7,000 USD). Foreigners and tourists who sort rubbish improperly (or just litter) also pay fines.

Currently Chinese authorities track some residential complexes by the QR code on rubbish bags. Cases of improper sorting are easily tracked, and sanctions follow. Correct sorting is rewarded with a sum of 0.1 yuan (about 1 RUB). The next step was to provide incentives. Each citizen is awarded points for correctly sorting waste, which are used to buy household items and affect their credit rating. So, if the number of points is between 600 to 1000, a person can take out a loan of 500 thousand yuan (approximately 5 million RUB) without tedious checks. A person with a rating below 300 will not even be able to buy a long-distance transport ticket. Chinese residents are actively training in environmental literacy. For example, in Shanghai a Zero Waste Shanghai community has appeared whose activists (Chinese and foreigners) hold various events, master-classes developing careful attitude to the environment. The official website provides useful information about Zero Waste initiative in China. The community cooperates with Chinese eco-shops and brands [4].

China's waste sorting experience is so effective that it is currently one of the few countries that imports waste. Having introduced a compulsory system for sorting waste into 4 types: compostable, solid, toxic and recyclable, the Chinese authorities faced the disapproval of people. The indignation was caused by difficulty in determining which category this or that object belongs to [5]. IT technologies came to their rescue. Based on WeChat, a popular application in China, a service for waste identification was created. In only 3 days since launching, the number of its users has reached as much as 1 million. It has become much easier to sort waste without doubting and spending time for identification.

The main function of the app is sorting advice, waste identification and O2O (online-to-offline) recycling. Using the app through either typing, a voice assistant or camera, a user can easily obtain a response about waste type and recycling options, and even sell waste to recycling platforms online. Registration is simple and requires only valid phone number or a social network account [6]. International experience has proved that the introduction of separate waste collection is realistic and profitable. For Buryatia, this practice can be implemented through the use of effective incentives.

Here are 3 basic components to do a breakthrough in this direction:

1. A positive incentive for separate waste collection can be a differentiated tariff (bonuses and discounts on housing and utilities for separate waste collection) for the account of reducing municipal solid waste. Those who do not separate waste will pay the full tariff. Tax exemption for entrepreneurs engaged in sorting and recycling of waste and on preferential terms providing space for collection of recyclable waste.
2. IT technology can help the republic cope with the rubbish crisis. On the basis of Chinese experience and a Moscow pilot project TrashBack with cashback, we suggest introducing a waste-separation programme in Buryatia through creating a mobile application for separate waste collection.

The functions of the application are as follows:

- ordering and delivery of recyclable waste bags. Each bag has a unique QR code, which after being scanned is assigned to the owner.
- tracking the path of the rubbish bag to the recycling points.
- notification of bag acceptance for recycling.
- points are awarded for each bag accepted for recycling, which can be spent in the city's shopping centres and pay up to 30% of the purchase amount.

In addition to this programme we propose to launch a start-up programme in Buryatia. All PET products produced in the republic should be labelled with a QR code. Its purpose is to advise on sorting, identification and further recycling of waste [7], because not all the material can be recycled after sorting. For example, clear plastic bottles are recyclable while bottles made of coloured plastic (e.g., brown ones, beer or kvass) cannot be recycled. Glass bottles and jars of any colour, and metal and white plastic lids are recyclable without restrictions. If the lids are coloured plastic, however, they are not recyclable [8]. To retrieve the encrypted information, simply scan QR with smartphone's camera and get information on recycling and disposal options for the item [7].

3. Recyclable raw materials should be in demand and have a market: ballpoint pens, composite panels, manhole covers, tiles, composite boards from tetra Pak; toilet paper from waste paper; non-woven materials (fleece) from recycled plastic; glass wool from glass, etc. Economic incentives for producers of recyclable materials, and easing the tax burden on transactions is a proven tool [9].

The reorganization of the waste management system in Buryatia through proposed mechanism can give the following effects:

A) Increasing the culture of waste handling among the population. Every citizen will be able to contribute to preservation of environment.

On the republic' scale waste sorting can provide the following benefits:

- creation of additional jobs at recycling plants.
- making profit from the sale of recycled products.
- reducing the population's expenses.

B) In Buryatia the need to allocate large areas for landfills and burial sites will disappear, that will improve the appearance of urban and rural areas, leading to the stability of ecosystems.

4. Conclusion

A review of China's waste management experience revealed some specific approaches in separate waste collection that can be disseminated to other regions, and first of all, to Buryatia, known for its invaluable natural wealth. It should be noted that moving of ecologically advanced countries to their modern condition was not immediate, and took decades for solving waste management issues. Often these countries had much smaller landfill space, but high potential of social responsibility. In Buryatia, as globally, the ultimate goal should be to reduce consumption and making informed purchasing decisions.

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