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CONSUMER CHALLENGES WITH WASTE SORTING AT LATVIAN HOUSEHOLDS

Jelena Titko

EKA University of Applied
Sciences,
Riga, Latvia
E-mail: jelena.titko@eka.edu.lv
ORCID 0000-0003-1333-0941

Laura Zarane

EKA University of Applied
Sciences,
Riga, Latvia
E-mail: laura.zarane@gmail.com

Tatjana Tambovceva

Faculty of Engineering Economics
and Management, Riga Technical
University, Latvia
E-mail: tatjana.tambovceva@rtu.lv
ORCID 0000-0002-9516-1530

ABSTRACT. The research goal is to evaluate the challenges of waste management at Latvian households. Latvian citizens were surveyed using the authors' developed questionnaire. Test for internal consistency using Cronbach alpha was performed to evaluate the quality of the questionnaire's scales. Data was analyzed applying the methods of frequency analysis, rank correlation (Spearman rho coefficient), Mann Whitney U test. The main identified problem for Latvian consumers was a limited availability of waste sorting containers. Besides, the research revealed a low motivation of Latvian consumers. Financial matters were identified as the most important motivating factors. This pilot study was aimed at technical testing the measurement scale and preliminary testing of some hypotheses. The authors' developed scale can be used for a large-scale study, or cross-country research. The results provide a background for further investigation of people intention to participate in waste management or reasons why people refuse. This research distinguishing itself from others its focus on factors affecting citizens' attitude toward waste sorting and their motivation.

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Introduction

The introduction should briefly place the study in a broad context and highlight why it is important. It should define the purpose of the work and its significance. The current state of the research field should be reviewed carefully and key publications cited. Please highlight controversial and diverging hypotheses when necessary. Finally, briefly mention the main aim of the work and highlight the principal conclusions. As far as possible, please keep the introduction comprehensible to scientists outside your particular field of research. According

to the Global Waste Management Outlook, the total volume of waste on the planet continues to grow significantly, and it is expected to achieve 3.8 billion tonnes by 2050. Statistics shows that 38% of the world's total waste is not recycled or disposed of in landfills. (UNEP, 2024) The total amount of waste generated in Latvia significantly increased since 2018 that was driven by the largest waste categories, in particular household waste. (European Environmental Agency, 2025) EU waste management targets are 60% household waste recycling and 10% waste disposal in landfills by 2035, whereas Latvian current indices are equal to 44% and 53%, respectively. Based on this data, Latvia is considered to be at risk of not achieving EU target goals.

Waste management issues are frequently discussed in the academic literature. Latvian researchers are also quite active in this field (Kubule et al., 2019; Vesere, 2022; Cudecka-Purina, 2025). There are also a good number of surveys conducted in Latvia and related to household waste (Bormane et al., 2023; Melece et al., 2016). However, these papers were focused on general attitudes to the waste management or specific waste types. There is a lack of systematic distinguishing between the factors affecting citizens' behaviour in the context of waste management in households. In turn, this study does not aim at analysing attitudes or behaviour, but instead explores the factors that motivate individuals to sort waste—or, conversely, those that diminish this motivation.

The closest to our study are the surveys conducted by the largest Latvian waste management company "Getliņi" Ltd. (Saulitis, 2024) and the Ministry of Environmental Protection and Regional Development (VARAM, 2021). Despite the similarities of the idea, these previous institutional researches did not test scale reliability, statistical hypotheses, or motivational structures. Besides, they were conducted before major policy changes: deposit and return system (DRS) introduction in 2022 (UNESDA (2024) and mandatory bio-waste collection system in 2024 (European Environmental Agency, 2025).

The goal of the research was to examine the challenges of waste management in Latvian households - focusing specifically on waste sorting - and to identify both the motivating and hindering factors. To achieve this goal, 181 Latvian citizens were surveyed, using the authors developed questionnaire. The main limitations for this study was a limited and unbalanced sample (80% females among the respondents). However, this pilot study allowed checking the quality of the measurement scale and preliminary testing of some hypotheses.

The current research revealed that the main factors that hinder waste sorting in Latvian households include: 1) a reluctance to spend time on the activity; 2) a lack of interest; and 3) limited or inconvenient access to sorting containers. In turn, the key motivators for sorting are: 1) the availability of containers in urban areas; 2) potential financial savings; 3) higher fees for unsorted waste; and 4) awareness of landfill overcapacity, along with accessible information on the importance and methods of sorting. Behavioural aspects that have not been sufficiently addressed in previous Latvian studies. Understanding the factors affecting citizens' attitude and behaviours helps in developing effective programmes to encourage sorting and recycling in Latvian households.

This research contributes to the academic literature twofold: 1) methodological contribution, by testing the developed measurement instrument for future large-scale or cross-country research, and 2) empirical contribution, by providing up-to-date data after the integration of the deposit system and bio-waste collection in Latvia that was not available in the earlier studies.

The paper consists of five main parts. The Introduction is followed by the Literature review that provide theoretical insights in waste management, as well as substantiation for the formulated research hypotheses. The Methodology part describes the research instrument and provides the results of the internal consistency test. The Results section summarizes key

outcomes of the survey, indicating the most frequently mentioned reasons for waste sorting and refusing, as well as main motivating factors. The Conclusion part provides a summary of the results and discusses directions for further investigation.

1. Literature review

Circular economy is focusing on the extension of the life-cycle of resources. “In the transition toward a more resource efficient and circular economy, resources used to produce goods are minimized and kept in use as long as efficiently possible and waste is diminished” (de Sa & Korinek, 2021). Thus, the transition toward circular economy presumes “moving beyond the perception of ‘waste as a problem’ to ‘waste as a resource’” (Hollins et al., 2017).

Waste management system in the EU is established around the five-step “waste hierarchy”, created within the Waste Framework Directive (European Union, 2008). World Health Organization (2024) suggested an extended version of the waste hierarchy (*Figure 1*), adapted from Whiteman et al. (2021).



Figure 1. Waste hierarchy

Source: *World Health Organization (2024)*

The waste hierarchy offers a general framework for categorizing different waste management methods, ranking them from the most environmentally sustainable to the least sustainable. This hierarchy provides a broad classification system for the management of different solid wastes, categorizing the methods that are most or least environmentally desirable (Ravichandran & Venkatesan, 2021). The hierarchy clearly shows which types of waste management are preferable and which, on the contrary, should be eliminated. The waste hierarchy is also the main principle that guides EU waste policy, placing waste prevention as a top priority and serving as a cornerstone of the circular economy. However, it should be noted that in practice, waste prevention is often given minimal attention, namely that EU Member States are hardly obliged to actively reduce waste.

Another point is that waste prevention cannot be confused with recycling. A real waste prevention involves reducing packaging, limiting production and limiting overall consumption (Ginevicius, 2022; Gedvilaite & Ginevicius, 2024). This requires significant social and cultural changes to reduce waste generation at source. However, such changes directly challenge the EU's current economic growth model, which prioritizes the opposite: increased production and consumption (Wegmann, 2020).

In an ideal case, waste management model that everyone globally should be moving towards is the Zero Waste model. Zero waste business models focus on reducing waste, and

maximally reusing and recycling resources (Khalil & Nimmanunta, 2023). Zero-Waste concept is one of the promising and an effective way to solve the waste management & recycling issues (Awasthi et al., 2021).

This clearly highlights the need to reduce consumption, shift the focus from ownership to sharing, eliminate the usage of single-use items and ensure that all existing materials remain in continuous circulation without being damaged or destroyed in waste management processes. This approach helps reduce the extraction and use of non-renewable resources, thereby lowering our eco-logical footprint (InOff Plastic, 2024).

Effective waste sorting is a crucial step toward reduction of waste, therefore, a basis for implementation of zero-waste approach (Bogusz et al., 2021; Prodyanatasari et al., 2024; Solekah, & Jumriyah, 2023). Waste management, including waste sorting issues, have been investigated by many researchers through national or cross-country surveys (*Table 1*).

Table 1. Surveys on waste management

Source	Country/ Region	Number of respondents	Details
ING (2020)	North America; Europe Australia; China; India; Japan; Singapore	15 001	Questions on shopping/choice criteria/habits, as well as waste sorting and general waste reduction potential in households
Abdullah et al., (2017)	Malazia	398	Households' awareness, knowledge and understanding of waste management and reduction, waste storage and collection problems, household satisfaction with waste managers customer service
Lazo et al. (2022)	Bolivia	105	Investigation of waste generation and its components in households
NSW Environment Protection Authority (2016)	Australia	2100	Investigation of the drivers of waste recycling, the quality of individual waste sorting, the availability of sorting containers and the quality of service.
Jorissen et al. (2015)	Italy and Germany	859	The investigation of the amount of food waste generated by households, as well as their food shopping habits.

Source: Authors' compilation

The current research is focused on revealing the motivating and demotivating factors affecting citizens' attitude toward waste sorting, and, consequently, their behavior.

Besides the analysis of the responses, the authors formulated two specific hypotheses within the research. The first hypothesis assumes the relationship between household income and citizens' engagement in waste reduction activities.

H1: Residents with higher incomes are more active in their waste reduction activities than residents with lower incomes.

The similar hypotheses were tested previously (Omotayo et al., 2020; Viscusi et al., 2020; Daoud et al., 2025). The results are controversial. For instance, Valenzuela-Levi (2019) stated that "The recycling gap within metropolitan areas does not necessarily mirror the existent income inequality". In turn, Konstantinidou et al. (2024) concluded that "people who received higher incomes had more opportunities and resources for participating in pro-environmental activities". "income level moderates the relationships between attitude and recycling intention"

H2: There is a statistically significant difference between women's and men's attitudes towards waste reduction.

The second hypothesis was formulated, following the results of many studies devoted on gender differences in perception of circular economy, green values and sustainable behaviors. For instance, some researchers tested the statement that women are more likely to adopt sustainability-oriented behaviors (Mutand & Haron, 2012; Dhir et al., 2021; Hannibal & Vedlitz, 2018; Martinho et al., 2015). The conclusion made by Handayani et al. (2018) is that "...women and older people have better waste management compared to men and younger people."

2. Methodological approach

To achieve the research goal, the authors conducted a survey among Latvian citizens. The research instrument was developed, based on previously conducted surveys. (ING, 2020; German Environment Agency, 2020; VARAM, 2021; Saulitis, 2024) The structure of the questionnaire is reflected in Table 2.

Table 2. Structure of the questionnaire

Part	Question	Type of the question; responses
A	Respondent profile	Gender, age, family status, household size, education, income level, employment status
B	Waste sorting and waste reduction, general questions	B1: Attitude toward Green Deal B2: Waste reduction activities B3: Waste sorting B4: Attitude toward landfills
C	Waste sorting, specific questions	C1: Types of sorted waste C2: Reasons for sorting C3: Reasons for not sorting C4: Motivation for sorting

Source: Authors' developed

The current paper does not reflect the results of the responses to questions B1 and B4. Besides, only "gender" and "income" have been used as variables for hypotheses statement and testing. The reason is focusing on waste sorting only and pilot nature of the research. The authors plan a separate investigation of the impact of social-demographic characteristics on attitude towards waste management, based on data from the larger sample.

181 respondents participated in the survey, 80% of them were females. The majority of respondents were in the age groups 35-44 years, 25-34 years, and 45-54 years (33.1%, 28.7%, and 14.4%, respectively). 81.2% or 147 respondents had higher education, 18.2% - secondary education. 53% of respondents assessed their income level (including salary, pension, benefits, scholarships, etc.) before taxes as high (over 1537 euros/month). 37% of respondents noted that their income level is average (701-1537 euros), and only 5% of respondents noted that their income level is low (up to 700 euros), or the respondents' salary does not exceed the minimum monthly salary set in Latvia (700 euros, gross).

C3 and C4 scales were tested for internal consistency using Cronbach's alpha (α) (Table 3).

Table 3. Internal consistency of C3 and C4 scale

Labels of C3 statements	α if item deleted	Labels of C4 statements	α if item deleted
No information	0.886	Fines for non-sorting	0.752
No interest	0.879	Financial savings	0.749
Don't want to spend time	0.878	Containers in the urban environment	0.756
There are no containers at home	0.878	Overcrowding of existing landfills	0.725
Rare waste collection	0.880	Construction of new landfills	0.723
The bill does not change	0.880	Information on why and how to sort	0.739
No trust in recycling	0.876	Rarer waste collection	0.755
Containers are not easily accessible	0.877	More frequent waste collection	0.731
Difficult	0.878	EU fines	0.771
There is no room at home	0.878	Nothing	0.784
There is no pay for it	0.880	No opinion	0.785
This should be done by municipality	0.879		
Family is against	0.881		
Don't believe in environmental impact	0.877		
Don't believe in own influence	0.875		
No knowledge of how	0.876		
Other	0.887		
No opinion	0.885		

Source: Authors' compilation based on JAMOVI calculations

The value of Cronbach's Alpha for the whole C3 and C4 scales was 0.885 and 0.770 respectively, what points to the high internal reliability. The analysis of the measure "alpha if item deleted" pointed to good relevance of almost all statements. The removal of several statements could increase the scale consistency. However, considering that the increase would not be significant, we decided to leave all statements in the scale.

Survey data was processed by means of frequency analysis. The only the answers "4" (agree) and "5" (completely agree) have been analysed by the authors in order to rank the statements in the scales. To test the relationship between the level of income and engagement in waste management activities, we conducted Spearman rank correlation analysis. To evaluate the difference in attitudes towards waste sorting by males and females, Mann-Whitney U test was performed. The selection of the non-parametric technique has been substantiated by the results of the Shapiro-Wilk test. In all cases, $p < 0.05$ indicated that data did not follow a normal distribution.

3. Conducting research and results

Figure 2 summarizes the responses of respondents on the question about waste reduction activities (B2 question).

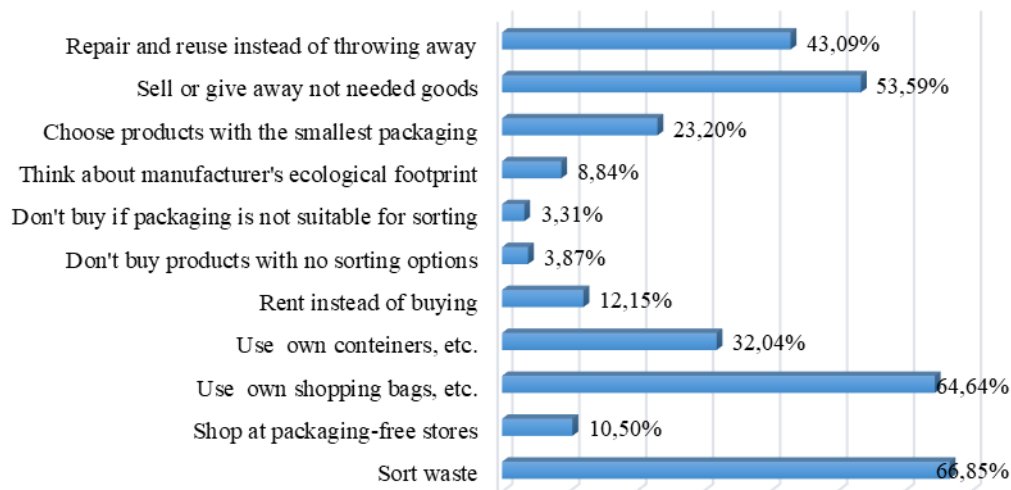


Figure 2. Respondents' engagement in waste reduction activities

Source: *Authors' calculations*

The results show that only 67% of respondents sort their waste, and 65% of respondents use their own bags when shopping, etc. 32% of respondents use their own containers and only 10.5% of respondents shop in packaging-free stores. The types/ categories of waste that people sort are presented in *Table 4*.

Table 4. Categories of sorted waste

Category	Respondents who sort
Plastic	92.27%
Batteries	91.71%
Glass	88.95%
Paper	83.98%
Electrical equipment	83.43%
Textile waste	71.27%
Tires	68.51%
Metal	65.75%
Medicines	59.67%
Biological waste	56.35%
Oils, oil filters	48.62%

Source: *Authors' summarized*

It is worth to compare these responses with the results of 2021 survey, conducted by the Environmental Ministry (VARAM, 2021), specifically regarding the plastic. Only 55% of respondents confirmed that they sort plastic packaging. This could be easily explained by the fact that the Deposit system was introduced in Latvia in 2022. Based on UNESDA (2024), in countries with DRS in place, collection rates are very high, from 65% to 95% for PET bottles. The percentage of respondents who sorted batteries in 2021 was 49%. It also, probably, related to the placement of specialized battery collection containers in stores and gas stations. However, there is no official information on when these initiatives were launched.

One of the lowest positions takes bio-waste. This could be explained with the fact that bio-waste sorting system was introduced in Latvia only in 2024.

The questions C2 and C4 are actually very similar: reasons for sorting and motivating factors. This was done purposefully, to get more reliable results from the respondents. For instance, when we asked the direct question “Do you sort waste?”, we received 80% of positive answers (B3 question). In turn, evaluating the waste reduction activities, only 67% of respondents marked the answer “sort waste”.

Analysis of the responses on C2 question (reasons for sorting), 76.24% of respondents agreed with the statement “desire to reduce environmental impact”. This is followed by 74% of respondents who are motivated by accessible infrastructure, and 62% motivated by their family. The statement “easily accessible sorting containers” was on the second place with 31% respondents. Other reasons, such as “financial benefits” and “pressure” were selected by 40.88% and 35.36% of respondents, respectively.

Factors affecting respondents’ attitudes and behaviour toward waste sorting (questions C3 and C4) are summarized in *Figure 3*.

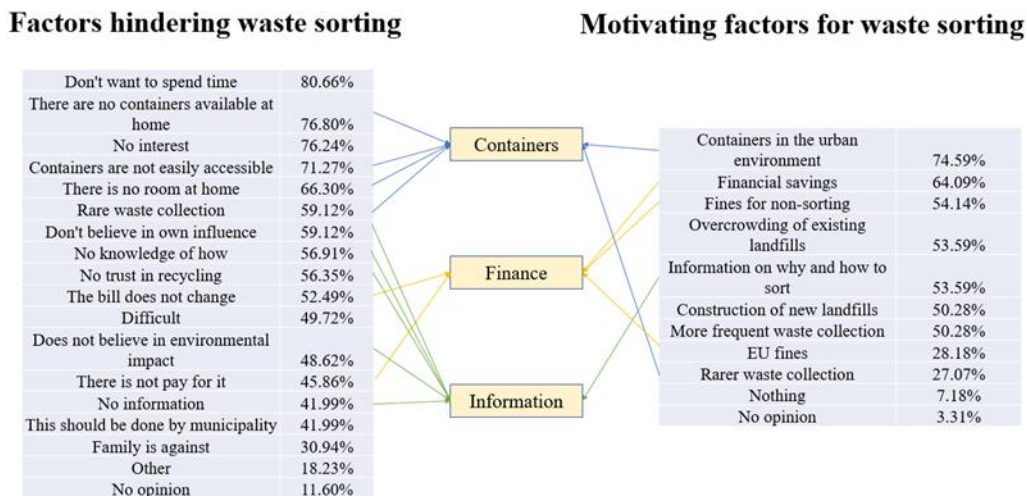


Figure 3. Factors affecting waste sorting

Source: *Authors' developed*

The most highly rated motivator for waste sorting (74% of respondents) was the availability of containers in urban environment. Financial savings ranked second, with 64% of respondents indicating it would motivate them to sort waste. In contrast, a study by on BIO waste sorting (Saulitis, 2024) revealed that informing residents about potential financial benefits was the least effective motivator. Instead, the most important for respondents was the information about the impending closure of the Riga largest landfill due to capacity limits, as well as Latvia’s potential EU fines for insufficient BIO waste sorting. Again, we can see the inconsistency in the results, comparing C2 and C4 responses (40.88% and 64.09%, respectively).

In turn, the most frequently mentioned factors negatively affecting people intention to sort waste were lack of motivation (81% “don’t want to spend time” and 76% have no interest) and, again, the infrastructure. People are demotivated by not accessible containers (more than 70% of respondents).

56% of respondents agreed with the “there is no trust in recycling”. In a similar study (Saulitis, 2024), only 14% of respondents, answering to the question “Why is there no sorting at the moment”, selected the statement “there is no confidence that the landfill will recycle it”. 42% of respondents named the lack of information as one of the demotivating factors for waste

sorting, whereas 57% - “no knowledge of how”. In turn, 54% would be motivated with the available information about the importance of waste sorting and the procedures.

For testing the first hypothesis about the relationship between income level and level of engagement in waste reduction activities, data received from the responses on the question A6 (“Income level”) un evaluation of B2 statements (“Waste reduction activities”) has been analyzed. The results of the Spearman correlation analysis indicated the statistically significant negative correlation between income level and intention to avoid buying non-recyclable products or packaging (B2.6 “Don’t buy products with no sorting options”, B2.7 “Don’t buy if packaging is not suitable for sorting”). So, considering that the income did not correlate with B2 responses in most cases and the negative correlation coefficient in other two cases, we can reject H1 hypothesis.

Mann-Whitney U test analysis results, conducted for testing the second hypothesis, are presented in *Table 5*. The only B2 scale data was used for analysis the difference between males’ and females’ behavior.

Table 5. Difference between male and female behavior (B2: waste reduction activities)

Lables of B2 statements	Mann Whitnes U test Sig.
Sort wast	0.97
Shop at packaging-free stores	0.173
Use own shopping bags, etc.	0.204
Use own containers	0.957
Rent instead of buying	0.136
Do not buy products with no sorting options	0.586
Don’t buy if packaging is not suitable for sorting	0.727
Think about manufacturer’s ecological footprint	0.259
Choose products with the smallest packaging	0.033
Sell of give away not needed goods	0.195
Pepair and reuse instead of throwing away	0.875

Source: Authors’ summarized

The statistically significant difference was revealed only regarding the statement about selection of packaging. So, H2 can be rejected as well. However, to get more reliable results, we need to balance our sample in terms of gender distribution.

The results of the current survey are mainly aligned with the results from previous studies in Latvia. There was no large inconsistency found. The percentage of people who sort waste (67%) is closed to the figures provided by the Nordic Council of Ministers’ in Latvia in 2022 (76%).

Latvian residents are gradually getting used to using their own shopping bags in supermarkets. However, about 35% still refuse. The reason is still easily available and free bags in stores (for example, in the fruit and vegetable departments of supermarkets), as well as the insufficiently increased price of large shopping bags at the entrance and checkouts.

Only 10.5% of respondents shop in packaging-free stores. Comparing with 2022 survey (“Getliņi EKO”, 2022), positive answer regarding packaging-free stores was received only from 3% of respondents. The trend is increasing, but the number is still low. It could be explained by the fact that actually we almost do not have packaging-free shopping places in Latvia (Scerbinskis, 2024). Considering that retail trade in Latvia occurs mainly through chain stores, like RIMI Baltic, Maxima, Lidl, DEPO, K Senukai, the issue might be resolved, by using their capacity. The supermarkets should provide more packaging-free options to customers and encourage them to use these options. In turn, retailers should be motivated by the government.

One of the problems in effective household waste management is a low readiness to sort bio-waste. According to the latest data provided by the Latvian Environment Protection Fund (2024), biological waste makes up the largest proportion of unsorted household waste: an average of 32% in residential buildings. The biowaste collection system was introduced in 2024. However, citizens are still not really engaged. Representatives of one of the largest waste management services providers in Latvia – ZAAO Ltd. – state that the majority of society is cautious about sorting organic waste, emphasizing shortcomings and without seeking solutions or arguments pro. (ZAAO, 2024)

Most frequently mentioned factors hindering waste sorting are related to people internal motivation and problems with infrastructure. In the survey conducted by the Nordic Council of Ministers' Office in Latvia (2022), 48% of respondents did want to spend time on waste sorting and 42% pointed to the lack of easily accessible recycling containers (42%). These results are also aligned with Daoud et al. (2025) stating that "...barriers such as time constraints, complexity, and lack of infrastructure hinder participation [in recycling]".

The fact that Latvian citizens express their willingness to care of the environment is treated very positively. 76.24% of respondents agreed with the statement "desire to reduce environmental impact", evaluating the reasons for sorting. These results are aligned with the results of 2021 survey (VARAM, 2021). Answering the same question, 64% inclined towards the statement "want to reduce their impact on the environment".

Latvian citizens need more information about waste sorting. Simultaneously, many people treat the lack of information as a barrier for engagement. These results indirectly confirm the conclusion made by Daoud et al. (2025), citing: "high awareness levels significantly predict positive recycling attitudes and behaviors." In the study conducted by Jusoh et al. (2018), knowledge was admitted as one of the factors "...that affect the behaviour of household solid waste management...". This is another point for investigation and discussion, researchers cooperating with government authorities and educational institutions.

2023 public opinion poll revealed that 72% of residents think about reducing the amount of waste they generate on a daily basis (Getlini EKO, 2023). The newest poll data shows that 75% of respondents aware of the use of BIO waste, and 67% of respondents are confident or partially aware that sorting BIO waste brings longterm economic benefits. (Getlini EKO, 2024) The most important now to understand how to transform knowledge, awareness and even a positive attitude in the conscious behaviour.

Conclusion

The current paper reflects the results of the authors' conducted pilot survey in Latvia aimed at identification of main barriers and stimulus perceived by Latvian citizens' regarding the household waste sorting. Based on the results, three main blocks of factors affecting citizens' engagement in waste reduction/sorting activities can be distinguished: containers, finances, and information. Thus, the main problem of waste management at the household level in Latvia is infrastructure, or more specifically the unavailability/absence of containers. Financial benefits or, in turn, financial punishments would have the largest influence on citizens' behaviour.

Two hypotheses have been tested within the research:

- H1: Residents with higher incomes are more active in their waste reduction activities than residents with lower incomes – rejected.
- H2: There is a statistically significant difference between women's and men's attitudes towards waste reduction – rejected.

Regarding the second hypothesis, a statistically significant difference between women's and men's evaluation of waste reduction activities has been confirmed only for the statement "Choose products with the smallest packaging". However, to make more reliable conclusions, the analysis should be done, based on larger sample data. 80% of the current sample were females.

The main directions for further investigation are in-deep analysis of people intention to sort or refusing sorting the certain type of waste, for instance, bio-waste. Besides, the information on citizens' attitudes towards concrete incentives of government or municipalities should be collected.

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