



Waste Sorting Habits by the Community of Kaunas University of Technology, Reasons and Influencing Factors

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The article presents the waste management system at Kaunas University of Technology, surveys the waste sorting habits of its community, both students and employees, and analyses the reasons and factors influencing waste sorting and non-sorting. The introduction of a separate paper waste collection system has made it possible to reduce the amount of mixed waste by 25% during the first three months of its functioning.

58% of employees and 45% of students sort some of their waste partly, 23% of employees and 11% of students sort all their waste. 8% of employees and 19% of students sort their waste sometimes. 8% of employees and 24% of students do not sort waste at all. 77% of employees and 66% of students think that the main problem caused by waste generation is pollution of the environment. Therefore willingness to reduce an impact on it is the main reason for sorting, while a lack of conditions to keep separated recyclable refuse and a lack of nearby containers are main factors that are distracting people from source-sorting.

Growth of environmental awareness and formation of sorting habits that are transmitted to family members are identified as the strengths. Lack of conditions for sorting (e.g. no place to keep sorted waste at home, insufficiently developed waste collection infrastructure), mistrust in a sorted waste collection system (e.g. belief that sorted waste goes to a landfill), and lack of information are the weaknesses. The opportunities comprise development of a convenient waste collection infrastructure, introduction of economic incentives and rise of further awareness. Identified threats for sorting at the source that discourage source sorting are the following: a developed infrastructure will not satisfy real needs; sorting will not become financially rewarding; improper decisions about a waste management system and waste treatment practices made at the state level, no real use of sorting.

Keywords: waste, paper waste, waste management, Kaunas University of Technology, sorting.

1. Introduction

Usage of products and services is part of our everyday lives that causes huge amounts of waste. However, some of this waste can be prevented. Purchase of products without packages or purchase of manifold products instead of single-use products (e.g. dishes), re-usage (e.g. printing or writing on both sides of paper), and, finally, recycling are the examples of the possibilities of waste reduction. This would cause less harm to the environment less and would also save the resources. In Lithuania reality recognizes that around 90% of municipal waste goes to landfills (Eurostat 2009). Thus, we lose resources, pollute our clear waters, soil, atmosphere, and, consequently, cause harm to ourselves. In many cases

recycling is cheaper than production from raw materials, because it saves energy and water, reduces great amounts of waste and emissions of CO₂. A number of companies get more and more involved in these activities and their capacities are increasing. In 2008, in Lithuania there were about 30 enterprises with a capacity of about 150 thousand tons per year involved in waste sorting and preparation for recycling. Paper and carton, plastic, glass and metal waste were recycled by some 40 companies having a capacity of 450 thousand tons per year (Uselytė et al. 2008). A sufficient amount of recyclable waste is needed for these facilities to function. Even more, sufficient quality of recyclable waste is essential

which, in addition, preferably requires qualitative source-separation.

The amount of waste generated at Kaunas University of Technology (KTU) in 2011 reached 5 402 m³, its disposal expenses were 131 046 Lt. The majority of that waste (70%) was recyclable – paper and plastic. However, in 2011 the infrastructure for recycling was of very limited scope and most of the waste was going to landfill, as it was a case in the whole country. A new strategy has been approved at KTU in 2012. Focusing and directing of University activities towards human well-being and sustainable development of the country, also sustainable development of the University itself by ensuring high quality and effectiveness, are among the strategic activities of KTU. Waste management practices, corresponding to higher levels within the waste management hierarchy, are under implementation at the University.

The aim of this article is to survey the waste management system at Kaunas University of Technology, to examine the source-sorting habits of its community, both students and employees, and to analyse the reasons and factors that influence sorting or non-sorting.

2. Review of Literature on Reasons and Factors that Facilitate Waste Sorting

Social consciousness, inner motivation and some other factors can make a strong effect on waste sorting efficiency. First of all, the decision not to sort is made due to a possibility to do so: it depends on infrastructure, knowledge and other physical factors such as time, place and other inconveniences (Evison&Read 2001). According to sociologists, social, economical and environmental factors form society's opinion about waste sorting. Society's behaviour is formed not only by opinion, moral virtues, but also by ethnic and cultural affiliation, age and place of residence (Bulkeley et al. 2005).

Willingness to sort can be substantiated in motivation, which can be divided into internal and external motivation. Internal motivation and behaviour are substantiated by person's opinion, awareness and self-respect. The expression of attitude towards preservation of the environment is considered as internal motivation. External motivation is based on someone's or something's influence, for example, economic factors, such as growth of taxes. All forms of both internal and external motivations lead to sorting (Halvorsen 2004). Though some other scientists say that much of people's recycling behaviour is born out of habits. The introduction of new rules and demands can be confusing in the first run, but in a longer perspective it helps increase a possibility to change society's behaviour: new rules can become a background for new habits (Henriksson et al. 2010).

In 2009 a research on the factors influencing not to sort was done in England. Respondents from

different age groups were interviewed. Factors influencing not to sort were put into four groups:

1. Individual behaviour: due to personal motivation, inconvenience, impracticality, insufficient amount of certain types of recyclable waste (e.g. green biodegradable one), age or disability;
2. Place of residence: there are no sorting containers nearby the residence place, or they are too far, also the size of residence plays an important role;
3. Attitudes and motivation: scepticism, which comes from local authorities, media, family, and no personal profit as an economical stimulus;
4. Information and knowledge: respondents mentioned lack of information and knowledge.

One of the reasons not to sort, according to respondents, is that the neighbours would know what products are used in their household. Research shows that elderly people and persons who live in the outskirts of the city or in a smaller residence, or are less-paid want to sort the least (Jesson&Stone 2009).

Economical stimulus is used in waste management and sorting in recent years. The most popular monetary stimulus is so-called unit-price, when a waste disposal tax is paid according to the weight of one person's waste. Further research shows that this system reasonably enhances household sorting, but there is no evidence that the total amount of waste is decreasing. Other systems of waste management are also used, e.g. forehand deposit, which has to refund sorting of the product. Forehand deposit is included into the price of a product. One more system is based on a polluter pays principle, according to which producer of the product is responsible for both the product's effect on the environment and the expenses of its disposal (Jenkins et al. 2003).

Some research shows that waste measurement by weight reduces the total amount of waste, which means that people strive to sort their waste (Dahlén&Lagerkvist 2007; Houtven&Morris 1999; Linderhof et al. 2001.). At the same time, other researchers say that this is not an effective way to reduce the amount of waste. According to them, economical stimulus to recycle can damage morality and motivation of society (Berglund 2005; Jenkins et al. 2003). Though sometimes external interventions, such as taxing based on the weight of waste, can increase and internalize personal expertness, motivation and actions to sort waste.

A research done in Sweden in 2009 has shown that the most important aspect in waste sorting is the effect on the environment. Respondents said they would like to get even more information about the effects of various types of waste onto the nature and environment, and about the positive influence of sorting (Henriksson et al. 2010).

A research covering Lithuanian population in general was carried out in summer of 2012 (Vilmorus 2012). It has revealed that 26.4% of the population sort always or almost always, 32.2 % sort sometimes and 41.4% never sort or sort very seldom. Looking at

the social status, only 8.7 % of the house-wives and women on maternity leave have indicated they are always or almost always sorting, while in the other social groups this percentage is from 16.1% to 33.6%. Willingness to contribute to waste recycling, saving of natural and energy resources were indicated as the main reason for sorting, the same as it was in Sweden. More educated population is more active in sorting. 32.9 % of people with higher education sort always or almost always (higher than average), while 33.3 % never sort, or almost never (lower than average).

It is difficult to reach a general and overwhelming conclusion on what stimulates waste sorting and recycling. Some researchers say that sorting should be discussed from an economic point of view: the best is to set fair prices and conditions for free competition, and in this way the effective waste sorting level would be reached (Ackerman 1997). Another group of researchers and activists say that recycled materials, stock and products should be sold under much lower prices than primary resources and products, whereupon consumers would be obliged to sort the waste (Morris 1996).

There are some suggestions for developing a model of general balance according to which consumers should motivate producers to use less packaging, make products of simpler design, thus alleviating their recycling (Fullerton & Wu 1998). There are also some people who suggest integrating economical and social motivation to sort waste. According to them, authorities should economically stimulate waste sorting, but they should not constrain or punish those who do not sort, because this action has to come from their own consciousness (Gunter 2007).

3. Method

Analysis of the waste management system at Kaunas University of Technology has been carried out for the year 2011. Based on this, proposals for development of the system to climb in the waste hierarchy have been presented and then implemented since September 2012.

Research on the factors stimulating the community of Kaunas University of Technology to sort waste was carried out applying the method of survey. Respondents were asked a set of questions with a view of finding out what they think about waste sorting and what stimulates or would stimulate them to sort waste. The survey was conducted in April and May 2012. The questionnaire consisted of 11 questions (both predefined and open) considering basic information about a respondent (including age, gender, place of residence), attitude towards waste, sorting activities, prevention of paper waste (the biggest waste stream at the University). Respondents were divided into two groups: employees and students. 292 respondents were questioned (171

employees and 121 students). 54% (92) of employee respondents were women, 46% (79) – men. 60% (73) of student respondents were women and 40% (48) were men. According to results of the survey, strengths, weaknesses, opportunities and threats (SWOT) of waste sorting by the University community were evaluated.

4. Results

4.1. Waste Management at Kaunas University of Technology

All municipal waste generated at Kaunas University of Technology, except waste from one of the buildings (No. II), was collected as mixed waste and was going to a landfill in 2011. University had 34 containers with a volume of 1 452 litres for mixed municipal waste, distributed among faculty buildings and the main University building. Containers were emptied 8 times per month as an average; their filling reached about 98 %. Total amount of generated municipal mixed waste was 5402 m³, and cost – 131 046 Litas in 2011. Also, additional picking of 23 tons of sawdust, leaves, pruned branches was arranged.

The biggest amount of waste was generated and the highest cost paid in September (14 351 Lt) and October (14 325 Lt.). That was influenced by the rotation of students, preparation for the new academic year by tidying the premises, old documentation. The lowest amount of waste and the lowest price paid was in July (2051 Lt.) and August (1940 Lt.) (see Fig. 1).

The first initiatives for waste sorting at KTU started at the Faculty of Chemical Technology some years ago, and in KTU building No. II in 2011. However, the first one did not survive due to organizational problems. The first initiatives made it possible to present a preliminary estimate of the amount of recyclable waste in the whole KTU municipal waste stream, it being up to 50%-70 %. The majority of recyclable waste i.e. up to 73% was that of paper.

The system of separation and collection of paper waste from the main flow of municipal waste was implemented and started functioning at KTU since September 2012. The main system actors, an initiative group of the project, established an infrastructure for paper collection on site. More than 600 specially developed boxes were sent and installed in all faculties and office buildings of KTU. Special containers were installed outside the buildings and an agreement (regarding the pickup of collected paper) with the paper mill “Grigiskes” was signed. Informative material on the rise of awareness and information of university members and students was printed and disseminated. Informational events and public presentations of ongoing activity were launched by the KTU Students Union.

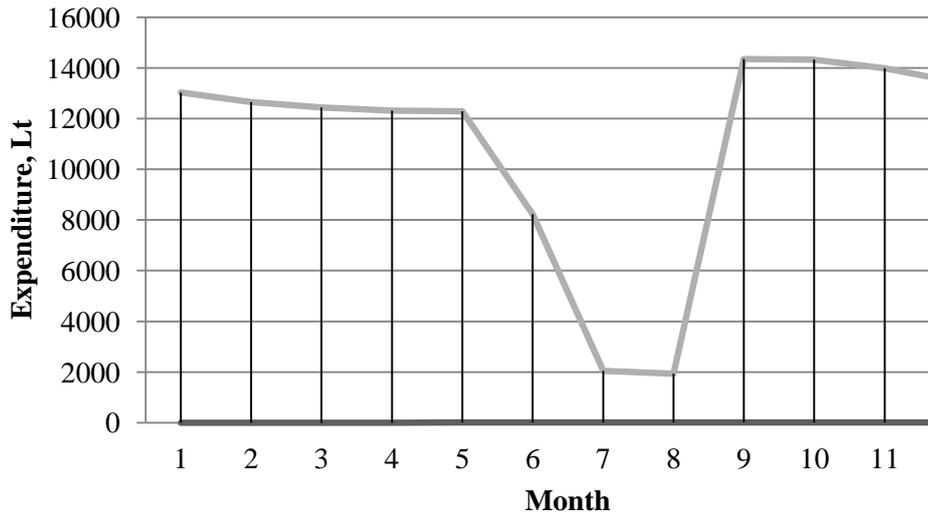


Fig. 1. Total expenditures of KTU for waste management in 2011

During the first three months of the project, outstanding results of paper waste collection were obtained. More than 14 tons of clean paper waste were collected and transported to the paper mill “Grigiskes”. Separation of paper from the main flow of generated waste in KTU made it possible to reduce the number of containers for municipal waste by 25%. Ongoing development of a paper collection infrastructure, introduction of economic incentives and further awareness rise will help increase the amounts of collected paper, and according to the targets of the project, in future University expects to eliminate up to 50% of the containers for municipal waste.

4.2. Perception of waste

Participation of the society in waste source-sorting depends on several factors. One of them might

be society’s attitude towards and awareness about the generated municipal waste and its effect on the environment: how people perceive waste influences, certain behaviour of these people, when they dispose of and/ or sort waste. Most of the KTU employees consider waste as: objects or materials which their possessor disposes of, wishes or has to dispose of (40%); as valuable resources which can be recycled (30%); as contaminants which threaten the environment and people’s health (9%); as unreasonable consumption (5%); and as all of the above mentioned (15%). As for students, they understand waste as: objects or materials which their possessor disposes of, wishes or has to dispose of (47%); as valuable resources which can be recycled (30%); as contaminants which threaten the environment and people’s health (17%); as unreasonable consumption (12%); and as all of the above mentioned (2%) (see Fig. 2).

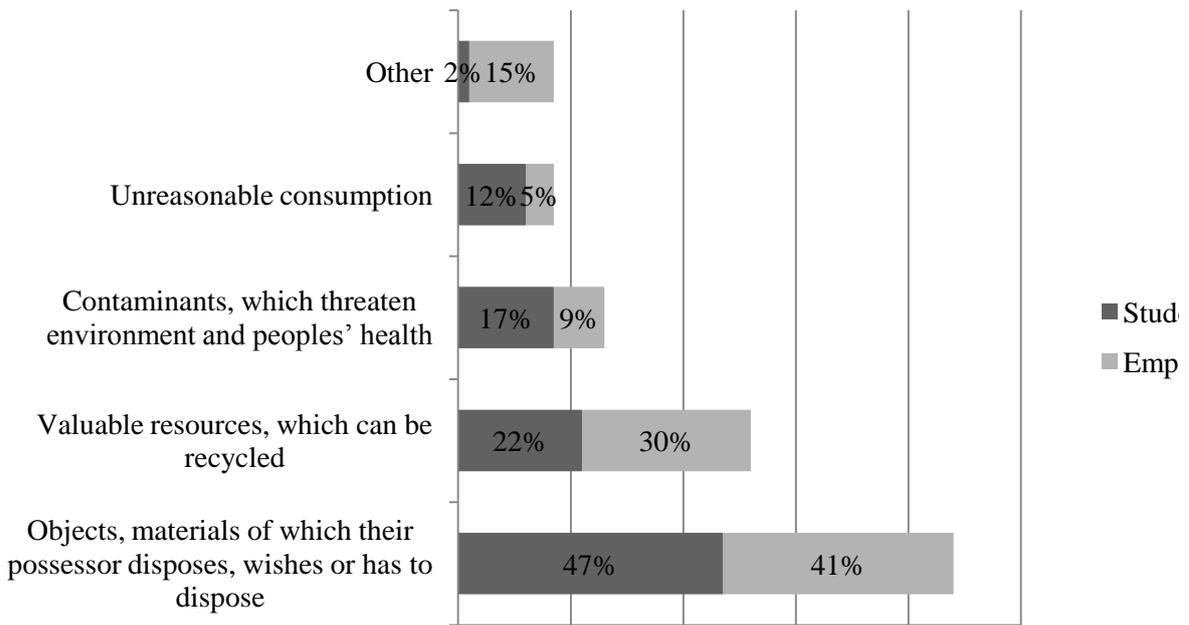


Fig. 2. Perception of waste by the KTU employees and students, %

4.3. Problems caused by waste generation

According to 77% of KTU employees and 66% of KTU students, the most important problem related to waste generation is environmental pollution. 53% of respondents from both groups agree that another

serious problem is a growing amount of waste in landfills. The survey shows that the KTU community does not attach much importance to waste disposal expenses (employees - 10%, students - 10%) and to the depletion of limited natural resources (employees - 5%, students - 3%) (see Fig. 3).

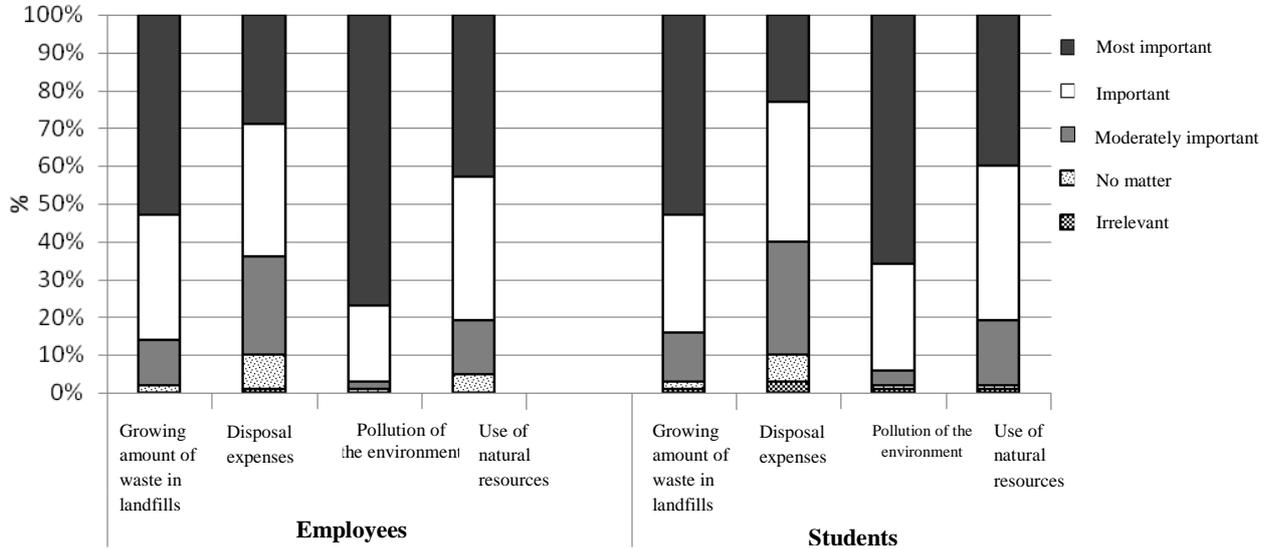


Fig. 3. Ranking of problems related to waste generation

4.4. Attitudes towards waste sorting

The effectiveness of waste management depends on people's will, knowledge and possibilities to sort their waste. 81% of KTU employees and 62% of students think that waste must be sorted. 12% of employees and 28% of students say they want to sort their waste, but it takes a lot of time and efforts.

According to KTU employees, waste sorting is a complex problem, because there are problems to deliver some of the sorted waste to the right place, sorting does not give any financial profit, and sometimes it is not clear where to dispose some waste. None of the respondents has said that he or she does not want to sort waste (see Fig. 4).

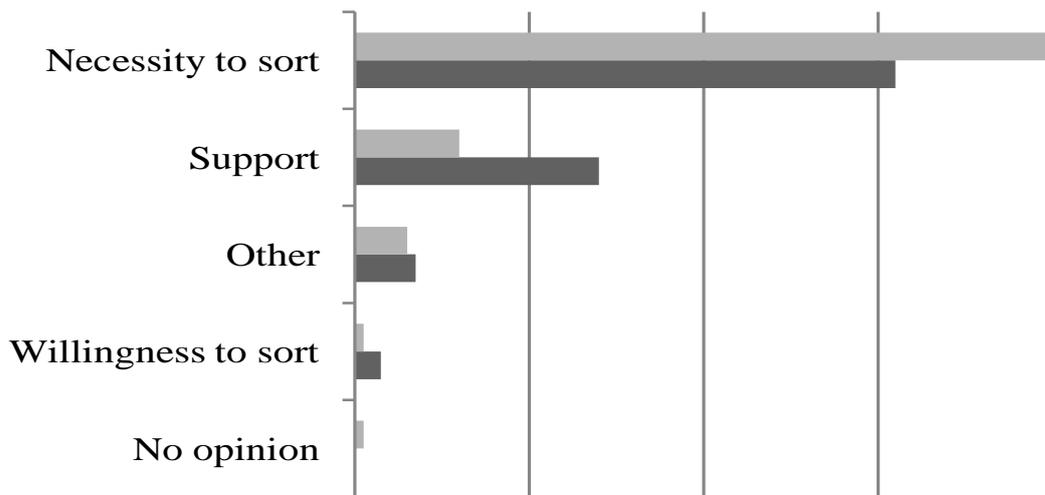


Fig. 4. Opinion of respondents about the need of waste sorting

4.5. Waste sorting in daily life

Respondents were asked if they sort their waste at home. 58% of employees and 45% of students have said they partly sort some of the waste. 23% of employees and 11% of students have said they sort all of their waste. 8% of employees and 19% of students sometimes sort their waste. 8% of employees and 24% of students (mostly undergraduate students) do not sort their waste at all. 3% of employees and 1% of students note that they sort their waste when there is an opportunity, e.g. containers are nearby. Also, they

sort only waste which in their opinion is surely to pass to recycling: polyethylene film, PET bottles, paper and glass (see figures 5, 6).

Moreover, some say they feel a lack of information what needs to be put where. A statement that elderly people and people living out of the city or in a smaller accommodation and those less-paid are the least wanting to sort their waste can be proved. Employees in the age groups between 30 and 50 are the ones who most often tend to sort all the waste. The rest of employees usually do not sort the waste.

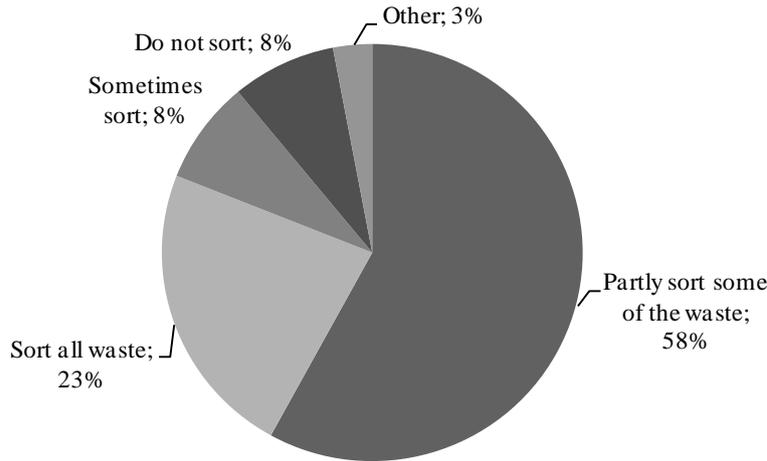


Fig. 5. Sorting at home by KTU employees

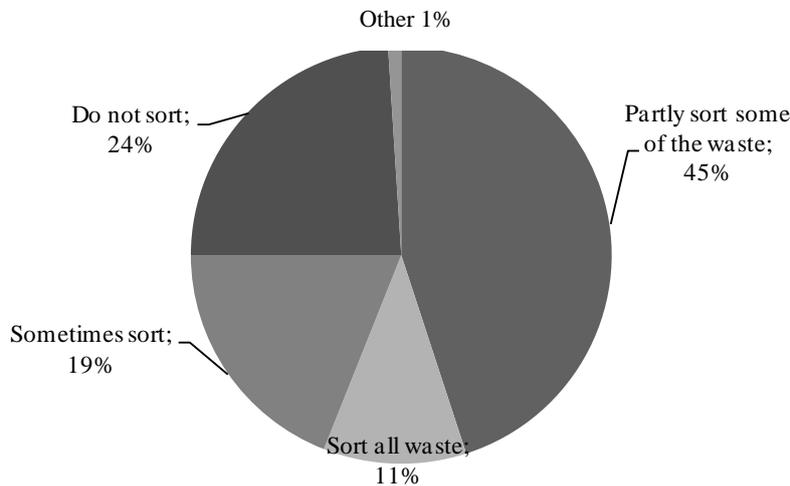


Fig. 6. Sorting at home by KTU students

KTU employees usually sort glass (26%), paper and cardboard (25%), and plastic (22%) waste. This is encouraged by the containers put not far away from living places. In addition to that, there are some possibilities to deliver plastic, glass and paper to the so called complementary waste collectors for money. Employees also have noted they are sorting out electric and electronic equipment waste and batteries.

4.6. Reasons for sorting of waste

Respondents have listed various reasons why they have decided to sort: willingness to reduce an impact on the environment (employees – 31%, students – 30%); habits and awareness (employees – 31%, students – 29%); saving natural and energy resources (employees – 24%, students – 20%). Knowledge, financial profit, parental upbringing and

availability of containers for sorting were mentioned as other factors (see Fig. 7). This is very much in line with the results obtained during different other

investigations (Vilmorus 2012, Henriksson et al. 2010).

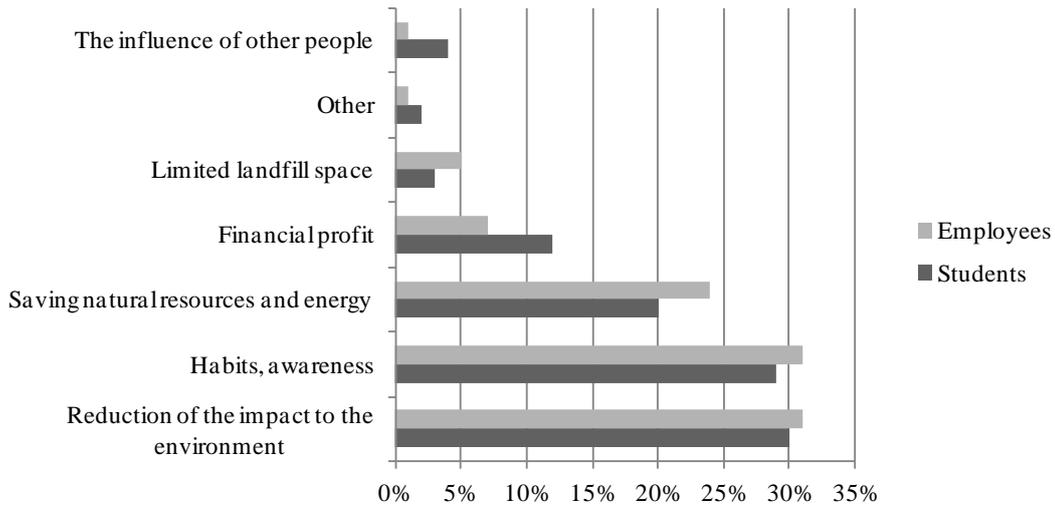


Fig. 7. Reasons for waste sorting

4.7. Reasons for non-sorting of waste

The most often mentioned reason for non-sorting is having neither space nor container to keep separately collected recyclable waste (32% students and 28% employees; among respondents who live in

flats, this was mentioned in more than 70% of cases). The second reason is that students (16%) believe that all sorted waste still goes to landfills; on the other hand, employees say that containers are too far (16%) (see Fig. 8).

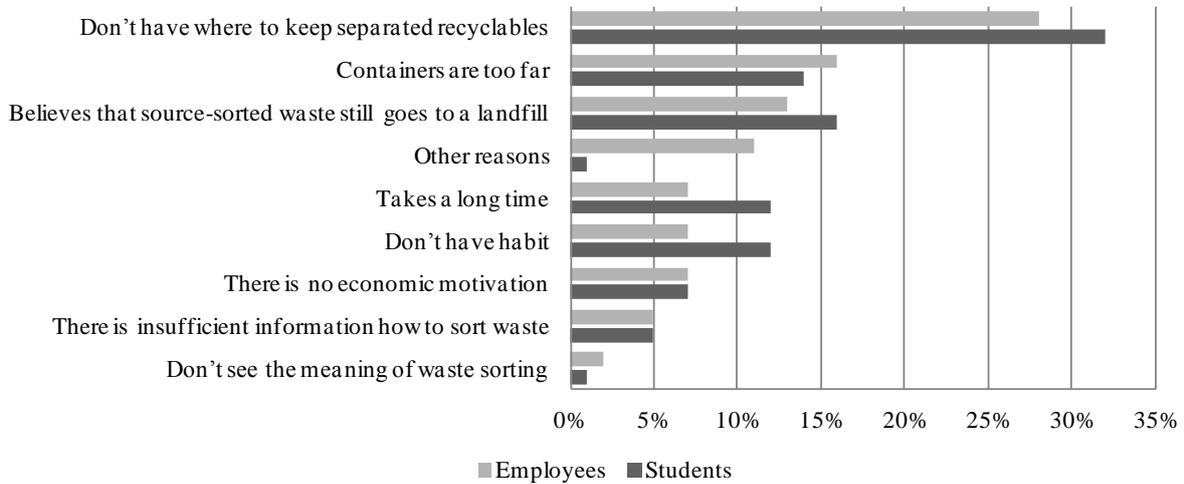


Fig. 8. Reasons for non-sorting waste

4.8. Factors stimulating sorting of waste

KTU employees and students have been also asked what factors would stimulate them to sort waste, and if they sorted waste, what is still needed and should be improved. Employees (26%) and students (22%) note that there is a need of conveniently located and properly equipped waste collection sites as well as more containers for recyclable waste. Awareness rise in educational

institutions is mentioned as an important factor (employees – 20%, students – 20%). Respondents say they would sort more actively, if waste taxes for those who sorted were lower (employees – 19%, students – 16%), and economic incentives introduced e.g. deposit system (employees – 15%, students – 19%). Students are also strongly affected by family members and friends who are interested in waste sorting (see Figure 9).

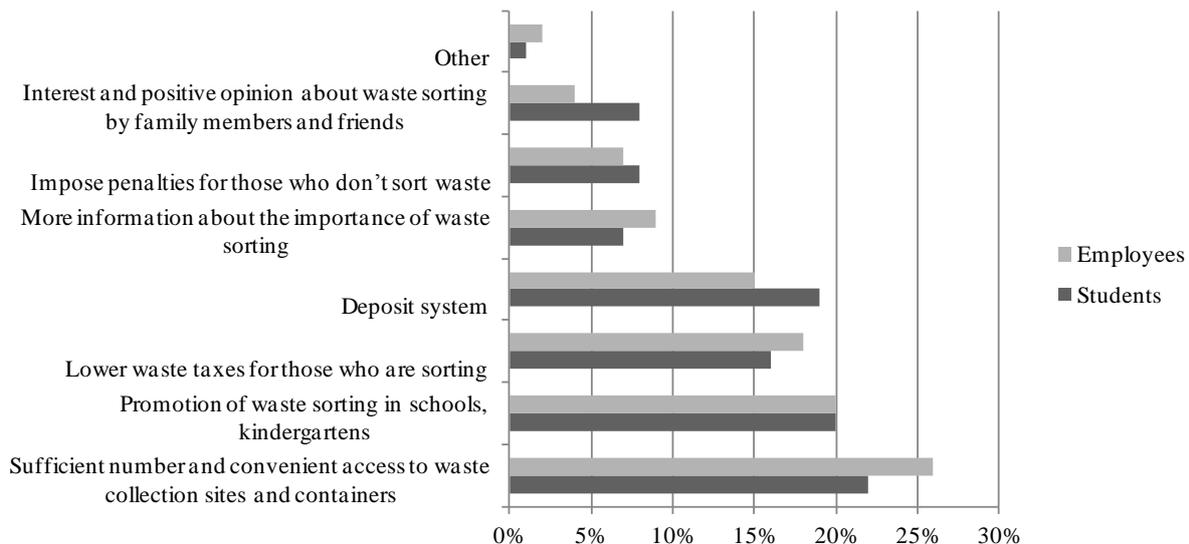


Fig. 9. Factors that stimulate waste sorting

4.9. SWOT of waste sorting

Strengths: Growth in environmental awareness: most of respondents note that waste must be sorted and the University has to develop its waste sorting system; habits that are transmitted to family members are under formation as well as growth in environmental values (strive to reduce pollution, save natural and energy resources).

Weaknesses: Lack of conditions (no place to keep sorted waste at home, insufficiently developed waste collection infrastructure); disbelief in the waste collection system, its benefits and effectiveness (belief that sorted waste still goes to landfills); lack of information about benefits and importance of waste sorting.

Opportunities: Development of a convenient sorted waste collection infrastructure; introduction of economic incentives (lower taxes for those who sort waste, deposit system); further awareness rise.

Threats: A developed infrastructure will not satisfy real needs; sorting will not become financially rewarding; improper decisions about the waste management system and waste treatment practices on the state level, when people do not see any real benefit of sorting; all this discourages people from source-sorting.

5. Conclusions

1. Implementation of separate paper waste collection system at Kaunas University of Technology resulted in more than 14 tons of clean paper waste collected, and the required number of municipal waste containers reduced during the first 3 month of system implementation.
2. Most of the University community (both employees and students) understand waste as materials and objects which their possessor

disposes of, wants or has to dispose of (41% and 47%).

3. 77% of employees and 66% of students think that the main problem caused by waste generation is pollution of the environment.
4. 58% of employees and 45% of students sort partly some of their waste. 3% of employees and 11% of students sort all their waste. 8% of employees and 19% of students sometimes sort their waste. 8% of employees and 24% of students do not sort waste at all.
5. KTU community representatives usually sort glass, paper, cardboard and plastic waste.
6. Main reason for sorting waste is willingness to reduce an impact on the environment (employees – 31%, students – 30%), habits and awareness (employees – 31%, students – 29%).
7. Main reason for non-sorting waste, according to the survey, is lack of conditions to keep separated recyclable waste and lack of containers nearby. In all respondents' opinion, they need convenient access to waste collection sites.
8. Awareness of waste sorting should be developed at all educational institutions.

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KTU bendruomenės atstovų atliekų rūšiavimo įpročiai, priežastys ir lemiantys veiksniai

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Aplinkos inžinerijos institutas, Kauno technologijos universitetas

(gauta 2012 m. spalio mėn.; atiduota spaudai 2012 m. gruodžio mėn.)

Straipsnyje pristatomas Kauno technologijos universitete įdiegtas atskiras popieriaus atliekų surinkimas, apžvelgiami atliekų rūšiavimo įpročiai, analizuojamos elgesio priežastys ir veiksniai, kurie skatina darbuotojus ir studentus rūšiuoti atliekas ar jų nerūšiuoti.

Buvo įvertinta, kad antrinės žaliavos visame KTU komunalinių atliekų sraute sudaro 50 – 70 proc., iš jų popierius – iki 73 proc. Priėmus tinkamus organizacinius sprendimus, pravedus informacijos kampaniją, atskiro popieriaus atliekų surinkimo sistema pradėjo funkcionuoti nuo 2012 m. rugsėjo mėn. Jau per pirmuosius 3 sistemos veikimo mėnesius buvo surinkta 14 tonų makulatūros, o mišrių komunalinių atliekų konteinerių sumažinta 25 proc.

Siekiant išanalizuoti, kas skatina darbuotojus ir studentus rūšiuoti atliekas ar jų nerūšiuoti, tyrimas atliktas apklausos būdu 2012 m. gegužės–balandžio mėn. Buvo apklaustas 171 darbuotojas ir 121 studentas. Nustatyta, kad 58 proc. darbuotojų ir 45 proc. studentų rūšiuoja iš dalies tik kai kurias atliekas. 23 proc. darbuotojų ir 11 proc. studentų teigė rūšiuojantys visas atliekas. 8 proc. darbuotojų ir 19 proc. studentų rūšiuoja kartais. 8 proc. darbuotojų ir 24 proc. studentų visai nerūšiuoja atliekų. 77 proc. darbuotojų ir 66 proc. studentų nuomone, svarbiausia su atliekomis susijusi problema – aplinkos teršimas. Būtent siekis sumažinti poveikį aplinkai ir yra pagrindinė priežastis, dėl kurios išitraukiama į rūšiavimo veiklą. Neturėjimas sąlygų, kur kaupti antrines atliekas, ir antrinių žaliavų konteinerių nebuvimas prie namų nurodyti kaip svarbiausi veiksniai, dėl kurių nerūšiuojama.

Aplinkosauginio sąmoningumo didėjimas, rūšiavimo įpročių, kurie perduodami ir šeimos nariams, formavimasis buvo identifikuoti kaip stiprybės. Tinkamų sąlygų nebuvimas (pvz., neturėjimas vietos namuose, kur kaupti išrūšiuotas atliekas, nepakankamai išvystyta atliekų surinkimo vietų infrastruktūra), nepasitikėjimas rūšiuotų atliekų surinkimo sistema (pvz., manoma, kad rūšiuotos atliekos vis tiek keliauja į sąvartyną), informacijos trūkumas nustatytos kaip silpnybės. Galimybės: patogios rūšiuotų atliekų surinkimo infrastruktūros sukūrimas, ekonominių paskatų įvedimas, tolesnis sąmoningumo ugdymas. Grėsmę atliekų rūšiavimui šaltinyje kelia tai, kad nesukurta rūšiuotojus tenkinanti atliekų surinkimo infrastruktūra, nėra finansinės naudos, taip pat tokie atliekų tvarkymo sistemos sprendimai šalies mastu, dėl kurių rūšiuotojai nematytų rūšiavimo poreikio.