CONSTRUCTION WASTE MANAGEMENT IN CONTEXT OF SUSTAINABLE DEVELOPMENT CASE STUDY OF POLYGON "BRAKŠĶI" JEGAVA MUNICIPALITY, LATVIA

Sandra Gusta, Nils Mezsargs

Latvia University of Life Sciences and Technologies, Latvia sandra.gusta@lbtu.lv, mezsargsnils@gmail.com

Abstract. With the growing urgency of environmental problems and the increasing density of urban populations, solutions are increasingly being sought to reduce human impact on the environment and improve the current situation. The construction sector is one of the sectors where it is necessary to find effective ways to reduce negative environmental impacts. Construction and demolition waste management is becoming increasingly topical, and various solutions, such as recycling and reuse, are being implemented in Latvia, contributing to sustainable construction and reducing pollution. This work explores existing waste management models, their effectiveness, and possible improvement strategies. The paper aims to investigate the state of construction waste management in Jelgava Municipalities in the context of sustainable development. The work examines the regulatory framework for construction waste management is identified. Examples of good practices of households in managing construction waste generated during construction are assessed. Surveys have been developed to promote proper construction waste management and sustainable development. Conclusions are drawn and possible solutions in the context of sustainable development are given.

Keywords: construction and demolition waste, management, sustainable development.

Introduction

Based on Eurostat data, construction and demolition waste is the largest waste stream in Europe, accounting for about one-third of all waste generated. One of the most pressing problems in Europe and Latvia is environmental protection and sustainability. As construction works increase in Jelgava Municipality, construction waste also increases, which creates an important burden on the environment. Insufficient waste processing, and sorting, and a lack of resources, hinder sustainable development and pose a threat to the environment.

The construction industry requires effective ways to reduce its negative impact on nature and human health. Construction waste management is becoming more important, and Latvia is introducing various solutions, such as waste processing and reuse, which promote more sustainable construction and reduce pollution.

The problem: construction and demolition waste constitutes the largest portion of total waste in Europe, placing a considerable strain on the environment. In Latvia, inadequate sorting and recycling of construction waste hinder sustainable development.

The aim of the paper: to analyse construction waste management in Jelgava Municipality, identify challenges, and suggest solutions.

The tasks are as following.

- 1. Study the theoretical foundations and regulatory framework of waste management.
- 2. Analyse statistical data on construction waste management from the Jelgava Municipality landfill "Brakšķi".
- 3. Survey the residents of Jelgava Municipality, along with representatives of construction companies, to gauge their attitudes and awareness regarding issues related to construction waste management.
- 4. Propose sustainable solutions for construction waste management in Jelgava Municipality.

The goal of the waste management system is to reduce the impact of the waste management process, which is achieved by reducing the amount of waste generated, processing and regenerating waste safely, or returning waste to the economic cycle [1].

Materials and methods

The research is based on both theoretical and empirical research methods. The authors analysed scientific and practical literature and the main subject of the study (CDW and circularity) was divided into several parts as characteristics of construction waste, hierarchy in construction waste management,

principles of sustainable development in construction waste management, characteristics of CDW circularity process in the construction system, main directions, analysis of CDW management in Jelgava Municipality, an example of the landfill "Brakšķi", a survey on participation and awareness of citizens and entrepreneurs on construction waste management, etc. The study also used systematic, structural, and functional research methods. The authors described the general problems of CDW management development and drew conclusions using concretization and abstraction, a survey method was applied to better analyse the situation, to find out the opinion of the population in the field of construction waste management, and the awareness of the population on sorting issues.

Characteristics of construction waste

Construction waste is generated during the demolition or renovation of the building. It can also be considered as leftover materials from the construction process (Fig. 1). Waste management is all processes, related to the collection, transportation, recycling, storage, or disposal of waste.



Fig. 1. Construction waste [3]

Sustainable development is a development that ensures the satisfaction of today's needs without threatening the satisfaction of the needs of future generations. Sustainable development is characterized by three interrelated dimensions: environmental, economic, and social (Fig. 2).



Fig. 2. Spheres of sustainable development and waste management hierarchy [4; 5]

The waste hierarchy is: Prevention, Reduction, Reuse, Recycling, and Responsible disposal. Preventing waste is the preferred option, and sending waste to landfill should be the last resort. A search of CDW studies in the Scopus database revealed 5,245 published scientific articles [6-11].

Proper waste management has a significant impact on reducing emissions. Landfilled waste produces greenhouse gases such as methane. Recycling or using waste to produce energy can reduce these emissions and thus contribute to climate change mitigation. To illustrate how much carbon dioxide (CO₂) is emitted per kilogram of waste, the graph below is plotted by activity (Fig. 4).

The diagram in Fig. 4 shows that recycling and energy from waste are much more effective methods of reducing emissions than landfilling. This is necessary to move towards sustainable waste management practices that help to prevent the negative effects of climate change [12-14].



Fig. 3. Keyword co-occurrence in the reviewed papers created by the authors using VOSviewer, version 1.6.16 [6]



Fig. 4. Comparison of emissions from recycling and landfilling (developed by the authors)



Fig. 5. Classification of construction and demolition waste per activities [6]

As shown in Figure 5, CDW types in most cases include the following common materials: concrete, glass, cement, bricks, wood, plastic, etc. Many of these materials contain chemicals and can be highly flammable, so they should not end up in a landfill site where they would be disposed, or in nature where they would not disintegrate but contaminate soil and groundwater. Construction and demolition waste include an extensive list of waste subtypes, that have potential for reuse in the circular economy [6].

Sustainable waste management improves environmental quality and helps prevent potentially harmful substances from waste that pose health risks to society. Construction projects have an impact on the environment, and proper waste management can help mitigate this impact. By implementing recycling and waste reduction, construction companies can reduce the amount of waste generated and any waste sent to landfills. This reduces the environmental impact and helps protect natural resources [15].

Sustainable waste management raises public awareness of environmental issues and motivates people to participate in sorting and recycling. Good waste management can also lead to cost savings. By reducing waste, recycling materials, and implementing good disposal practices, construction companies can save on landfill fees, reduce transportation costs, and potentially generate revenue from recycling materials [15].



Fig. 5. Non-hazardous construction waste collected 2016-2023

Several institutions are responsible for the development and implementation of management. The Ministry of Smart Administration and Regional Development of the Republic of Latvia (MoSARD; until 1 July 2024 – the Ministry of Environmental Protection and Regional Development) develops policies and regulations in waste management and coordinates the development and implementation of national plans and programs. The State Environmental Service (SES) controls and monitors compliance with regulatory enactments in waste management issues, permits, and carries out inspections related to waste management. Municipalities organize waste management in their territory, ensuring collection, transportation, disposal, or recycling of construction waste, adopting binding regulations, and monitoring their implementation. Waste managers (businesses) collect, transport, recycle, and dispose of construction waste by regulatory enactments and agreements with municipalities or private individuals. Construction companies and construction contractors ensure the correct sorting, storage, and transfer of construction waste to waste managers, and comply with the requirements of regulatory enactments regarding waste management at construction sites [1].

Five waste management regions are planned in Latvia, in which ten landfills will operate (Ķīvītes, in South Kurzeme; Cinīši, Dziļā vāda, Križevņiki in Latgale; Daibe, Kaudzītes in Vidzeme; Janvāri, Pentuļi in North Kurzeme, and Getliņi, Brakšķi in Vidzeme) [2; 9]. In Jelgava Municipality, waste management is provided at the Jelgava Municipal Services Landfill "Brakšķi".

It is planned to combine as many management regions as possible to promote better infrastructure development and economic aspects, according to the planning, established by Latvia. Namely, the fewer landfills, the greater the number of centralized landfills, the greater the waste circulation, which contributes to greater income for managers. With high income, it is possible to develop the infrastructure much faster.

The second factor is the proportionality of the existing infrastructure and the volume of waste management - in several landfills, a serious problem is the disproportionally small flow of incoming waste with waste disposal and management and insufficient quality infrastructure maintenance.

Waste management is one of the most essential sectors in Latvia. More than 40 laws, regulations, and documents regulate waste management in Latvia [3].

Analysis of the situation in polygon "Brakšķi" in Jelgava Municipality

This chapter analyses and compares the volumes of construction waste managed by the landfill "Brakški". In total, in 2023 "Jelgavas Komunālie Pakalpojumi" Ltd. managed 29.51 thousand tonnes of unsorted municipal waste and 4.85 thousand tonnes of construction waste, of which only 1.16 thousand tonnes were sorted.

Jelgava Municipality has one waste reception landfill – "Brakšķi", where construction, biological, and asbestos waste is disposed of and sorted. This landfill is in "Līvbērze" parish. There are three waste reception points in Zemgale region, including the Jelgava Landfill for Municipal Services. Dobele Municipal Services Ltd. is in Dobele Municipality, accepts various types of waste, and cooperates with the landfill "Brakšķi" to deliver waste for further treatment. In Bauska, "Vides Serviss" Ltd. accepts all types of waste, making it easier for residents and businesses to manage their waste.

Based on the statistical data of the Latvian Environment, Geology and Meteorology Centre (LVGMC), a chart has been created, summarising the amount of unsorted construction waste disposed or recycled by the landfill "Brakšķi" each year (Table 1).

Table 1

Year	2016	2017	2018	2019	2020	2021	2022	2023
Sorted, t	287	523	1307	1490	1662	1507	1069	1157
Non-sorted, t	353	1057	2642	2074	1667	2672	3037	3690
Total	641	1580	3949	3564	3329	4179	4107	4848
Sorted, %	45%	33%	33%	42%	50%	36%	26%	24%

Separated and unsorted non-hazardous waste in 2016-2023, t and% [22]

From the chart above, the amount of unsorted construction waste has increased steadily since 2016 by around 3,000 tonnes (Fig. 6). This indicates that the construction market continues to grow, but at the same time, the amount of unsorted waste is also increasing, which hurts the sustainability targets. Based on statistics from the LVGMC, a chart summarising the amount of sorted construction waste disposed of or recycled by the "Brakšķi" landfill each year has been produced (Table 2).



Fig. 6. Comparison of volumes of separated, unsorted non-hazardous waste and total waste in 2016-2023, in tons

Looking at the data in the diagram, it can be concluded that the amount of sorted waste has decreased proportionally. This shows that companies and individuals do not properly sort materials after construction. For example, in 2023, unsorted waste reached 3.69 thousand tons, while only 1.16 thousand tons were recycled in the same year. This means that only about 24% of the managed waste was sorted.

Based on the data in Table 1, it can be concluded that the percentage of sorted waste has decreased in the work with unsorted construction debris. This indicates that waste generators are not making enough efforts to sort waste, and this trend is worsening every year, until by 2023 the proportion of sorted waste has decreased to 24%.

It is important to note that all construction waste delivered to the "Brakšķi" landfill is recycled, thus contributing to the achievement of the European Union goals, to ensure that 70% of construction waste is reused, recycled, or involved in other material recovery processes.

The data in the chart above shows that a significant proportion of construction waste is still composed of asbestos (see Figure 10). These hazardous wastes pose a significant burden on landfills, as they are disposed of rather than recycled, and pose a risk to human health if not properly treated and collected.



Fig. 7. Comparison of volumes between hazardous, non-hazardous, and total waste 2016-2023

The above chart includes hazardous construction waste (asbestos). It is important to stress that these materials still exist and are only landfilled, not recycled. According to sustainability, asbestos will be tackled for a long time. In the 1970s and 1980s, it was discovered that asbestos fibres and dust could have dangerous effects on human health and life. Diseases usually develop over a long period - 15 to 30 years after first asbestos exposure. Asbestos-related diseases are not curable [3].

Table 2

Year	2016	2017	2018	2019	2020	2021	2022	2023
Hazardous, t	287	523	1307	1490	1662	1507	1069	1157
Non-hazardous, t	353	1057	2642	2074	1667	2672	3037	3690
Total, t	727	1711	4294	3876	3795	4899	4409	5109
Hazardous, %	12%	8%	8%	8%	12%	15%	7%	5%

Hazardous and non-hazardous waste 2016-2023, t and% [22]

Compared to non-hazardous construction materials, asbestos accounts for about 9% of total construction waste per year (Table 2, Fig. 7). However, it should be noted that the costs of transferring unsorted construction waste are significantly higher than sorted waste (Table 4). This increase in costs is mainly related to the natural resource tax, which is gradually being increased and serves as an effective tool to promote waste sorting (Table 3).

Table 3

Year	Natural resource tax rate on construction waste by year, EUR per tonne
2021	65
2022	80
2023	95
2024	110
2025	120
2026	130

Natural resource tax rate for construction waste 2021-2026, EUR per tonne [23; 24]

The cost of managing sorted waste is lower because much of it is sent to recycling plants where the materials are used as resources. However, the costs of managing unsorted waste are higher because it is often sent to landfills, where higher disposal fees are payable. In addition, unsorted waste puts more pressure on landfills and increases the amount of polluting waste. Managing this waste requires extra work to separate valuable materials from the total mass.

Table 4

Waste type	Total, EUR per tonne without VAT	Total, EUR per tonne with VAT
Unsorted construction waste, including insulation materials	187.81	227.25
Sorted construction and demolition waste	55.00	66.55
Asbestos-containing building materials	320.00	387.20

Current tariff for construction waste at the "Brakšķi" landfill [25]

Public awareness campaigns should be carried out regularly in Latvia to promote participation and awareness among citizens and businesses. They should focus on separate waste collection, prevention, and litter reduction. The main priority for public involvement is education and training on waste sorting and finding the most cost-effective solutions tailored to everyone's needs.

Results and Discussion

The questionnaire was administered on the VisiDati platform in December and January 2024 to find out the position and awareness of Jelgava Municipality residents and construction industry representatives on waste management. A total of 33 persons from Jelgava Municipality who have carried out construction works, either in their home or business-related works in the last 5-10 years, voluntarily participated in the survey.

When asked about their awareness of the nearest sorting points, 59% of respondents indicated that they knew of several locations, 26% reported being aware of only one or two, and 15% stated they did not know where they were. 38% of respondents indicated, that they do not sort their waste and instead send it to landfills. However, 31% stated that they sort and deposit waste at drop-off points, while another 31% reported contracting waste managers to remove their waste.

The responses indicate that most information is disseminated through friends or colleagues 34% and local government sources 27%. Social networks influence 21% of respondents, while the least popular way of obtaining information is searching on the Internet 12%. Only 6% said they had heard about waste management from all these sources (Fig. 8).

Other answers: To be honest, I have this type of waste piled up in the garden. I do not know how to get rid of it, as far as I understand you have to rent a container for several days and load it with your own hands, long and expensive, no vehicle is available, no challenges, long process.

When asked about the challenges faced in managing construction waste, the biggest obstacle was high costs, with 37% of respondents indicating this was the case. This was followed by 25% of

respondents, who highlighted insufficient information, and another 25% who mentioned the lack of tools to sort waste (Fig. 9). 13% gave other answers.



Fig. 8. Responses to the question "From which sources have you been informed about construction waste management (in Jelgava Municipality)"



Fig. 9. Responses to the question "What are the main challenges related to waste management?"

Fifty-two percent of respondents believe that a lack of awareness regarding sorting construction waste is a barrier to recycling. Sixteen percent indicated the lack of sufficient containers poses a barrier, while thirteen percent felt that the sorting process is too time-consuming. Nineteen percent expressed a differing view: it becomes expensive when the building material is deemed dangerous, and people's indifference, laziness, and unwillingness to change their everyday habits contribute to the issue.

When asked about the availability of collection points, 44% said they considered them to be partially available, 31% said that collection points were sufficiently accessible and 25% thought they were not accessible.

In the question asking respondents to choose measures that would encourage more active waste management, 50% indicated that price reduction would be the most effective solution, 22% considered that more educational material was needed, 13% suggested stricter controls and 12% stressed the need for more sorting points (Fig. 10).

76% of respondents supported using recycled materials, 12% indicated that it was difficult to judge, and only 3% were completely against the idea. On the other hand, 9% of respondents gave another answer.

The chart below shows that 63% of respondents indicated that concrete, brick, and metal waste were the most common types of waste in their households or businesses. This was followed by 27% who mentioned wood, plaster, and glass waste, while hazardous materials were the least common (Fig. 11).



Fig. 10. Responses to the question "What measures do you think would encourage more active waste management?"



Fig. 11. Responses to the question "Which types of construction waste are most commonly generated in your household or business?" (in Jelgava Municipality)

57% of respondents said they would only receive information material if it was useful in practice. 12% said they would receive them in any case, while 31% were completely uninterested.

When asked whether they would be willing to separate or recycle waste if the right facilities were available, almost all answered in affirmative, 3% said they would not be willing to do so.

Metal was the most recyclable material, with 29 votes. This is followed by plastic with 23 votes, wood with 20 votes, and concrete with 17 votes. Ceramic products and glass were the least recyclable (Fig. 12).

A majority of 87% of respondents believe that waste management contributes to sustainable development. 10% are not sure, while 3% think that it does not contribute to sustainable development. 34% of the respondents chose a construction waste manager based on the sorting and recycling services offered, 28% indicated that location is an important factor and 25% chose a construction waste manager based on cost. 13% gave other answers.

Inadequate waste sorting is a major problem in Jelgava Municipality. In 2023, only 24% of construction waste was sorted. This situation puts additional pressure on the sorting process, increasing labour and resource consumption, contributing to (CO₂) emissions, to sort the waste or dispose of it in

the landfill "Brakšķi". This 24% is also confirmed by the survey, as 38% of the population claim that they do not sort their waste and take it to landfill, and 31% claim that they do special sorting.



Fig. 12. Responses to the question "Which of these materials do you think are most suitable for recycling?"

The main obstacle to sustainable waste management is the lack of public awareness and understanding of the principles of sustainable waste management. As seen by the survey, 52% of respondents indicate that this factor is one of the most important problems hindering the implementation of sustainable development.

Most information on construction waste management is disseminated through friends, colleagues 34%, and municipal information materials 27%, while only 12% of respondents obtain information through the Internet searches.

Conclusions

- 1. The EU has set a target that at least 70% of non-hazardous construction and demolition waste must be prepared for reuse, recycling, or other forms of material recovery. In Latvia, the National Waste Management Plan for 2021-2028 has been approved to achieve this target.
- 2. According to the analysed data from the "Brakšķi" landfill, only 24% of construction waste is sorted, which creates a burden on the landfill and increases the amount of emissions.
- 3. Analysing the survey data, the authors conclude:
 - As the most significant obstacles to sorting, respondents to the survey mentioned: too high costs for transfer of sorted waste (50%), lack of public knowledge about sorting options (22% of complex ones), lack of additional containers and sorting points (12%), stricter control and the need for inadequate construction waste management (13%).
 - 76% of respondents support using recycled materials, habits and lack of motivation hinder more active involvement in construction waste sorting.
 - 87% of respondents support that effective construction waste management is essential for sustainable development and understand its importance.
- 4. The main challenges, according to the authors, are: quite low sorting rates, lack of awareness among residents and construction companies, quite high costs, insufficient infrastructure, and lack of public motivation.
- 5. The results of the study could be used in further scientific work, studying waste management problems in Zemgale and Latvia as a whole.

The authors proposals

- 1. Ministry, local authorities, waste managers, and educational institutions to carry out awarenessraising activities and campaigns.
- 2. Provide economic incentives for the public.
- 3. Enhance infrastructure and expand the number of collection points.
- 4. National and local authorities to develop and improve legislative frameworks.
- 5. Carry out public motivation measures (clean-ups, actions, etc.).

Author contributions

Conceptualization, S.G., methodology, S.G., and N.M., software, N.M., validation, S.G., and N.M., formal analysis, N.M., and S.G., investigation, N.M. and S.G., data curation, N.M., writing – original draft preparation, N.M., writing – review and editing, S.G., N.M., visualization, N.M., S.G. All authors have read and agreed to the published version of the manuscript.

References

- Cabinet of Ministers Order No. 45 of 22 January 2021 "On the National Waste Management Plan 2021-2028". Par atkritumu apsaimniekošanas valsts plānu 2021.-2028. g. Ministru kabineta rīkojums Nr. 45 [online] [20.02.2025]. Available at: https://likumi.lv/ta/id/320476
- [2] Waste statistics 2022. [online] [19.12.2024]. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title = Waste_statistics
- [3] Atkritumu apsaimniekošana. (Waste management) (In Latvian) [online] [10.12.2024]. Available at: https://www.atkritumi.lv/lv/
- [4] Sustainable Development#2 The Spheres of Sustainable Development [online] [20.02.2025]. Available at: https://steemit.com/earthnation/@donfelix/sustainable-development-2-the-spheres-of-sustainable-development
- [5] Waste Framework Directive [online] [20.02.2025]. Available at: https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en
- [6] Mavlutova I., Atstaja Dz., at all. Management of household-generated construction and demolition waste: circularity principles and the attitude of Latvian residents. Energies Vol. 17(1) (2024), article number 205.
- [7] Norouzi M., Chàfer M., Cabeza L.F., Jiménez L., Boer D. Circular Economy in the Building and Construction Sector: A Scientific Evolution Analysis. J. Build. Eng. 2021, 44, 102704. DOI: 10.1016/j.jobe.2021.102704.
- [8] Yu Y., Yazan D.M., Junjan V., Iacob M.-E. Circular Economy in the Construction Industry: A Review of Decision Support Tools Based on Information & Communication Technologies. J. Clean. Prod. 2022, 349, 131335. DOI: 10.1016/j.jclepro.2022.131335.
- [9] Oluleye B.I., Chan D.W.M., Saka A.B., Olawumi T.O. Circular Economy Research on Building Construction and Demolition Waste: A Review of Current Trends and Future Research Directions. J. Clean. Prod. 2022, 357, 131927. DOI: 10.1016/j.jclepro.2022.131927.
- [10] Jahan I., Zhang G., Bhuiyan M., Navaratnam, S. Circular Economy of Construction and Demolition Wood Waste – A Theoretical Framework Approach. Sustainability 2022, 14, 10478. DOI: 10.3390/su141710478.
- [11] Hildebrandt J., Hagemann N., Thrän, D. The Contribution of Wood-Based Construction Materials for Leveraging a Low Carbon Building Sector in Europe. Sustain. Cities Soc. 2017, 34, 405–418. Available to: DOI: 10.1016/j.scs.2017.06.013.
- [12] Mājsaimniecības ir galvenais avots būvgružiem dabā 2023. Ziņas Jauns. (Households are the main source of debris in nature in 2023. News New.) (In Latvian) [online] [5.01.2025] Available at: https://jauns.lv/raksts/zinas/545335-majsaimniecibas-ir-galvenais-avots-buvgruziem-daba
- [13] Drupināšana metode. (Crushing method). (In Latvian) [online] [7.01.2025.] Available to: https://www.drupinasana.lv/lv/sakums
- [14] Environmental Statement Report 2022. European Environment Agency. [online] [7.01.2024] Available at: https://www.eea.europa.eu/en/analysis/publications/environmental-statement-report-2022
- [15] The Importance of Proper Waste Management in Construction Projects. Justhire. [online] [2.01.2025] Available at: https://justhire.com/knowledge/Importance-waste-managementconstruction
- [16] Atkritumu apsaimniekošanas statistika 2021-2023. Oficiālās statistikas portāls (Waste Management Statistics 2021-2023 Official Statistics Portal). (In Latvian) [online] [4.01.2025] Available at: https://stat.gov.lv/lv/statistikas-temas/vide/atkritumu-apsaimniekosana
- [17] Atkritumu apsaimniekošanas likums 2010. Saeima. (Waste Management Act 2010. Parliament). (In Latvian) [online] [7.01.2025.] Available at: https://likumi.lv/ta/id/221378-atkritumuapsaimniekosanas-likums

- [18] Atkritumu apsaimniekošanas atļauja. Vides un ģeoloģijas serviss. (Documentation for A, B and C permits. Environment and Geology Service). (In Latvian) [online] [7.01.2025.] Available at: https://vidgeoserviss.lv/atkritumu-apsaimniekosanas-atlauja/
- [19] Dokumentācija A, B un C atļaujas saņemšanai. Vides un ģeoloģijas serviss. (Documentation for A, B and C permits. Environment and Geology Service). [online] [7.01.2025.] Available at: https://vidgeoserviss.lv/dokumentacija-a-b-un-c-atlaujas-sanemsanai/
- [20] Jelgavas valstspilsētas pašvaldības sadzīves atkritumu apsaimniekošanas saistošie noteikumi 2023. Jelgavas pilsētas dome. [online] [7.01.2025.] Available at: [Skatīts 2024. gada 10. janvārī] Pieejams: https https://likumi.lv/ta/id/349665-jelgavas-valstspilsetas-pasvaldibas-sadzivesatkritumu-apsaimniekosanas-saistosie-noteikumi
- [21] Poligonā "Brakšķi" atklāta bioloģiski noārdāmo atkritumu pārstrādes rūpnīca 2024. Sabiedrisko attiecību departaments. [online] [7.01.2025.] Available at: [Skatīts 2024. gada 10. janvārī] Pieejams: https://www.jelgava.lv/jaunumi/poligona-brakski-atklaj-biologiski-noardamo-atkritumu-parstrades-rupnicu/
- [22] Valsts statistiskais pärskats. Latvijas Vides, Ģeoloģijas un Meteoroloģijas centrs. (National Statistical Yearbook. Latvian Centre for Environment, Geology and Meteorology) (In Latvian).
 [online] [7.01.2025.] Available at: [Skatīts 2024. gada 1. janvārī] Pieejams: https://parskati.lvgmc.lv/#viewType = reportIndexView&type = 3WA&incrementCounter = 1
- [23] Darziņa L. Dabas resursu nodokļa maksājumi pakāpeniski pieaug 2021. (Natural resources tax payments gradually increase in 2021). (In Latvian) [online] [10.01.2025] Available at: https://lvportals.lv/skaidrojumi/323876-dabas-resursu-nodokla-maksajumi-pakapeniski-pieaug-2021
- [24] Helmane I. Dabas resursu nodoklis arī tekstilizstrādājumiem, mitrajām salvetēm un baloniem 2023. (Helmane I. Natural resources tax - also on textiles, wet wipes, and balloons 2023.) (In Latvian) [online] [10.01.2025.] Available at: https://lvportals.lv/skaidrojumi/358384-dabasresursu-nodoklis-arī tekstilizstradajumiem-mitrajam-salvetem-un-baloniem-2023
- [25] Poligonā "Brakšķi" ievedamo atkritumu veidi un tarifi. Jelgavas Komunālie Pakalpojumi. (Types and tariffs of waste to be imported to the landfill "Brakšķi". Jelgavas Komunālie Pakalpojumi) (In Latvian). [online] [10.01.2025.] Available to: https://atkritumijkp.lv/pakalpojumi/papildpakalpojumu-cenradis/poligona-brakski-ievedamoatkritumu-veidi-un-tarifi