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Master's Thesis

Legal aspects of sustainability in waste management

Teisiniai tvarumo užtikrinimo atliekų tvarkymo srityje aspektai

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ABSTRACT AND KEYWORDS

In this era of increasing environmental awareness due to uncontrolled waste, the research focuses on the role of law in ensuring sustainability in waste management. The role of law is analyzed taking consideration the source hierarchy and its targeted sectors for implementation. The thesis builds on the concept of circular economy, provisions of the European Union law and national (Lithuanian) law by highlighting different legal interpretations and implementation practice examples in other EU countries from a sustainability perspective. Research findings reveal that current waste management practices do not entirely match the implementation of principles formulated in the legal framework with recommendations outlined in the conclusions.

Keywords: sustainability, waste management, municipal solid waste, circular economy, biodegradable waste, composting.

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LIST OF ABBREVIATIONS

BDW	Biodegradable waste
CE	Circular Economy
CEP	Circular Economy Plan
COM	Commutation Order
DRS	Deposit Refund System
EC	European Council
EEA	European Economic Area
EEB	European Environmental Bureau
EPR	Extended Producer Responsibility
EUROSTAT	European Statistics Bureau
EU	European Union
ELV	End-of-Life Vehicles
GDP	Gross Domestic Product
GPP	Green Procurement Plan
GHG	Greenhouse gas
IED	Industrial Emissions Directive
LAAIF	Lithuanian Environmental Investment Protection Fund
LT	Lithuania
MBT	Mechanical Biological Treatment
MoE	Ministry of Environment
MSW	Municipal Solid Waste
NSWMP	National Solid Waste Management Plan
NGO	Non-Governmental Organization
RRR	Reuse, Recovery, Recycling
UNEP	United Nations Environmental Program
WFD	Waste Framework Directive
WMGE	Waste and Materials in a Green Economy

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INTRODUCTION

Waste is a challenging global issue. Urbanization, changing consumer patterns, growth in *per capita* earnings have led to more waste generation. Today, waste has become a non-detachable aspect of mankind's existence. Waste is considered as any substance which is discarded after primary use, or is worthless, defective and of no use (Longdom Publishing). Its availability and exponential generation have become a huge global threat and a beneficial resource on the other hand if well managed.

In the European Union, the revised Waste Framework Directive (WFD) is the principal legal framework responsible for the protection of the environment and public health through proper management of waste (Directive 2008/98/EC on waste and repealing..., 2008). The WFD defines waste as "any substance or object which the holder discards or intends or is required to discard" (Article 3(1) of the directive). This definition also draws a clear line between the terms 'waste' and 'by-products' as most academics often use both terms interchangeably. The directive clearly defines by-product as "substance or object, resulting from a production process, the primary aim of which is not the production of that item which has a lawful use in accord with environmental protection requirements" (Article 5(1) of the WFD). However, the definition of waste by the directive seems broad as it does not reveal the different kinds of waste but only categorizes waste substance based on its "hazardousness".

Agricultural waste, domestic (municipal) waste, industrial waste, hazardous waste, medical waste and construction debris are considered the main categories of waste. However, the way in which we produce and dispose of waste is generally unsustainable. Therefore, sustainability in waste management must be taken into account to survive this growing waste problem.

Sustainable waste management can therefore be defined as the control of generation, collection, storage, transfer, processing, and disposal of solid wastes in a manner that is in accordance with the best principles of environmental protection, public health and resource (cost) efficiency. To guarantee sustainability, the waste sector has become a highly regulated one on a global scale.

This master thesis strives to create coherent legal analysis on the role of law in ensuring sustainability in waste management and to provide some recommendations that outline what actions and legal measures that could be taken in the Republic of Lithuania to ameliorate

processes on waste prevention, collection, recovery, recycling that embodies sustainability in compliance with EU legislation.

The motive for this research topic stems from my passion in organic agriculture. Whilst waste is a problem, it can also be a solution to some global problems like food insecurity. Sustainable processing of biodegradable waste via composting can result in a rich bio fertilizer for building healthy soils necessary for cultivating clean and healthy food. As a matter of fact, policy, waste management and the agricultural sectors may be considered loosely integrated.

The objective of this master's thesis is to analyze the impact of the role of law on sustainability in waste management. Despite the promulgation of many regulations to ameliorate waste management, the role of law in sustainable waste management is yet to be fully felt.

The tasks involved to satisfy the objective will be to: (1) perform an exhaustive overview of the EU waste legislation and to analyze aspects of the Law on Waste Management and its implementation towards sustainability in the Republic of Lithuania as a member state; (2) perform interview-based survey in sample area to judge the attitude of citizens towards law and waste management; (3) gather specific quantitative data on waste and trends in waste management to ascertain the role of law; (4) load count of stock flows and stocks of bio waste materials from source generation, collection and disposal.

The selected tasks are vital to guide the analytical approach of the legal acts by providing a systematic exposure of waste rules, how they apply and areas of difficulty which aid to predict future developments in concrete factual circumstances. Empirical data gathered from waste load counts and analysis of survey statistic results will serve as measurements that give effect to the legislative provisions in place by looking at what policy requires and what is practiced to be able to draw conclusions that answer the question on the effect of law of sustainability in waste management.

The relevance and urgency of this research cannot be overlooked. Continuous unsustainable waste management may result in environmental degradation in the form of air, water, and land pollution that pose risks to public health. The environment has limited capacity for waste assimilation. If too much waste enters the environment rather than being recycled or reused, the assimilative capacity of the environment is put under too much stress to be able to handle the total quantity of waste generated. As such, law makers, municipal

environmental engineers and planners have a daunting task to employ green technology approaches that are viable and sustainable guided by a pragmatic rule of law.

This research lays particular emphasis on biodegradable waste because it constitutes the greatest proportion of the entire waste flow chart. Taking into account the influx of people into the Republic of Lithuania mainly as a result of the current socio-political crisis in Europe at the moment, waste generation would surge.

The methodology implored in this thesis is the analytical research methodology which is reflected by analyzing EU law acts of sustainability in waste management alongside concepts of sustainability proposed by national law, notably the Law on Waste Management of the Republic of Lithuania and practice in other EU countries. The idea is to determine interconnections of the sustainability principles in both hierarchies and how the force behind these laws is recognized through implementation by analyzing case law.

Qualitative data gathered through the small area estimation (Kontokosta *et al.*, 2018) will be analyzed to serve as measurements giving effect to the legislative provisions in place that is looking what policy requires and what is practiced to be able to draw conclusions that answer the question on the role of law of sustainability in waste management.

This study therefore serves as a reference to Ministry of Environment of the Republic of Lithuania as far as sustainability and law is concerned as it gives an in-depth understanding by analyzing the current EU framework legislation on sustainability in waste management and the best ways to estimate at the national level. The study will contribute to existing the knowledge on EU legislation and how it impacts sustainability that seeks to stimulate the further research on the role of law on sustainability in the Lithuanian municipalities.

In assessing the progress of Lithuania towards the EU sustainability goal, one research aspect incorporated by the author is the interview sample survey to ascertain facts and judge the behavior of citizens considered as the primary waste generators and how their behavior affects sustainability in waste management. The survey aspect is very uncommon in legal research and usually limited to scientific research but law is a social science as the aim is to know the consequences of implementing the law, its impact on sustainability and the effects of that law on the society offering a chance to suggest the changes in the current applicable law.

This legal research makes use of two types of sources: legal sources and non-legal sources. The main sources include directives and regulations of the European Union, waste

management laws approved by the Lithuanian Parliament and orders issued by the Minister of the Environment of the Republic of Lithuania. The secondary sources include journals, legal reports and published articles on EU waste management. Since the WFD says little about the characterization of different waste streams, scholarly legal writings by scientists J. Stankevičienė and J. Bužinskė on municipal waste flows, composition and treatment in Lithuania were given due preference in a bid to gather data from previous best applicable techniques after studying the current economic, social, environmental and political climate of the country with the goal to understand trends in sustainable waste management to finally settle on how practice follows the principles of law and sustainability. This research analyzes current legislations both at the EU level and national level and makes recommendations that outline what actions and legal measures may be taken to ensure that waste is sustainably managed.

The research question that this thesis seeks to answer is:

Does the role of law have an impact on sustainability in waste management? The question tries to unravel the pillars of the CEP – reduce, reuse, recycle – and contributes towards sustainability in waste management. According to the structure of this thesis, the sub-question that emerges is: “Does Lithuanian national law play a big part in waste sustainable waste management, if not the case, what are the reasons for non-enforcement and in which areas is it successful?”

The main question will be answered in Part 2 of this thesis with a detailed overview of the policies of the circular economy plan that is geared towards sustainability and, of course, reaching the circular economy. In principle, the circular economy framework is very instrumental in its implementation to create a sound waste management endeavor, but in practice, this section will examine problematic aspects of this regulation and the areas concerned which will fully answer the question about its viability in enabling suitable waste management.

The sub-question will be answered in Part 3 of research work in practical manner using empirical data gathered regarding domestic waste segregation and results from a sample survey to show whether current practices are indeed as problematic as the theory with emphasis on biodegradable waste in the Republic of Lithuania and to depict how much national laws are involved in achieving the sustainability goal announced by the EU.

Waste management is an underlying field in the most important documents of Lithuanian environmental policy. The major objectives are: the prevention of waste,

development of modern waste management system, reduction of waste stream and negative environmental impact, education of environmental consciousness and culture of citizens. Just like other governments in the European Union, the Lithuanian government faces a huge task in the management of biodegradable waste and its increasing levels. Due consideration must be given to the population pressure that the country is facing at this time owing to the socio-political crisis in Europe.

Scope and limitations. This master thesis is confined to an analytical legal study of the EU law and the national (Lithuanian) law on sustainable waste management. At the international level the author has concentrated on the Circular Economy Action Plan policy framework and other surrounding directives that influence sustainability like the Waste Packaging Directive and the Landfill Directive. At the national level, the author focused on the provisions of the Republic of Lithuania Law on Waste Management of 16 June 1998, No. VIII-787, as amended in 2022 since this legal text is readily available in English as the author is a non-Lithuanian speaker. Due to lack of resources for an extensive survey, the author targeted residential area of the Sauletekis District in the capital city of Vilnius.

1. SUSTAINABILITY AND WASTE MANAGEMENT AS A GLOBAL ISSUE

1.1. Bibliographical overview of the role of law in sustainable waste management

The European Union's policy on waste aims to make waste management more efficient throughout the Union, treating waste as a resource and moving towards a European recycling society in which the member states can develop sustainable autonomous waste elimination systems.

The goal of the EU's policy is to create a waste management atmosphere where waste can be viewed as a resource and not an evilputting sustainability at the front. Many studies have been carried out in this respect with a huge divergence of opinion. J. Stankevičienė and J. Bužinskė in their article titled "Trends of municipal waste flows, composition, treatment in Lithuania and its regions" incorporated a more integrated research towards sustainability taking into consideration many factors: generation, waste types, quantities, projection flows vis-a-vis the current applicable legislation (Stankevičienė, Bužinskė, 2021). In their work these authors duly recognized the efforts by EU legislation in controlling biodegradable waste (especially through the provisions of the Landfill Directive and the Industrial Emissions Directive). A. Bozo in "Albania's challenges of the implementation of EU environmental legislation on e-waste management as part of the accession process" claims that EU law purports to have little influence on sustainability as opposed to the impacts if one were to consider biodegradable waste side by side (Bozo, 2021).

At the EU level, the Circular Economy Action Plan is the umbrella framework dictating sustainability in waste management. In order to comply with increasing national and international requirements to achieve sustainability, one goal is the reduction by 35% (by weight) of the total quantities of biodegradable municipal solid waste which ends up at landfill until 2026 as the first step to accomplish this requirement. The views of S. Kumar *et al.* in "Emerging Trends to Approaching Zero Waste" assert that laws, policies and regulations have significantly influenced the development of sustainable waste management systems across the globe and add that a well set up system must be in place to sustainably manage waste (Kumar *et al.*, 2022). But considering that the waste management sector is a highly regulated sector, how can such systems be put in place first without any law guiding their implementation?

As a part of its sustainability goals, the aspect of waste prevention is detailed in the CEP. To support this, EU Directive 2008/98/EC sets objectives to reduce the amount of

biodegradable waste sent to landfills through separate collection, composting, and energy (biogas) recovery and recycling.

The Republic of Lithuania adopted its first Waste Prevention Program in 2014. However, according to the regional policy evaluation factsheet, the country was witnessing a decline in biodegradable waste that had an operation impact on MBT (Mechanical Biological Treatment) (Kiškis, 2016).

B. Tot *et al.* argue that in Lithuania there has been a moderate increase in generation from 2017 onwards as in 2019 MSW generation reached 472 kg *per capita* per year (Tot *et al.*, 2012). I would definitely agree to the latter opinion of the authors especially with the influx of people into the country and the fact that the waste prevention program is still gathering steam. The deposit system only became operational in 2016, which has been the greatest contributor to the country's waste reduction and recycling strategy aimed at permitting the nation to attain the goals set by the EU legislation.

Arguably, one of the most neglected areas in the waste management literature is the lack of research surrounding the impact of law solely on biodegradable waste (BDW) which has the most impact on sustainability. Past research studies conducted on this topic have jointly analyzed the entire waste stream paying very little attention to bio waste that forms the greatest portion of the waste flow chart. Similarly, there have not been many comprehensive studies that supplement the application of Lithuanian waste management law by providing examples from other developed systems in the EU like Germany and France as the trend has been to compare domestic law and EU legislation.

1.2. Waste management: a contemporary environmental problem

The Global Waste Management Outlook reveals that, 7 to 10 billion tons of waste were generated in 2010, of which around 2 billion tons is Municipal Solid Waste (MSW). It is estimated that, about 50% of global waste is generated in high-income, developed countries found in Europe, USA, Canada, Japan, Australia, and New Zealand, the other half in low-income, developing countries while high-income countries generally have advanced waste treatment plants and strict environmental laws, destined at protecting human health and the environment. Around 2% of all MSW in high-income countries is sent to landfill sites or disposed of in another way (Wilson *et al.*, 2015).

In poor countries, the situation is different as around 80% of waste goes to open dump sites (rivers, open incineration), which has adverse consequences on human health and the ecosystem. In this sense, unsustainable waste management leads to soil and underground water contamination through leaching, odors, uncontrolled incineration and air pollution which propounds the spread of diseases as well as greenhouse gas (GHG) emissions. Some waste management experts claim that, the financial costs of improper waste management may be 10 times higher than the costs of sustainable waste management.

According to the Circular Economy Monitoring Framework, the total amount of waste generated in the Republic of Lithuania alone stood at 1.4 million tons (Eurostat, 2019). Total waste generation values are available only after every 2 years; thus, with limited data, it is difficult to make conclusions on trends pertaining to the 2020-2022 periods. It is estimated that 49.9% of the entire waste stream comprised of biodegradable waste (food scrap, agricultural waste, paper and card board waste, plastic waste, yard waste, animal waste, sewage sludge) having the greatest impact on sustainability due to GHG emissions. Solid waste disposal on land is the largest GHG emission source from waste sector.

It contributed around 69.6% of the total GHG emission from waste sector in 2019. Targets for reduction of biodegradable waste disposed in the landfills were not reached as about 47.9% of all municipal biodegradable waste generated in the year 2019 was landfilled signaling a 1% growth from the previous year (Konstantinavičiūtė *et al.*, 2021).

According to the Ministry of Environment of the Republic of Lithuania, 1.5 million tons of waste was generated in 2020 and lays down ground work for the waste management capacity planning – at least 65% municipal waste should be reused or recycled and no more than 5% of municipal waste can be disposed in landfills. Therefore, forecasting waste flows is instrumental to attain goals by applying various control measures to deal with littering, food waste and disposal of biodegradable waste at landfills (Stankevičienė, Bužinskė, 2021).

On a global scale, legislators around the world are developing policies and legislations to deal with sustainability in waste management. Governments also form part of international conventions that deal with sustainability issues. According to the United Nations Environmental Program (UNEP) 175 nations are confirmed signatories to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (as of 31 March 2011). Authorities are also framing laws at the regional, national and municipal levels to deal with waste in a proper manner. Today, the majority, if not all 193 UN member countries have enacted at least basic environment and waste management

legislation(Shulman,2021).However, this coverage can be misleading, as it proves that there is little left to do in terms of regulating the sustainable management of waste in many countries as these policies are non-legally binding strategies but only operate in principle.

Waste management in the Republic of Lithuania has become a crucial matter ever since the nation broke away from the Soviet Union in 1990. Since then, the mass exodus of people to the cities and today the influx of foreign expatriates into the country have necessitated the need to develop plans for sustainable waste management and put rules in place to this effect. Of utmost importance, another driver for the development of its waste management law is country's accession to the European Union in 2004. The country has been implementing the EU legislation (Waste Framework Directive, Landfill Directive) and accordingly amending its national law on waste management.

Generally, waste management regulation is very complex. It comprises of many legal acts, different directives, orders and general standards/guidelines aimed at a particular waste stream of treatment model(Langlet, Mahmoudi, 2016).

Despite these fortified legislations in place, there are many challenges regarding sustainable waste management at the Lithuanian level. One is the unsuccessful implementation and the incoherent nature of policies. For instance, the Landfill Directive had set a deadline for non-compliant landfills to be shut down. 800 of them were closed. However, between 2000 and 2006, 11 new landfills were to be built in 10 regional waste management territories with about 50% waste landfilled between 2014 and 2016 (Kiškis,2016).

1.3. The concept of sustainability and waste management

The concept of sustainability may be understood as the avoidance of the depletion of natural resources in order to maintain an ecological balance for future generations. In the context of waste management, it is to protect environmental health, promote the quality of the urban environment, support the efficiency and productivity of the economy and generate employment (Schubeler, 1996). The concept of sustainability accommodates three main aspects in the ecosystem: the environment, people (the social aspect) and cost (the economic aspect). The three-pillar conception of social, economic and environmental is most times represented by three intersecting cycles. (Purvis *et al.*, 2019). It is believed that these pillars are interrelated and influence each other in multiple ways. Of all three pillars, environmental

sustainability is the most widely defined and researched area within sustainability based on the premise that the depreciation of capital cannot go endlessly. The concept of sustainability is therefore concerned with resources (natural resources), quality of the environment, and capital that is envisaged for the future generations. However, though the loss of some natural resources is inevitable it may be compensated for by increased capital. From another perspective, the capital can substitute for natural resources by saying that sustainability is a matter of preserving natural resources essential for mankind's survival. (Deeksha *et al.*,2018).

The two opinions have been called weak and strong sustainability respectively. Weak sustainability represents the current sustainability principle which describes each pillar as a part of a whole with each considered equal. In other words, economic capital is able to substitute natural capital and the place of social which is then equivalent to non-decreasing capital stock. The concept therefore does not restrict the substitution between different pillars as represented in the diagram below.

Strong sustainability contrasts weak sustainability as it considers the environment as central to all social and economic activities by virtue of the fact that social and economic activities only take place within the environment and further that economic activities can only take place within the society.

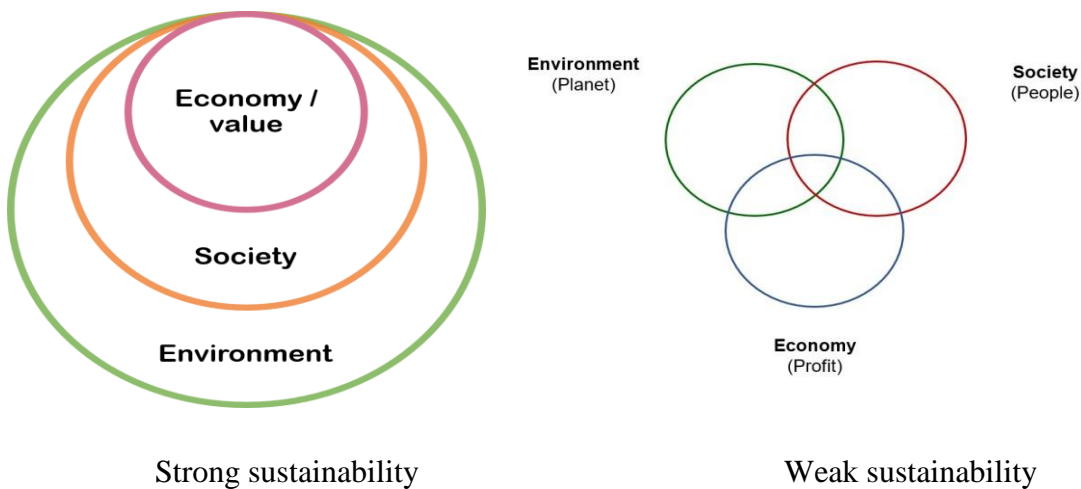


Figure 1: Concept of strong sustainability and weak sustainability

Source: Deeksha *et al.*,2018

The latter concept of strong sustainability seems to relate more to the issue of sustainability in waste management. Waste management systems built based on the interdependency of these three factors may suggest an all-round viable potential. Sustainability in waste management aims to keep materials in use for as long as possible to reduce the amount that is sent to landfills or left for incineration. Sustainability entails that business and individuals choose products that require the least resources to produce including packaging and to avoid disposable goods with a one-time value at all cost so that they will not immediately become waste after single use.

The primary fundamental concept of waste management and sustainability is the identification of solid waste based on its nature and its source. This is very important for environmental utilization and disposal processes. Despite the waste reduction and prevention measures enforced by the WFD, waste continues to increase alongside many variables, population and exorbitant lifestyles due to increased earnings. While disposal sites tend to shrink, the concept of identification is a step to mark products that are waste and those that have a resource value as an end to reduce waste generation (Hohnholt, Meyers, 2002).

The economical aspect of sustainability in waste management as it states entails that waste that cannot be prevented be regarded as a resource where useful materials can be recovered e.g., via composting. This concept is grounded on the philosophy that, if the consumption of a product cannot be avoided then focus should be on buying products that can be reused or repaired. The aspect of reuse is important in sustainability because it is done without the processing of raw materials which have the potential to reduce pressure on natural resources and cut financial costs simultaneously. The economic potential is usually portrayed through processes that are aimed for this value recovery as it necessitates the creation of jobs in the waste management sector. These processes include creating facilities to refurbish used items like textile that would finally be deposited into the environment after their life time. For this reasons, Zero Waste Europe proposed a Zero Waste Hierarchy to shift the mindset from waste management to resource management that differs from the EU waste hierarchy in the upper and lower levels, aiming to achieve value preservation by designing waste out of the system (Zero Waste Europe, 2019).

In the European Union, sustainability in waste management relies on the waste management hierarchy as it focuses on the avoidance, reduction reuse, recycling, and energy recovery before treatment or disposal. It aims to prioritize actions for the most efficient use of resources placing renewable and less detrimental practices at the top of the hierarchy.

2. SUSTAINABILITY ASPECTS OF WASTE MANAGEMENT IN THE EUROPEAN UNION

2.1. Circular economy initiatives

2.1.1. Overview

Sustainable waste management is a major focus of the European environmental policy. Upon establishing the waste hierarchy, then Union gives priority to the prevention of waste and its hazardousness, the recovery of materials via at source separation and lastly its recycling for energy and product recovery thereby offering little regards to the disposal of waste (Gómez *et al.*, 2009). Based on the 3Rs cycle that is: reducing, reuse, and recycle, the philosophy of the circular economy was born.

The philosophy behind the WFD can be traced back to the Council Directive 75/442/EEC of 15 July 1975 on waste which stratified methods for waste management into: (i) reduction in quantities of waste; and (ii) disposal via recycling and re-use, via recovery, and via storage and underground. This description did not give a preference or hierarchy as to which method was preferable as the new laws have demonstrated. The waste hierarchy is established Article 4 of the WFD (2008/98/EC, revised in 2018) which ranks five steps for dealing with waste according to its environmental impact. It also sets operating requirements for extended producer responsibility schemes ranging from design and packaging content which include organizational aspects to contribute towards waste prevention, the reusability and recyclability of products for member states.

It should be noted that the attitude of producers and consumers must be considered for sustainability regarding natural resources and all aspects of handling waste in order to retain or restore the assimilative capacity of the environment. Proponents of technical, more practice-oriented concepts of a circular economy with roots in disciplines such as industrial ecology share this view in principle (Wiesmeth, 2020). The Circular Economy Plan was adopted in December 2015.

The new law also sets new recycling targets for recycling municipal waste such that, at least 55% of all MSW be recycled by 2025 and to establish a separate collection of all textiles and hazardous waste generated at the household level. It also provides for all bio waste to be

collected separately or recycled at source through composting and any acceptable alternative treatment method with a pay as you throw scheme.

Four years later, the Commission of the European Union published a comprehensive report pointing out that 54 actions under the action plan have now been completed or are being implemented including the new European waste legislation (Report from the Commission..., 2019).

The plan restricts the materials which can be landfilled or incinerated, and requires that waste which is separately collected for recycling must not be incinerated or sent to landfill which paves the way for more recyclable materials to be kept in circulation within the resources and waste system, instead of being burned or buried. The action plan also sets a target to recycle 65% of municipal waste by 2035 and to have no more than 10% municipal waste going to landfill by 2035.

The Commission expressed so much dedication in its drive toward sustainability in waste management after endorsing four principal legislative proposals on waste packaging, land filling and separate waste collection (Varbova *et al.*, 2020).

Summarily, the Commission's intention was to encourage a uniform collection of waste materials for processing and to contribute to the creation of a circular economy. These agreements establish binding waste reduction targets and updated rules to reduce waste generation, enable sound waste management with a goal to motivate sustainability through recycle across EU member states.

The legal implication of these circular economy initiatives and waste reduction initiatives as a prerequisite for sustainability will be analyzed in details in the following chapters.

2.1.2. Green packaging

The green packaging initiative is governed by the Green Packaging Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. It is a stand-alone legal act covering the packaging of products with ambitious targets. According to this directive, 70% of product packaging should be recycled by 2030. The figure is different for individual packaging materials: 30% for wood, 55% for plastic, 75% for glass, and 85% for paper. Governments must ensure an interim overall target of 65% as set by the CEP action plan is met by the end of 2025. It is envisaged that extended producer responsibility fondly dubbed as "the polluter

pays the price principle”will become mandatory for all packaging by the end of 2024 (Europen, 2021).

An interpretation of the percentile ratio for different packaging materials is important to justify the drive of the commission towards sustainability in the sense that, it intends to make it easier for products wrapped with such packaging to be easily treated, processed and brought back to use in the economy in a bid to avoid the one-use system which is common with the linear economy of waste management. Since this thesis is centered on sustainability, it will not focus much on legal acts but to explain how the law seeks to create that environmental and socio-economic balance involved in sustainability.

That said, food and drink is at the center of the EU sustainability goal. Research shows that, this sector accounts for a large proportion of the environmental impact of waste in the EU. Member states must therefore ensure that packaging used on consumable must be in a material that is recyclable so that it is possible for return or collection after use (Article 7, Article 22 as amended in 2004; EU Directive 94/62/EC). This purports to be the aim of the CEP and its drive towards sustainability as this will not only reduce the quantity of waste but will also enable the creation of new products that guarantee resource efficiency and cost reduction(socio-economic). The environmental balance of this law is commendable since pollution is reduced as these packaging materials are environmentally friendly and can easily be recycled into usable products. Therefore, it is possible to assert here that green packaging is a major contributor to waste prevention.

However, the presumption that food waste may be relative to other variables and not entirely linked to consumer behavior is true. Environmental changes (humidity, temperature), biological influences (e.g., respiration, post-harvest variations) or from socioeconomic influences (e.g., insufficient marketing or distribution) (Kader, 2005). In the wordings of Articles 7 and 22 of the EU Directive 94/62/EC, the legislature found that in proposing a particular product composition design for packaging, there were chances to increase both customer satisfaction and decrease the environmental impact from the food-packaging system in the EU considered attractive from a business and usability context plus an environmental dimension. The relationship between packaging designs and food losses (waste cannot be overlooked).If consumers can purchase the right quantity for their specific need in different packaging sizes for different household sizes, it can decrease the amount of food that is wasted taking into consideration the amount of packaging used and the type compliant with the EU circularity law, which ameliorates sustainability in a nutshell.

At the national level, regulations governing green packaging in the context of sustainability is not new. Even before the advent of the 2015 Circular Economy Action Plan, some member states of the European Union already had circular economy principles enshrined in their domestic laws. In Germany, the principal tenets of the circular economy are set out in the Circular Economy Act (KrWG), enforced on 1 June 2012. In 2018, the German Federal Government for Environment, Nature Conservation and Nuclear Safety (BMU) presented a 5-point enforceable plan to reduce plastic packaging and promote more recycling as a step towards sustainability.

In the Republic of Lithuania, the aspect of sustainability in waste management is echoed in Law No. IX-517 on the Management of Packaging and Packaging Waste of 2001 as it implements the polluter pays the price principle as their German counterparts which applies to producers, importers, manufacturers of packaging, sellers, consumers, users of products, and waste management entities as it lays down requirements for collecting used packaging (recyclable), green packaging and imposes a liability for non-compliance as steps by the government to ensure sustainability in waste management (Articles 6, 7, 8 of the Law No. IX-517, respectively).

In 2002, the packaging and packaging waste management rules were approved by the Minister of Environment by Order No. 348 of June 2002 to restrict harmful packaging materials and direct their disposal (Žvaigždienė, 2016, p. 108). Since the country's waste management structure is stratified, with each municipal region individually managing its waste stream though aligning to the national law and the CEP, the Mayor of Vilnius passed a law in 2021 restricting the use of plastic packaging bags entirely to protect the environment (Rosella, 2020).

The ban is beneficial for sustainability as it aims to educate citizens on the dangers posed by plastics to the environment and to be more mindful of waste disposal.

According to data collected in 2017, Lithuania ranked first in the European Union in overall plastic packaging waste recycling with 42% recycle rates (Eurostat, 2017). This signals a huge effect of the waste packaging policies in place in ensuring sustainability as the country was decorated as recycling world champion by the World Economic Forum in 2017.

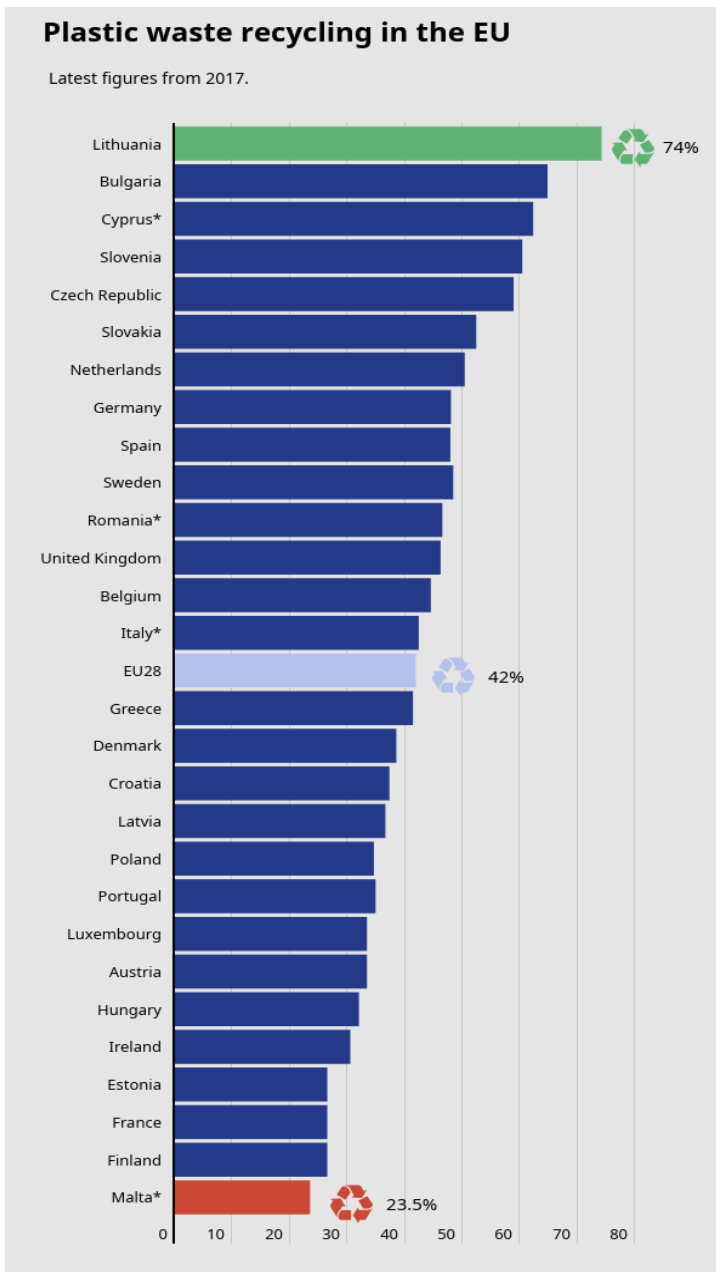


Figure 2:Chart: Plastic waste recycling in the EU
 Source: Eurostat, 2017

Despite the huge rates in plastic recycling owing the targets set by the CEP, the legislation on green packaging proves to be problematic in the case of containers like glass bottles. While the law dictates producers of packaging products to use more recyclable primary material at the production phase, the latest proposal that concerns glass bottles is neglects separate mandatory collection targets for items like beverage bottles as with plastic bottles under the single use plastic directive. As such the 2035 targets may be compromised

as there are no conditions in place at a large rate. By the EPR, when the burden is on the sector to enhance recyclability of the packaging, it is up to the member state to organize collection schemes for these materials to reach recycling sites.

Often referred to as the derogation requirement, Article 4(7) of the WFD the EU Commission may allow certain materials in case there is no recyclable content provided that the environmental impact of such packaging materials is taken into consideration. This requirement has a potential not only to let non-recyclable products circulate in the economy but also it may trigger industry experts to manufacture more packaging with less recyclability rendering the targets set by the legislation bleak. According to the alliance of Beverage Cartons and the Environment, recycling rates for beverage cartons across the EU rose to 51% in 2019. One can immediately think that this increase is as a result of the huge quantity of recyclable content in these packaging products as the law recommends. I think the best plan of action would be to subsidize the operations of bottle manufacturers and limit the applicability of the derogation clause of the EU Commission as it represents a weakness of the directive to support more non-recyclable materials in their packaging via the derogation clause instead of supporting innovation and efficiency through promoting prevention, re-use and the recyclability of waste.

In the French case of *Sapod Audic v Eco-Emballages SA*(C-159/00) which involved the issue of non-communication of the technical requirements of the packaging design and failing to comply with procedure set out in directive, the European Court of Justice was quick to rule thus endeavor as null and void but with some caution. The court's conclusion was subject to the condition that the applicable rules of national law are not less favorable than those governing similar domestic actions and are not framed in such a way as to render impossible in practice the exercise of rights conferred by Community law, hence the supremacy of the EU law.

This ruling is important for the topic because of its emphasis on the aspect of manufacturers to use more recyclable and environmentally friendly raw materials in packaging products to prevent their hazardousness when these products eventually become waste. The ruling of the ECJ against such production environmental-based contracts shows that if national regulation is made with a procedural defect in failing to comply with the procedure set out in the directive, then the national courts are not obliged to apply it. This ruling is therefore contributive to the achievement of a single market of packaging products within the union by restricting the manufacturing of packaging products with varying raw

material that poses a threat to environmental sustainability. The French circular economy law No.2020-105 of February 2020 promotes the circular economy model based on the eco design of products, the reuse of products and recycling and financial penalties in the event of non-compliance. Article 112 of this legal act prohibits the use of mineral oils as a plasticizer in plastic packaging starting from January 2023 as a waste prevention measure. The European Commission has also taken action by launching a call until February 2023 subject to a proposal for a waste packaging regulation to decide such prohibitions on EU level in respect of its waste prevention goals. It is also a good practice that technical requirements must be respected by companies manufacturing packaging and where domestic law does not see infringement tendencies in their tenders, the EU courts have the discretion to discourage such contracts when brought before the courts.

The WDF has made some effort to improve on collection as it provided for mandatory separation at the household level from 2023 and obliges industries to financially empower EPR schemes but it becomes very difficult as materials that are in circulation with little or no recyclable raw material means that they need to start thinking about new investments which may prove costly for some small countries in the EU.

One legal problem that can be raised with the Green Packaging Directive is the threat that the principal purpose of packaging to protect the goods within is overshadowed as policy makers through the directive are more concerned about reducing packaging with hazardous materials. However, the protection those plastic based packaging products provide to their content against variances like moisture and humidity that cannot be neglected. Therefore, EU lawmakers need to consider that packaging should rather be more sustainable and circular by requiring the use of more recyclable materials like fiber-based products in the manufacturing process.

2.1.3. The deposit refund system(DRS)

The waste deposit refund system has close ties to the green packaging measures as seen in the previous section of the thesis. This is because the principles of the deposit system are also governed by Directive 94/62/EC. The deposit system widely implemented under the EU CEP puts in place mechanisms for the separate collection, reuse of used packaging and the recycling or recovery of packaging waste with a financial incentive in order to channel it to the most correct waste management division and prevent waste from going to landfills. These

systems are mainly directed towards the recollection of used lead-acid batteries, plastic, glass, food and beverage containers plus other hazardous materials. In the European Union, consumer beverage packaging accounts for around 20 % of total packaging by weight (Report from the Commission..., 2006, p. 8).

Waste recovery and reuse have the potential to bring forth direct economic benefits (Batool *et al.*, 2008). In my view, the waste deposit refund system may be perceived as the most prominent driving factor towards sustainability as it accelerates transition to the circular economy because it embodies the segregation aspect which is less mentioned in many studies. It tries to create the social and economic balance (individuals earning money and simultaneously preventing harmful packaging materials from entering the ecosystem). In effect the DRS prevents additional production of packaging materials which prevents more waste generation by encouraging people to reuse packaging, recycling and recovery of packaging waste via these systems. Waste recovery is therefore important factor that can reduce the amount of waste generated sent to landfill of by up to 65 % (Armijo De Vega *et al.* (2008), Donnini Mancini *et al.* (2007)). From a sociological and psychological perspective, the deposit refund systems prove to be inclusive as they bring in consumers as actors to be part of the sustainable waste management system. By receiving premiums in the form of cash or shopping coupons, many consumers would be motivated to segregate waste which is vital in any waste management system as it can lead to enhanced energy recovery from waste and may improve the recycling process (Stoeva, Alriksson, 2017) since operators will be dealing with a uniform waste.

It is worthy of note that, the flexible nature of EU law does not predefine any specific rules as to the design of DRSs within member states provided that the aim of the legislation is met in accordance with the proportionality principle (Article 5(4) of the Treaty on European Union). A variety of systems are therefore implemented according to the law that provides room to compare the effectiveness, fairness and transparency. However, the EU Commission in 2009 issued the Communication 2009/C 107/01 on beverage packaging, deposit systems and free movement of goods which identifies certain targets DRSs must pay attention to address frictions that may arise when environmental and economic interests come into play. To an extent, this move presupposes socio-economic and environmental balance aimed at sustainability.

At the national level, the DRS became operational in the Republic of Lithuania in 2016. Environmentalists reveal that, after the implementation of the deposit system in

Lithuania public hygiene and the situation in Lithuanian forests have been improved considerable due to less littering in public places and park. With the economic benefit many citizens prefer to gather reusable and recyclable beverage packaging waste and return to deposit points. Between 2019 and 2020, the rate of packaging returned and recycled rose from 70% to 90% with collection points obligatory in the shops from 300 m² in urban areas and from 60 m² in rural areas(DRS Lithuania: MoE,2020). The decrease of beverage packaging waste in public spaces, landfills also correlated with the economic benefits for vendors of these materials as about 70% of deposit (in the form redeemable coupons or cash is spent in the same shop prompting a high degree of consumer loyalty that benefits the client relationship management of many supermarket brands as about 78.1% of Lithuanian citizens uphold the system quite positively (Baltnews, 2016).

Lithuania has one of the highest recycling rates in Europe thanks to the DRS systems. In a broader context, the relation between job creation and environmental pollution cannot be underestimated while looking at Directive 94/62/EC, and the 2001 Law № IX – 517 On the Management of Packaging and Packaging Waste in the Republic of Lithuania amended by Law № IX – 517 of 2012. The first law introduced EPR for importers and producers of the packaging of different types as they were responsible for collection and recycle under established licenses and the rates traced. However, since the new dispensation obliged them to either register with local waste management companies and finance their activities or contract them to so thereby creating more jobs. On one side, if an obliged entity (producer or importer) failed to meet the defined targets, it had to pay a special pollution tax that was chosen to be weight-related(Seimas of the Republic of Lithuania, 2016). This charge acts as deterrence to pollution by producers and importer to such packaging materials.

However, successful implementation of zero waste programmes involves potential execution challenges arising from the micro and macroenvironment (Pietzsch *et al.*, 2017). As such, waste types, law, weather and consumer behavior must be taken into account for the sustainability to be met.

Despite this flexibility, application of the law has been met with problems. For instance, inconsistencies in applying the Directive 94/62 with regards to the deposit refund system were seen in the ruling of the ECJ in the German case of Radlberger Getränkegesellschaft mbH & Co. and S. Spitz KG v Land Baden-Württemberg(C-309/02) owing to the fact that before the CEP these countries already had national legislations

covering recovery and recycling. As such, the EU should therefore accompany countries towards the sustainability journey.

According to this case, the German government imposed a mandatory deposit for beverage packaging after realizing that reusable drinks packaging fell below 72% for the first time, to 71.33%. Under the VerpackV (German national packaging law), the claimants were required from that date to charge the deposit on mineral water, beer and soft drinks prescribed in Paragraph 8(1) of the law on most of their packaging for drinks distributed in Germany and then to accept the return of, and recover, the empty packaging but would be availed from such deposits if they joined a global packaging recovery scheme set by law and transition in time into the new system. The transition became the point of contention as presented before the ECJ.

The ECJ in its ruling applied Article 7 of Directive 94/62 on packaging and packaging waste which does not confer on the producers and distributors concerned any right to continue to participate in a given packaging-waste management system, it precludes the replacement of a global system for the collection of packaging waste with a deposit and return system where the new system is not equally appropriate for the purpose of attaining the objectives of that directive or where the changeover to the new system does not take place without a break and without jeopardizing the ability of economic operators in the sectors concerned actually to participate in the new system as soon as it enters into force.

While considering the aspect of environmental protection, the court applied Article 28 of EC that precludes national law. When packaging-waste collection system is to be replaced by a deposit and return system without the producers and distributors concerned having a reasonable transitional period to adapt thereto and being assured that, at the time when the packaging-waste management system changes, they can actually participate in an operational system. Such rules can be justified by reasons relating to protection of the environment only if the means which they employ do not go beyond what is necessary for the purpose of attaining the desired objectives.

The relevance of the case is seen in the lights of Article 7 of Directive 94/62 which questions the national courts to assess whether the German legislation at issue is compatible with those provisions, and secondly, the subject-matter of the main proceedings, which seek a declaration that the claimants are not required to comply with the obligations to charge a deposit on their non-reusable packaging and accept its return in applying the directive.

However, to protect the interests of consumers from hardship dealing with used packaging, the court stated in its judgment that system must take place without a break and without jeopardizing the ability of economic operators in the sectors concerned actually to participate in the new system as soon as it enters into force. Therefore, the burden is on the economic operator to ensure a smooth transition and not a question of the law to determine the time for the changeover.

In my opinion, the effectiveness of Directive 94/62 on packaging and packaging waste should be reviewed as it is portraying loopholes in the interpretation and implementation as seen in the ECJ ruling in the Radlberger case. While Article 7 does not confer any rights for economic operators to continue using a global deposit system, it fails to point out measure taken during the period of transition into a new system. It also fails to specify a particular period of time necessary for this transition to take place which clashes with national regulation as the German law set it at six months. Even though Article 7 gives economic operators the liberty to not participate in a particular deposit system provided the system is consistent with the requirements of the Directive, it does not guarantee sustainability as different systems apply different procedures for separate waste collection. Thus, one may term the structure of the Directive as under-regulated as it leaves room for economic operators to circumvent national laws meantime causing great damage to the environment.

According to the ECJ ruling one can say that the legal framework for the DRS adopted in Lithuania more consistent. This is explicit of the high collection and recycles rates. This DRS is a nationwide method with an identical procedure giving as the amended law № IX – 517 of 2012 on the management of packaging and packaging waste obliges producers to either register with local waste management companies and finance their activities or contract them to satisfy their collection procedures. The effect of this regulation is that it promotes a uniform and collection procedure as the companies in charge operate under particular licenses and standards.

2.1.4. The Landfill Directive

The Landfill Directive has been very instrumental in ensuring environmental sustainability in waste management processes. The EU Council Directive 1999/31/EC and the EU Council Directive 2008/98 EC categorically regulates what kind of waste that is deposited in dumpsites. It establishes that organic waste and recyclables produced in the EU must be sent

to composting plants and recycling units. The applicability of this directive limits environmental damage in the sense that it goes as far to restrict initially authorized dumpsites naming them as unsanitary landfills. In principle, The Landfill Directive lays down strict requirements for landfills to reduce the harmful contamination of the environment (underground water, soil, air) via pollution and infiltration not forgetting GHG emissions. By preventing waste going to landfills it creates alternative systems for waste to be recycled.

The Landfill Directive implements standard waste acceptance procedure measures so as to avoid health and environmental risks (Ponce Del Castillo, 2014). Therefore, waste must be treated before being land filled as certain types of waste that may not be accepted in a landfill (liquid waste, used tyres, and batteries *etc.*) in a bid to support member states transition to the circular economy minimize such human and environmental risks, landfills are classified into three classes: landfills for hazardous waste, landfills for non-hazardous waste and landfills for inert waste under this directive.

According to the European Environmental Bureau, 24% of all generated waste in the union was land filled in 2018 (EEB report, 2020). Based on research, the Landfill Directive further accentuates its drive towards sustainability because it requires member states to send reports every three years on waste streams deposited and their respective based on a standard questionnaire regarding landfill practices and their implementation of the directive. This therefore creates a platform where the weaknesses on member states in disposal practices can be examined and recommendations taken.

On Lithuanian level, 843+ landfills and dumpsites were up for closure between 2000-2006 (Denafas, 2014) with 3.4 million tons of waste removed with huge remediation costs. However, 11 new “sanitary” landfills were to be built in 10 regional municipalities following the Law on Waste Management. Additionally, between 2011 and 2014, more than 50% of municipal solid waste was landfilled (Ministry of Environment, 2013, p. 7). The recent study reveals that only 67187.71 (sixty-seven thousand, one hundred and eighty seven) tons of waste was retrieved from landfills across Lithuania of the 1,318,626 of total and waste generated between 2018 and 2019 keeping sight of the 2025 targets set by the landfill directive of the EU depicting a huge contrast from the 2006 operation. Their findings imply the total waste generated in the country will be reduced by another 1.36% at 2025 compared to 2019 and treatment of waste by land filling as a result of the CEP (Stankevičienė, Bužinskė, 2021).

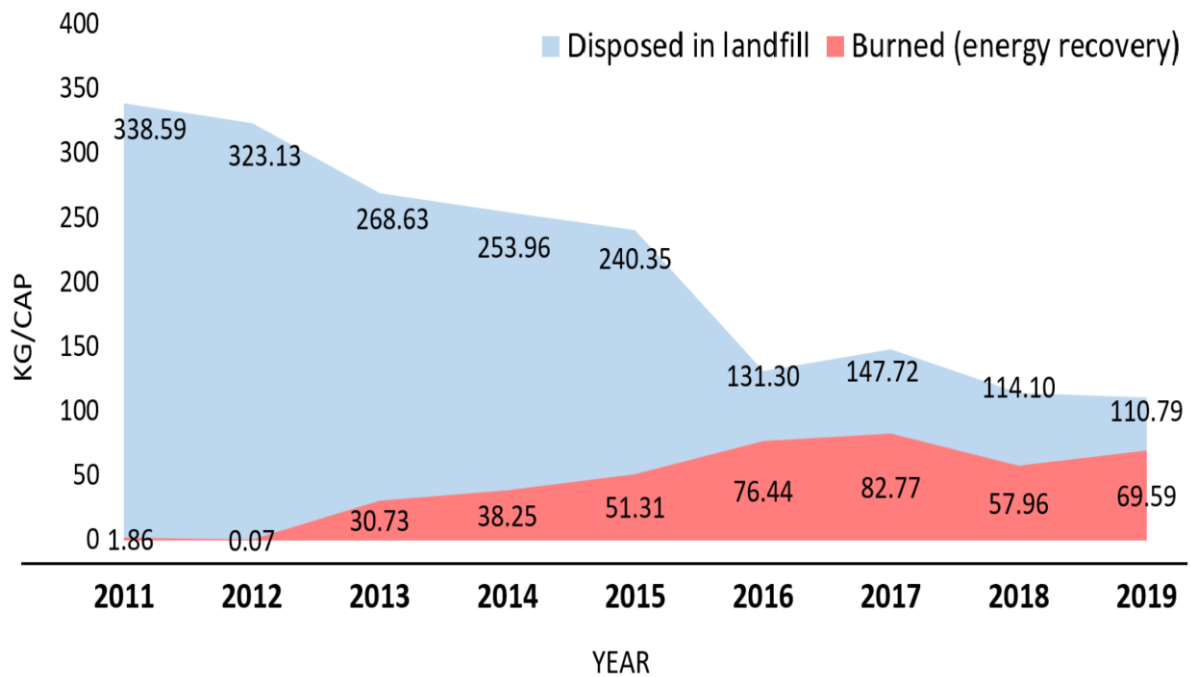


Figure 3: Amount of municipal waste deposited in landfills – Lithuania

Source: Raudonis, Paulauskaite-Taraseviciene, Eidimtas, 2022

According to the author, waste disposal in landfills is the most dangerous option. Even with the available legislation, there are marked fluctuations in between years of waste that is deposited in landfills. The target set by the EU (10%) by the directive against 2030. However, since the calculations were made on a per capita basis, there has been a considerable decrease from the last 4 years since 2016 but additional measures are needed for the nation to catch up with the 2030 target.

From a legal perspective while the Landfill Directive strives to reduce waste sent to landfills, it has considerably reduced GHG emissions even though waste continues to grow. Before adoption of the Landfill Directive, methane emissions from landfills accounted for 30% of the global anthropogenic emissions of methane into the atmosphere (Strategy paper for reducing methane emissions, 1996). To incorporate the best applicable techniques as mentioned in the early stages of this document, the legal act has set requirements for operational (treatment) standards for small plants dealing in municipal waste. This in effect gives room for effective waste management at treatment sites and dump fields to minimize pollution resulting from waste treatment. For instance, Article 43 of the Industrial Emissions Directive (IED), lays certain requirements for plants treating over 50 tons of bio-waste per

day (most composting and digestion capacity). Plants treating below 50 tons was found disproportionate (Impact Assessment on the Proposal of Directive on Industrial Emission).

However, there is evidence of gaps in the existing regulatory framework concerning the operational standards for plants which do not fall under the IED scope as even facilities treating less than 50 tons of waste per day are capable of influencing environmental pollution operating indifferent locations at scale.

In the Lithuanian landfill case of Association Kazokiskes v The Vilnius Regional Department for Environmental Protection (2009), the association representing public interest of the Kazokiskes village in Elektrenai raised a dispute regarding concerns of a proposed landfill with projected capacity of 6.8 million tons of waste over a period of 20 years which was supposed to serve as a regional landfill for the Vilnius region. The issue was that the landfill was capable of causing a health hazard as some of its installations were located within 500 m of residential houses. The association then filed a complaint to the Supreme Administrative Court of Lithuania that requirements for setting up such a facility as per the National Framework for approving landfills was not met, e.g., a detailed waste management plan, approval of the technical project and IPPC permit were contested by the association on the grounds that all the above formalities were carried out improperly.

In applying Article 15 of the Directive 96/61/EC as amended concerning the integrated pollution and control on access to information, public participation in the issuance of permits for new installations. The Court admitted the claims of the association. The Court also relied on Article 15(a) of the directive that grants access to justice on in accordance with relevant national laws. However, the administrative court ruled in favor of the Vilnius Department for Environmental Protection on the grounds that the landfill was justified based on the IPPC permit obtained. However, I think the ruling by the Court did not take into account the environmental concerns as it undermined possible health hazards for the vulnerable population in proximity. The ruling also might disregard Article 30 of the Lithuanian Constitution that requires the state to protect the constitutional rights or freedoms of persons who have been violated from applying to court as it turned down the petitions of the association representing the public interest.

2.1.5. Concluding remarks

In concluding this chapter, several observations can be made. As a response to the growing waste problem and imminent sustainability issues like littering, air pollution GHG emissions and underground water pollution of assorted materials from land filling, the EU Parliament via the circular economy initiatives have been very instrumental in restoring a viable ecosystem through recycling and reuse.

While the Waste Packaging Directive has ushered a boost in recycling rates by dictating that nature of materials used, the landfill directive has categorically restricted the kind of waste and eliminated a great percentage of waste to be sent to landfills with closures as seen in the Republic of Lithuania and the reduction in per capita waste sent to landfills.

However, in my personal opinion, contrary to the projections of many researchers, I think that landfill the targets set by the EU legislation might not curb waste increase and the amount going to dumpsites against other variables if there is not effective recycling system.

This chapter contributes to the research question by providing a comprehensive overview of the CEP in the management portfolio of waste for sustainability by assessing the effort of the Landfill regulation in reducing waste sent to dumpsites. This is an opener for the next chapter to elucidate on how waste can be prevented first to avoid management costs and environmental pollution beforehand.

2.2. Waste prevention initiatives

2.2.1. Overview

Before the CEP in 2015, the issue of waste prevention was echoed in the Waste Frame Directive. According to the WFD wasteprevention is the priority. The principal objectives of this framework are to prevent and reduce waste generation and require that waste be managed without endangering human health and harming the environment. The foundation of the EU waste management strategy is a five-step waste hierarchy in order of importance for managing waste.



Figure 4: The EU wastehierarchy

Source: <https://environment.ec.europa.eu/> (official EU portal)

As per the waste hierarchy, prevention is the preferred choice and opportunity to improve resource efficiency via recycling, recovery, reuse that limit the amount of harmful substances in products used across member states. To achieve sustainability, the EU plans to further prevent materials and products that would eventually become waste and recycling those that are inevitable (consumer packaging, food scraps) into resource so that nothing goes to landfill which is in accordance with the CE.

Waste prevention involves active measures before a substance becomes waste with the aim to reduce the quantity of waste for the same purpose that they were manufactured (Article 3(12, 13) of the WFD). The European Commission clarifies that “reducing the amounts of waste can be called quantitative waste prevention, reducing the content of harmful substances in materials and products can be termed qualitative waste prevention”. It is understood that, waste prevention does not constitute a waste management measure as it strives to inhibit unwanted materials from becoming waste that could be a threat to environment and public health.

The propositions towards waste prevention by the CEP constitute mainly economic and regulatory instruments and the promotion of research and development in the area of manufacturing less wasteful products and technologies also mentioned in Appendix IV of the WFD. These concepts as reflected in the CEP towards waste prevention are carefully analyzed below.

From a legal stand point, following the WFD, member states adopted measures to cut waste and boost recycling. The measures can be seen in the enactment of specific targets and requirements and how member states have translated them into their national law.

Article 9 (1) (j) WFD obliges member states to reduce the generation of waste, in particular waste that is not suitable for preparing for reuse and recycling. It would be cumbersome to mention how the goal of prevention is reflected across all 27 member states but those mentioned here clearly demonstrate the implementation of the EU waste prevention law and the measures these states are taking to meet the overall objective of the EU legislation for sustainability.

In the Republic of Lithuania, Article 1(1) of the Law on Waste Management(as last amended in 2022)clearlyestablishes general requirements for waste prevention and management in order to avoid adverse effects of waste on public health and the environment.

The Extended Producer Responsibility concept has been adopted in Article 2 Paragraph 36(1) of therevised Law on Waste Management (2022 version) which holds importers and manufacturers accountable for the quality of packaging that gives the duty to work towards waste prevention.

The Government Decree No. 366 of April 16, 2014 on Approval of the National Strategic Waste Management Plan for 2014-2020(NSWMP) and the Draft national action plan for waste prevention and management2021-2027are the main legal acts significantly transposing the requirements of the WFD into national law. According to the plan that ran until 2020, waste prevention objectives of the program were divided into 2: quantitative objectives (waste reduction) and qualitative objectives (reduction of hazardous substances/environmental impacts).

The plan gives priority to some particular sectors like construction and infrastructure, manufacturing and industry, retail, households, service activities, hospitality, public services (including procurement). The plan also gives priority to particular waste types like food/organic textile waste, construction and demolition waste, hazardous waste, household/municipal waste, packaging waste. The reasoning by the legislator in this stratification is attempts to prevent wasteby dealing with the sectors that reveal high waste generation and the particular types of waste that have high adverse impacts to the environment. Totrack progress in meeting the goals set by the CEP, the effectiveness of the existing program evaluated every twoyears and published on the website of the Environmental Protection Agency.

In Spain, The Catalan General Waste and Resource Management and Prevention Programme 2019–2025 (PREMET25) has set ambitious waste reduction targets: to reduce total primary waste generation and, specifically, to achieve a 15% weight reduction in waste

generation. The legal act also has a goal to reduce maximum of 150 kg of residual waste generated per inhabitant per year by 2025.

In France, the government in 2020 passed the law related to anti-waste and the circular economy (No. 2020-105) geared towards waste prevention. Article 77 of the act states: free distribution of plastic bottles containing drinks is forbidden from 2021 establishments open to the public are required to be equipped with at least one accessible drinking water fountain from 2022, any retail business selling unprocessed fresh fruit and vegetables is required to exhibit them without plastic packaging if sold in batches below 1.5 kg from 2022, catering establishments are required to serve meals and drinks consumed on the premises in reusable cups (including their means of closure and lids), reusable plates and containers as well as with reusable cutlery from 2023.

France's Environmental Code Article L541-10 prescribes that as part of the EPR scheme, any natural or legal person who develops, manufactures, handles, processes, sells or imports waste-generating products or elements and materials used in their manufacture is obliged to implement or contribute to waste prevention measures.

The motive for analyzing waste prevention acts of France and Spain in comparison with the Republic of Lithuania is to demonstrate a difference in the wordings of the legal acts towards the waste prevention initiative. The Spanish legal act strives to reduce waste per habitant, the French Environmental code targets legal persons with a more potential to influence consumer behavior but the Lithuanian legal act wording does not define a specific audience, it instead sets requirements for 'producers' of waste in different sectors of waste generation. One observation is that, by drafting the law in a manner that holds each person accountable spurs a feeling of legal consciousness that can even translate into applying the law on a per capita basis capable of influencing social recognition of these requirements.

2.2.2. Taxation policy

Taxation policy represents a core economic and regulatory instrument in the area of waste management across the EU. The importance of taxation of waste generators is to extend liability to environmental polluters (importers, manufacturers and consumers) in the form of an extra surcharge. In the European Union, most taxes in waste management are either contributions for a community service (like the collection of municipal waste) or taxes on disposal in order to make separate collection and recycling more attractive. This section

therefore gives a critical analysis in of the role taxes in achieving sustainability in waste management from a socio-economic and environmental context.

Most governments have used tax regimes on waste for long time to discourage consumers from certain products that may end up as waste which is detrimental to the environment and costly to manage. Governments have also imposed high taxes for the importation of certain goods perceived as a threat to public health or the environment. Environmental taxes are very influential in creating a direct product policy capable on influencing consumer behavior towards certain products. (Jacobs and Steenge, 1990). Since more recycling stands as a goal towards sustainability, there are chances that the policy design of charges levied on different forms of waste for an individual user can contribute to waste reduction and controlled waste separation which makes it easy for recycling to take place. The charges can be differentiated into flat-rate user charges, service-unrelated variable-rate user charges, and service-related variable-rate user charges (unit-pricing). (Kai Schlegelmilch *et al.* 2002, p. 2).

The latter having commendable potential to create incentives for waste reduction and improved separation but this system is not uncommon within the European Union. The Packaging Directive offers a flat rate via the waste packaging directive as a unique surcharge is added to the price of goods that have a potential to undergo recycling. To confirm the influence of taxation polices on sustainability, studies show that recycle rates of up to 90% for have been attained in the Republic of Lithuania due to the taxes on packaging and fees associated with the DRS (TOMRA, 2018).

A marked increase in sanitation can be witnessed in the country; clean streets, clean beaches, waste free forests and free non-blocked waterways.

The overall success of taxation policies towards sustainability is owed to the tax design. As of 22 January 2002 seven widely used products, which account for a large portion of the waste stream, were added to the Law on the Tax on Environmental Pollution of the Republic of Lithuania: tyres, accumulators, galvanic elements (batteries), fuel or oil filters, air intake filters, shock absorbers and mercury lamps (Šleinotaitė-Budrienė *et al.*, 2016). Results of their study show that more producers and importers of galvanic like elements (batteries) chose to pay the tax in 2015 (20%) compared to 2004 (95%), the most positive shift of all the taxable products. This aligns with the intentions of the legislature to encourage greater producer responsibility.

Taxation on pollution started in the Republic of Lithuania with General Pollution Act of 1999; in 2003 the tax was applied for packaging waste. It was only until 2016 that the country adopted the landfill tax. Article 5 of the Law No. VIII-1183 amended by Law No. 321 “On environmental tax” requires landfill operators to be exempted from landfill waste disposal fees for disposal of phosphogypsum waste and disposal of hazardous waste which deters landfill operators from depositing hazardous waste and availing them from the fees.

The landfill tax rate in Lithuania is calculated according to the waste type and hazardousness based on some landfill restrictions by environmental pollution legal act. They include no liquid waste to landfills, no medical and infected waste, prohibited to dispose of corrosive and highly combustible waste. Since year 2002 there should be no tyres, and biodegradable waste from parks, and green areas to be deposited in landfills, and no untreated municipal waste to be deposited since January 2013. On average, non-hazardous landfills are taxed at 28 euros per ton and 50 euros per ton for hazardous waste as against 152 euros in France for unauthorized landfills (CEWEP, 2021).

Vilnius had a recycling rate of only 5.8%, which looked really poor in comparison to other capitals like Paris at 21% and Madrid with 22% with one principal target of the CEP oriented towards zero waste (Pawel, 2017).

One necessary option to reduce land filling and improve sustainability in waste management must include the increase in landfill tax in Lithuania and the strengthening of EPR and at source waste separation.

The landfill tax is very crucial for sustainability, as seen in the earlier chapters of this essay, land filling is the least of choice of treatment methods advocated by the European environmental agency and the EU Commission. The landfill tax slightly assists in minimizing waste generation and facilitates recycling.

It is estimated that, external marginal cost attributable to greenhouse emissions is \$3.27 per compacted ton of waste disposed in landfills without energy recovery and \$2.22 per compacted ton for landfills with energy recovery (Davies/Doble, 2004).

As per Eurostat and the European Environmental Agency report of 2019, there exists a need to accelerate zero-carbon practices in EU countries although there has been a noted decrease of 22% in emissions when compared to their 1990 levels. There has been a noticeable increase in taxation on emissions and environmental sustainability in the European Union (EU).

The push for landfill taxes is to internalize external costs and to bring forth incentives for waste producers and waste management units to apply environmentally friendly methods of waste disposal, to recover more value from waste, through recycling or composting that reduces waste generation. By imposing taxes on waste disposal, waste recovery (through reuse, recycling or incineration) becomes relatively cheaper. Landfill taxes are environmental incentives with the objective to change the behavior of producers and/or consumers (Schlegelmilch *et al.*, p. 37).

The application of environmental taxes also has an economic potential as they offer member states revenue. In 2020, the governments in the EU collected environmental tax revenue of €300.5 billion as against €368.8 billion as of 2017. The value represents 2.2 % of the EU gross domestic product (GDP) and 5.4 % of the EU total government revenue from taxes and social contributions (Eurostat, 2021). It is only normal to justify this decrease in the sense that more ecofriendly ways of managing waste were adopted and emissions reduced by polluters with after having felt a pinch from the surcharge.

This tax not only has been imposed on sources of pollution harmful to the environment, but also revenues gained from it serve for financing of protection of the environment (Dybiec, 2013). Between 2004 and 2015, 70% of the revenues were paid to local municipalities and used to finance measures planned in the Specific Municipal Environmental Support program, whilst 30% were paid to the state budget and used to administer the Lithuanian Environmental Investment Fund (LAAIF) and to finance the planned environmental investment projects (Budrienė, Silvestravičiūtė, 2016). It is worthy of note to end this section by saying that there exists conflicting data from different studies pertaining to the amount of revenues generated by the country post 2015, however environmental taxes stood at 2.3% of the GDP in 2019 with the largest percentage from environmental taxes (Eurostat, 2019). Pollution and landfill tax represented only 0.2% of the amount.

In another dimension, the tax instrument is vital for sustainability in the form of incentives in other domains by offering financial support in the form of tax deduction to companies to implement environmental management systems like promoting food sharing and food donation opportunities.

The 2022-2027 new programme draft includes measures to assess the need and, if necessary, initiate amendments to the VAT law, providing for a reduced VAT rate on electric vehicles, second-hand products and their repair services (textiles, furniture, toys, books, sporting goods, household goods, electronics).

However, this has the potential to backfire on waste prevention as second-hand goods have a limited life span compared to new good which may in less than no time become waste unless recycling opportunities are made available.

2.2.3. Green Procurement Plan

In the last quarter of 2021, the World Bank published its very first report on Green Public Procurement. In December 2021 the green procurement plan was launched. According to the World Bank, governments and institutions around the globe spend approximately US\$13 trillion in public contracts every year, representing approximately 12 percent of GDP(World Bank, 2021).

Before the advent of the GPP, most environmental laws focused on the environment and natural resource protection. The Green Public Procurement (GPP) is governed by Directive 2014/24/EU that comes with a double dimension aimed to boost sustainability by motivating governments to select products and services that cause minimal adverse environmental impacts. It considers the environment when searching for eco-friendly products and services at competitive prices and, more broadly, encourages sustainable procurement to include human health and economic concerns. Additionally, under the GPP government institutions purchase goods taking into account environmental costs and benefits along a product's life cycle, with the goal of contributing to sustainable consumption and production(Bugge,Voigt,2008, p. 425).

By basing purchase decisions against environmental concerns, pollution is mitigated and one hand taking the life cycle costing and shelf life of the good permits goods to be used for long periods by consumers with the ability of being recycled preventing waste being deposited in landfills. This then reduces waste generation, useless spending of financial resources and encourages recycling which all represents principles of sustainability which correlates with the principles of the Circular Economy Plan of the EU.

At the EU level, one question I raise during this research is whether the GPP Directive 2014/24/EU on member states still have room for operation in the EU as a sustainability tool. Understandably, it serves as an extra boost to sustainability alongside the CEP. The GPP attempts to serve as an effective environmental regulatory cushion side by side environmental governance allowing public institution to create both public and private markets for more environmentally friendly goods, creating a model for environmental

progress that bridges the gap between conventional environmental policy and private environmental governance(Vandenbergh,2013).

In another context, waste can be prevented as governments through the GPP may galvanize industry to develop green technologies and products (Joint Research Centre, 2019). By their green nature, any by-product emanating from such goods is still a resource after use with the potential to increase demand for green products. Such purchasing decisions by governments strongly encourage (green) innovation by giving start-ups access to economies of scale (Mazzucato, 2013) that maintains a balance between prevention of harmful products and economic benefits there from. The GPP portrays a non-binding character when it comes to purchase decisions as governments sometimes base their purchase prerogatives on product efficacy than environmental concerns.

Under the GPP, the recently amended Clean Vehicles Directive, which includes a binding minimum target for clean vehicles as a percentage of total concerned vehicles procured for each EU country is an attempt to prevent cars into the EU market place with huge carbon emissions that after their life span will not have any resource potential. This provides governments the opportunity to purchase goods based on a specific needs and environmental criteria hence avoiding wanton purchases which may encourage waste prevention. This tendency can be further corroborated with the decision of the ECJ in *Concordia Bus Finland Oy AB v Helsingin Kaupunki* case (C-513/99) as the European Court of Justice in its ruling of September 2002 confirmed the possibility of taking into consideration an environmental award criteria when deciding the most economically advantageous tender in the rehabilitation process of the Finnish public transport bus system.

At the national level, while research show that the GPP directive is not binding on all members states, each state has its own governing practices tailored to the guidelines given in the public sector directive. In the Republic of Lithuania, the public procurement policy is regulated by the Ministry of Environment with several implementing bodies and a separate public procurement office. Research show that Public Procurement (PP) amounts to 13% of GDP that is 6.3 billion Euros (PPO, 2019). Given the importance of waste prevention and meaningful government buying, the country adopted Law No.XIII-1330 on Public Procurement in 2018 as amended. Section 5 of the General Rules establishes Article 17 (2) that contracting authorities shall ensure that the performance of public contracts would be conformity with applicable environmental laws and obligations establish by the Union.

Green Public Procurement (GPP), it is not as effective in Lithuania as it accounts only for 3.3% of all public procurement in Lithuania, and is declining year after year. In Germany green public procurement stands at 15% (OECD Country Factsheet, 2019). However, according to the new dispensation, it is envisaged that, by 2030 green procurement must account for 55% of the value of all public procurement according to the new National Progress Plan 2021-2030 (NAP)(Dvarionienė, 2021).

One legal problem experienced under the GPP has been the basis of the interpretation of the Public Procurement Directive 2014/24/EU when tenders are negotiated. The issue whether to award a tender based on economic reasons or environmental concerns favored by the EU law under the Public Procurement Directive has been argued upon on 2 significant disputes.

In the Lithuanian case of 2010 between the Israel company 'eVigilo' v Fire and Rescue Department under the Ministry of the Interior (C-538/13), a dispute over a tender issued by the Ministry for the development of a system for public warnings via mobile phones the Lithuanian Supreme Court referred questions to the ECJ because the dispute involved applying EU legislation. The plaintiff brought action as it challenged the purchase and the criteria for evaluating the successful tender under EU law.

In its judgment the ECJ held that, a conflict of interests entails the risk that the contracting authority may choose to be guided by considerations (like environmental) unrelated to the contract in question and that on account of that fact alone preference may be given to a tenderer. Such a conflict of interests is thus liable to constitute an infringement of the principles of public procurement. The fact that the contracting authority appointed experts acting on its mandate in order to evaluate the tenders submitted does not relieve that authority of its responsibility to comply with the requirements of EU law. In addition, the ECJ stated that the award criteria must be formulated, in the contract documents or the contract notice to avoid any conflict of interest that may result in dispute.

Similarly, in *Evropaiki Dynamiki v European Environment Agency* (Case T-331/06 of 8 July 2010), the ECJ gives more clarity as the approach taken by public authorities in assessing environmental management laws forwarded by tenderers. According to the facts, the EEA won a bid for the supply of IT consultancy services but the contract was challenged by plaintiff pointing the use of award criterion based largely on environmental policy. The ECJ ruled in favor of the EEA as it met the environmental criterion detailed in the bid. This case was decided under the financial regulation which governs award of contracts by the

EEA. Although different from the Public Procurement Directive, the inclusion of the environmental criteria makes them similar.

The cases are very relevant to authorities as the reasoning of the court provides guidance on the aspect of assessing environmental criteria. The fact that the EEA met the environmental criteria with third party certification standards encourages public procurement that favors environmental sustainability. Even though such standards are not mandatory in offering contracts, it however puts environmental concerns into perspective during public procurement activities.

As a measure to adapt to the circular economy, Lithuania will improve the requirements in green procurement, with recent changes in the public procurement law in 2022 of to set the requirements for public procurement up to 100 %. Increase green procurement by 2023, from 50% in 2022 (Lithuania Waste Prevention Country Profile, 2021).

2.2.4. Digital technology and sustainability

As a technology law proponent, I believe contemporary tech has a great role to play in sustainability in waste management. These technologies can be represented in any form; in waste sorting using AI, waste quantity tracking tool and cloud-based waste data spreadsheets. Startup investor such as Norrsken Foundation in Stockholm, Sweden, has recognized this branch of new innovative startups. According to Norrsken, they aim to bridge digital technology and sustainability to create commercial businesses that make a positive impact (Roséen,2019).However, since this chapter is focused on waste prevention initiatives the analysis will likely be centered around the of revolutionary technologies that prevent waste and the impact on sustainability.

To support this, it is a positive step for governments to enforce legislations that support by subsidizing tech start-ups geared towards this motive. Therefore, good legislations surrounding innovations around waste management are paramount(Asase *et al.*, 2009) postulate that, the absence of satisfactory policies and weak regulations are detrimental to sustainable waste management.

In the EU, the issue of digital technologies in waste management is popular as in 2020 the European Environmental Agency released a briefing asserting to the fact that digitalization is already impacting daily lives, the environment. It continues that, digital

technology will offer more sound waste management strategies that will allow the Union to recover more valuable materials present in waste streams, reduce the amount of raw materials mined and imported thereby evading associated environmental problems that ushers in sustainability in the sector (EEA Briefing No.26/2020). This concept is already being implemented in some member states like the Republic of Lithuania. However, for this to be successful, society must accept changes and fosters a mindset that sees tech as a major contributor to the way we treat waste. This has caused a division of digital elites and analog illiterates that will have consequences for societies in embracing digital technologies in the waste prevention.

At the national level, the Republic of Lithuania adopted Law No. XIII-3039 in 2020 approving the 2021-2030 national progress plans. One of the objectives of this law that encourages sustainability is to support technological innovations to boost that nation's digitization process.

To ensure sustainability, a food waste prevention scheme using digital technology through a food sharing app called OLIO to prevent food waste is already being implemented. Launched in 2016, the app is already gaining steam and playing a vital role in waste prevention as users subscribe to share and give away unwanted and excess food stuffs. There were 1000 subscribers with the OLIO at inception and the number grew to 3000 in 10 days (Gaisyte, 2019).

There is little and inconsistent data related to food waste from different studies, however at the household level, about 75 kg per head of food is wasted each year (Codamine, 2020). This amount could even be high as consumption relative to per capita income levels and population growth. In another recent study, approximately 88 million tons (173 kg per person) of food is wasted every year in the EU-28 (28 EU Member States) along the entire food value chain. This corresponds to about 20 % of all food produced (EEA Report No. 04/2020). Can an app be capable of preventing waste in Lithuania and the EU at large?

While an increase in digital technologies across the EU is crucial in shifting EU waste management towards more sustainable materials management. It comes at a cost. A legal problem that arises is the issue of lack of legislations to govern such technologies particular when related to waste management. These technologies are new and legislation is yet to catch up. This presupposes a legal vacuum in case of dispute while utilizing such technologies. New business models like e-trading platforms and waste specific software are already emerging in the EU but such technologies are even new to some legal practitioners and lawyers who are

ignorant of their functionality. While there exists room to adapt and respond to flexible waste patterns, authorities must develop and adopt frameworks that govern such technologies in waste management. Although technology purports to be a pull towards circularity, lack of a compelling legal framework, security issues and investment costs are some of the major barriers.

It is safe to say that in the event to reduce costs and reap the benefits of automation, some systems are already using robotics to sort waste. Mindful of the facts that robots are not humans, their social characteristics put them under the umbrella of the law in case of any infringement as with the recent case of robot liability in South Africa by Pretoria High Court (*Lekgothoane v Road accident fund*, 2017). However, there have been calls for an EU wide legislative framework that will govern the ethical development of artificial intelligence (Taylor, 2018).

2.2.5. Concluding remarks

To round up this section, one cannot deny the fact that sustainability in waste management has been increased through the CEP and its promising nature as seen from the analysis above. In a nut shell, the Circular Economy plan takes into consideration many aspects like separation, handling, disposal and also gives treatment directions about different waste variables, waste categorization and even set targets to achieve and deadlines necessary for member states to transpose its provisions into their respective national laws which seems to accelerate transition from a linear waste economy to circular economy in an attempt to meet the goals.

However, the analysis revealed some issues of interpretation of the EU law by national courts with the non-alignment of EU circularity principles with domestic legislations. If waste laws are not implemented efficiently, waste handlers will use the most convenient and inexpensive way to dispose of waste which adversely impacts sustainability. This leads me to say that the wordings of the CEP do not match actions. For instance, considering the problem of sustainable waste management is a social one, which integrates consumer consumption patterns and their behavior, the CEP in its reformist circular society discourse has not mentioned anything with regards to curbing overconsumption and downscaling bad consumer behavior as core targets of a circular attempt which gives the CEP a somewhat vague tone.

Similarly, in an attempt to penalize polluters through the extended producer responsibility principle, the taxation policies supported by the CEP seem to be controversial to achieve the objectives of the CEP. Taxes sometimes risk creating financial dependency on the very thing we want to see disappear because some of them are non-binding and give operators rooms to pollute because they are able to pay the tax with as little as 50euros per ton for hazardous landfill taxes in Lithuania. However, it would be economically unjust to use direct command tax measures that would see many investments go down. To achieve a balance in this instance gives room for further research.

Lastly, there are questions as to the Monitoring Framework of the Commission to track circularity transition. Many studies across the EU proof that the Republic of Lithuania has aligned well to the Circular Economy plan with up to 90% recycling rates and environmental protection since 2016. By contrast the country's attempt to adopt a new law that makes Green Procurement mandatory is testament of the fact that the non-binding nature of the green public sector directive under the circularity program had a limited impact on the nations transition agenda following a set of indicators by the EuropeanCommission in its Communication on a monitoring framework for the circular economy (COM (2018)29). This therefore suggests that, such indicators lack targets or policy actions that limit them to a purely informative role. It will be unjust to say the CEP has not had a role towards sustainability but in my opinion weaknesses from its applicability obscures its full potential.

According to the CEP, incineration is a bad practice. Sadly, the Republic of Lithuania operates an incineration center within the country which contradicts the intentions of the EU legislative framework on management and the national law of waste management. Till date, the Republic of Lithuania has not implemented the incineration tax.

By highlighting sustainability measures at sustainability framework, this section has contributed to highlight the effect of policies and their implementation to guarantee sustainability in waste management.

3. MANAGEMENT OF BIODEGRADABLE WASTE IN THE REPUBLIC OF LITHUANIA

3.1. Sustainability aspects of the treatment of biodegradable waste

3.1.1. Overview

The last section of this thesis focuses on the sustainability aspects of the treatment of biodegradable waste in the Republic of Lithuania using composting as a viable model. Waste management in the Republic of Lithuania is pretty decentralized as it is the competence of each municipality. These municipalities are responsible for separate and selective collection of different waste streams; paper glass plastic metal, bio waste. As such, basic requirements for the quality of waste collection services by municipalities are established in 2012 Decree No.DI-857 by the Minister of Environment (Žvaigždinienė, 2016, p. 101-104).

It highlights the current waste management systems which are governed by the Waste Management Law No. VIII-787 amended in 2022. Article 2(25) of this law defines biodegradable waste as “any waste that is capable of undergoing, or may be subjected to, anaerobic (with oxygen) or aerobic decomposition (without oxygen)”. Studies show that biodegradable waste occupies the largest share in the entire waste stream. On average, about 34% of total waste in the Republic of Lithuania is biodegradable waste (ETC/WMGE, 2019, Eurostat, 2020), comprising of garden waste, yard waste, food scrap, green packaging, waste paper and wood waste.

Research proves that biodegradable waste has the most adverse impact on sustainability, first due to GHG emissions from anaerobic decomposition, odors, a threat to public health and hygiene. This chapter therefore presents the current situations as timidly controlled and focuses on legal steps taken by the republic of Lithuania to separate waste at source for treatment: a prerequisite for effective and sustainable bio waste management. The section analyses the treatment and processing of bio waste into bio fertilizers (composting).

This part also identifies certain obstacles and challenges in the second chapter based on a survey carried out in the city of Vilnius regarding the separation and collection of bio degradable waste aimed at facilitating composting and closes up with the results of the study and proposal from the author based on the metrics obtained.

3.1.2. Policy on separate collection at source

The Law on Waste Management fully provides for the separate collection of waste in the Republic of Lithuania. Article 2(59) provides that, separate waste collection entails the collection of waste where a waste stream is kept separately by type and nature so as to facilitate a specific treatment of the waste of such type and nature. To enable biowaste to be used as a source of high-quality fertilizer and soil improver, it needs to be collected separately at source while keeping impurity levels low. Contamination with plastics is a growing concern, and plastics need to be prevented from entering bio-waste (Van der Linden *et al.*, 2020).

The revised Waste Framework Directive (2018 version) introduced several substantial changes made relevant for biowaste that are binding and relevant to bio waste in the Republic of Lithuania (as EU member state): firstly, Articles 10(2) and 11(1) make the separation at source mandatory for all EU member states as well as ensure successful and high recycling rates from the end of 2023 onwards (WFD) (EU, 2008).

Additionally, it is understood that, the main legal provisions of the WFD 2008 were finally transposed into national law by two legal acts: the Strategic Waste Management Plan (NSWMP) approved by Government Decree No. 366 of April 16, 2014 that ran from 2014-2020 and the (TAR, 2014-04-30, No. 4989) now replaced by the draft National Action Plan for Waste Prevention and Management 2022-2027.

Just as the WFD, the plan takes a firm stance on the issue of separate collection of waste and directly contributes to the application of the waste hierarchy, i.e., promotes waste prevention, preparation for re-use, recycling and other recovery of waste. The legal act set up a requirement for separate collection of the following waste streams: hazardous waste, biodegradable waste, secondary raw materials (paper and cardboard, plastic, glass, metal), WEEE, used tyres, bulky waste, construction and demolition waste, mixed municipal waste (waste remaining after sorting), waste oils and ELVs representing regional waste management systems created in the 10 municipal districts of Lithuania (Alytus, Kaunas, Klaipėda, Marijampolė, Panevėžys, Šiauliai, Tauragė, Telšiai, Utena and Vilnius).

As opposed to the Lithuanian Law on Waste Management, the NSWMP establishes strict requirements for municipalities to implement separate collection systems. As of January 2015, it grants schemes of bring points and provides containers for separate collection of secondary raw materials in the largest cities (Alytus, Kaunas, Klaipėda, Marijampolė,

Panevėžys, Šiauliai and Vilnius), i.e., at least one bringpoint in apartment building areas with 600 inhabitants; for other cities: not less than one bring point in apartment buildings with 800 inhabitants. In areas where residents are not supplied with individual containers, install not less than one bring point at the main entrance into the residential area. According to the act collection points must be present in public places with frequent visitors and temporary bring points to be established during public events.

For easy collection the legislation has also detailed certain distance parameters; the national legislation specifies average distance to bring points in the apartment building areas should be not more than 150 m by 2016; the average distance to bring points in apartment building areas is to be not more than 100 m by 2018; at least one bulky waste collection site serves 50 000 inhabitants, but there should be at least one such site in any municipality (NSWMP, 2014).

The definition of separate collection of waste in Articles 2(13) of the Law on Waste Management of the Republic of Lithuania and the requirements in Articles 22, 3 (11) of the WFD seek to take measures to encourage the separate collection of biowaste was in view of directing bio waste for composting and alternate digestion processes which it terms “specific treatment”. Similarly, Article 53(3) of the WFD states that the state and each person must protect the environment from harmful influences. In a broader context this provision may encompass the aspect of separation as a determining factor to not introduce harmful and hazardous materials to the environment especially where these materials are destined for landfills.

According to the Lithuanian Environmental Protection Agency, the current waste management law requires business entities (supermarkets, cafes, restaurants and other food processing entities) to sort biodegradable waste (atliekos.gamta.lt). Though many economic operators expressed discontent for the penalty for non-compliance as reprisal of their constitutional right of economic freedom, point 6 of Paragraph 19 of Article 34(23) of the Law on Waste Management which consolidates an entity on the grounds for revoking a business license for non-separation of waste is not in conflict the Constitution.

In a 2017 ruling No. KT6-N5/2017, case No. 8/2016, the Constitutional Court stated that a petitioner whose licenses revoked after warning of a possible suspension of the validity of the license has been issued for the third time in 2 years, should be regarded as an effective measure aimed to prevent harm to the environment and human health from improper management of waste (On the grounds for revoking..., 2017).

3.1.3. Composting as a treatment model: strengths and weaknesses

Simply put, composting embodies the controlled decomposition of organic matter using oxygen or without oxygen that is aimed at either production of bio fertilizers (compost) or biogas extraction. In Lithuania, anaerobic (without oxygen) BDW digestion is a widely applied management method due to generation of renewable energy, reduction of land filling, stabilization of biodegradable material, and mitigation of climate change (Stunzenas, Kliopova, 2018).

Notably, biodegradable waste is a big environmental challenge. At the same time, it represents a vital socio-economic resource material in the waste stream. Successful treatment of bio degradable waste by composting first requires it to be segregated at source from other residual waste. If done diligently, composting would be the most efficient way of treating bio waste. The benefits are not farfetched, a well-coordinated waste separation strategy gives room for less residual waste to be transported, hence reducing transport and management costs (Vázquez, Soto, 2017) and CO₂ emissions from burning fuel. Consequently, citizens can benefit from a highly fortified and rich organic fertilizer (compost) for their farms which build healthy soils and intends revives the ecosystem in a whole.

Composting is not new in Lithuania. Especially in remote areas with vast open lands. The country's kind of de-centralized waste management system can offer an opportunity for bio-waste treatment establishing compost facilities in every county. Home composting is very popular in the Republic of Lithuania, at least 1 out of 5 homes practice backyard composting. However, requires people to have some knowledge of good composting practice to avoid unnecessary environmental impacts and to ensure good-quality compost. Odors and greenhouse emissions (e.g., methane, nitrous oxide) can be emitted during the process if not well managed (Colón *et al.*, 2012).

The activity is regulated by orders of the Minister of Environment and provisions of the WFD. However, the European Commission took a bold step that will affect bio waste treatment in the Republic of Lithuania as the EU Product Fertilizers Regulation (EU) 2019/1001 was published in 2019 and enforceable from 2022. Requirements of Article 24 of Commission Regulation (EU) No 1069/2009 also lay down specific directions as to where

biodegradable waste, including green waste, is composted or anaerobically treated with animal by-products; it must be treated in a facility which complies with that law.

In Lithuania the guidelines for composting green waste are set out in Order No. D1-57 of the Minister of Environment of the Republic of Lithuania of 25 January 2007 “On the Approval of Environmental Requirements for Composting and Anaerobic Treatment of Biodegradable Waste”(as amended in 2020). The 2020 amendment is highly appreciated in reference to composting green waste in conjunction with the animal waste that may be used for the production of technical compost used as a stabilate for landfills. Article 5 of the general provision of the new composting law lays down requirements for composting green waste with animal by-products. However, between 2007 and 2019, in the case of co-composting with animal products including food and kitchen waste, additional requirements under Article 24 of the Regulation (EU) No. 1069/2009 applied to govern co-composting.

The Minister of Agriculture passed an Order in 2019 on the Procedure for Adding and Removing Fertilizer Products Placed on the Market of the Republic of Lithuania in a bid to identify and valorize fertilizer products placed and delivered on the market of the Republic of Lithuania.

According to this Order, fertilizer products made from bio waste are divided into the following categories-fertilizers (inorganic; organic; organic-mineral), starvation substances, soil improvers, growing media, inhibitors, plant bio stimulants, ash, mixtures of fertilizers.

The objective of the law is placing secondary raw materials on the EU fertilizer market in order to protect primary raw materials through strict labeling requirements. It aims to enable recycled organic fertilizers and soil improvers (composts and digestate products) access to the EU internal market so that they can compete on an equal level with mineral fertilizers. Registered individual compost producers may be able sell compost on the market for a premium while healthy soils and partaking in the waste minimization program.

Considering that composting as a treatment model abates in waste management which also satisfies the waste separation objective, it proves to be a very costly endeavor to government. Estimates show that estimates that 10.91 l/t is needed for composting 1 ton of green waste (Staugaitis *et al.*, 2016, Staniškis *et al.*). The costs are split from the high fuel consumption resulting from shredding of green waste (up to 51.51%), and significant costs for the transport of primary waste materials to the maturing site (about 27%).

However, cost benefit analysis has shown that the potential environmental, economic and social benefits for citizens and waste operators are overwhelming provided that the entire

waste system is optimized(Niskanen, Kemppe, 2019). The actual cost is related to door-to-door collection services, population count and weather conditions. For instance, since 2014, 8.5 thousand composting bins (containers) for green waste and backyard composting have been distributed for individual houses in the region. According to the results of monitoring and theoretical calculations, over 3 thousand tons per year of BDW can be composted in these containers. In addition, centralized composting sites have been successfully working in this region. Approximately 4.7 thousand tons of green waste from public territories were collected and aerobically treated. A part of produced compost has already been used for town gardening and landscaping(Stunzenas, Kliopova, 2018, p. 643).

On account of a private investigation, it was discovered that BDW, food and kitchen waste is not collected and treated separately within the surveyed area in Vilnius municipality due to the lack of a robust separation system. These mixed varied streams usually end up in mixed municipal waste containers as well as different waste filled in green waste containers built on individual holdings, from which the green waste is composted at green waste composting sites. This is a possible challenge to waste composting.

It should also be noted that from a cost analyses perspective, if BDW collection is not optimized by collecting specific waste materials at certain intervals, it may prompt waste recovery companies to make several rounds which increases overall fuel costs, labor costs and additional taxes on energy.

Similarly, when a particular stream of waste is not disposed of by the generator in the proper manner and becomes a nuisance to the environment or where distinct waste is left unattended to by the operators and causes environmental damage like land filing, a prosecution policy comes into play. However, prosecutions are not random but subject to a number of factors like the nature of the breach, how it was discovered and the attitude of the offender difficult to ascertain atimes(Richardson,1982).

In the Republic of Lithuania, when damage is caused to land or under land by polluting substances, restoration measures approved by Order No.DI-228 of the Minister of Environment in 2006 and Directive 2004/35/CE. These acts oblige the operators to take necessary measures to makes sure that these polluting substances are removed and the damage mitigated accordingly (Žvaigždienė, 2016). As per this provision, the use of compost can be beneficial for landfill operators to rejuvenate polluted landfills from underground water pollution and soil pollution using compost applications to restore the soil structure underneath. Since, the new EU Fertilizing Product Regulation requires certain

standards of compost uses in agriculture, that which is not suitable for cultivate, otherwise called technical compost as per the regulation can be used only as a stabilate for overlay of landfill layer and landfill restoration as such optimization possibilities of municipal BDW management has been tested in one of the Lithuanian regions.

3.1.4. Concluding remarks

This chapter has analyzed in detail the treatment of bio waste through compositing in the Republic of Lithuania as a sustainability component by tilting attention towards laws that revolve around the model. By examining national laws and the EU legislation, Lithuania's national law and further modifications gave composting a place as to what and how to compost.

One legal problem in the composting domain in the Republic of Lithuania was the legal vacuum that existed in regulating co composting between 2007 and 2019. However, the new 2020 composting by the Order of the Minister of Environment solved this legal problem by setting requirements for co composting.

A legal problem evident with the separation policy is that, while the law may be used to trace and control business entities with obvious penalties it is not the case when it comes to consumers at the household levels as the law is rarely respected as it is difficult to monitor or force each individual to influence their waste separation habits.

But in any society the enforcement of legally binding principles is key to success. The policy on waste separation could not be left out of the analysis because for any successful bio waste compost treatment model, the collection strategy plus the application of waste segregation law by citizens must be optimized.

I think, the parameters to improve composting in Lithuania must include increased consumer responsibility by making waste separation laws binding as this can even have an impact on cost reduction from waste operators on fuel and labor costs from presorting at the maturing sites. Even though government in its national waste management strategy issued that waste separation at the household level is mandatory, many consumers are not conscious of the fact that failure to separate waste could bring liability and therefore portray a timid attitude when it comes to separating waste at the household level that represents a huge percentage of at-source generation. At the very end, more and more awareness campaigns should be undertaken so that citizens may know not separating waste is

punishable by law. However, the question is how would this be monitored to ensure compliance? Are smart bins the way out? Should individuals be offered bins with two compartments?

Many environmental advocates discern the imbalance between the new legal framework that complies with EU standards and the limited human and financial resources to optimize bio waste separation at source. The national waste management strategy plan lays enough emphasis on green recycling and need to modernize organic agriculture which may serve as an open market response to any compost endeavor in the country. Targets set by the EU legislation falls short of details on how Lithuania as an independent entity plans to achieve them taking into context mechanisms peculiar to the country. The document may be seen as a tool to re-evaluate country framework to fulfill the obligations of membership in European Union to achieve sustainability at its own expense.

From an environmental angle, in order to optimize the composting process of BDW by reducing the environmental impact during composting and increasing the value of the compost produced as a fertilizer, it is proposed to use small quantities of microbiological preparations, which are also widely used as natural odor control agents.

Though composting is a costly model which needs technical knowledge, it can bring positive impact in through increased recycling rates on the entire waste sector if approached tactically.

3.2. Results (Extent of Lithuania's adaptation to EU sustainability goals)

3.2.1. Quantitative data analysis

The quantitative approach was very fundamental in this research in gathering data from studies on the topic already covered under waste management which would not have been possible for the author of this work to perform alone due to lack of resources. Even though there were various data sources with quite different values, the author relied on data only from published works and reputable organizations like the EU Statistic Bureau and statistics provided by government readily available through the Ministry of Environment in Lithuania. This data was then used to make calculations and make projections to determine the role of law in ensuring sustainability in waste management which answers the first research question of this thesis.

Though not perfect, Lithuania's adaptation to the EU sustainability goals is commendable in response to the targets set by the union in the 2015 circular economy plan.

Findings according to this thesis show that country has witnessed marked increases in the recycling rates of packaging waste. According to the statistics of 2017 by Eurostat, Lithuania scored a 74% recycling rate of plastic packaging against the 70% reduction target set by the Circular Economy Action Plan. By this, the country has successfully met the 2030 target as per the EU legislation. The adoption of the DRS is also a testimony of Lithuania's adaptation to the EU sustainability goals as it has not only contributed to the increase in recycling rates as seen above but also it has boosted an attitude of waste separation which is paramount in the Circular Economy. The waste system also encourages waste prevention which is a priority of the EU commission in its drives towards sustainability as it enables the use of recycling and reuse of products rather than bringing new secondary materials into the economy and limiting costs of sourcing additional primary materials for production.

Also, I think the most prominent addition that is noticeable is the 50% recycling target of all household waste required by the CEP. In a bid to meet this requirement, the country adopted a new development strategy in 2015 and one of the top priorities included the transition to a circular economy where it planned to revise its recycling policy and the use of alternative fuels to increase energy efficiency (Grigoryan, Borodavkina, 2017).

According to the findings, there has been a 0.76% reduction in municipal waste deposited in landfills between 2018 (Year X) and 2019 (Year Y). Calculations have been made based on per capita waste deposited in landfills for two respective years since the CEP was adopted in 2016 and assuming implementation started in 2016 and gained traction in 2017.

Calculation methods:

Per capita waste deposited on landfills x Total population =

Sum of multiplication of Total waste deposited ÷ Total annual waste generation x 100 = %
landfilled

% Year Y - % of Year X = Difference in % within both years for municipal waste landfilled.

It should be noted that this sum does not include other waste (industrial waste, agricultural waste, *etc.*).

On the EU sustainability plan, a decline in land filling means that less waste goes to dumpsites and more recycled. According to I. Žvaigždiniene, most of the municipal waste is landfilled (Žvaigždiniene, 2016). The author has not provided a definite percentage as there are inconsistent figures regarding the amount of waste deposited in landfills from several studies. In a 2016 report from the Ministry of Environment depicting trends in land filling over 5 years it can be said that the effect of the Landfill Directive and national laws on the Lithuanian waste management system will continue to grow as 59% of solid waste was land filled in 2014 against 92% in 2004. The decrease can be attributed to the new national waste management plan (NWMP) for the period of 2014–2020 was adopted in 2014 that provided impetus for separate collection hence reducing amount of waste sent to landfill.

As seen data collected and the research findings, since 2016 there has been a slightly significant decrease in the amount of MSW taken to landfill and an increase in the amount of energy produced by burning waste forecasting waste and its potential to be used as secondary raw materials but is still a challenging task in the country and requires more detailed studies and experiments as incineration is harmful to the air and environment. The decrease in land filling in the later years may be attributed to the adoption of the landfill tax in 2016 but however this tax was dropped from the initial planned 27 euros per ton to only 5 euros giving room for more land filling.

Policies of this nature reveal that it will take the country an additional effort to fulfill the 10% landfill reduction target of the EU Commission by 2035.

The results obtained from this study are important because they can be used to project the future trends regarding the amount of waste that goes to landfill so that appropriate legal measures can be put in place. Such predictability can be evaluated using autocorrelation function. Autocorrelation function is a mathematical representation of the similarity degree between a two-time series signal, where one is lagged version of itself over successive time intervals. It measures the relationship between a variable's current values and its past values (historical data). This function varies between positive 1 and negative 1, where +1 represents positive correlation, 0 represents no correlation and -1 demonstrates negative correlation. This method has been applied in this thesis to measure past trends of how waste deposited on landfills were affected between 2011 and 2016 in Lithuania.

The vision of the CEP was to give a new boost to job creation, increased recycling rates, carbon neutral and resource efficient competitive economy (EU Commission CEP, COM(2015) 614). Conversely, several scholars emphasize that the EU's interpretation

and implementation of the CE concept be re-examined(Colombo *et al.*, 2019). While various articles have analyzed specific aspects of the EU's CE policies, no research so far has comprehensively analyzed the discourse and sustainability implications of the CE package at an EU level(Calisto *et al.*, 2020).

3.2.2. Qualitative data analysis

Secondly, due consideration was given by the author to qualitative data from case study surveys based on interviews to give more clarity and originality to the endeavor.

Qualitative data analysis is very prevalent in the social sciences and other public research areas. The value it adds to this thesis is that, the author did not want to establish conclusions based on wider implications and proclamations from past studies. The qualitative aspect was chosen to get first hand data from waste subjects who are the main generators to create extensive and in-depth analysis. The findings from the qualitative analysis go a long way in answering the second research question of this thesis as its combines data analyzing consumer behavior relative to the rule of law.

Waste management studies are very complex often involving different variables law, the global market, the environment technology, consumers, which usually have different outcomes when sustainability is concerned. To formulate this thesis, studies on different sustainable waste management systems were reviewed across the EU that would be of motivation to the current waste management situation in Lithuania as the cosmopolitan city of Vilnius was chosen for the survey for reason of proximity and looking at the demographics and current waste management practices.

In the course of the research, it was noted that waste segregation is core driver for sustainability even though little regard is showed for it. The potential for RRR was found to be high due to waste segregation but, it is affected by lack of facilities, inadequate enforcement of the policy as well as lack of awareness and strategies for its promotion.

The survey involved a total of 9 respondents in a residential area in the Sauletekisdistrict. No reference was made to demographics as everyone generates waste. However, 90% of the respondents were 22 and above. The author put 5 questions before the interviewee

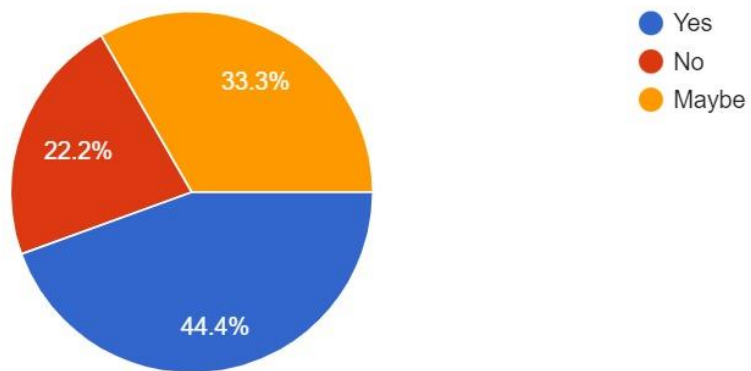
1. Are you in support of waste segregation?
2. Do you separate waste?
3. Do you find waste separation advantageous?
4. What do you think are its disadvantages?
5. Do local laws require the segregation of wastes from your region of origin?

Figure 5: Table of survey questions

Source: The author

Do you often separate waste?

9 responses



Are you in support of waste segregation?

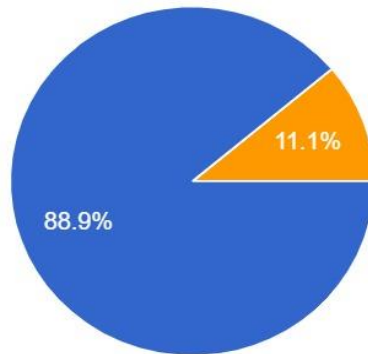
9 responses



- Yes
- No
- Maybe

Do you find waste segregation advantageous?

9 responses

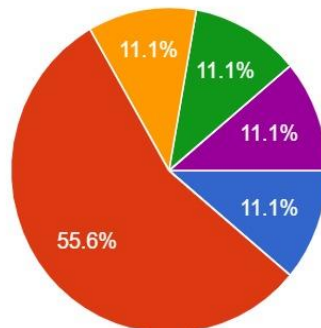


- Yes
- No
- Maybe

What do you think are its disadvantages ?

9 responses

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- Expensive
- Time Consuming
- Inconvenience(odors)
- Well, no disadvantage at all, but my concern is that we dont have enough facilities in dormitory to dump our solid waste categorically in different bins
- Space consuming (you need to have to more bins for separation wich takes space)

Are there waste segregation laws from you region of origin?

9 responses

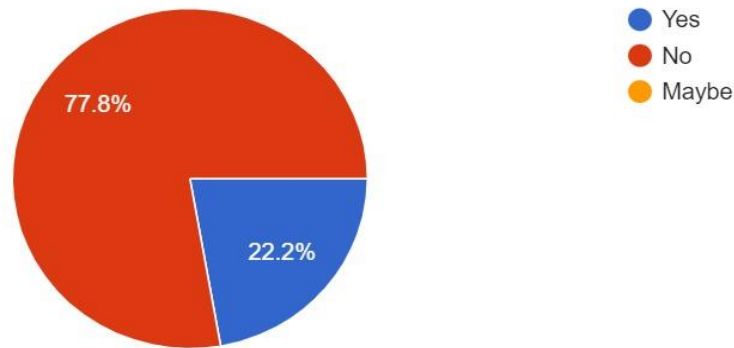


Figure 6: Survey statistics

Source: The author

The findings reveal that there is a positive attitude towards waste separation which seems to correlate with studies carried out by other researchers in the area as mentioned in the early chapters of this thesis. This is a plausible step towards recycling and resource recovery. It is fair to say that waste segregation simultaneously contributes to the success of the DRS system because materials fit for recycling can be channeled to appropriate deposit points. However, 22% of the respondents were categorical about not separating waste which may be due to ignorance or deliberately refuse to separate waste while 33% are reported to do it at will. From the data, it seems a sense of self commitment overrides all other factors.

According to figure 5, almost 90% of the respondents find separation advantageous. The reasons why people do not segregate their waste include, high cost for due to lack of utensils (separate bins). Just 11% of the respondent were of the opinion that the endeavor was expensive meaning that many residents are already equipped with the necessary utensils for separate collection. Therefore, it may be agreed that the provision materials can facilitate and promote waste segregation rather than subjecting consumers to obey the law as 77% percent of the respondents revealed to be unaware about mandatory waste segregation laws.

To make waste segregation fruitful for recycling laws that include provision of economic incentives for reuse and recycling as highlighted should be considered (Boonrod *et al.*, 2015).

An interview with public authority revealed that one of the factors affecting RRR is consumer behavior and the lack of knowledge about the mandatory nature of waste

segregation, as such awareness campaigns should be increased. The negative behaviors of consumers towards segregation are revealed in this with findings from this study as 56% of the respondents indicated their inability due to time wasted from waste segregation and the stress from transporting additional separated waste bins to the residential disposal points. The NSWPM obliges residents to carry waste to transfer points so that it can be collected and hauled to the disposal sites.

M. Banga stresses on the importance of increased awareness and sense of ownership for waste segregation to be integrated in the waste management chain (Banga, 2011); while T. A. Otitoju and L. Seng highlight the need for effective regulations and legislation coupled with adequate enforcement which suggests a prerequisite for good governance in waste management (Otitoju, Seng, 2014).

CONCLUSIONS AND PROPOSALS

1. The Circular Economy plan has played a great role in guiding member states towards sustainability in waste management. The attractiveness of its principles has even been adopted by some third world countries in Africa. Although the situation is improving, it holds that meeting the targets and fulfilling the waste management obligations in the EU remains difficult if reliance on Circular Economy is seen as the only option. It must be backed with actions required by the law. The non-binding nature of the plan is the first relevant indicator about the conception plan of the CEP. The EU Commission has not sufficiently revealed possibilities of a Circular Economy Directive which could harmonize the focus of the environmental measures in the framework to make it more binding and actionable. For instance, incineration under the EU circularity law is not a desired waste option and the imminent pollution from burning waste has not been adequately addressed. In Lithuania, as recourse to land filling incineration of waste is the second option even where the country already transposed the WFD to its national law and management mechanism. This therefore implies that the country's commitment to its EU partners to reduce emissions to 40% by 2030 would not be achieved. The legal problem depicted here is that, on an EU level the Circular Economy plan is not a binding document and only a body of guiding principles as seen in the earlier chapters of this thesis as member states tend to apply its provisions at their discretion. Therefore, one recommendation to target this concern would be for the Commission to foster a draft law for a new EU-wide Circular Economy Directive binding on all member states. As such the waste monitoring triennial waste monitoring exercise by the experts from the Commission should not only focus on attainment of the targets but should also pay attention on the modification in form and implementation of the CE. By virtue of any country's membership in the Union, it has the obligation, for example, to implement effectively the requirements of the CEP in a binding manner as efforts by any member state to construct more incineration plants contradict the intentions of the EU circularity plan. One issue with the structure of the law is the wording of the CE plan. Many actions are stated vaguely for a document that commands utmost compliance. For example, "scoping" the development of further EU-wide end of waste and product criteria as seen in the Annex section of the CE action plan of 2020.

2. In practice, the research reveals that landfilling is the greatest problem with huge consequences both on health and the environment and the directions to mitigate the issue put forth by the EU law are not well represented. In line with the findings, 52% of all waste in the EU was landfilled in 2020 which does not show any considerable change if trends were examined for the last 10 years. Lithuania recorded less than one percent (0.76) as per the findings between 2017 and 2019 after fully adopting the Circular Economy agenda. Even though considerable amounts of waste diverted through attempts made at plastic recycling, the percentage sent to landfill is still very significant. However, this can be blamed on other auxiliary measures put in place like the landfill tax which is still considered very low as compared to other member states to deter waste disposal on landfills. As an economic instrument, the flexibility given by the EU legislature under Green Procurement Plan and taxation policies is a soft spot for sustainability because in choosing when not to implement green procurement and choosing to pay the tax gives room to take decisions that foster environmental harm that limits sustainability. As a recommendation, it is imperative to make green procurement binding on all tenders and for EU decision makers to engage with waste management experts and companies, stakeholders, municipalities, NGOs and civil society syndicates for consultations on waste management strategy in a bid to ensure that policies are well designed against the reality on the ground to meet the intentions of the EU legislature as this prompts a balance evaluation from the stakeholders on how to meet the desired targets. It is also recommended to undertake in-depth statistical analysis of selected or all taxable products and their waste streams. Based on the results, legislators should adopt recycling/recovery targets and tax rates, e.g., if the targets are easily reached within five years (as in the case of tyres) they could be increased. If the targets are not reached and producers and importers choose to pay the tax, they should consider raising the tax rate to provide financial motivation for taxpayers to organize waste management. It would also be useful to properly clarify the objective of the tax, to make sure that all parties know why it exists, what it is seeking to do, how its success can be measured (e.g., success criteria).
3. The implementation of the EU circularity plan reveals gaps like ambiguity in the Extended Producer Responsibility principle as a measure intended to ensure producers of products and packaging to take responsibility for the fate of their

products at the end of their life to promote recycling. One example is the interpretation of the EU legislation by economic operators and national courts alike. As seen in the German bottle packaging case to levy deposit chargers for packaging on importers and producers, problems with the interpretation of the EU laws in conjunction with national laws seems to obstruct the ambitions of the circularity agenda. It is therefore recommended that the EU Commission should take into consideration the legal atmosphere and waste management status of each member states in applying the principles. This can be done by sending experts every year to monitor developments and modifications in the national waste laws and report to prevent any eventuality of misinterpretation and non-alignment with national laws.

4. It must be understood that products manufactured for use end up with consumers who are the primary actors that eventually transform these products into waste. Little is said about waste separation in the circular action plan and ways to achieve as more emphasis is laid on recycling which is rather the result. Due consideration must be given to the actions of citizens as waste generators and their obligation to separate waste must be established under the EPR. As per the findings, 55.6% of the respondents portrayed a lukewarm attitude towards waste separation while 76% were ignorant of mandatory waste laws which is a determinant factor to foster recycling. It is therefore necessary that robust EU-wide campaigns on awareness of waste separation and liability measures taken for non-separation must be uniform across all member states. While this may seem as pressure for the consumer sector, it should be noted that the challenges from unsustainable waste management seems to bring even more pressure which should give everyone that sense of responsibility. Sustainability in waste management relies on appropriate regulations and their enforcement as a prerequisite to protect human health and the environment. It would be difficult to attain sustainability and sound waste management without efficient legislations that can be yielded to. This answers the primary research question on the importance of law in achieving. Should the Republic of Lithuania embrace the above recommendations and changes then waste disposal and management system mechanism, encourage composting, sustainability will be enhanced and the nation will likely meet all its 2030 targets set by the Circular Economy Action Plan.

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SUMMARY

Legal aspects of sustainability in waste management

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The world has witnessed an exponential growth of waste in the 21st century. Waste management is increasingly challenging. If waste is not sustainably treated, it can lead to many environmental, health hazards and can even become more costly. For this reason, the European Union has tendered several legal measures among its member states to enable sustainable waste management. Sustainable waste management can reduce GHG emissions, preserve natural resources, create jobs and even save cost. The Republic of Lithuania, an EU member state, has made some progress in the management of municipal waste but has continued to reform its solid waste management policy since 2014.

This thesis aims to demonstrate the role of law in ensuring sustainability in waste management. It attempts a coherent legal analysis of the European Union Circularity Action Plan alongside the national laws of Lithuania aimed at waste management with the goal to improve the processes on waste prevention, collection, recovery and recycling.

In order to demonstrate the gravity of the problem, quantitative data was collected on waste trends in the EU and a survey was conducted in the Republic of Lithuania with empirical data collected and analyzed to determine the influence of law on consumer attitude in ensuring sustainability in waste management.

Results from the findings show that the Republic of Lithuania has already passed many laws which are in line with the EU circularity ambition. However, there is room for improvement both at the EU level and at the national level to make waste management more sustainable.

This research work is concluded with comments based on the results and recommendations directed at improving EU law and outlining what actions and legal measures that could be taken in Lithuania to ensure sustainability in waste management to further enforce waste segregation policies at the national level, and improve policies on the economic instruments aimed improving sustainability in waste management.