# PLASTIC WASTE MANAGEMENT IN NORTH MACEDONIA: A COMPARATIVE ANALYSIS WITH WESTERN BALKANS AND SELECTED EU COUNTRIES

**Ivana Ivanova**
*PhD student at Ss. Cyril and Methodius University in Skopje,*
*Faculty of Economics – Skopje*
*Ivana_kole@yahoo.com*

**Elena Makrevska Disoska, PhD**
*Professor at Ss. Cyril and Methodius University in Skopje,*
*Faculty of Economics – Skopje*
*elenam@eccf.ukim.edu.mk*

***ABSTRACT***
*This paper aims to compare North Macedonia as an EU candidate country, to the Western Balkan countries in circular economy movements. It shows that the country still struggles with advancing circularity and is more focused on waste management practices, which also do not function well. Lack of waste separation, weight equipment, and qualitative waste data with limited access to funds, finance, and knowledge are possible reasons. Plastic as a future raw material which is gaining more attention at a global scale is not even a priority in the Macedonian economy. This paper gives for the first time a link between plastic waste and the circular economy in North Macedonia, highlighting the economic sectors and the role that EPR schemes are playing in increasing higher recycling rates, compared with other materials used for packaging. In the end, the authors compare the country with developed EU countries like Slovenia and Germany to examine the effects of higher communal fees would contribute to a more efficient municipal waste system, by using the municipal costs as a percentage of GDP per capita, minimal wage and Income and Living Conditions Indicator.*

***Keywords:*** *Western Balkan, Municipal waste, Waste management, Circular economy, European Union, Republic of North Macedonia, Plastic, Resource productivity.*

***JEL classification:*** *F63, Q53, Q52.*

## 1. INTRODUCTION

Faced with threats from the negative effects of climate change and standing at the door of the European Union as a full membership candidate country, North Macedonia, as well as the countries of the Western Balkans, are very interested in the benefits of the circular economy model. The replacement of the classic linear model in which resources are used once and end up being thrown away as waste at a landfill, simultaneously losing their added value, with the concept of a circular economy is of particular importance for the countries of the Western Balkans. Their economies are based mainly on economic sectors that further undermine linear resources, such as mining, agriculture, construction, or tourism, and the citizens of these national economies face air quality that is among the worst in the world.

The competitiveness of the companies from North Macedonia and the Western Balkans is also under attack from the high competition from the EU, which is the region's largest trade partner, with a share of 70% of the region's total trade exchange (Aspen Institute Germany, 2022, p.41). Therefore, the circular economy should contribute through sustainable development, the

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creation of additional jobs, and more efficient use of resources from the region to enable a safer economic transition to the European family. However, unlike most EU countries, the Macedonian as well as Western Balkans economies still associate the circular economy primarily with activities in the area of waste management and its management, at a rather low basic level.

Although the amount of waste generated per capita is increasing both in North Macedonia and the region, the waste management system is not efficient enough to respond to the growing expansion of resource utilization in these economies. Instead, it is mostly thrown into landfills, and the low rates of recycling compared to the European average, as well as the selection by citizens at the place of generation of waste in households is a challenge that has yet to be implemented in the Macedonian economy. Positive rates in terms of increased participation in the selection and recycling of individual types of waste can be attributed primarily to extended responsibility schemes, which try to encourage innovation and increase the participation of recycled waste. However, in the absence of a state functional system that will complement them and jointly cooperate with producers of extended responsibility by offering them adequate infrastructure, the challenge for a detailed restructuring of the entire national system of waste management in the Macedonian economy remains.

Yet, one of the most important problems is the reliability of data on the waste amounts in the WB countries, not only due to the lack of equipment for adequate waste measurement, but also due to the suboptimal access to quality reliable databases for individual countries. More detailed sectoral analyses are also missing in this section, but also in the section of materials that can be future raw materials and resources on the market, such as the case of plastic.

This paper is the first attempt in North Macedonia to look at the circular economy through the lens of plastic. In a society where households are not in the habit of sorting waste, we cannot expect plastic data to be available for academia research. While global and European trends place plastic high on the agendas of circular development strategies, in WB countries, plastic is prioritized only in the Circular Economy Roadmap strategies of Albania and Serbia.

The idea behind the research in this paper is to show that not always due to lack of finances, the state can find excuses for non-functionality in waste management. The examples of more developed countries from the EU such as Slovenia and Germany through descriptive examples give an idea of how our economy can profit from the selection of waste, at the same time not raising the price of waste management which is paid by the citizens as a communal fee. Another added value of the paper is the attempt of the authors to give an overview of plastic through circularity in the country with the available data for processing and in certain areas of the circular economy to compare the situation of Macedonia with the countries of the Western Balkans. The role of EPR schemes and the application of European legislation is clearly captured here, which indirectly creates development in recycling rates through harmonization and adoption of experiences and rules from more developed countries. This can be noticed in the area of plastic and plastic packaging.

For the first time, the relative participation of plastic is calculated, and a clear picture is given of how much the Macedonian business community participates in the fulfillment of European and national goals in the management of plastic waste. The EU dictates the pace, but does the Macedonian economy, apart from declaratively, follow the European trend qualitatively as well?

## 2. LITERATURE REVIEW

Since the publication of the first report Towards the Circular Economy, quantifying the possibility of the Circular Economic Forum in 2012 (Ellen MacArthur Foundation, 2013), the Western Balkan countries need a whole decade to finally put the circular economy model into

Strategy Roadmap on a national level. Serbia was the first country who develop the *Roadmap for Circular Economy* document (UNDP, 2020) highlighting the manufacturing industry, agriculture and food, plastics and packaging, and construction as priority sectors. Two years later in that country also the Circular Economy Development Programme (2022 – 2024) was adopted, as a complex and comprehensive document that defines the areas of waste management, water, renewable energy sources, and energy efficiency (The Government of the Republic of Serbia, 2022). As an outcome of collaboration between the Montenegrin Chamber of the Economy, UNDP, Circular Change and Deloitte BiH, Montenegro has developed such a Roadmap in 2022 (UNDP, 2022) with five focus areas (food and forest systems, the built environment, tourism and manufacturing) that are highly interconnected and, through the principles of industrial symbiosis and synergies, can result in systemic change, followed by strategy for circular transition with an action plan (Ministry of Economic Development and Tourism of Montenegro, 2022). Kosovo developed such a Roadmap in 2023, and North Macedonia together with Albania developed Roadmap in 2024 (OECD, 2024). Bosnia and Hercegovina is the only WB countries that still do not have a developed Roadmap toward the circular economy.

In comparison, the EU had the first circular economy action plan adopted in 2015, followed by a new one, who was adopted in 2020, with the European Strategy for Plastics being part of it, adopted in January 2018, putting plastic among the priority areas as a key element of Europe's transition towards a carbon neutral and circular economy. As the European Commission lately pays attention to microplastics as part of the circular economy, unfortunately, the WB countries have still trouble making a difference between circular economy and waste management approaches. Although the EU in May 2023 has revised the Circular Economy Monitoring Framework (European Commission, 2023) with Waste Management being only one of 5 indicators measuring the circularity progress, WB countries are lacking a comprehensive approach towards measuring circular economy progress. Waste management stays in focus in WB countries, but here also data and information stay largely insufficient, although many initiatives are in place to improve data quality (EEA, 2022). The lack of comprehensive, innovative, and comparative academic research in the circular economy field, especially in plastic, is noticed by the authors of this paper. While OECD through the Report for *Western Balkans Competitiveness Outlook 2024: Regional Profile,* 2024 gives under the Greening Cluster insight into the Circular economy progress in WB countries underlying that „the circular economy is gaining momentum in the WB, to transition to a circular economy, the region will need to shift its focus from waste management to policies that also target more circular production and consumption". From the research from EEA, OECD, Eutopia, and Eunomia, authors agree that only minimal positive trends can be seen in waste collection offer and recycling rates in the EPR schemes, but appropriate waste management is still a challenge for the WB, which is one more reason why EU and other international funds have to stay open and available for further WB development in this field. This manner speaks also to the fact that North Macedonia and other WB countries (especially Skopje, Tirana, and Podgorica) have one of the highest plastic leakage rates into the Mediterranean through rivers (estim.3,2kg per person in the year for NM) (Boucher, J.et al., 2020). Cross-border pollution from WB in the EU can be evident also in air pollution where "the air quality across WB is among the lowest in the world" (JRC, 2022), and annual average concentrations of PM 2,5 remain on average almost four times higher than WHO recommended levels of 5UQ/m3" (EEA, 2023). With the fact that microplastic have the potential to travel a long distance and undergo several cloud processes through atmospheric transport (Xu *et al.,* 2023), the EU should not close funds to help WB countries towards a cleaner and more circular economy in the future. For this, according to Ingnjatovic *et al.* (2024) circular economy might be an appropriate approach toward green transition, since the WB region has 5 times lower resource productivity than the

EU, while the generation of waste (excluding major mineral waste) per GDP is almost the same.
From above it is clear that academic research in the field of circular economy, waste management improvements, and plastic analyses are more than welcome to spread awareness among all stakeholders in every WB national economy and raise a discussion from which often ideas for further collaborations and projects could be introduced.

## 2. CIRCULAR ECONOMY, MUNICIPAL WASTE AND PLASTICS IN NORTH MACEDONIA

### 2.1. Circular economy scores in North Macedonia and WB countries

From its initial focus on minimizing the generation of waste and recycling it, the circular economy has undoubtedly grown into a broad approach to resources aimed at making them more sustainable, while creating more jobs, less dependency, and a cleaner environment. While interest in the circular economy model is growing, "the global economy is only 9% circular" (WBCS online), a clear indication that "one possible reason for this is that it is still more cost-effective and requires lower costs to produce products." from natural primary resources and discard them after use than to preserve goods, components, and materials in use at their highest utility at any time" (Steinfatt, 2020). In other words "…efficiency in production and spreading waste is higher than efficiency in collecting and removal of that waste" (Hardin, 1998, p.10).
Compared to the environment policy of the countries of the Western Balkans, North Macedonia is keeping pace with the WB6 countries average. However, in the area of evaluation of the national efforts for a circular economy, the country records below-average achievements (OECD, 2024, p.190).

*Table 1: North Macedonia`s scores for circular economy and environment policy*

North Macedonia's scores for environment policy

| Dimension | Sub-dimension | 2018 score | 2021 score | 2024 score | 2024 WB6 average |
|---|---|---|---|---|---|
| Environment | 13.1: Climate action | | | 2.3 | 2.5 |
| | 13.2: Circular economy | | | 2.0 | 2.2 |
| | 13.3: Protection of ecosystems | | | 2.3 | 2.1 |
| | 13.4: Depollution | | | 2.3 | 2.3 |
| **North Macedonia's overall score** | | **1.6** | **2.3** | **2.3** | **2.3** |

*(Source: OECD, Western Balkans Competitiveness Outlook 2024, North Macedonia, OECD Paris, 2024, p.190)*

The first Circular Economy Roadmap in the country was published on March 26th, 2024, with the help of the OECD. Compared with the countries of the Western Balkans, North Macedonia together with Albania is the last country to develop a circular economy strategic document. Serbia published such a document in 2020, Montenegro in 2022, and Kosovo in 2023. The priority areas in which the Macedonian economy decided to develop the circular economy are circular business models for small and medium enterprises, construction, bioeconomy (biomass and food), textile products, mining, and metallurgy. In these priority areas, between seven and 10 recommendations for the short, medium, and long term, as well as relevant examples of good practices with appropriate indicators for evaluation and monitoring, are foreseen.
However, unlike Serbia and Albania, North Macedonia does not place plastic as a priority area for the development of the circular economy. In the world and the European streams of circular economy, plastic ranks high on the agendas of governments of developed economies, because plastic is a material created from polymers, and cannot be decomposed in nature within five

centuries when it breaks down into microplastics that never disappears (Prairie Research Institute, 2021 online).

## 2.2. Waste management and plastics

The conditions in North Macedonia show that the country is up to the challenge of managing waste and, above all, affecting its reduced new production, which is the first principle in the EU hierarchy for waste management. Even the country's foreign trade relations should be seen through the prism of waste management and the circular economy, and plastic is gaining more and more importance in those flows as well. "…The annual trade in plastics currently accounts for about 5% of the total global trade or over 1.2 trillion US dollars in 2020, of which 2% is actually waste…" (WTO online, 2021). Yet statistics and data available for detailed research in this area, especially in the part of plastics are limited and the authors of this paper tried to come up with some kind of analysis to reflect the situation in the Macedonian market.

In North Macedonia, the total waste in 2023 amounted to 873,303 tons, of which 621,686 tons were collected as municipal waste. Compared to 2022 (when the total generated waste in the country was 856,766 tons), the collected waste increased by 2.6%, due to the increased number of populated areas included in the municipal waste collection system (State Statistical Office of the Republic of North Macedonia, 2023).

A comparison of the types of waste by quantity shows that mixed municipal waste takes the first place (85.4%), followed by organic municipal waste (6.4%), and plastic at 2.3%. Paper accounted for only 1.7%, glass for a minimal 0.5%, and metals such as iron, steel, and aluminum for 0.3%. The least amount collected was rubber waste (See Table 2, State Statistical Office of the Republic of North Macedonia, 2023).

*Table 2: Amount of collected municipal waste in 2023 in North Macedonia, by type*

| Amount | Waste type | % of total |
|---|---|---|
| **621686** | **total** | |
| 531033 | mixed municipal waste | 85,41 |
| 39690 | organic waste (food, leaves, etc.) | 6,38 |
| 14532 | plastic | 2,34 |
| 11920 | other | 1,92 |
| 10914 | paper | 1,75 |
| 6695 | textile | 1,08 |
| 3397 | glas | 0,55 |
| 1301 | rubber | 0,21 |

*(Source: State Statistical Office, Republic of North Macedonia, Municipal waste 2023)*

The annual amount of municipal waste generated per capita was 503 kilograms (7.7% more than the previous year), and the majority of the waste is disposed of in landfills (99.8%). A more detailed analysis reveals that 82% of the collected municipal waste comes from households, while 18% comes from legal and citizens (commercial waste). This means that North Macedonia urgently needs a circular approach that views waste management from a business perspective, as an irreversible consumption of resources. A full 18% of the waste, or nearly one-fifth, comes from the business sector, which, unfortunately, fails to find a way to offer it as a resource for the needs of related industries or to recycle it. When comparing the total collected municipal waste in our country to the European average in 2022, according to Eurostat, North Macedonia is below the European average of 513 kilograms of waste per capita for the same year (See Table 3).

Additionally, when comparing our national economy to economies from WB, only Montenegro and Serbia had higher municipal waste per capita for 2022. In Germany, municipal waste in 2022 amounted to 593 kilograms per capita, which is 80 kilograms more than the European average. Considering that Germany has over 80 million residents, this represents an enormous amount of municipal waste, yet they lead in its processing. In Slovenia, which has a population size similar to North Macedonia, each resident produced an average of 487 kilograms of municipal waste annually in 2022, which is below the European average. Macedonian citizens, compared to Slovenians, generate 20 kilograms less municipal waste per capita annually (2022 data) (Eurostat, 2024).

*Table 3: Municipal waste generated, kg per capita, 1995-2022*

| | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2022 | Change 2022/1995 (%) |
|---|---|---|---|---|---|---|---|---|
| EU | *467* | *513* | *506* | *503* | *480* | *521* | *513* | *10.0* |
| Germany | 623 | 642 | 565 | 602 | 632 | 641 | 593 | -4.8 |
| Slovenia | 596 | 513 | 494 | 490 | 449 | 487 | 487 | -18.2 |
| Bosnia and Herzegovina | : | : | : | 340 | 352 | 352 | : | : |
| Montenegro (4) | : | : | : | 494 | 530 | 486 | 537 | : |
| North Macedonia | : | : | : | 381 | 441 | 441 | 467 | : |
| Albania | : | : | : | : | 491 | 369 | 295 | : |
| Serbia | : | : | : | 363 | 259 | 427 | 472 | : |
| Türkiye | 441 | 465 | 458 | 410 | 424 | 415 | 382 | -13 |
| Kosovo (5) | : | : | : | : | 252 | 255 | : | : |

*(Source: Eurostat, Municipal waste statistics, Eurostat, Brussels, 2024)*

Data provided by the State Statistical Office of North Macedonia is concerning, indicating that only 86% of citizens in our country use the municipal waste collection system, while a high 14%, especially in rural areas, dispose of waste wherever convenient, often along roadsides or by burning it in the open, polluting the environment (State Statistical Office of the Republic of North Macedonia, 2023).

According to the 2021 report by the European Environment Agency on North Macedonia, the main problem lies in the lack of funds and resources to improve waste management in the country. "…The budget needs to be allocated to improve waste management, close illegal landfills, introduce separate collections, and expand the area where municipal waste is collected. The structure of fees does not encourage waste prevention and recycling. The introduction of landfill taxes could promote increased recycling, but dumping waste in landfills will remain a challenge as long as it is considered the cheapest option (European Environment Agency, 2021, p.4). The report also states that the dominant method of waste collection is without separation, and the separation rate hovers around 0.3%, which is a very low level. In comparison, the average recycling rate of waste in the EU in 2022 was 48% (Eurostat, 2024).

The EEA report also highlights that "…municipal waste is collected for recycling mainly by informal waste collectors, who collect waste from landfills, containers, and bins…" (EEA, Ministry of Environment and Physical Planning of the R.N. Macedonia, 2021, p.15). The same applies to the collection of plastic.

According to the Ministry of Environment and Physical Planning, more than 150 registered entities collect, store, and treat waste such as paper, plastic, and scrap metal, employing a total of 4,385 people in 2019. However, unofficial estimates suggest that around 5,000 people actively contribute to the collection and separation of waste from landfills and containers (EEA, 2021, p.15). The information above makes it clear that the issue of financial subsistence for all informal and unofficial waste collectors adds an additional burden to the state, which must address it alongside the already cited problems of insufficient funds for waste management, its separation, and recycling. The black market on which informal collectors continue to operate will fall on the shoulders of the state (social insurance), and without a national plan for solving

the problem, it remains overlooked by political authorities. Additionally, most of these waste collectors belong to the Roma community, and every administration in the country avoids addressing inter-ethnic issues. However, the state is making small steps toward improvement. For example, Eunomia states that "…at the Drisla landfill, some collectors of PET plastic bottles, which they used to bring to the landfill, are now formally employed there…" (EEA, 2021, p. 15).

If we can rely on the accuracy of the waste data in North Macedonia according to the State Statistics Office, the comparison of the total plastic waste (14 532 tons in 2023) with the data from EPR collective operators for collected plastic waste in 2023 (8856.7 tons) show that about 61% of the total plastic collected in the country is directly related to the work of the EPR actors. Statistics Office data are disappointing on selected waste by Macedonian households. Hence, the EPR schemes mandated by the EU legislation, which our economy follows and implements as a candidate country, are of positive significance, because it offers the opportunity for businesses to perform where the state cannot easily organize, usually due to a lack of finances, staff or unattractive political moves.

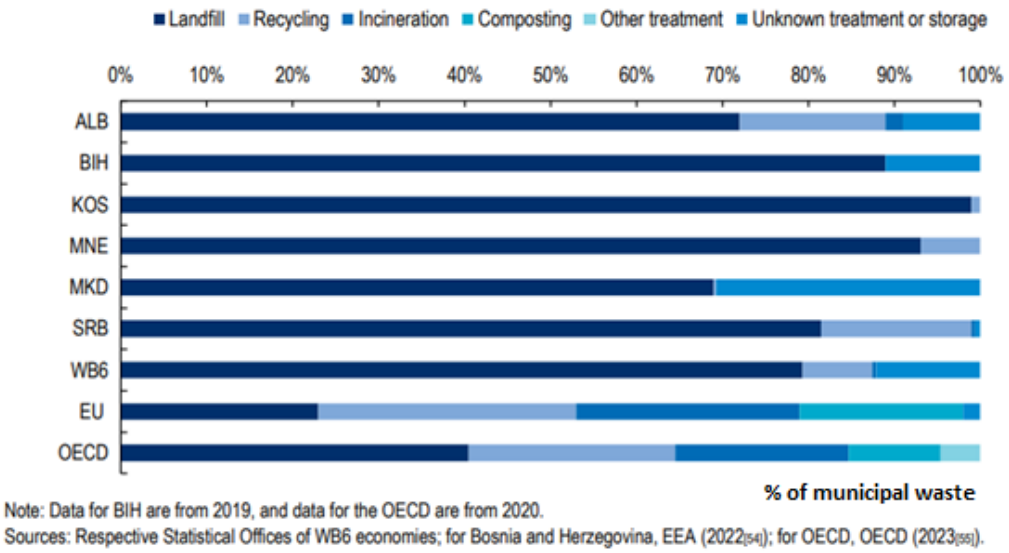
### 2.3. EPR analyses for plastic packaging and waste in North Macedonia

The analysis of the Macedonian market, Ministry of Environment and Spatial Planning of the RN. Macedonia, 2022) reveals that out of a total of 22,309.2 tons of plastic released by collective operators on the Macedonian market, only 8856.76 tons collective actors manage to collect plastic, which is about 40% of it. Of that 40% collected plastic, a total of 3,663.91 tons are recycled, and 5,192.85 tons are exported. In terms of percentages, a total of 16.4% of the plastic placed on the Macedonian market (produced or imported) is recycled, and 23.3% is exported from the country. The rest of the registered plastic, unfortunately, ends up in mixed waste and landfills, becoming a big concern for all eco-activists and a burden we leave unresolved for future generations.

A more detailed analysis of the data points to the fact that the interest in collecting paper among collective operators is much greater and they manage to collect as much as 24 547.47 tons of paper or 93%, which is a much higher percentage than plastic. Most of the paper collected ends up as export, 81%, and only a small percentage of 12.1% is recycled. There is similar interest in collecting metal as a type of material, which out of a total of 3971 tons, even 2814 tons are collected again, which is a percentage of 71%, of which the largest part ends up as export 70%, and only 30% of the collected metal is recycled with us. In the case of glass, the data show that almost half of the glass put into circulation by collective operators is collected again and most of it, almost all of it, is exported from the country.

In developed countries, landfill is the last circular economy waste treatment option, but in the Western Balkan countries, more than 83% of waste is disposed of in landfills, with only a small amount recycled (OECD, 2024, p.232). This is probably because illegal waste disposal in dumpsites or unsanitary landfills requires no fees. Also, open burning of waste is not a rare case in rural areas in North Macedonia and WB countries, and sometimes plastics are part of it. In comparison to the EU landfill situation, WB countries are far behind, which is alarming, keeping in mind that WB economies have witnessed a constant increase in waste generation per capita.

*Figure 1: Municipal waste treatment in WB, EU and OECD countries*




*(Source: OECD, Western Balkan Competitiveness Outlook 2024, Regional Profile, OECD, Paris, 2024, p.232)*

Plastic waste in 2022 in North Macedonia, calculated by the sector of economic activity in which it is generated, is mostly present (in quantity) in the sector of water supply, wastewater disposal waste management, and environmental remediation activities, with the participation of 6,313 thousand tons. In second place, the most plastic waste is created in the processing industry with a total of 5588 thousand tons, followed by construction with 1325 thousand tons of plastic waste. There are 32 thousand tons of plastic waste in mining, and 27 thousand tons of plastic waste in the energy sector (supply of electricity, gas, steam and air conditioning). The remaining 15,300 thousand tons of plastic waste were generated in other service activities. All plastic waste falls into the category of non-hazardous waste. According to the State Statistics Office, 1,397 thousand tons of waste were created in 2022, of which 70.5% is non-hazardous waste, which also includes plastic waste listed according to the sectors where it was generated (State Statistical Office of the Republic of North Macedonia, 2023, p. 4).

*Table 4: Generated plastic waste by section of economic activity in North Macedonia, 2022*

| Agriculture, forestry, and fishing | Mining and quarrying | Manufacturing | Electricity, gas, steam, and air conditioning supply | Water supply, sewerage, waste management, and remediation activities | Construction | Other service activities |
|---|---|---|---|---|---|---|
| n.a. | 32 | 5.588 | 27 | 6.313 | 1.325 | 15.300 |

*(Source: State Statistical Office of the R. N. Macedonia, Waste by section of economic activity 2022, Makstat 29.03.2024, p.4.)*

Through the prism of the circular economy model, a more detailed sectoral analysis should be made in North Macedonia and the model of connecting the sectors in the country should be approached, so that what is plastic waste for a company or industry can be seen as possible

resource for another company or industry. Before approaching the last stage of recycling, the possibility of using plastic waste unprocessed for the needs of some other related industry should be considered, if that model does not fit, it is logical to approach recycling.
North Macedonia also lacks a national circular economy platform, where the business community, the state, citizens, non-governmental organizations, and academics can be informed and share information and positive practices from this area. Compared to the countries of the Western Balkans, only Serbia is a pioneer, and Montenegro through the Chambers offers such platforms, thus keeping businesses motivated and more informed to actively participate in the circular economy (Direct links for Serbia https://circulareconomy-serbia.com/ and Montenegro https://www.ce-hub.me/en/homepage).

## 3. MUNICIPAL WASTE PRACTICES IN GERMANY AND SLOVENIA AND WHAT CAN NORTH MACEDONIA LEARN FROM IT

### 3.1. Useful practices in Germany

In the Federal Republic of Germany, which is the most populous and strongest economy in the EU with a total population of 83.4 million (2022 census), each citizen, according to Eurostat, generated an average of 593 kilograms of municipal waste in 2022, which is 80 kilograms per person more than the European average. Given that Germany has over 80 million inhabitants, this represents a massive amount of municipal waste generated. However, Germany leads in waste processing and serves as an example of proper municipal waste management. According to data from the European Environment Agency in 2021, Germany managed to recycle 67.8% of the total collected municipal waste, and two decades earlier, in 2004, it still managed to recycle more than half, or 56.4%. This reflects decades of experience and consumer behaviour with a high level of awareness and culture of waste sorting where the process of teaching starts in kindergartens. Waste separation in Germany is mandatory for every citizen.
Waste management in Germany is not a cheap service and costs for waste collection vary from one municipality to another, or from one region or state to another. The fees depend on the services and companies responsible for waste collection and management. According to a study by the Zentralverband der Deutschen Haus et al., in 2022, waste collection every two weeks in Wolfsburg costs 128.44 euros per year for a family of four (two adults and two children) who separate their waste by bin. In contrast, in Hamburg, the same service costs an average of 267 euros, and in Freiburg, as much as 309.60 euros. The cheapest city to live in Germany in terms of waste collection is Nienburg. These costs are calculated annually (Haus und Grund Germany, 2022).
According to the same study, which covered 100 German cities, the average cost of waste management has increased by 8% over the past three years to 312 euros per year. Only 19 out of the 100 cities have managed to reduce waste management costs. However, in Germany, the cost of waste depends not only on where one lives but also on the amount of waste generated, which indirectly depends on the number of family members living under the same roof. If a family produces less waste and collection occurs every two weeks instead of weekly, this affects the final price that households must pay. Only 17 of the 100 cities offer a calculator where residents can transparently calculate the waste management fees they must pay (Haus und Grund Germany, 2022). Citizens often complain about overly complicated methods of calculating municipal charges, which makes it difficult to compare German systems quantitatively with Macedonian ones.

### 3.2. Useful practices from Slovenia

Research on waste management within the framework of a circular economy often highlights Slovenia as a country that has successfully become a green European leader in recycling rates

within the EU. The interest in comparative qualitative analysis, specifically with Slovenia in this study, is aimed at comparing two national economies with several shared characteristics. The goal is for the Macedonian economy to learn and adopt positive practices from its Slovenian partners. Both countries have similar population sizes, share a history in the former Yugoslavia, are NATO members, and also have similar land areas. Slovenia has become a model for sustainable municipal waste management in Europe, achieving significant success in recycling and reducing waste generation through well-developed political measures and engaging the public in the fight against increasing waste and its improper disposal.

In Slovenia, as in the German example, households have been required for over a decade to separate waste into categories such as plastic, paper, glass, bio-waste, and mixed waste that doesn't fit into other categories (disposed of in black bins). Municipalities are responsible for waste collection, transportation, and management. Data from EUROSTAT shows that Slovenians produced 487 kilograms of waste per capita in 2022, which is below the European average of 513 kilograms per capita for the same year. North Macedonia, in the same year, produced 20 kilograms less waste per capita than Slovenia, although both countries remain below the European average.

In 1995, the average EU citizen produced 467 kilograms of municipal waste annually, and over nearly two decades, this increased by 10%, with Europeans generating 513 kilograms of municipal waste annually in 2022—an increase of 46 kilograms per capita. Slovenia's progress in waste management is evident, as in 1995, each Slovenian citizen produced 596 kilograms of waste annually, but by 2022, this was reduced to 487 kilograms per capita, a decrease of 109 kilograms. (Eurostat, 2024) This shows that Slovenia is not only working on recycling and increasing recycling rates but also actively raising public awareness about waste reduction and encouraging adherence to the hierarchy of circular economy principles in waste management, which prioritize avoiding waste creation, reducing waste, reusing products, and recycling. How has Slovenia achieved this?

A case study by Zero Waste on the city of Ljubljana reveals how the largest public sanitation company, Snaga, has not only made Ljubljana the cleanest and greenest city in terms of municipal waste but also reduced the cost of waste management for citizens. Snaga is a public company that manages municipal waste in Ljubljana and 10 other suburban municipalities, serving a total of 395,328 citizens. Snaga is responsible for managing waste for around 19% of Slovenia's total population of 2.1 million. Snaga's approach of collecting separated waste through a door-to-door system was first tested in the smaller municipality of Brezovica. After seeing that the system was highly effective, with recycling rates for packaging tripling and mixed municipal waste decreasing by 29% within just a few months, Snaga decided to implement this system across the entire area it serves. A second principle that the company focused on was reducing the frequency of collecting mixed waste (unsorted waste in black bins), while maintaining a high frequency of collecting separated waste. In less densely populated areas (single-family homes), mixed waste was collected every three weeks instead of weekly. In more densely populated areas (apartment complexes), mixed waste was collected weekly, while sorted waste was collected several times a week. This incentivized residents to sort their waste, as they did not want unsorted waste lingering in their homes or yards, thus indirectly stimulating waste separation (Zero Waste Europe, 2019).

Initially, there was resistance in less populated areas, and significant waste separation was not achieved. However, through strong media and political support, residents were shown how little mixed waste remains if it is properly sorted. As a result of these efforts, the amount of separated waste grew, reaching a 55% separation rate by 2013 and rising to 68% by 2018. What is particularly interesting is that the average monthly waste management costs per household fell to 8.20 euros in 2018, one of the lowest in all of Slovenia. If the average annual waste

management cost in Slovenia is around 150 euros, in Ljubljana it decreased to an average of 100 euros per year (Zero Waste Europe, 2019).
This waste management approach by Snaga resulted in each resident in the area producing only 358 kilograms of waste on average in 2018, of which 68% was recycled, composted, or recovered. By 2018, the amount of waste sent to landfills had decreased by 95%, and total waste generation had dropped by 15% (Zero Waste Europe, 2019). Avoiding the creation of waste is a key factor in Slovenia's success in waste management. „…While the European average waste generation was 486 kilograms per EU citizen in 2018, residents of Ljubljana were already 31% below that average...“ (Zero Waste Europe, 2019). Snaga's system also offers eight waste centers where citizens can dispose of waste that cannot be separated through the door-to-door system, such as hazardous waste, metals, plastics, electronics, garden waste, construction materials, car parts, wooden products, bulky waste, and textiles. Once a year, Slovenians can leave bulky waste outside their homes on a specified date, and the waste is collected by the municipal company.
All these practices led Ljubljana to be named the European Green Capital in 2016 and,,…The city's future goals include achieving a waste separation rate of 78% by 2025, 80% by 2035, and reducing waste generation per capita to 280 kilograms annually…“(Zero Waste Europe, 2019).

### 3.3. Municipal waste costs comparison between North Macedonia, Slovenia and Germany

In Skopje, the public enterprise responsible for municipal waste management (collection and transportation) is the Public Enterprise for Communal Hygiene – Skopje (PE Komunalec). It operates in the city of Skopje and in most rural areas within the Skopje municipalities, such as Kisela Voda, Gazi Baba, Butel, Karpoš, Aerodrom, and Saraj (serving 20,004 households in rural areas). “…The frequency of waste collection is six times a week, with plastic waste being collected twice a week, and in rural areas, waste is collected once a week using 8 to 10 specialized vehicles…“ (JP Komunalna higiena Skopje, 2022). Komunalec Skopje collects and transports municipal waste for Skopje, which, according to the latest census, has a total population of 526,502 residents. This accounts for managing waste for around 28.7% of the total population of North Macedonia, which, according to the latest census, consists of 1.8 million residents (Authors calculations). Comparing Slovenia’s Snaga with Macedonia’s Komunalec, it is evident that North Macedonia could achieve greater economies of scale and manage a larger financial input to organize waste management more efficiently.
Unlike Slovenia, in North Macedonia, waste separation is only possible at designated locations in containers meant for this purpose across the city. The population does not separate waste at home, as is the practice in Slovenia and Germany. Waste separation is not a legal obligation in our country, unlike in Germany and Slovenia. The largest percentage of revenue for the enterprise comes from fees that Macedonian households pay for municipal waste management. According to a decision by the City of Skopje, these fees amount to 3.59 denars per square meter and are calculated based on the living space owned by citizens, without including the yard areas. According to the latest census, the number of apartments in Skopje has increased by over 50,000 in the last two decades, reaching 213,850 apartments, which affects the total revenue collected by Communal Hygiene Skopje. Unlike in Germany and Slovenia, where the cost is determined based on the frequency of waste collection and the size of the waste bins, in our country, the basis for calculating municipal waste fees does not provide an incentive for waste separation, nor is it economically justified.
Even if someone with greater environmental awareness attempts to separate more waste, there is no way for them to be incentivized. Even though some people produce less waste, they must pay more simply because they live in larger homes. In rural areas, households pay a flat rate of 286 denars per household, or approximately 4.6 euros. Annually, families in rural areas pay

around 56 euros for municipal waste management. An additional 5% tax is applied, bringing the total to 300 denars per month, or around five euros, which amounts to 60 euros annually, including tax (JP Komunalna higiena Skopje, 2022).

In our country, the sorted waste in Skopje is handed over to PAKOMAK and Nutrivet, companies that are part of the extended producer responsibility system. The waste separation efforts in our country are largely attributed to the work of these companies, which manage the separated waste. The State Statistical Office of North Macedonia informs us that an average Macedonian household allocates about 70.4% of its consumption to basic needs such as food, clothing, housing, and household items. A more detailed analysis of household consumption distribution shows that the costs for housing, water, electricity, gas, and other fuels (which include municipal waste management costs) account for 10.7% of the total household expenses. The cost-of-living indices indicate that in 2022, compared to the previous year, these costs increased by as much as 14.2% (MAKSTAT, 2023, p. 31). Such trends will undoubtedly encounter resistance from Macedonian citizens regarding the implementation of the Ministry of Environment and Spatial Planning's commitments. In the Waste Management Plan of North Macedonia for 2021-2031, based on the National Waste Management Strategy 2006-2020 and EU legislation, it is stated that "…in addition to capital investments, municipalities must improve cost recovery, mainly by establishing appropriate fees… The estimated cost would be 10 to 15 euros per household in the medium and long term..." (Ministry of Environment and Physical Planning of the R. N. Macedonia, p.66) Currently, the fees stand at 5 euros per month, meaning a doubling or tripling of costs. „…To raise awareness at the municipal level among the population and companies, the plan proposes maintaining a budget of 1.5 euros per household (0.8 million euros annually)..." (Ministry of Environment and Physical Planning of the R.N. Macedonia, p.64). These extra costs, amid rising inflation and living expenses, will be highly unpopular for implementation.

Our analysis shows that municipal costs as a percentage of gross domestic product (GDP) per capita in Slovenia, Germany, and Macedonia show a disparity, but this is not a sufficient indicator to reflect the situations in these countries. Therefore, we compared the share of municipal costs in the respective countries with the minimum wage, and while they amount to 1.22% in Slovenia, 1.70% in Germany, in North Macedonia, they are somewhere between the two countries at 1.40% (see Figure 2).

However, a better indicator for comparative analysis is the Income and Living Conditions Indicator, with the latest available comparative data from Eurostat for 2020. This set of statistical measures is used to assess the economic well-being and quality of life of individuals or households in a country or region. It is often used by governments worldwide to shape policies and is primarily based on indicators of income, living conditions, social and economic factors, and subjective indicators. Therefore, it is a more relevant indicator than GDP per capita, which represents the total value of all goods and services produced in a country divided by the total population. According to the Income and Living Conditions Indicator, we see from the chart below that Slovenia is ranked about five times better than the Macedonian national economy, and Germany is ranked about twice as well as Slovenia. However, municipal costs expressed as a percentage of the Income and Living Conditions Indicator do not differ much between Slovenia and Germany (1.01% and 1.22%), while in North Macedonia, this percentage is twice as high at 2.01% (Authors' calculations). This clearly shows that Macedonian citizens bear waste management costs that are reflected in a quality of life and economic power that is twice as poor compared to other countries, even though in absolute numbers, these costs are the lowest.

*Figure 2: Municipal waste management costs comparison between Slovenia, North Macedonia and Germany*

**Municipal waste management costs**
(annual in EUR)

| | Slovenia | Germany | N.Macedonia |
|---|---|---|---|
| **Estimated average municipal management costs*** | 150 | 318 | 60 |
| GDP per capita (WBG, 2023) | 23845 | 39876 | 5.906 |
| Municipal costs as % of GDP per capita | 0,63 | 0,79 | 1,01 |
| Minimum wages (Eurostat 2021, half yearly,S2) | 1024 | 1602 | 358 |
| Municipal costs as % of minimal wages | 1,22% | 1,70% | 1,40% |
| Income and Living Conditions Indicator (Eurostat 2020) | 14774 | 26008 | 2983 |
| Municipal costs as % of Income and Living Conditions Indicator | 1,01% | 1,22% | 2,01% |

*(Source: Author's calculations based on data from EUROSTAT 2021 and World Bank Group 2023)*

## 4. CONCLUSION

This paper is the first attempt in North Macedonia to look at the circular economy through the lens of plastic. In a society where households are not in the habit of sorting waste, we cannot expect plastic data to be available for academic research. While global and European trends place plastic high on the agendas of circular development strategies, in the countries of the Western Balkans, plastic is prioritized only in the Circular Economy Roadmap strategies of Albania and Serbia. Lack of data for plastics is also an issue in WB countries and North Macedonia. Our research shows that ERP schemes play a crucial role in collecting and recycling plastics. About 61% of the total plastic collected in the country is directly related to the work of the EPR actors. The EPR schemes mandated by the EU legislation, which our economy follows and implements as a candidate country, are of positive significance because they offer the opportunity for businesses to perform where the state cannot easily organize, usually due to a lack of finances, staff, or unattractive political moves. In this manner, collaborations on the international level should be a priority for our country as we can provide more advanced solutions from more developed circular economies.

The 2022 Report on EPR in Macedonia shows that out of 22,309.2 tons of plastic released on the market, only 40% is collected, with 16.4% being recycled and 23.3% exported, while the rest ends up in mixed waste and landfills, posing significant environmental concerns. The waste management system needs a core restructuring, focusing on waste separation, digitalization, and accurate waste tracking, as only 86% of citizens use municipal collection services, while a significant portion still improperly disposes of waste, contributing to environmental pollution. Instead of advocating for an increase in municipal waste costs, the state could turn to a strategy of waste separation and, through capital investments or citizen obligations, provide waste separation bins for every household along with a brochure on their use. This would directly start waste separation at the family household level, and then, in cooperation with companies under the extended producer responsibility system, work together to collect the separated waste. What nowadays North Macedonia must begin with is spreading awareness for not making too much waste. Prevention is the key and first recommendation in the never-ending battle with waste, and second step is to reuse it.

About 18% of the waste in North Macedonia, or nearly one-fifth, comes from the business sector, which, unfortunately, fails to find a way to offer it as a resource for the needs of related industries or to recycle it. Macedonian authorities and municipalities can work closely also with the business sector to find out where to reuse these 18 % and give a platform where business sector can communicate for using waste materials like a resource for another related industry sectors. Our conclusion leads to a recommendation that also paying more for

municipality waste management services does not mean better quality of this service in the future. Municipal costs as percentage of income and living conditions indicator that are already paid by Macedonian citizen in comparison with the Germany and Slovenian citizen show that we are already paying too much money for having bad quality services and no offer in proper waste selection options.

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