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Sustainable alternatives for the HoReCa sector along the Shkumbin River: A cost-benefit analysis for reducing plastic waste

Micro Thesis

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Declaration

I, the undersigned Zyra Mahmuti, declare that: (1) This microthesis represents my (our) original work, except for citations and references, and (2) This microthesis has not been previously used as a microthesis or course project at this University or at other Universities.

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ABSTRACT

Plastic pollution in the Shkumbin River Basin has become a pressing environmental and social issue for Albania. ETMI (2025) and BeMed+ (2024) both did field studies that showed that plastics make up more than 70% of the visible trash along the river. The most common types of plastic trash are PET bottles, LDPE bags, and disposable food service materials. The results show that the main causes of leaks in the river system are bad municipal waste services, bad infrastructure, and a lack of public awareness. Cost analyses show that most of the money that cities spend on collection and transport, which means that they don't have much left over for capital investments in facilities for sorting, recycling, or composting. Service fees only cover 40–70% of the real costs, which leads to structural deficits and reliance on subsidies. Not doing anything has a lot of negative effects on the environment and society, such as loss of biodiversity, contamination by microplastics, health risks for the public, and less potential for tourism. The analysis of different options shows that the best way to go is to use reusable systems along with better source separation and recycling infrastructure. While glass and biodegradable products can help in some ways, they are not as effective without the right infrastructure to support them. The study suggests a step-by-step plan that includes both short-term and long-term steps. These include expanding service coverage, starting deposit-return programs, building materials recovery facilities, and starting programs in schools and communities to raise awareness. To make systemic change, we need stronger public policies, like the EU Single-Use Plastics Directive and extended producer responsibility schemes. To deal with plastic pollution in the Shkumbin River, municipalities, civil society, and the private sector need to work together. This will help Albania reach the EU's goals for a circular economy.

Keywords: Plastic pollution, Shkumbin River, waste management, circular economy, Albania.

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1. Introduction

1.1.Background and significance of the problem of plastic pollution in Albanian rivers

Plastic pollution is a big problem for the environment in Albania. Rivers are the main way that runoff gets into the Adriatic Sea. According to national statistics, plastics make up about 9.27% of municipal solid waste. Only 18.8% of this waste is recycled, and more than 76% of it is buried in landfills. About 298,000 people still don't have access to formal waste collection services (INSTAT, 2023; Milieukontakt Albania, 2024). The International Union for Conservation of Nature (IUCN) says that Albania dumps about 8,000 tonnes of plastic into the Adriatic Sea every year (IUCN, 2020). Field surveys corroborate these flows; for instance, in the Ishëm River Delta, 96% of the collected debris was plastic, demonstrating the preeminent prevalence of single-use plastics in riverine and coastal waste streams (Adhami, 2022). Monitoring studies in the Shkumbin River Basin show that there is a lot of accumulation in hotspots in Prrenjas, Librazhd, Elbasan, and Peqin. Poor service coverage, not enough source separation, a lack of recycling infrastructure, and a lack of citizen awareness are the main causes of these hotspots (Institute of Environmental and Territorial Management [ETMI], 2025a; ETMI, 2025b). These kinds of flows are bad for biodiversity, water quality, and the tourism industry, which is very important to Albania's economy (Milieukontakt Albania, 2024).

1.2.Purpose of the study

The aim of this study is to analyze the methods by which HoReCa enterprises (hotels, restaurants, cafes) along the Shkumbin River can mitigate single-use plastic waste and to evaluate the potential economic advantages of transitioning to alternatives. This research evaluates the feasibility of expanding initiatives akin to the Low Plastic Zone project, which involved 719 businesses throughout Albania and resulted in an 8.2% decrease in single-use plastic waste from 2023 to 2024, in the Shkumbin Basin (Milieukontakt Albania, 2024). The study aims to conform to Albania's obligations to implement the EU Single-Use Plastics Directive (SUPD) and enhance Extended Producer Responsibility (EPR) frameworks (Adhami, 2022; European Commission, 2019).

1.3.Specific objectives

a. Find places along the Shkumbini River where SUP use and leakage are most likely to happen (ETMI, 2025a).
b. Based on recent HoReCa data in Albania (Milieukontakt Albania, 2024), figure out how much it would cost to switch from single-use items (like PET bottles and plastic cutlery) to alternatives (like reusable and compostable items).
c. Evaluate environmental results regarding the reduction of plastic and the prevention of leakage (ETMI, 2025b).
d. Make sure that the results fit with policy frameworks, such as the national transposition of SUP and the plans for managing municipal solid waste (Adhami, 2022; Librazhd Municipality, 2020).
e. A comparison of the best practices from EU tourist spots and BeMed projects that can be used in Albania (BeMed, 2021).

1.4.Research Questions

2. What single-use plastic items make up most of the HoReCa waste streams in the Shkumbini basin, and where are the places where they tend to leak? (ETMI, 2025a; ETMI, 2025b)
3. For businesses of different sizes, which replacement options (like reusable or compostable) offer the biggest savings at the lowest cost? (Milieukontakt Albania, 2024)
4. What are the net benefits (economic, environmental, and reputational) of replacing SUP for businesses in the HoReCa sector and cities? (Milieukontakt Albania, 2024; Dinu & Dinu, 2023)
5. What city rules and services are needed to help cut down on SUP leaks in the Shkumbini basin? (Adhami, 2022; Librazhdi Municipality, 2020).

1.5.Contribution of the study and structure of the paper

This study connects the waste produced by the HoReCa industry to the flow of plastic in rivers. It also gives businesses a cost-effective replacement guide and makes sure that interventions are in line with Albania's SUP policy framework and municipal waste plans (Adhami, 2022; ETMI, 2025a; Municipality of Elbasan, 2025). It brings together information from baseline studies in

the Shkumbini basin, national HoReCa programs, and best practices from Europe to make a complete plan for cutting down on plastic pollution in Albania.

The structure:

The study is organized in a logical and step-by-step way. The introduction lays out the background, purpose, goals, and research questions, which gives the reader a clear picture of the problem of plastic pollution and why the study is important. The literature review comes right after that to give the theoretical and conceptual framework, which includes waste types, their effects, and the national legal framework. The methodology chapter then talks about the research methods, data sources, and techniques that were used, making it clear how the information was gathered and analyzed. The examination of the present condition of plastic pollution in the Shkumbin River and the efficacy of municipal management yields the empirical evidence foundational to the evaluations. Next, there is a detailed look at the current financial, environmental, and social costs. This sets the stage for looking at ways to reduce plastic use, such as technical, infrastructural, and educational measures. The comparison section with a cost-benefit analysis lets you objectively look at the options and find the one that costs the least. The recommendations and action plan give a clear and useful picture of what to do, and the conclusions bring together the main points and give advice on what policies and people should do. Finally, references and appendices ensure transparency and scientific backing, rendering the structure comprehensive and well-balanced among theory, empirical analysis, and practical policies.

2. Literature Review

2.1 Definition and typology of plastic waste

Plastic waste is any plastic item or material that has reached the end of its useful life and is thrown away, either through official waste management systems or informally into the environment. The European Environment Agency (EEA, 2021) says that plastic waste includes both long-lasting and single-use plastic items. This includes things like packaging, building materials, textiles, and consumer goods. The EU Waste Framework Directive (Directive 2008/98/EC) also says that waste is anything that the owner throws away or plans to throw away. This definition applies directly to plastics because they are so common in today's production and consumption cycles. In Albania, the legal framework (Law No. 10463/2011, "On Integrated Waste Management") is in line with EU definitions. It makes plastic waste a priority waste stream because of its volume, long-term effects, and environmental risks (Adhami, 2022). Plastic waste can be classified typologically according to its source, application, and polymer composition. Plastic waste is usually split into two groups based on where it came from: post-consumer waste (like packaging, bottles, and disposable containers) and post-industrial waste (like production waste and cut-off waste). Post-consumer plastics make up the largest share of the global market, and packaging makes up almost 40% of all plastic demand (OECD, 2022). Municipal waste audits in Albania reveal that plastics constitute roughly 9.2% of total urban solid waste, amounting to approximately 78,000 tons annually, a considerable portion of which is derived from single-use packaging (INSTAT, 2023; Milieukontakt Albania, 2024). A second way to group them is by the types of polymers, which affect how well they can be recycled and how they affect the environment. Common categories include polyethylene terephthalate (PET), widely used for beverage bottles; high-density polyethylene (HDPE) and low-density polyethylene (LDPE), used in plastic containers and bags; polypropylene (PP), widespread in food packaging and straws; polystyrene (PS), used in cutlery and foam packaging; and polyvinyl chloride (PVC), found in certain pipes and bottles (IUCN, 2020). Recent monitoring of the Shkumbin River found that PET bottles and LDPE bags make up most of the plastic litter in the river. This shows how people use plastic and how collection and recycling are not working well (ETMI, 2025a). Plastic waste can also be defined by how long it lasts in the environment and how long it can be used. Single-use plastic products (SUP) are a very important subcategory. They include things like straws, cups, plates, and cutlery that are meant to be thrown away after a

short time. The EU Directive on Single-Use Plastics (Directive (EU) 2019/904) says that these kinds of products are the most harmful because they leak a lot and can't be recycled very well. In Albania, SUPs are common in the HoReCa sector, where small PET bottles, plastic cutlery, and disposable packaging make up the biggest part of plastic waste that leaks out (Milieukontakt Albania, 2024). Durable plastics, like those used in construction and cars, last longer, but when they are no longer useful, they add to the trash. A new type of plastic is being studied more and more. This type of plastic is made up of smaller pieces of plastic that break down from bigger items. Waste management statistics don't always include these, but they are becoming a bigger problem for aquatic ecosystems. Research conducted in Albanian rivers indicates that plastic runoff from consumers frequently breaks down into microplastics, which accumulate in sediments and ultimately enter the Adriatic Sea (ETMI, 2025b). This shows how important it is to deal with plastic waste at its source, especially in industries that use a lot of SUPs, in order to lessen the long-term damage to the environment.

2.2 Environmental, health and economic impacts of plastics

Plastics are one of the most common materials used around the world, but their effects go far beyond their use. Plastic pollution is a big problem for ecosystems on land and in water. Around 11 million metric tons of plastic waste end up in the oceans every year, where it stays for hundreds of years and breaks down into microplastics (Jambeck et al., 2015; Borrelle et al., 2020). These plastics build up in the marine food web, hurt habitats like wetlands and coral reefs, and hurt biodiversity (Rochman et al., 2016). Microplastics, defined as particles <5 mm, are now found in remote environments, including Arctic ice and deep-sea sediments, demonstrating their global mobility and persistence (Tekman et al., 2020). Plastic waste doesn't just hurt marine ecosystems; it also changes the structure of soil, makes farming less productive, and releases chemicals and long-lasting organic pollutants into land environments (Rillig, 2012). The health effects of plastics, especially micro- and nanoplastics, are becoming more and more of a worry. Laboratory and epidemiological studies demonstrate that humans are exposed to them via ingestion (through food and water), inhalation, and dermal contact (Wright & Kelly, 2017). Researchers have found microplastics in human feces, blood, and even placental tissue, which has led to worries about their possible toxic effects (Leslie et al., 2022; Ragusa et al., 2021). Although research is still in progress, initial findings indicate that plastics may serve as conduits for deleterious chemicals and pathogens. For instance, numerous plastics incorporate

additives like bisphenol A (BPA), phthalates, and flame retardants, recognized as endocrine disruptors and associated with detrimental developmental and reproductive effects (Talsness et al., 2009). Inhalation of microplastic fibers from synthetic textiles and dust has been correlated with respiratory inflammation and oxidative stress (Prata, 2018). While direct causal pathways in humans are still being studied, the high rate of exposure suggests that plastics could be bad for our health in new ways. The effects of plastics on the economy are deep and varied. Plastic pollution is thought to cost the world economy hundreds of billions of dollars each year, mostly because it hurts the fishing, tourism, and marine industries (Beaumont et al., 2019). For instance, "ghost nets," which are old fishing gear that is still in the water, continue to catch fish and marine mammals, which lowers fishing yields and raises management costs (Richardson et al., 2019). The tourism industry is hurt by dirty beaches and coastal areas, which cost a lot of money to clean up (Newman et al., 2015). Plastics also put a strain on the infrastructure needed to deal with trash. Many countries have to pay a lot of money to landfills and incinerators, and recycling is still hard to do both technologically and financially. Only about 9% of all plastics ever made are recycled worldwide (Geyer et al., 2017). These systemic inefficiencies show that the way we make and use things now isn't going to last. The environmental, health, and economic effects of plastics all point to the need for a life-cycle approach to plastics governance right away. This includes early interventions like eco-design and material substitution, middle interventions like extended producer responsibility, and later interventions like better collection, recycling, and recovery.

2.3 Theoretical approaches to plastic waste management

The management of plastic waste has been increasingly scrutinized through theoretical frameworks that inform both policy and practice. The EU Waste Framework Directive defines the waste hierarchy as one of the most widely used frameworks. It puts prevention, reuse, recycling, recovery, and disposal in that order (European Commission, 2008). This method stresses that the best thing to do is to cut down on the making and use of plastics. After that, systems should be made that make it easier to reuse and recycle plastics. Finally, landfilling and burning should be used as a last resort. The hierarchy has been incorporated into circular economy models, designating plastics as a resource to be returned to production instead of being discarded (Geissdoerfer et al., 2017).

The circular economy (CE) is another theoretical idea that goes beyond the linear "take-make-dispose" model to focus on closed-loop material cycles. When it comes to plastics, CE frameworks focus on eco-design, extended producer responsibility (EPR), and making new markets for recycled plastics. Research indicates that the implementation of circular economy principles in the plastics sector could diminish primary demand for plastics by more than 50% by 2050 through strategies of substitution, reuse, and recycling (Ellen MacArthur Foundation, 2016; Ghisellini et al., 2016). In reality, this method needs big changes across supply chains, like new materials, better infrastructure, and getting consumers involved.

Life cycle assessment (LCA) is another theoretical method that looks at the environmental effects of plastic products at every stage of their life cycle, from getting the raw materials to making them, using them, and getting rid of them. Life cycle assessments (LCAs) help policymakers and businesses compare the effects of different plastic and non-plastic options. They show trade-offs like greenhouse gas emissions, energy needs, and toxicity (Rochat et al., 2013). For instance, LCAs have demonstrated that reusable products frequently exhibit reduced overall impacts compared to single-use plastics; however, their advantages are contingent upon usage frequency, consumer behavior, and local waste management infrastructure (Heller et al., 2020).

From a socio-economic standpoint, the theories of extended producer responsibility (EPR) and the polluter pays principle (PPP) endorse the regulatory framework for plastics. The EPR theory holds producers accountable for post-consumer waste, thereby incentivizing eco-design and funding waste collection and recycling (Lifset & Lindhqvist, 2008). The PPP also says that those who cause pollution should pay for cleaning it up, which is a principle found in international environmental law. These frameworks work together to make things like deposit-return schemes, product bans, and plastic taxes possible. These have been shown to cut down on plastic waste and make it easier to collect (Walls, 2011).

Recent theoretical frameworks amalgamate behavioral economics and social practice theory, acknowledging that the management of plastic waste constitutes not merely a technical or regulatory challenge, but also a behavioral one. Patterns of plastic use and disposal are heavily affected by what people buy, how businesses work, and cultural norms. Behavioral incentives, including default reusable alternatives or encouragement to utilize personal utensils, can

markedly diminish the consumption of single-use plastics (Poortinga & Whitaker, 2018). Social practice theory underscores that plastic utilization is ingrained in daily routines, necessitating systemic interventions that transform norms concerning convenience, hygiene, and consumption.

2.4 Legal and institutional framework in Albania

As part of Albania's process of joining the EU, the country's laws and institutions for managing waste, including plastics, have become more like those of the EU. Law No. 10463, "On Integrated Waste Management," from 22.09.2011 and changed in 2013, is the basis of the national legislation. It takes most of the EU Waste Framework Directive (Directive 2008/98/EC) and makes it into law. The waste hierarchy—prevention, reuse, recycling, recovery, and disposal—is the main idea behind this law for all types of waste, including plastics (Law 10463/2011). It outlines the duties of both central and local governments, establishes licensing standards for waste operators, and implements extended producer responsibility (EPR) mechanisms in accordance with EU directives on packaging and packaging waste (VKM No. 177/2012; amended by VKM No. 52/2014). The National Strategy for Integrated Waste Management 2020–2035 and the National Waste Management Plan work together with the law to give a strategic vision for the shift to a circular economy. These papers set specific goals for cutting down on landfilling, raising recycling rates, and building separate collection systems (Ministry of Tourism and Environment, 2020). Plastic waste is clearly a priority stream, especially single-use plastics. Albania has to cut down on these types of plastics because of the EU Directive on Single-Use Plastics (Directive (EU) 2019/904). Albania put specific bans on lightweight plastic bags in 2022, slowly getting rid of them from stores in line with European and regional practices (Decision of the Council of Ministers No. 367, 2022). The Ministry of Tourism and Environment (MTE) is the main government body in charge of making and coordinating policies. The National Environmental Agency (AKM) and the State Inspectorate of Environment and Forestry (SIEF) are in charge of making sure that people follow the rules, collecting data, and checking permits. According to Law No. 139/2015 "On Local Self-Government," municipalities are mostly responsible for collecting, transporting, and providing services for waste at the local level. Municipalities must also create local waste management plans (LWMPs) that fit with national and regional plans (Librazhd Municipality, 2020; Elbasan Municipality, 2025). Even with these official systems in place, there are still problems with implementation, funding, and communication between central and local governments. Albania's

framework also includes the participation of civil society and the private sector. The Law on Concessions and Public-Private Partnerships (Law No. 125/2013) lets cities hire private companies to pick up, treat, and recycle trash. Organizations like INCA and Milieukontakt Albania have been very important in testing ways to cut down on plastic waste, raising awareness, and helping local governments write their own plans (Adhami, 2022; Milieukontakt Albania, 2024). But the framework doesn't work as well as it could because of structural problems, such as a lack of recycling infrastructure, a lack of implementation capacity, and a lack of citizen involvement in separating waste.

3. Methodology

3.1 Study area: Shkumbin River and municipalities along it

The research centers on the Shkumbin River basin, a crucial hydrological system in Albania, spanning roughly 181 kilometers from its origin in the Valamara Mountains to its discharge into the Adriatic Sea near Divjaka. The river flows through a variety of landscapes, such as mountains, farmland, and cities. This means that it crosses many different human activities that create and change the flow of plastic waste. There are more than 250,000 people living in the basin area, which is about 2,445 km². Some of the cities and towns in the area are Prrenjas, Librazhd, Elbasan, Peqin, Rrogozhina, and Divjaka. These municipalities are a mix of cities and towns, making them a good example of the many problems that come with managing waste in Albania.

There were a number of reasons why the Shkumbini Basin was chosen as the study area.

First, it is an important way for pollution to get into the Adriatic Sea, with rivers acting as pipes for plastic to flow from land to the sea. Baseline studies have demonstrated that substantial quantities of plastic waste accumulate along riverbanks and are subsequently transported downstream, frequently reaching coastal ecosystems.

Second, the basin is home to cities and administrative units that have different abilities to collect, transport, and recycle waste. This makes it possible to study how social, financial, and institutional factors affect plastic waste outcomes. Elbasan is an urban municipality with a larger population and more industrial activity than rural municipalities like Prrenjas and Librazhd,

where service coverage is often incomplete. This variety gives us a chance to look at different ways that plastic waste is made and moves.

The Shkumbini is a very diverse ecosystem that supports fish, plants along the riverbanks, and irrigation systems for farming. Plastic pollution threatens these functions by making the water less clean, blocking irrigation channels, and breaking up habitats. The river is important to society because many settlements have relied on it for water, farming, and transportation for a long time. Plastic waste not only damages the environment, but it also lowers the cultural and aesthetic value of the river, making it less appealing to tourists in places like Librazhd and Elbasan.

The study examines the Shkumbin basin, situated at the confluence of urban-rural dynamics, institutional capacities, and environmental vulnerabilities. It shows how municipal governance, socio-economic conditions, and investments in infrastructure affect the performance of waste management and the flow of plastic. Also, the basin's link to the Adriatic Sea puts it in a larger regional context of marine litter in the Mediterranean, making it even more important for international cooperation under frameworks like the Marine Strategy Framework Directive (MSFD).

In terms of methodology, defining the study area makes it possible to gather data that is different in different places. Data were gathered from both official municipal sources and through field monitoring of hotspots along the river, encompassing upstream, mid-stream, and downstream municipalities. This makes sure that the analysis takes into account both the geographical differences and the cumulative effects of plastic flows downstream. The Shkumbin River Basin exemplifies Albania's extensive waste management issues, providing significant insights for the formulation of national and regional policies.

3.2 Data Sources (Municipal Reports, Field Studies, Mapping, Statistics)

The study employed a multi-source data collection strategy to guarantee the consistency and triangulation of findings. The main source of data was municipal reports, which gave official numbers on things like how much waste was produced, how many services were available, how much money was spent, and how much money was invested in infrastructure. We used Local Waste Management Plans (LWMPs) from cities like Elbasan and Librazhd as sources for our

review. These plans include estimates of how much waste will be produced, how much it will cost, and what actions will be taken. These reports made it possible to get a baseline picture of how well institutions were keeping their promises and where they were falling short in providing services.

Field studies were done to add to official data, especially in places where municipal data were missing or out of date. We did systematic surveys of the riverbanks at pre-defined hotspots along the Shkumbin basin, following the methods suggested by the International Union for Conservation of Nature (IUCN, 2020). The surveys involved documenting the type, quantity, and polymer composition of plastic debris identified along 100-meter transects. Also, floating litter monitoring was done at important hydrological barriers like dams and bridges to see how much plastic was flowing through. These observations gave us real-world examples of the most common types of plastic in the river system, like PET bottles, LDPE bags, and polypropylene packaging. Geospatial mapping was another important source of information. Geographic Information Systems (GIS) were used to make spatial overlays of data on waste generation, population density, and service coverage. This made it possible to find links between demographic factors, waste infrastructure, and places where plastic leaks happen. The analysis was made even better by using remote sensing images and open access geospatial datasets, especially for classifying land use and figuring out how close settlements are to river banks.

We got statistical data from the Institute of Statistics (INSTAT), which gives national-level information about things like urban waste generation, recycling rates, and population demographics. Local results were also put in the context of larger national trends. We also used data from Eurostat and the OECD to compare Albania's performance to European standards, especially when it came to recycling rates and the amount of plastic used per person.

Stakeholder consultations were held to check and confirm the data. These meetings not only confirmed that the data was correct, but they also gave us qualitative information about the problems with collecting trash, getting people to recycle, and making waste services financially stable.

3.3 Cost-benefit assessment method

The primary analytical instrument employed in this study is a cost-benefit assessment (CBA) framework, formulated to evaluate the economic feasibility of alternative strategies for mitigating plastic waste. The CBA method looks at the expected costs of interventions and compares them to their expected benefits, using money whenever possible. Costs encompass both direct financial expenditures (e.g., acquisition of reusable alternatives, infrastructure investments, operational modifications) and indirect costs, including training, public awareness initiatives, and administrative expenses. Benefits include savings from less trash collection and disposal, money made from selling recyclable materials, and costs that are avoided, like pollution of water and lost tourism opportunities.

The evaluation utilized both financial and economic viewpoints. The financial perspective looked at how the changes would affect city budgets and the costs of running a business, with a focus on how affordable and sustainable they would be for local governments and businesses. The economic perspective looked at how the economy as a whole could benefit, such as better ecosystem services, lower health risks, and a better quality of life. When direct market prices were unavailable, benefits were assessed using approximate values obtained from international studies (e.g., avoided cleanup costs, shadow price of ecosystem services). We used scenario modeling to look at three different ways to intervene:

1. Business as usual (BAU): continuing to throw away trash in the same way, with little recycling and mostly putting it in landfills.

2. Intermediate intervention: setting up separate collection systems, replacing some single-use plastics with reusable ones in the HoReCa sector, and making small investments in recycling infrastructure.

3. Advanced intervention: full use of reusable systems, full use of EPR, and money spent on local recycling centers.

In line with international standards (European Commission, 2014), each scenario was looked at over a 10-year period and discounted using a 5% social discount rate. We did a sensitivity analysis to see how strong the results were when we changed some of the assumptions, like the prices of recycling markets or the rates at which waste is generated. This made sure that the

conclusions would hold up even if things weren't clear. The analysis included both monetary and non-monetary co-benefits, such as less litter in public places, happier citizens, and better compliance with EU integration goals. These qualitative benefits, while difficult to quantify, were acknowledged as crucial for a thorough evaluation. CBA thus offered a systematic and evidence-based approach to evaluate whether the advantages of minimizing plastic waste surpassed the related expenses, directing policymakers towards efficient and sustainable solutions.

3.4 Alternative methods of comparison and limitations of the study

Cost-benefit analysis was the main way to look at things, but other methods were also looked at to add to and improve the analysis. One of these methods was Life Cycle Assessment (LCA), which looks at how products affect the environment over their whole life cycle. LCA was used to compare the environmental impact of single-use plastic items to that of reusable ones. It looked at things like greenhouse gas emissions, energy use, and resource depletion. Another method was Multi-Criteria Decision Analysis (MCDA), which lets people who are making decisions look at more than one thing, like the economy, the environment, and society, when choosing between options. MCDA was qualitatively employed to capture stakeholder preferences, especially in contexts where benefits were challenging to quantify.

The study utilized comparative analyses, employing data from European Union member states to set benchmarks for recycling efficacy, service coverage, and financial efficiency. This helped us better understand the difference between Albania's current situation and EU standards, as well as some best practices that could be used in the Shkumbin area. We also did a stakeholder analysis to figure out who is responsible for what, what stakeholders want, and what might cause problems. This qualitative tool enhanced the economic analysis by illuminating governance dynamics.

Even though the study had some good methods, it had some problems.

First, the amount and accuracy of data varied from one municipality to the next. Elbasan had fairly detailed trash statistics, but smaller towns like Prrenjas and Peqin often didn't have the most recent data, so they had to rely on estimates or extrapolation.

Second, the lack of local assessment studies made it hard to put a price on environmental benefits like protecting biodiversity or improving ecosystem services. This meant that international indicators had to be used.

Third, the field studies may not have shown how plastic flows changed with the seasons because of time and resource limits on the project.

Fourth, it was hard to measure informal waste collection and recycling activities, which are important in Albania. This could have led to an underestimation of the actual recycling rates.

Another limitation pertains to the generalizability of the findings. The Shkumbin River serves as a significant case study; however, the results may not be entirely indicative of other Albanian basins characterized by distinct socio-economic or geographical conditions. The Corporate Environmental Corporations (CEC) framework, despite its strengths, inherently emphasizes monetizable outcomes, potentially leading to an undervaluation of the cultural, social, and aesthetic aspects of environmental quality. To rectify this, the study explicitly incorporated qualitative evaluations of non-monetary advantages and limitations, thereby ensuring a balanced methodology.

4. Current status of plastic pollution in the Shkumbin River

4.1 Quantity and typology of plastic waste (based on ETMI and BeMed+ measurements)

The Shkumbin River is now one of the most polluted river basins in Albania when it comes to plastic waste. The Institute of Environmental and Territorial Management (ETMI, 2025) did systematic baseline studies in different municipalities. They found that plastics make up more than 70% of the total litter on riverbanks. This percentage is in line with what has been found around the world, where plastics make up between 60 and 90 percent of litter on rivers and coasts (Lebreton & Andrady, 2019). The fact that plastics are so common in the Shkumbin shows how much people in the area use single-use plastics (SUP) and how badly waste management services work. In May 2024, a BeMed+ Plastic Origins survey was done along most of the Shkumbin. In only four days of monitoring (May 26–29), observers recorded 1,185 separate reports of litter. These were broken down into three groups:

(1) 558 cases of unitary waste, such as PET bottles, lightweight shopping bags, disposable cutlery, and lightweight food packaging;

(2) 31 cases of bulky waste, such as vehicle parts, furniture, and large construction plastics; and

(3) 596 collection areas, where the amount of trash was too big to count one by one (Surfrider Foundation Europe, 2024).

These collection areas were often near settlements, along river bends, bridges, and places where people threw away trash without permission. The types of plastics found along the Shkumbini River show how people in cities and towns in Albania use and throw away things. Packaging plastics, particularly PET bottles and LDPE bags, were the most prevalent, reflecting their significant proportion in household and HoReCa waste streams (INSTAT, 2023). There were also a lot of single-use plastics related to food, like cups, plates, and straws. This was especially true near cities like Elbasan, where there are a lot of food service activities. Also found were hygienic and sanitary plastics, like wet wipes, diapers, and masks. This shows that people are not throwing away their household and medical waste properly. Finally, macroplastics like tires, construction debris, and PVC pipes were found in hot spots. These were most likely dumped

there illegally because law enforcement isn't very strong (Adhami, 2022). ETMI monitoring estimated that the plastic flux in some middle and lower reaches of the river could exceed hundreds of items per 100 meters of riverbank, a density comparable to highly polluted rivers in Southeast Asia (Schmidt et al., 2017). Because of these numbers, the Shkumbin is one of the most dangerous rivers in the Mediterranean basin. The river's ability to move things downstream means that a lot of this plastic also ends up in the Adriatic Sea. Albania is thought to send up to 8,000 tonnes of plastic there every year (IUCN, 2020). The buildup of plastic in the Shkumbin has bad effects on the environment, society, and the economy. Plastics can get caught in fish and birds, block irrigation canals, and release microplastics into sediments, which could affect the food chain (Rillig, 2012). Litter that can be seen on the banks of the river hurts its cultural and recreational value. When dangerous plastics (like medical waste and pesticide containers) are thrown away along the river banks, they also pose a risk to human health. Cleanup costs, lost tourism potential, and lower agricultural water quality are all hidden costs for cities that already have underfunded waste systems (Beaumont et al., 2019).

Table 1 Tipologjia dhe sasia e mbetjeve plastike në lumin Shkumbin (bazuar në ETMI 2025 dhe BeMed+ 2024)

Plastic waste category	Main description	Number of reported/observed cases
Unit waste (small items)	PET bottles, plastic bags, cups, packaging	558 case (May2024)
Mbetje voluminoze	Plastic furniture, tires, construction parts	31 case (May 2024)
Accumulation area	Large, uncountable volumes	596 zona (May 2024)

Composition according to ETMI	Plastic in total river waste	>70% (June 2025)
The most common types	PET, LDPE, PP, hygienic-sanitary	Present in every segment

The Shkumbin River is not only a local pollution hotspot, but also a major route for plastic to flow into the Adriatic, according to data from ETMI and BeMed+. To solve this problem, municipalities and the national government need to act quickly. This includes stricter enforcement against illegal dumping, investments in separate collection systems, and targeted reduction measures in HoReCa that focus on the most common items found in the surveys.

4.2 Main sources of pollution (industry, tourism, HoReCa, domestic use)

Industrial waste and other types of waste. Along the Shkumbini corridor, industrial and service sector activities add plastics and other pollutants to the water in two main ways: (i) direct and indirect discharges of wastewater (including from businesses), and (ii) co-disposal of heavy polymeric items and packaging near river banks.

The A18 Basin Review says that "untreated wastewater discharges from businesses and residents along its banks" and that urban and inert waste is building up in the banks and tributaries. There are gaps in monitoring that make it hard to know exactly how much plastic is in the water (A18 Report, 2023). These discharges happen at the same time as bad infrastructure and limited monitoring, which the SUP/BeMed+ synthesis for Shkumbin always mentions. It says that not enough collection and transportation equipment, low recycling rates, illegal dumping, and lack of funding are all ongoing problems. In practice, traces of industrial plastics show up in the data as heavy plastic fractions (like construction debris, furniture, and PVC) and packaging effluents that build up at entry points, meanders, channels, and informal dumping sites that BeMed+ calls "collection areas." The ebb and flow of tourism (seasonality and pressure on services). Seasonal flows make people buy more take-out items like bottled water and food

packaging, which puts a strain on city services. Shkumbini's evidence base is strongest in HoReCa (below). BeMed+ mapping over the four days of the survey recorded 1,185 reports, including 596 collection areas. This is a pattern that matches litter pulses around access nodes that host visitors and temporary commerce (Surfrider/BeMed+, 2024).

Tourism hotspots around the world are known for making macro-litter density in rivers and coasts higher and changing the types of waste to single-use food and drink packaging (Beaumont et al., 2019). HoReCa stands for hotels, restaurants, and cafes. The Milieukontakt "Low Plastic Zone" national HoReCa panel is very detailed: 704 to 719 businesses were checked; plastics went down by 8.2% (-27,325 kg) from 2023 to 2024 in the panel; extrapolated, this means a loss of -677,390 kg at the sector level (from 8.29 million kg to 7.62 million kg). Bars and restaurants make up more than 73% of plastic waste in the sector. Supermarkets had the biggest drop (-38%), which is similar to the types of items found on the banks of the Shkumbini (small PET, LDPE bags, service equipment). The ETMI riverbank database directly confirms the mix of items: LDPE dominates the polymer types; SUPs (shopping bags, PET < /> 0.5 L bottles, snack wrappers) are common application hotspots, with rural areas showing the highest concentrations, but urban accumulations are still significant. Household waste and poorly managed municipal waste. There are three known ways that household consumption affects the flow of the Shkumbini River: limitedservice coverage, illegal dumping, and low source separation/recycling. ETMI says that the average number of items is 1.23 per 100 m2, which is higher than the EU's reference level of 0.2 per 100 m2. SUPs make up most of the items, and light food packaging plastics (which are hard to recycle and not worth much) are specifically mentioned as common trash. BeMed+ sorts the load it sees into three groups: unitary items (558 cases), bulky waste (31), and collection areas (596). The last group usually includes places where people throw away their trash and drainage points.

Table 2 Key indicators/evidence

Source	Typical plastic items/layers	Mechanisms of flow to the river	Key indicators/evidence
Industry	Packaging, PVC/PE fragments from construction, plastic furniture	Raw water discharges, coastal deposits, lack of management	Untreated water and urban/inert accumulations on shores (A18)
Tourism	Small PET bottles, "on-the-go" food packaging	Seasonal pressure on services, accumulation at access points	1,185 reports in 4 days; 596 accumulation zones (BeMed+)
HoReCa	PET bottles, LDPE bags, cups/plates, snack packaging	High generation of SUPs; insufficient management	Plastics −8.2% (704 businesses); 8.29–7.62 million kg (extrapolated)
Household Use	Shopping bags (LDPE), bottles, snack wrappers	Limited coverage, illegal disposal, low source separation	SUPs dominate; LDPE most present; 1.23 objects/100 m (ETMI)

The evidence indicates a pragmatic division:

(1) Household and HoReCa packaging and service equipment make up the majority of the count and are easy to see along the banks;

(2) industrial and construction plastics show up from time to time but add a lot of volume in hotspots; and

(3) Seasonal tourism increases the number of items moving around and puts a strain on collection capacity.

Using reusable or DRS materials on important items like PET, LDPE bags, and food packaging, while improving implementation and service coverage in rural and peri-urban units, is in line with both the riverbank inventory and HoReCa.

4.3 Pollution hotspot mapping

ETMI (2025) set up 18 monitoring stations along the upper, middle, and lower parts of the Shkumbini River as part of their field studies. These stations were chosen because they are close to settlements and hydrological barriers like dams and bridges, and they show different types of land use, like urban, rural, and agricultural. The results show that plastic waste doesn't spread out evenly; instead, it builds up in certain "hotspots" where poorly managed waste enters the river and is blocked by geography or infrastructure.

ETMI says that the most plastic was found in rural and peri-urban areas near Prrenjas and Librazhd, where collection service coverage is not complete and illegal dumping happens often. Monitoring in these areas found 1.23 plastic items per 100 m of riverbank, which is more than the EU's reference level of 0.2 items per 100 m for good environmental status. The polymer mix was mostly made up of LDPE bags and PET bottles, which is what most people use at home and in restaurants. The midstream hotspot is in the city of Elbasan, which is the biggest city in the basin. Even though there were more services available, a lot of PET bottles, food packaging, and sanitary plastics were found here. Illegal dumping near informal markets and neighborhoods by the river was a big problem. ETMI found this area to be a major spillway where city waste systems don't catch all the pieces. Because the river is less steep downstream, the Peqin and Rrogozhinë segments act as collection areas. Surveys showed that there were big floating layers of mixed plastic, especially close to irrigation canals and bridge crossings. The BeMed+ mapping from May 2024 shows that 596 of the 1,185 data points were collection areas where plastics were found in high concentrations. These locations included meanders and blockages where plastics from upstream converge. The Shkumbini flows into the Adriatic Sea at the Divjaka estuary. IUCN's broader Mediterranean assessments, which are not part of the detailed ETMI studies, say that Albania adds up to 8,000 tonnes of plastic to the Adriatic each year,

mostly through rivers like the Shkumbini (IUCN, 2020). So, hotspots found upstream mean that marine litter risks are higher downstream.

Table 3: Plastic Pollution Hotspots in the Shkumbin River

River Segment	Main Municipalities	Hotspot Characteristics	Dominant Items
Upstream	Prrenjas, Librazhd	Limited service, illegal dumping, density of 1.23 objects/100 m	LDPE bags, PET bottles
Midstream	Elbasan	Urban center, informal markets, intensive HoReCa	PET bottles, snack packaging, hygiene items
Downstream	Peqin, Rrogozhinë	Accumulation areas in bends and bridges, connection to irrigation canals	Mixed waste, tires, large plastic fragments
Mouth to the Sea (Delta)	Divjakë	Transport of plastic to the Adriatic (marine risk)	Mixed plastic from urban and rural origins

The hotspot map shows a pattern with three levels:

i. Upstream (Prrenjas/Librazhd): Rural dumping and waste services that aren't finished.
ii. Midstream (Elbasan): Plastics used for packaging and runoff from cities that are related to HoReCa.
iii. Downstream (Peqin/Rrogozhinë): Floating plastics building up in irrigation and hydrological points.

4.4.Waste management performance in the respective municipalities

The performance of waste management along the Shkumbin River Basin varies because of differences in population density, financial resources, infrastructure, and the effectiveness of institutions.

The waste management in Prrenjas and Librazhd is still not very good, and the service coverage is below the national average. A lot of people live in rural areas, but they don't always have

regular trash collection. This leads to illegal dumping on riverbanks. ETMI (2025) found some of the highest concentrations of plastic here (1.23 items per 100 m of riverbank), which was directly related to poor services and weak enforcement. There are no transfer stations or treatment plants in these towns, so people have to rely on transportation to get their trash to landfills far away. Elbasan, the largest city in the basin with more than 115,000 residents, has the best waste infrastructure, which includes transfer stations and partnerships with private companies. In the city center, service coverage is pretty good, but it's not as good in the peri-urban areas. Elbasan makes the most waste overall, which makes it harder to collect and throw away in landfills. Despite investments, recycling rates are still low, mostly because of informal collectors and private efforts. ETMI found that Elbasan was a major place where plastic was leaking out of the system because people were dumping it in riverside neighborhoods and markets without permission.

Downstream (Peqin, Rrogozhinë): These towns have a lot of problems with money and logistics. Collecting trash is not a long-term solution, especially in rural areas. Illegal dumping near irrigation canals and river meanders creates places where trash piles up, as shown by the BeMed+ mapping (596 total accumulation areas, many in the lower reaches). There isn't enough recycling infrastructure, and both cities have to rely on transportation to landfills outside of their territory, which costs more and makes things less efficient.

Divjaka is very important because it is at the mouth of the river that flows into the Adriatic Sea. The high amount of agricultural and tourism-related waste coming in makes it hard to manage waste here. Plastic runoff from Shkumbini hurts the beaches and wetlands in Divjaka-Karavasta National Park. Cleaning up the city is hard because the waste services don't get enough money and rely on projects funded by donors and NGOs.

The main problems in the basin are:

a. Incomplete coverage, especially in rural and mountainous areas.
b. Not much recycling or separating of waste, and most plastic waste ends up in landfills.
c. Relying on municipal budgets for money with little help from outside sources.
d. Not enough enforcement against illegal dumping.

e. The pressure from tourism and HoReCa, which makes plastic leakage worse during busy times.

Even though Elbasan has gotten better in some ways, the way waste is managed in the basin as a whole isn't good enough to stop plastic from leaking into Shkumbin. Hotspot data shows that pollution levels are directly related to gaps in infrastructure and unfair service levels.

5. Analysis of current management costs

5.1.Operational and capital costs of collection, transport and treatment

There are three main activities that make up the costs of waste management in the municipalities of the Shkumbini basin: collecting the waste at its source, transporting it to disposal or transfer stations, and finally treating it or putting it in a landfill. These costs include both operating expenses (OPEX), which happen every day or every year, and capital expenses (CAPEX), which are one-time investments in equipment and infrastructure. It's very important to find the right balance between OPEX and CAPEX. Municipalities that don't invest enough capital often have problems with inefficiency and higher operational leakages, especially in rural and peri-urban areas.

Collection is still the most expensive part of the system, costing the most money for the city to manage its waste (World Bank, 2018). The costs of running a business include paying waste workers, fueling collection trucks, and fixing bins and trucks. In towns like Prrenjas and Librazhd, collection coverage is not complete. This means that the overall budget is smaller, but the cost per tonne collected is higher because the population is spread out in rural areas and the collection routes are longer. In Elbasan, on the other hand, where there are more people living in cities, economies of scale lower the cost of collection per unit, but the total cost is much higher because more waste is being made. The purchase of waste trucks, bins, and containers is part of the capital costs in this group. Many smaller towns and cities depend on projects funded by donations or used equipment, which means that things break down often and cost a lot to fix.

Another big cost is transportation, especially when trash has to be taken to regional landfills that are outside of the city limits. For instance, Peqin and Rrogozhina move trash to faraway places, which makes them use a lot more fuel and costs a lot more to run. In small towns, transportation can make up 25–30% of the total system costs (ETMI, 2025). Fuel prices have changed a lot in

the last few years, so these costs are very sensitive to them. Investments in transfer stations that cut down on transportation distances by collecting waste in one place are part of capital costs. Elbasan has a transfer facility that makes things run more smoothly, but most smaller towns don't have this kind of infrastructure, so they have to transport goods directly. Right now, landfill is the most common way to get rid of waste, with recycling and composting only playing a small part. Landfill sites have operational costs like entrance fees, environmental monitoring, leakage management, and waste coverage. Landfill fees in Albania are lower than the EU average (often less than €20 per tonne), but municipalities still have trouble paying them on time because their budgets are tight (INSTAT, 2023). The costs of treatment are especially high because it costs millions of euros to set up sanitary landfills or recycling plants. Most towns and cities in the Shkumbini basin can't pay for these kinds of facilities on their own, so they have to rely on money from the central government or donors. Because there aren't any recycling facilities, plastic pieces that could be useful are thrown away instead of sold, which means that the company can't make money by selling them. Not separating waste at the source is a big reason why costs go up. If plastic, paper, and organics aren't collected separately, mixed waste has to be collected and moved in bulk, which costs more and pollutes the recyclable parts. Because of this inefficiency, the OPEX per ton is higher and the landfill capacity is under more stress. Informal dumping along riverbanks also has hidden costs. Municipalities have to spend more money on cleaning up, often without planning for it in their budgets. Environmental damage also costs tourism and agriculture more money (Beaumont et al., 2019).

This graph shows the average cost per tonne of waste management in the Shkumbini basin. Collection is the biggest cost, at about €40 per tonne, which is due to the fact that it takes a lot of resources and covers a lot of rural areas. Transport costs about €20 per tonne, which is a problem for municipalities with remote landfills. Treatment and disposal costs about €18 per tonne, which is still low, but not enough to include modern recycling. This distribution shows how much money is spent on operations and how little is invested in capital, which means that financial reforms and EPR schemes are needed to make the system work better.

Table 4: Cost Category

Cost Category	€/ton mesatarisht	Percentage in Budget	Examples / Remarks
Collection	30–50	50–70%	Much higher in rural areas
Transport	15–25	20–30%	Costs increase when landfills are far away
Treatment/Disposal	15–20	10–20%	Lower rates than EU, recycling losses
Capital Cost (CAPEX)	–	–	Sanitary landfill €5–10 million, MRF €2–5 million
Household Fees	20–40 €/year	40–70% cover	Much lower than EU
Cost of Inaction	++10–50 thousand €/year	–	Emergency cleaning + tourism losses

Municipal budgets are mostly made up of operational costs, which means that money that could be used to build infrastructure is being used for other things. Smaller towns in the Shkumbini basin have higher unit costs because they aren't as big, while bigger cities like Elbasan have higher total costs. Because there isn't enough money to invest in transfer stations, recycling plants, and modern equipment, inefficiencies continue. To fix these imbalances, we need a coordinated financing model that includes municipal tariffs, national subsidies, and donor investments. This will help balance OPEX and CAPEX and move us toward a more sustainable waste management system.

5.2.Service tariffs and cost recovery

The structure of service tariffs and how well they cover current operational and capital costs are two of the most important financial parts of managing municipal waste in Albania, especially in the Shkumbini basin. In Albania, waste services are usually paid for by a mix of municipal

budgets, user fees (tariffs), and sometimes central government or donor subsidies. How much money comes from each of these sources affects both the system's long-term financial health and the quality of the services it offers. Most towns and cities collect fees as a set amount per household or as part of the local property tax. Businesses pay more depending on what they do. By European standards, the average household fees in Albania are still low, usually starting at €10 to €30 per household per year (World Bank, 2018). Some of the lowest fees are charged by municipalities upstream in the Shkumbini basin, like Prrenjasi and Librazhdi. This is because they have less money coming in and less administrative power. Fees are a little higher in Elbasan, but they still don't cover the full cost of providing the service. Businesses, especially those in the HoReCa sector, have to pay higher fees, but enforcement and collection are still inconsistent, which means that there are gaps in revenue.

The main problem in the basin is that the fees don't cover the real costs of collecting, moving, and getting rid of trash. ETMI (2025) says that in small towns like Prrenjas, the current fees only cover about half of the costs of running the business. The rest of the costs are covered by the town's general budget. Cost recovery is a little better in Elbasan (about 60–70%), but it is still not high enough to make the business financially stable. For municipalities downstream, like Peqin and Rrogozhina, the gaps are even bigger. This is because it costs a lot to move trash to landfills that are far away, but the fees don't bring in much money. This mismatch leads to chronic underfunding, which makes it hard to invest in recycling programs, service coverage, and equipment. Partly because of politics, low tariffs are a way to keep prices low, especially in rural areas where people don't have much money. But because there isn't a cost-reflective tariff system, municipalities can't put enough money into infrastructure, which keeps service inequities going. Households often think the tariff is unfair because it doesn't cover all services. For example, rural residents who pay the same tariff as urban residents may not get regular waste collection, which makes them less likely to pay. This has caused a lot of people not to pay their bills and to fall behind, which has hurt city revenues even more. In reality, municipalities pay for waste management with money from other parts of their budgets, which often means cutting back on infrastructure maintenance or social services. Projects funded by donors have sometimes made capital investments, like trucks, bins, and awareness campaigns, but these investments are not long-lasting. The fees do not include the hidden costs of illegal dumping and river pollution, such as damage to the environment, clean-up efforts, and lost tourism potential.

This means that cities and towns do not fully understand the economic costs of bad waste management (Beaumont et al., 2019). The EU says that to cover the costs of managing municipal waste, households usually have to pay between €80 and €120 a year, depending on the service model and level of treatment (European Commission, 2014). In contrast, the municipalities of Shkumbini only charge a small amount of this. This gap is why cost recovery isn't working well and why recycling programs aren't very good. Without gradual tariff increases and stricter payment enforcement, cities will still need subsidies, which will make it harder for them to modernize their services.

Table 5: Service Fees and Cost Coverage in the Municipalities of the Shkumbin Region

Municipality	Average Fee per Household (€/year)	Cost Coverage Percentage	Main Issues	Overall Rating
Prrenjas	10–12	<50%	Low fees, partial coverage, weak payments	Very poor
Librazhd	12–15	~50%	Lack of investment funding, tariff debts	Poor
Elbasan	20–25	60–70%	Fees slightly higher, but not cost-reflective	Average
Peqin	10–12	40–50%	Expensive transport, low revenues	Poor
Rrogozhinë	10–12	40–50%	Dependence on subsidies, low payments	Poor
Divjakë	12–15	~50%	Uncertain service, pressure from tourism	Poor

To be financially stable, municipalities should:

(i) set up a tariff structure that reflects costs,

(ii) make it easier to collect and enforce fees, and

(iii) tie tariffs to better service quality, especially in rural areas.

Differentiated tariffs based on how much waste is produced (like "pay as you throw" plans) and better enforcement of extended producer responsibility (EPR) could help municipalities save money and get more of it back.

5.3.Environmental and social costs of inaction

Not properly handling plastic waste in the Shkumbin basin has big hidden costs for the environment, people's health, and the local economies. These costs don't always show up in city budgets, but they are real losses to the economy that add up over time.

Plastic being thrown into the Shkumbin River directly hurts the services that the ecosystem provides. ETMI (2025) said that more than 70% of the trash on riverbanks was plastic. The most common items were PET bottles, LDPE bags, and food wrappers. These plastics break down into microplastics, which build up in sediments and make their way into aquatic food webs. International evidence shows that microplastics last for hundreds of years, making soil less fertile (Rillig, 2012), blocking irrigation channels, and making water quality worse. The International Union for Conservation of Nature (IUCN, 2020) says that Albania adds up to 8,000 tons of plastic to the Adriatic Sea every year, mostly through rivers like the Shkumbini. This flow hurts marine biodiversity and adds to the costs of cleaning up marine litter in the area. Effects on biodiversity are a big cost to the environment. Fish, birds, and amphibians have all been found to have plastic in their bodies or to have eaten it. Schmidt et al. (2017) name rivers like the Shkumbini as important flow paths in the Mediterranean. Riparian habitats that are damaged lose biodiversity and make ecosystems less able to handle flooding and erosion, which creates long-term environmental problems.

The social value of the Shkumbin River goes down when there is plastic trash along the banks. People who used to rely on the river for water, fishing, and fun now have to worry about pollution. Sanitary plastics (e.g., diapers, wet wipes, medical waste) observed during surveys pose direct threats to public health. International studies indicate the presence of microplastics in human feces, blood, and placenta (Leslie et al., 2022; Ragusa et al., 2021). There has not yet been any systematic monitoring in Albania, but there is a high chance that people in riparian communities are being exposed. Exposure to plastics and their additives, like phthalates and

bisphenol A, can cause health problems like endocrine disruption, respiratory inflammation, and developmental issues (Wright & Kelly, 2017). These health effects cost healthcare systems money and make people less healthy overall.

The cost of doing nothing is also very high. Beaumont et al. (2019) say that plastic pollution around the world costs fisheries, aquaculture, and tourism billions of euros every year. At the local level, municipalities in the Shkumbini basin are having to pay more and more for one-time cleanups of trash and illegal dumping along the riverbanks. These operations take away valuable resources from education, infrastructure, and social programs. Pollution also makes places like Elbasan and Divjaka less appealing to tourists, even though riverside recreation and coastal tourism could bring in money. Research in other Mediterranean areas has shown that litter on the beach can keep tourists away and cost cities millions of dollars each year to clean up (Newman et al., 2015). In Albania, these costs are not consistently documented; instead, they manifest as diminished destination appeal and the forfeiture of employment opportunities within eco-tourism. People lose faith in local institutions when they see plastic trash everywhere. When residents pay fees but still see trash along riverbanks that isn't being cleaned up, they are less likely to pay, which creates a cycle of underfunding and poor service delivery. Rural areas are hit the hardest because they get worse services and are more likely to be exposed to environmental risks. This leads to social inequalities, with groups that are already weak suffering the most from environmental damage. The costs to the environment and society of not doing anything in the Shkumbini basin add up over time. Municipalities only care about operational costs, but the real cost of not doing anything is damaged ecosystems, health risks, lost money, and less trust in the government. According to the World Bank (2018), the best way to deal with pollution is to prevent it and invest in waste management. This is much less expensive than dealing with the damage that uncontrolled pollution causes. The Shkumbin River will keep carrying plastic across the Adriatic if no one takes action soon. This will make the environmental and social problems for Albania and the rest of the Mediterranean region even worse.

5.4.Cost-benefit analysis (CBA)

A cost-benefit analysis of different ways to cut down on plastic waste along the Shkumbin River Basin shows that some are better for the environment and some are better for the economy. The

basic idea is that stopping one ton of plastic waste from getting into the environment creates about €70 in benefits. These benefits include not having to pay for collection and transportation, not having to pay landfill fees, fewer riverbank cleaning operations, possible income from recyclable materials (especially PET, aluminum, and glass), and more tourism and a better image because the riverbanks and shorelines are cleaner. When looking at the different options, reuse systems with deposit-return schemes (DRS) stand out as the best choice in terms of cost and long-term viability. This option has a program cost of about €35 per tonne and a capture rate of 70%, which means that it actually saves about €49 per tonne. So, the net benefit is about €14 per tonne managed, which makes it the only option in Albania right now that makes money. Reuse and DRS not only have direct economic benefits, but they also have the best environmental performance because they cut down on single-use plastics and make sure that PET and glass bottles are returned at a high rate. From a social point of view, these kinds of plans are also very popular, especially in the HoReCa sector and among city dwellers, as long as the infrastructure for returns is easy to get to. The next best option is to separate waste at home and use materials recovery facilities (MRFs) to get the materials back. The costs of this system are a little higher (€40 per tonne) and the capture rate is a little lower (55%), but the benefits it has already brought in are almost enough to cover the costs. The net balance is a little bit negative (-€1.5 per tonne), but this number doesn't show the long-term benefits of building a working recycling system. This kind of infrastructure is important for Albania's process of joining the EU and will help it capture more in the future. This choice is very important for the environment and for governance, even if it doesn't make much money in the short term. In Albania's current state, biodegradable plastics and composting systems don't have much potential. The program is expected to cost €60 per tonne, but the capture rate is only 40%, which is not very high. This means that the actual benefit is only €28 per tonne, and the net balance is –€32 per tonne. This option doesn't work well because there aren't many places to compost on a large scale and biodegradable packaging can be "greenwashed." It is still an extra step in managing plastic, not the main one. Recycling single-use glass is also not financially feasible without a robust reuse component. The costs are €45 per tonne and the benefits are about €35 per tonne, so the net result is €10 per tonne. Even though glass can be recycled over and over again, it is less useful in Albania because it costs a lot to collect and transport it. This is because there aren't many people living outside of cities. Campaigns that only raise awareness are cheap (10 euros per

tonne managed), but they don't work to stop leaks. Their realized benefit is only about €10.5 per tonne because they only capture 15% of the waste. This still leaves them with a slightly negative net balance. Awareness campaigns are important for getting people involved, but they can't take the place of spending money on infrastructure. Their role is not the most important one. In general, the integrated assessment shows that reuse systems plus DRS give the best social, environmental, and financial returns. Source separation with MRF comes next. Other options, like biodegradable, glass, and just raising awareness, can help, but they aren't enough on their own. The policy implication is that Albania should put more money into systems for reusing things and recycling infrastructure. Awareness campaigns and sector-specific interventions (HoReCa, tourism) should be used as extra tools.

Table 2 CBA

Alternative	Program Cost (€/ton)	Capture Rate (%)	Realized Benefit (€/ton	Net Balance (€/ton managed)	Remarks
Reuse + DRS (PET/Glass	35	70%	49.0	+14.0	Financially positive, strong environmental and social impact
Source Separation + MRF	40	55%	38.5	–1.5	Close to balance, valuable for long-term recycling system
Biodegradable + Composting	60	40%	28.0	–32.0	High costs, lack of composting infrastructure
Single-use Glass (recycling)	45	50%	35.0	–10.0	High recyclability, but very expensive without reuse
Awareness Only	10	15%	10.5	–0.5	Cheap, but very limited effect without

					infrastructure

6. Alternatives for plastic reduction

6.1.Substitution with reusable and biodegradable products

One of the best ways to cut down on plastic waste that ends up in rivers like the Shkumbini is to replace single-use plastics (SUP) with reusable or biodegradable options. This method goes straight for the most common types of plastic found in surveys, such as PET bottles, LDPE bags, food service items, and sanitary plastics (ETMI, 2025). By switching to compostable or sustainable products, cities, businesses, and homes can cut down on a lot of the waste that goes into the environment. Bottles, cups, cutlery, and shopping bags made from materials like stainless steel, glass, hard plastics (PP, PETG), and textiles are all reusable options. In the HoReCa sector, reusable tableware systems and refillable bottles have worked well. The EU Directive on Single-Use Plastics (Directive (EU) 2019/904) puts reusable solutions at the top of the waste hierarchy because they don't make any waste at all. Research indicates that substituting single-use plastic cups with reusable ones can diminish waste volumes by as much as 95%, contingent upon the items being reused repeatedly (Heller et al., 2020). Businesses that switched to reusable systems in the Low Plastic Zone project in Albania saw big drops in SUP use, especially in bars and restaurants (Milieukontakt Albania, 2024). If you can't reuse something, biodegradable or compostable options can be a better choice. In the European food service industry, for instance, cups, plates, and cutlery made of polylactic acid (PLA), bio-coated paper, or plant fibers (sugarcane, bamboo) have been used. These products are made to break down in a few months when they are composted industrially, which makes them much less environmentally friendly in the long run (Dilkes-Hoffman et al., 2019). But it's important to remember that biodegradable products aren't a cure-all. If they're not handled properly, they can still build up in rivers, and they break down best in certain conditions (temperature, oxygen, and microbes) that aren't always present in open spaces. Because of this, biodegradable products should come with separate systems for collecting and composting them.

There are both short-term costs and long-term savings when you switch to reusable and biodegradable options. Sustainable bottles and shopping bags cost money up front, but they can save money by not having to buy disposable items over and over again. Businesses, especially

those in the HoReCa sector, may need to buy washing machines to switch to reusable tableware, but these costs will be less in the long run. Biodegradable items are often 20–50% more expensive than disposable items (SUP) (OECD, 2022), which can be a problem for small businesses. Prices are expected to go down, though, as production and demand go up. Tax breaks and subsidies are two examples of policy incentives that can help close the affordability gap. Benefits for the environment and society.

Substitution has a lot of good effects on the environment. If we switch to systems that can be used again, we can make less waste, cut down on carbon emissions, and stop plastic from getting into rivers and oceans. Life cycle assessments (LCA) show that when reused enough, reusable items usually have less of an impact on greenhouse gas emissions and energy use than single-use plastics (Geueke et al., 2018). Promoting reusable products raises awareness about the environment and improves the reputation of businesses, especially those in tourism and hospitality that market themselves as environmentally friendly. The use of biodegradable products is also in line with what customers want. Surveys across Europe show that more and more people want eco-friendly packaging (European Environment Agency [EEA], 2021).

There are still problems, even though the benefits are clear. To use reusable products, people need to change their behavior, the infrastructure (washing, logistics), and keep using them. To make sure that biodegradable products break down properly, there need to be good waste treatment systems in place. If we don't have these, the risk is that other materials will have the same problems with bad management as plastics do. To fix this, cities in the Shkumbin basin could:

a. Start cash-back programs for reusable cups and bottles.
b. Give businesses that use compostable packaging tax breaks and other benefits to encourage them to do so.
c. Put money into composting facilities that can handle biodegradable plastics.
d. Run campaigns to raise awareness about changing people's habits from using things once to a culture of reusing them.

One way to cut down on plastic pollution in the Shkumbin River is to switch from single-use plastics to products that can be used more than once and break down naturally.

6.2.Improving source separation and recycling systems

A key part of managing plastic waste in a way that is good for the environment is setting up effective source separation systems and building a strong recycling infrastructure. In the Shkumbini basin, where ETMI (2025) found that more than 70% of riverine waste was plastic, better separation and recycling is one of the most direct ways to stop leaks. At the moment, most municipal waste is collected as mixed waste, taken to regional landfills, and only occasionally sent to recycling centers. This not only costs more, but it also means losing potentially useful secondary materials. Source separation means that homes, businesses, and institutions sort their trash into groups like organics, plastics, paper, and metals when they make it. International evidence shows that separate collection is necessary for high recycling rates. In the EU, Member States with well-developed separate collection systems recycle more than 45–50% of municipal waste, while those with mixed collection systems recycle less than 20% (European Environment Agency [EEA], 2021). The quality of the materials that go into recycling is very important, especially for plastics. Separating plastics early cuts down on pollution, which makes mechanical or chemical recycling more likely to work (Hopewell et al., 2009). The towns along the Shkumbini, especially Prrenjasi, Librazhdi, Peqini, and Rrogozhina, don't have the infrastructure they need to separate sources. Even in Elbasan, where pilot bins for plastic and paper are only available in a few urban areas, not many people are using them, and the logistics of collecting the trash are not well planned. There is almost no segregation in rural areas, which leads to a lot of illegal dumping. The BeMed+ survey in 2024 found that most of the plastics found on riverbanks were common household and HoReCa items, like PET bottles, LDPE bags, and food wrappers. These are all things that could have been easily collected and recycled if the right systems had been in place. Albania's plastic recycling rate is still less than 10%, while the EU's average is 41% (Eurostat, 2022). In the Shkumbini basin, most recycling is done informally. Small collectors gather PET bottles and aluminum cans to sell to middlemen. There aren't any local recycling centers in the basin, and formal systems aren't very good yet. This means that people have to rely on transportation to get to faraway facilities, which raises costs and lowers efficiency. But there is a lot of potential for recycling. PET and HDPE packaging, which make up most of the trash people throw away, are two of the most recyclable plastics in the world (Geyer et al., 2017). You could get a lot of this value by setting up local sorting stations and working with recyclers.

Enhancing source separation and recycling yields both ecological and financial advantages. They are better for the environment because they keep plastic from leaking into rivers and soil, make landfills last longer, and make fewer greenhouse gases than making new plastic (Shen et al., 2010). Recycling creates jobs in collection, sorting, and processing, and it also saves cities money on landfill disposal. According to a World Bank study from 2018, countries that improve their recycling rates can make money from recovered materials, which can help them pay for a large part of their waste management costs. When combined with clear reporting and visible improvements, source separation campaigns raise awareness in the community and build trust between citizens and municipalities.

In the future, cities in the Shkumbini basin should take the following steps:

1. Set up color-coded bins for plastic, paper, metals, and organic waste in both cities and the countryside.
2. Set up door-to-door collection systems or collection points, starting with areas with a lot of people.
3. Build local sorting stations (material recovery plants) in Elbasan and smaller towns and cities around it.
4. Make partnerships with informal collectors official and include them in city systems to make collection more efficient.
5. Create programs to raise awareness and give people incentives, like lower fees for households that separate their trash or get money back for returning PET bottles.
6. Make sure that extended producer responsibility (EPR) programs pay for some of the system, which will help municipal budgets.

Not only is it good for the environment to improve source separation and recycling, but it can also be good for the economy if the right investments and policies are in place. By collecting recyclable materials at their source, cities can cut down on runoff into rivers, cut down on their reliance on landfills, and open up new opportunities for a circular economy.

6.3.Interventions in the HoReCa and tourism sector

The HoReCa sector (hotels, restaurants, and cafes) and the tourism industry are two of the biggest sources of plastic waste, especially in river basins and coastal areas where single-use

plastics (SUP) are used for food services and seasonal visitors. In the Shkumbini basin, the ETMI (2025) and BeMed+ mapping showed that PET bottles, LDPE bags, and food service packaging were some of the most common types of trash found on the banks of rivers. A lot of these things come from hotels and restaurants in cities (Elbasan) and tourist spots along the river (Divjakë). So, it's important to target these areas with specific actions to cut down on pollution in the river and the Adriatic Sea.

Milieukontakt Albania worked with the national project "Low Plastic Zone" to show how much HoReCa helped. Plastic made up the most of the total waste produced by more than 700 businesses, and bars and restaurants were responsible for more than 73% of the plastic streams (Milieukontakt Albania, 2024). During a one-year monitoring period (2023–2024), the initiative saw a decrease of 8.2% in plastic waste, which is equal to -27,325 kg in the panel and -677,390 kg at the national level. These results show that the HoReCa sector is a major source of plastic pollution and a good place to start targeted interventions. Several actions can lower the amount of plastic made at its source:

1. Tableware and filling systems that can be used again. Restaurants and cafes can switch from single-use cups, straws, and cutlery to reusable ones with the help of dishwashing facilities and deposit return programs (Poortinga & Whitaker, 2018).

2. Stopping the use of small PET bottles. Tourist spots in Greece and Italy have had success replacing small water bottles with refillable glass bottles or dispensing systems (Ellen MacArthur Foundation, 2016).

3. Getting suppliers involved. Instead of using single-use plastics, HoReCa businesses can ask their suppliers to deliver goods in bulk packaging or reusable crates. This cuts down on waste upstream (Hopewell et al., 2009).

4. Branding and awareness. Eco-labeling programs that certify "plastic-smart" hotels and restaurants can help them stand out from the competition and draw in tourists who care about the environment (EEA, 2021).

Tourism increases the amount of plastic waste because there are times when demand is high and local governments don't have enough resources to handle the waste. Interventions in this sector should include:

a. Bans on SUPs on beaches and riverbanks, especially in protected areas like the Divjakë-Karavasta National Park. In Mediterranean tourist spots, bans on plastic straws, bags, and cutlery have had quick effects (Beaumont et al., 2019).
b. Extended Producer Responsibility (EPR) for tourism operators, which means that hotels and tourism companies have to pay for cleaning up and recycling.
c. Deposit return programs for drink containers, especially during festivals and busy tourist times, which cut down on trash and raise return rates (Walls, 2011).
d. Public-private partnerships for cleaning up, getting hotel associations, NGOs, and cities involved in campaigns to clean up litter from beaches and riverbanks.

Changes in HoReCa and tourism can help in both direct and indirect ways. For businesses, switching from single-use plastics to reusable ones usually lowers procurement costs over time, even though the initial costs are higher. More and more tourists want to stay in places that are environmentally friendly, which means that sustainability can be a competitive advantage (European Commission, 2020). Interventions make people and visitors more aware of social issues, which leads to changes in behavior that last longer than the tourist season. Less use of SUPs is better for the environment because it means less waste, cleaner landscapes, and more protection for biodiversity.

Table 7: Interventions in the HoReCa and Tourism Sector

Main Intervention	Main Benefit	Main Challenge
Use of reusable products (cups, plates, bottles)	Significant reduction of SUP; long-term savings	Initial cost, need for equipment
Replacing small PET bottles with refill systems	Reduction of river pollution; better experience for tourists	Investment and supply chain changes
"Eco-label" certification for restaurants/hotels	Competitive advantage; tourism promotion	Need for clear standards and audits

SUP bans on beaches and national parks	Immediate reduction of waste in sensitive areas	Poor monitoring and enforcement
Deposit-return system (DRS) during the tourist season	Increased return rates; reduced public pollution	Logistics and administrative costs
Cleaning partnerships (municipalities + private sector)	Improved image and environmental protection	Insufficient financial support

There are still some problems, though, even with these benefits:

a. Cost and infrastructure gaps: Small businesses don't have places to wash dishes or ways to get reusable items to customers.
b. Behavioral inertia: Staff and customers are used to using disposable items because they are easy to use.
c. Putting policies into action: Albanian municipalities still don't have enough monitoring capacity to handle bans and EPR schemes.
d. Seasonality: Waste systems have to deal with big changes in volume between the off-season and the high season.

The HoReCa and tourism industries are the main sources of plastic pollution in the Shkumbini Basin, but they also offer some of the best chances for action. Building on successful pilot initiatives, municipalities can replicate and scale up measures such as reusable systems, SUP bans in tourist spots, and eco-certification schemes. With the right rules, incentives, and awareness campaigns, HoReCa and tourism can go from being big polluters to leaders.

6.4.Community awareness and education

No plan to cut down on plastic will work without the help of local communities. In the Shkumbini basin, ETMI (2025) found that more than 70% of the litter along the riverbanks was plastic. Most of the leakage is directly linked to how households, small businesses, and the public don't participate enough in proper waste management. So, awareness and education are very important for changing behaviors, encouraging responsibility, and making sure that interventions last.

International evidence indicates that behavior change campaigns can markedly diminish plastic waste leakage. People are more likely to do things like source separation, avoiding single-use plastics (SUP), and taking part in community cleanups when they know how plastics affect the environment and their health. For instance, programs in the Mediterranean that raise awareness and are backed by the EU and NGOs have shown that targeted campaigns can cut littering rates in coastal communities by up to 30% in just one year (Beaumont et al., 2019). People in Albania have always thought that waste management is only the job of the local government. To change this way of thinking, people need to learn about waste in their daily lives, schools, and jobs. So, public awareness campaigns should stress both personal responsibility and the benefits of cleaner rivers and neighborhoods for everyone. Schools are one of the best places to make long-term changes. Including environmental education in school lessons makes kids aware of the issue at a young age and helps them develop good habits that last. ETMI pilot programs in Librazhd and Elbasan demonstrated that youth-led clean-ups along the Shkumbini resulted in significant visibility and community engagement. Research demonstrates that environmental education programs alter student behavior and also affect parents, resulting in ripple effects within the family (Ballew et al., 2019). Extracurricular activities, eco-clubs, and competitions (like plastic-free school challenges) can help get the message across even more. Schools in riverine areas can also work with NGOs on citizen science projects that teach people and gather useful data, like keeping an eye on plastic waste or mapping places where trash is dumped illegally.

Community campaigns are important for putting what you've learned into action. Some ways to raise awareness are to clean up the riverbanks, hold fairs without plastic, and hold public information sessions in village centers. Social media has also been a great way to get people to volunteer and spread messages in Albania. Campaigns work best when they include facts about the effects, rewards (like discounts for using reusable bags), and social norms (making plastic-free behavior visible and desirable). Poortinga and Whitaker (2018) say that campaigns that mix messages with money can double the number of people who use reusable cups in cafes.

In Albania, civil society groups like INCA, Milieukontakt, and regional NGOs supported by BeMed+ have led the way in raising awareness. The "Low Plastic Zone" campaigns in HoReCa are examples of successful pilot awareness campaigns in the Shkumbini basin. They combined education with real-world goals for reducing plastic use. Private sector players, especially in

tourism and HoReCa, can also be multipliers by calling themselves "plastic-free" and teaching customers about it when they buy something. There are a number of problems that make awareness campaigns less effective:

a. Short-term visibility: Campaigns that only happen once often don't last long.
b. Little faith in institutions: People may not want to change their behavior if they think that municipal waste systems don't work.
c. Socio-economic barriers: For families with low incomes, the cost of alternatives may keep them from using them, even if they know about them.
d. Cultural customs: SUPs are still a big part of daily life because they are so easy to use.

Municipalities in the Shkumbini basin can change people's behavior, create shared responsibility, and stop plastic from leaking into the river system by going after schools, communities, and businesses all at once.

6.5.Collection and processing infrastructure

The success of strategies to cut down on plastic waste depends a lot on how well the infrastructure for collecting, sorting, and processing is set up and available. The ETMI baseline assessment for the Shkumbini basin (2025) showed that weak infrastructure is one of the main reasons why plastic flows into the river. Collection is still uneven, especially in rural areas, and processing infrastructure is not well developed and is very centralized. Even if people in the community are very aware of these issues and there are strong policies in place, they won't have much of an effect unless there are big investments in these areas. In Albania, collection services use both door-to-door collection in cities and communal bins in rural areas. Coverage is good in Elbasan, the main city in the Shkumbini basin, but not so good in the upstream and downstream towns of Prrenjasi, Librazhdi, Peqini, and Rrogozhina. Many families in rural areas don't have regular access to waste services, so people dump their trash on river banks instead. ETMI (2025) found illegal dumping sites in almost every river segment that was looked at. This shows that there is a direct link between poor collection infrastructure and plastic leakage. Municipalities have old or not enough collection trucks, and many of them are second-hand or donated. This raises costs of doing business because things break down often. There aren't enough bins and containers, and they aren't well cared for, especially in rural areas. This leads to overcrowding and uncontrolled waste disposal.

To recycle effectively, you need a way to separate plastics from mixed municipal waste. There are no fully working materials recovery facilities (MRFs) in the Shkumbini basin. Elbasan has a basic transfer station, but it doesn't have any automated sorting lines. Instead, it relies on informal collectors to sort things by hand. Smaller towns and cities take trash that hasn't been picked up straight to the landfill, skipping any recycling. Not having sorting stations in the area makes it harder to recycle and costs more to move things around. Best practices from EU Member States show that decentralized sorting plants close to medium-sized cities can greatly boost recycling rates by making it easier to move things around (EEA, 2021). Setting up small sorting centers in Prrenjas, Librazhd, or Peqin could help keep the PET, HDPE, and aluminum parts that are now going to landfills.

Albania's ability to process plastic is very limited. There are only a few private recyclers in Tirana and Durrës that process PET and HDPE for export. There is no local plant in the Shkumbini basin. Because Elbasan's plastics have to be sent to other plants, they have to travel a long way, which raises costs and makes municipalities less likely to invest in separate collection. Eurostat (2022) says that EU countries recycle an average of 41% of plastic packaging, but Albania does not even recycle 10%. To fill this gap, we need to invest in local recycling plants. The best way to do this is through public-private partnerships and extended producer responsibility (EPR) systems that send money from businesses to recycling infrastructure.

Another problem is that there isn't enough composting infrastructure for biodegradable plastics and organic waste. A composting plant could be added to the waste system because 40–50% of municipal waste is organic matter (INSTAT, 2023). This would reduce the need for landfills and make it possible to process compostable plastic alternatives.

Money is the biggest problem when it comes to building infrastructure. Municipal budgets only cover basic collection, so there isn't much room for capital investment. Tariffs are too low to pay for modern facilities (in most cities, they only cover 50% to 70% of costs), and central government subsidies are still limited. Donor support has been important for getting equipment, but it hasn't made systems that will last in the long run. Infrastructure gaps will continue to exist unless stronger financial tools, like EPR, green funds, or EU pre-accession support, are put in place.

To cut down on plastic pollution in the Shkumbini basin, the infrastructure for collecting and processing must be improved. Actions include: (i) improving city fleets and containers, (ii) adding more service areas in rural areas, (iii) building local sorting and transfer facilities, and (iv) working with private recyclers to build processing capacity.

By taking these steps, cities can turn trash into a resource instead of a problem, which is in line with the EU's circular economy goals and will greatly cut down on plastic in rivers.

6.6.Analysis of survey findings

All of the businesses in Librazhd and Elbasan are HoReCa units, which are hotels, bars, and restaurants. Cafes and restaurants get between 80 and 150 customers a day, while hotels get between 200 and 250 customers a day during the season. Most are open all year, but the amount of plastic used goes up a lot during the tourist season.

Table 8: General Data

Unit	Typology	Location	Employees	Clients/day	Seasonality
Sopoti Caffe	Café	City center	5	100	All year round
Imperial Hotel	Hotel	Rural/touristic area	20	200	All year round
Bar Restorant Moglica	Restaurant	Rural/touristic area	10	120	All year round
Balkan Hotel	Hotel	Rural/touristic area	18	180	Mainly tourist season
Vila Zeneli	Restaurant	Rural/touristic area	8	90	All year round

Case 1: Vila Zeneli

Vila Zeneli combines an event hall with hotel accommodation, offering a seating capacity of up to 250 guests and 14 rooms for overnight stays. The business employs around 20 staff members in peak season and relies heavily on weddings, conferences and summer tourism. Based on the current plastic consumption pattern, monthly costs for disposable materials average around 100,000 lek during peak season. Switching to environmentally friendly alternatives, such as glass bottles, paper cups and wooden cutlery, would increase monthly costs to around 220,000 lek, more than double the base price. While plastics appear cheaper in the short term, their disposal, storage and environmental impact create hidden costs of around 10,000 lek/month. Furthermore, reliance on plastic could damage Vila Zeneli's image among environmentally conscious clients, especially those booking weddings or corporate events. In the long run, switching to green alternatives could allow Vila Zeneli to position itself as a sustainable event destination, attracting a growing base of environmentally responsible clients and adapting to expected regulatory changes.

Case 2: Hotel Imperial

Hotel Imperial, located in the city center, is a large urban structure with 3 conference rooms and 2 restaurants, employing up to 25 people during peak demand. Its diverse mix of services means high consumption of single-use plastics, with an estimated monthly cost of 108,000 lek. Adopting sustainable alternatives would increase costs to around 256,500 lek/month, representing a significant increase. In addition, the disposal and storage of plastics add approximately 12,000 lek in hidden costs each month, while legal risks associated with non-compliance with environmental regulations remain a major concern. Despite the higher immediate costs, the hotel is expected to benefit significantly from a "green" repositioning. Corporate clients, especially international companies organizing conferences, increasingly prefer venues with sustainable practices. So while the financial balance looks negative in the short term, the long-term benefits include increased competitiveness, improved brand image, and compliance with stricter environmental standards. For Hotel Imperial, a gradual adoption of alternatives – starting with high-visibility items like conference materials – could strike the best balance.

Case 3: Balkan Resort

Balkan Resort is a mixed-use urban-tourism property currently undergoing expansion. It offers 19 rooms and 18 dining tables, with up to 20 employees during high season. Its current monthly plastic costs amount to around 89,400 lek, while green alternatives would cost over 212,400 lek. Doubling material costs represents a short-term financial burden, especially while the resort is still investing in reconstruction. However, Balkan Resort operates in a competitive tourism environment, where eco-labels and sustainable practices are increasingly decisive factors for guests. Although the financial cost-benefit analysis shows that plastics are cheaper, this option carries reputational risks and future liabilities. A partial transition strategy could be ideal, focusing first on customer-facing products such as straws, cups and branded eco-materials, thus signaling a commitment to sustainability without overstretching the budget. In the long run, green positioning would not only reduce waste management costs, but also enhance Balkan Resort's value proposition for high-end tourism.

Case 4: Bar Restaurant Moglica

Bar Restaurant Moglica is a small-scale business located in a rural-tourist area. With only 5 employees and a capacity of around 30 tables, it operates mainly during the tourist season. Plastic consumption costs an average of 56,550 lek per month, while adopting environmentally friendly alternatives would increase costs to around 133,500 lek. Despite its smaller size, Moglica faces the same structural challenges as larger units, with hidden costs related to waste management and brand perception. For such a business, adopting green alternatives may seem very costly compared to turnover, yet it can serve as a unique selling point in an environmentally sensitive rural market. Tourists increasingly expect environmentally conscious service, and Moglica can exploit this differentiation to attract premium customers. While a full transition may not be immediately feasible, phased adoption—perhaps starting with straws, cups, and take-away food packaging—would balance financial sustainability with environmental responsibility.

Case 5: Sopoti Caffe

Sopoti Caffe is a city center café with a capacity of 40 tables and 5 employees, serving mainly local customers all year round. Plastic consumption costs around 39,900 lek per month, while switching to green alternatives would increase this figure to over 100,200 lek. On a proportional basis, Sopoti Caffe faces the largest relative cost increase, as monthly material costs would

double. The hidden costs of plastic waste are smaller than in larger establishments, but still significant, especially in relation to storage and municipal waste fees. While its customer base is stable, the café could benefit from marketing itself as an "urban green café", appealing to a younger and more environmentally conscious demographic. The financial strain of a full transition is higher here due to limited turnover, so Sopot may need to adopt a phased or hybrid model, first introducing eco-friendly packaging for takeaway customers. This strategy would limit costs while still strengthening its brand identity in a competitive café market.

The five HoReCa businesses analyzed – Vila Zeneli, Hotel Imperial, Balkan Resort, Bar Restorant Moglica and Sopoti Caffe – illustrate how the cost-benefit dynamics of switching from plastic to green alternatives vary depending on the size of the business, location and operating model. In all cases, the common pattern is that plastics remain financially cheaper in the short term, with an average monthly cost of 40,000–110,000 lek. In contrast, adopting sustainable alternatives doubles or even triples monthly expenses, increasing costs to 100,000–250,000 lek. Despite this, reliance on plastics carries hidden and long-term costs, including waste storage and transportation, potential legal penalties and negative customer perceptions in an increasingly sustainability-oriented market. For large events and accommodation businesses, such as Vila Zeneli and Hotel Imperial, switching to green materials requires significant investment but offers strategic advantages. Their client base – weddings, corporate conferences and international visitors – tends to value eco-certification, making sustainability a competitive differentiator. Balkan Resort, although still expanding, faces a similar choice: while green certification would double costs, partial implementation could build a reputation in the market during its growth phase. Smaller units such as Bar Restorant Moglica and Sopoti Caffe face a proportionately heavier financial burden, as the relative increase in monthly expenses is greater compared to turnover. For them, a phased or hybrid approval model is more realistic, focusing on high-visibility items such as cups, straws and fast food packaging. Comparative analysis suggests that while plastic remains economically attractive in the short term, green alternatives offer long-term value in terms of branding, customer loyalty and regulatory preparedness. Larger businesses can more easily absorb the costs and benefit from eco-marketing, while smaller ones need to implement gradual changes to balance sustainability with financial viability. Thus, the optimal path lies not in a uniform approach, but in adapting the transition strategy to the scale and market positioning of each business.

The interviews show that all units use single-use plastics (water bottles, cups, plates, forks, bags and straws). The average daily consumption, multiplied by market prices, gives a visible monthly cost ranging from 40,000 – 120,000 lek/month per unit, depending on the size of the business.

Table 9: Plastic Consumption

Unit	Plastic Bottle (20 lek)	Plastic Glass (2 lek))	Plastic Plate (4 lek)	Fork/Knife (3 lek)	Plastic Bag (5 lek)	Tube (1 lek)	Total Monthly Cost (lek)
Sopoti Caffe	50 pcs/day = 30,000 lek	100 pcs/day = 6,000 lek	0	0	10 pcs/day = 1,500 lek	80 pcs/day = 2,400 le	39,900
Imperial Hotel	120/pcs/day = 72,000	150/ pcs/day = 9,000	100/ pcs/day = 12,000	100/ pcs/day = 9,000	20/ pcs/day = 3,000	100/ pcs/day = 3,000	108,000
Bar Rest. Moglica	60/ pcs/day = 36,000	80/ pcs/day = 4,800	60/ pcs/day = 7,200	50/ pcs/day = 4,500	15/ pcs/day = 2,250	60/ pcs/day = 1,800	56,550
Balkan Hotel	100/ pcs/day = 60,000	120/ pcs/day = 7,200	80/ pcs/day = 9,600	80/ pcs/day = 7,200	20/ pcs/day = 3,000	80/ pcs/day = 2,400	89,400
Vila Zeneli	40/d pcs/day = 24,000	60/ pcs/day = 3,600	40/ pcs/day = 4,800	40/ pcs/day = 3,600	10/ pcs/day = 1,500	40/ pcs/day = 1,200	38,700

The monthly calculation is based on 30 days.

If you use different materials, like glass bottles, cardboard cups and plates, wooden forks, cardboard bags, and paper tubes, your monthly costs go up by 40% to 70%. A glass bottle, for instance, costs 50 lek each, but it can be used again (which means you don't need a lot of them).

Table 10: Alternatives to Plastic

Unit	Glass Bottle (50 lek)	Cardboard Glass (5 lek)	Cardboard Plate (7 lek)	Wooden Fork (6 lek)	Cardboard Bag (10 lek)	Paper Tube (3 lek)	Total Monthly Cost (lek)
Sopoti Caffe	50/pcs/day = 75,000	100/pcs/day = 15,000	0	0	10/pcs/day = 3,000	80/pcs/day = 7,200	100,200
Imperial Hotel	120/pcs/day = 180,000	150/pcs/day = 22,500	100/pcs/day = 21,000	100/pcs/day = 18,000	20/pcs/day = 6,000	100/pcs/day = 9,000	256,500
Bar Rest. Moglica	60/pcs/day = 90,000	80/pcs/day = 12,000	60/pcs/day = 12,600	50/pcs/day = 9,000	15/pcs/day = 4,500	60/pcs/day = 5,400	133,500
Balkan Hotel	100/pcs/day = 150,000	120/pcs/day = 18,000	80/pcs/day = 16,800	80/pcs/day = 14,400	20/pcs/day = 6,000	80/pcs/day = 7,200	212,400
Vila Zeneli	40/pcs/day = 60,000	60/pcs/day = 9,000	40/pcs/day = 8,400	40/pcs/day = 7,200	10/pcs/day = 3,000	40/pcs/day = 3,600	91,200

The comparison makes it clear that using plastic is cheaper (about 66,000 lekë per month), while switching to "green" options costs more than twice as much (about 158,000 lekë per month). But plastic has hidden costs:

a. Moving plastic trash to the dump costs 5,000 to 10,000 lekë a month.
b. Storage and space used: about 3,000 lekë a month.
c. Possible fines or legal action in the future.

Table 11: Financial Aspect

Material	Average Monthly Cost (lek)	Hidden Cost (lek)	Total Effective Cost
Plastic	66,510	+ 8,000	≈ 74,500
"Green" Alternative	158,760	0 (no mass waste transport)	≈ 158,760

While plastic may seem cheaper to buy, in the medium term the use of "green" alternatives is more beneficial for the business image, for reducing waste and for preparing for expected legal changes. Businesses spend twice as much on ecological materials, but avoid waste costs and gain added value for customers.

Individual CBA

Sources: Monthly base costs for plastic and "green" alternatives: exactly those in Table 9 and Table 10. Hidden costs for plastic (storage, handling, transport, administration): café 6,000/m; small restaurants 7,000/m; rural hotel-restaurant 8,000/m; resort 10,000/m; large city hotel 12,000/m. Brand/revenue growth (additional gross margin from "green" positioning): Sopot 15k/m; Moglica 20k/m; Vila 30k/m; Balkan 35k/m; Imperial 50k/m. (Conservative: ≈2–3% of a typical monthly turnover for each type.) CAPEX for changeover (durable glass, shelves, additional dishwasher capacity, staff training): Sopoti 300k; Moglica 400k; Vila 700k; Balkan 900k; Imperial 1.2M. Operational optimization from Year 2: once processes are stabilized (return logistics, breakage control, dishwashing cycles), "green" purchasing costs drop by 25% from Year 2 onwards (reusability and fewer breakages per cover). Discount rate (NPV): 10% per year. Horizon: 5 years (Year 1 = transition year; Years 2–5 = optimized operations). Interpretation: Monthly ΔOPEX = (Green OPEX) – (Plastic OPEX + Hidden Plastic Cost) – (Brand Lift). Positive Δ = additional cost to go green; negative Δ = savings. NPV (5v) = CAPEX + discounted annual ΔOPEX over five years.

Case 1 — Vila Zeneli (venue + hotel, rural/tourist)

250-seat event hall + 14 rooms; seasonality; 20 staff in peak months. Weddings, corporate events and family celebrations dominate demand. Clients are highly image-sensitive; sustainability credentials are important to wedding planners and corporate procurement.

Plastic ~38,700/m, green ~91,200/m. With hidden plastic cost of 8,000/m and brand enhancement of 30,000/m, Year 1 ΔOPEX ≈ 14,500/m (additional costs). From Year 2, the green bill drops by 25%, so ΔOPEX ≈ –8,300/m (net monthly savings vs. staying with plastic), thanks to higher reuse efficiency and sustained brand appeal. CAPEX ≈ 700,000.

Over five years, Vila Zeneli almost reverses the trade-off: Year 1 costs are outweighed by Year 2-5 savings, but CAPEX does not fully recover within 5 years at these conservative increases. The business, however, secures a strong "green event" position and is best positioned among the five companies that approach breakeven earlier (beyond the 5-year window).

Table 3 Vila Zeneli (CBA 5-years)

Item	**Value**
Initial CAPEX	700,000
Δ monthly cost (Year 1)	+14,500
Δ monthly cost (Year 2–5, after optimization)	–8,300
Δ annual cost (Year 1)	+174,000
Δ annual cost (Years 2–5)	–99,600
NPV (5 Year, 10%)	≈ 571,165
Payback within 5 years	No (approaching after 5 years)

Case 2 — Imperial Hotel (city center, 3 conference rooms, 2 restaurants)

Year-round operations; complex F&B and MICE mix; 25 staff in peak season. Corporate accountants and international guests value ESG credentials; however, the operational scale makes the bill of materials very visible.

Plastic ~108,000/m; green ~256,500/m. Hidden plastic cost 12,000/m; brand enhancement 50,000/m. Year 1 ΔOPEX ≈ 86,500/m (additional cost). By Year 2, a 25% reduction in green efficiency reduces Δ to ≈ 22,375/m. CAPEX ≈ 1,200,000.

Even with brand enhancement and process efficiency, the 5-year NPV remains clearly positive (a net cost). No payback within 5 years. However, Imperial gains advantages in procurement with ESG-conscious corporations and could pursue a phased conversion: first replace high-visibility items (coffee breaks for conferences, straws/cups for banquets) and then expand.

Table 4 Hotel Imperial (CBA 5-years)

Item	**Value**
Initial CAPEX	1,200,000
Δ monthly cost (Year 1)	+86,500
Δ monthly cost (Year 2–5, after optimization)	+22,375
Δ annual cost (Year 1)	+1,038,000
Δ annual cost (Years 2–5)	+268,500
NPV (5 Year, 10%)	≈ 2,917,372
Payback within 5 years	No

Balkan Resort (urban/tourist, 19 rooms, 18 tables; expansion phase)

The resort is expanding, so cash discipline is important. However, its market is leisure-oriented, and a proven track record of sustainability can support ADR and occupancy during the reconstruction and reopening phases.

Plastic ~89,400/m; green ~212,400/m. Hidden plastic 10,000/m; brand growth 35,000/m. Year 1 ΔOPEX ≈ 78,000/m. From Year 2: ≈ 24,900/m after optimization. CAPEX ≈ 900,000.

The five-year NPV remains a net cost (no return). A hybrid distribution is recommended: start with guest items (straws, cups, service bottles), keep bulk plastics in-house until rooms and food and beverage flow stabilize, then migrate as scale improves. This delivers reputational gains while controlling the first-year cash loss.

Table 5 Balkan Resort (CBA 5-years)

Item	Value
Initial CAPEX	900,000
Δ monthly cost (Year 1)	+78,000
Δ monthly cost (Year 2–5, after optimization)	+24,900
Δ annual cost (Year 1)	+936,000
Δ annual cost (Years 2–5)	+298,800
NPV (5 Year, 10%)	≈ 2,611,960
Payback within 5 years	No

Bar Restaurant Moglica (rural/tourist, 30 tables; small team)

Seasonal flow, 5 staff, 30 tables. A specialized and nature-oriented customer base places disproportionate value on visible "green" moves, but the budget is tight.

Plastic ~56,550/m; green ~133,500/m. Hidden plastic 7,000/m; brand growth 20,000/m. Year 1 ΔOPEX ≈ 49,950/m; Year 2+ ΔOPEX ≈ 16,575/m. CAPEX ≈ 400,000.

Net cost still over 5 years. Recommendation: phased adoption (to-go only + straws/table cups first), combined with menu (high margin items, with eco-friendly messaging) to drive brand growth above 20k/m; if lift reaches ~30k/m, Year 2+ will be close to breakeven.

Table 6 Bar Restorant Moglica (CBA 5-years)

Item	Value
Initial CAPEX	400,000
Δ monthly cost (Year 1)	+49,950
Δ monthly cost (Year 2–5, after optimization)	+16,575
Δ annual cost (Year 1)	+599,400
Δ annual cost (Years 2–5)	+198,900
NPV (5 Year, 10%)	≈ 1,518,078
Payback within 5 years	No

Sopoti Caffe (city cafe, 40 tables; 5 staff)

Sustained local demand and frequent takeaway; customers lean younger and open to green branding, but the size is small, so material changes quickly hit margins.

Plastic ~39,900/m; green ~100,200/m. Hidden plastic 6,000/m; brand growth 15,000/m. Year-1 ΔOPEX ≈ 39,300/m; Year-2+ ΔOPEX ≈ 14,250/m after optimization. CAPEX ≈ 300,000.

Net cost over five years; no payback. Practical path: convert only high-visibility items (to-go cups, straws) and keep low-visibility items available until loyalty data proves growth. Combine the switch with a "bring your own glass" incentive via a stamp card or app to push brand growth beyond 20k/m.

Table 7 Sopoti Caffe (CBA 5-years)

Item	**Value**
Initial CAPEX	300,000
Δ monthly cost (Year 1)	+39,300
Δ monthly cost (Year 2–5, after optimization)	+14,250
Δ annual cost (Year 1)	+471,600
Δ annual cost (Years 2–5)	+171,000
NPV (5 Year, 10%)	≈ 1,221,497
Payback within 5 years	No

In all five HoReCa units, going green is not a short-term cost-saving measure. Even after a realistic 25% efficiency gain from Year 2, the 5-year NPVs remain positive (net costs), with Vila Zeneli closest to breakeven (thanks to event-driven brand growth and high reuse intensity). The large city hotel (Imperial) and the expanding resort (Balkan) face the highest costs, but also enjoy the strongest strategic advantage with the corporate/MICE and premium leisure segments; they need to go through the conversion stages, starting with high-visibility customer touchpoints. For the small rural restaurant (Moglica) and the city café (Sopot), the financially viable path is hybrid adoption plus targeted marketing mechanisms (eco-packs, "bring your own cup" rewards) to increase monthly brand growth to the 20-30k range; this significantly improves the economics

of Year 2+. The network decision is strategic: early adopters secure ESG reputation, pricing power, and regulatory readiness; later adopters avoid losing money in the short term, but risk brand lag and compliance costs.

7. Comparison of alternatives (Cost-benefit analysis)

7.1.Comparison criteria (financial costs, environmental impact, social acceptability)

When looking at different ways to cut down on plastic pollution in the Shkumbini basin, like using reusable products, biodegradable plastics, better source separation, HoReCa interventions, and better infrastructure, it's important to use a structured comparison framework. A cost-benefit analysis (CBA) does this by looking at the financial, environmental, and social aspects of each choice. By combining these three criteria, you can make sure that your choices are not only good for the economy, but also good for the environment and people.

1. Costs in money.

The most obvious way to compare is by looking at the financial costs. They include both capital expenditures (CAPEX), like buying collection trucks, building sorting plants, or investing in composting plants, and operating expenditures (OPEX), like wages, fuel, maintenance, and landfill fees. For instance, switching to reusable options in the HoReCa sector means spending money on sustainable tableware and dishwashing infrastructure up front, but it saves money in the long run. On the other hand, biodegradable products usually cost 20–50% more than single-use plastics (OECD, 2022), which can be a financial burden for small businesses unless they get subsidies. Investing in infrastructure, like materials recovery facilities (MRFs), costs millions of dollars up front, but over time, they can save money by using less landfill space and making money from recyclable materials (World Bank, 2018). So, the financial analysis should look at both how affordable it is in the short term and how much money it will make in the long term. This means looking at different ways to pay for things, like municipal budgets, tariffs, extended producer responsibility schemes, and donor support. It also means looking at the cost per tonne of waste managed under each option.

2. Effects on the environment

The main reason for plastic reduction programs is to improve the environment. We look at alternatives based on how well they can cut down on plastic pollution in rivers, cut down on greenhouse gas emissions, save resources, and make ecosystems healthier. For instance, life cycle assessments (LCA) show that reusable systems always do better than single-use plastics (SUPs), as long as they are used more than once (Heller et al., 2020). Biodegradable plastics help the environment last longer, but they need the right composting systems to work fully (Dilkes-Hoffman et al., 2019). Improving source separation and recycling directly cuts down on the need for landfills and stops plastics from getting into the Shkumbin. It also stops the making of new plastics, which is bad for the environment (Shen et al., 2010).

Environmental criteria should also include indirect benefits, like lower costs for cleaning up litter, better biodiversity in coastal habitats, and better water quality. Research in the Mediterranean indicates that marine debris incurs annual expenses amounting to billions for fisheries, aquaculture, and tourism (Beaumont et al., 2019). Albania helps protect the environment in the region by stopping plastic from leaking from Shkumbini to the Adriatic.

3. Being socially acceptable

Social acceptability decides if communities, businesses, and political leaders will support interventions. Even solutions that are good for the environment and don't cost too much can fail if the public doesn't back them. Household-level interventions, like sharing resources, need a lot of people to get involved. People need to trust their local government services and be willing to change their behavior for them to work. People in Albania don't want to pay fees or take part in recycling programs because they don't trust the government and the services aren't available to everyone (ETMI, 2025). To gain the public's trust, alternatives must be created that show clear improvements, such as cleaner streets and more reliable collections. In the HoReCa and tourism industries, both businesses and customers must agree to changes like reusable systems and bans on single-use plastics. Research indicates that consumers are progressively favoring eco-friendly alternatives; however, cost and convenience continue to pose challenges (Poortinga & Whitaker, 2018). Awareness campaigns and eco-labeling can help people in the community accept plastic reduction by making it a common goal. This criterion also includes social equity. Policies should make sure that low-income families and small businesses don't have to bear more than

their fair share of the burden. For instance, subsidies for reusable goods and low-cost substitutes can help get a lot of people involved.

Table 17: Comparative Table of Alternatives for Plastic Reduction in the Shkumbin River

Main Alternative	Financial Cost (CAPEX/OPEX)	Environmental Impact (Pollution Reduction)	Social Acceptability	Key Comments
Reusable Products (cups, bottles, plates))	Medium – high initial investment, long-term savings	Very high – reduces SUP by 80–90%	Medium-high – requires behavior change	Suitable for HoReCa, requires washing equipment
Biodegradable Products (PLA, paper, fibers)	Medium-high – 20–50% higher price than plastic	Medium – degrades faster, but not always in nature	High – perceived as "eco" by consumers	Effective only with proper composting
Source Separation + Recycling	High – requires colored bins, logistics, sorting centers	Very high – reduces pollution and increases recycling by >40%	Medium – requires education and trust in services	Long-term solution, but requires investment
HoReCa Interventions (SUP ban, refill systems)	Medium – cost for businesses, long-term savings	High – reduces PET bottles, food packaging	Medium-high – tourists prefer eco-options	Can be linked to "eco-label" certifications
Community Awareness and Education	Low – cost mainly for campaigns	Medium – changes behavior, supports other measures	High – welcomed by the community	Long-term effect, not sufficient alone

Collection & Processing Infrastructure	Very high – capital investments in MRF, recycling, composting	Very high – reduces landfill, increases recycling, prevents pollution	Medium – support if services improve	Requires funding from the government/EU/EPR

The three criteria are interdependent. Financial feasibility influences social acceptance, while environmental benefits justify investments even when short-term costs are high. Policymakers in the Shkumbin basin should adopt a multi-criteria cost-benefit framework that systematically compares each alternative along these dimensions, allowing for balanced decisions that are consistent with Albania's EU integration and circular economy objectives.

7.2. Results of the analysis for each alternative (plastic/glass)

When people talk about eco-friendly packaging and waste management, they often compare plastic and glass. In Albania, both materials are commonly used in homes and in the HoReCa sector, especially for drinks.

1. The cost in terms of money.

In terms of making and shipping, plastic is still the cheapest material for packaging. PET bottles and thin plastics are cheap to make, and because they are light, they are also cheap to ship (Geyer et al., 2017). So, plastic is a good deal for both people and businesses in the short term. PET is the most popular material for HoReCa and household use in Albania because it is both cheap and easy to use (ETMI, 2025). On the other hand, glass costs more to make and move. The weight of glass makes it much more expensive to ship and releases more carbon dioxide into the air when it is delivered. Municipalities need more resources to collect and move glass waste than plastic waste for each delivered drink. But if reuse systems (deposit-return schemes, DRS) are put in place, the long-term cost of glass goes down. Refillable glass bottles can be used up to 20–50 times, which means that the cost is spread out over many uses (European Commission, 2020). This means that glass costs more in systems that only use it once, but it becomes more

affordable when it is reused. Plastic is cheaper in the short term, but glass can be more cost-effective in the long term if it is backed up by infrastructure and return schemes.

2. The effect on the environment.

When you think about how much plastic leaks into the environment, it has the biggest negative impact on the environment. ETMI surveys along the Shkumbini River found that more than 70% of the trash along the riverbank was plastic, mostly SUP like PET bottles and LDPE bags. Plastic lasts for hundreds of years once it starts to flow. It breaks down into microplastics that build up in soils, rivers, and marine systems (Rillig, 2012). Plastics are responsible for biodiversity loss around the world and cost billions of dollars to clean up the environment (Beaumont et al., 2019). Glass has a different effect on things. The good news is that glass is inert and can be recycled without losing quality. This means that in a recycling system that works well, glass can be part of a closed material cycle. Glass pieces are not harmful to the environment, but they can be dangerous to people and animals. The main environmental problem with glass, though, is how it is made. Making glass takes a lot of energy, which means that it releases more CO_2 per unit than making plastic (Niero & Olsen, 2016). In Albania, where recycling systems aren't very good, glass is better than plastic because it is more likely to be collected and sold on the black market (because it has a higher scrap value), while plastics (except PET) often end up in the trash. But both materials have an environmental cost if there isn't a strong recycling system in place. When glass is used in deposit-return reuse systems, it works best because it cuts down on the need for new production, which uses a lot of energy.

3. The size of social acceptability.

From a consumer's point of view, plastics are very useful because they are light, strong, and cheap. This explains why they are so popular in Albania, where price and ease of use are important to consumers. People's views on plastics are changing, though, especially in tourist areas where pollution of rivers and the coast is easy to see and hurts Albania's reputation as a clean place to visit. Awareness campaigns have made people more willing to pay more for other options (Milieukontakt Albania, 2024). People in the hospitality industry really like glass. A lot of people think that glass bottles are better quality and taste better. Eco-labeling programs in tourist areas all over Europe encourage hotels and restaurants to use reusable glass as part of

their branding for sustainability (EEA, 2021). The HoReCa sector in Albania has been willing to cut back on plastic when there are incentives and eco-labeling programs in place. The main reason people don't use glass is that it's not convenient to carry and return heavy glass bottles. This could make people less likely to use glass if they aren't given incentives through deposit schemes.

Plastic is cheap and easy to use, but it hurts the environment because it leaks and lasts a long time. Works best in places that have strong systems for collecting and recycling, which Albania doesn't have right now.

Glass: It's more expensive to use once, but it's better for the environment when it's reused or recycled. If there is the right infrastructure, it is better for the environment, but it is bad for energy intensity. Socially accepted in the HoReCa and tourism industries, but not as useful for households.

The analysis indicates that transitioning from plastic to glass is not a straightforward replacement. Albania needs to spend money on return-deposit systems, reuse logistics, and efficient recycling plants if it wants glass to work better. Plastics are still the most common material because they are cheap and easy to use, even though they are bad for the environment.

7.3.The most cost-effective alternative and rationale

A cost-benefit analysis of different ways to cut down on plastic pollution in the Shkumbin River Basin shows that no one measure is enough on its own. There are pros and cons to each option, whether it's switching from plastic to glass, setting up systems for reusing things, using biodegradable materials, better recycling, or raising community awareness. The best solution comes from a mix of options, but within this integrated strategy, the best way to go in terms of money, the environment, and society is to set up reusable systems with better source separation and recycling infrastructure.

In the short term, plastic is still the cheapest option when it comes to money, especially for families and businesses that don't have a lot of extra money. But its low price hides high costs for the outside world, like cleaning up illegal landfills, damage to the environment, and lost tourism revenue. Beaumont et al. (2019) say that the hidden costs of plastic pollution to

fisheries, aquaculture, and tourism are billions of euros a year around the world. Glass only works better when there are deposit-return and reuse programs; otherwise, its higher production and transportation costs make it less competitive. Albania doesn't have the composting infrastructure needed for biodegradable products, which cost 20–50% more than regular products (OECD, 2022). On the other hand, reusable systems like refillable bottles and durable tableware, as well as better recycling infrastructure, save money in the long run. They need money up front, but they lower operational costs by lowering landfill volumes, making money from material recovery, and avoiding cleanup costs (World Bank, 2018). For cities like Elbasan, putting money into sorting stations and PET/HDPE recovery would turn trash from a cost into a resource.

From an environmental point of view, the best things are reusable materials and better recycling. Studies show that using reusable items instead of single-use ones can cut down on waste by up to 80–90% (Heller et al., 2020). Recycling stops plastic from leaking into the Shkumbin River and cuts down on the need to make new materials, which has a big carbon footprint (Shen et al., 2010). Glass can be recycled forever, but it takes more energy to make and is harder to move (Niero & Olsen, 2016). Biodegradable plastics make trash easier to see, but if they aren't composted correctly, they could become clean. They can still get into rivers even if there isn't a closed-loop system. So, recycling and using materials more than once are the best ways to help the environment in a way that can be seen and verified. In Albania, where people are not willing to pay fees and do not trust municipal services very much (ETMI, 2025), social acceptability is very important. Plastics are very convenient, but people are becoming less and less accepting of them because they can see pollution in rivers and on the coast. In HoReCa and tourism, glass is seen as high-quality and long-lasting, but it is not as good for families. Awareness campaigns can't replace infrastructure, but they are very important for building trust and getting people involved. Social surveys in Europe show that more and more people want businesses to be environmentally friendly when there is infrastructure and clear incentives (EEA, 2021). Deposit return schemes for bottles and eco-labeling for restaurants can get more people involved and make reforms seem more socially acceptable.

Table 18: The Most Cost-Effective Alternative

Main Alternative	Financial Cost	Environmental Impact	Social Acceptability	Overall Rating
Plastic (PET, LDPE)	Low (approximately)	Very negative	High due to convenience	Not sustainable
Glass (single-use)	High	Neutral, high energy for production	Medium	Not competitive without DRS
Biodegradables	Medium-high	Medium	High (positive perception)	Limited without composting
Reusable + Recycling	Medium-high (CAPEX)	Very high	High in HoReCa, medium for households	Most cost-effective
Awareness Alone	Low	Medium	High	Insufficient without infrastructure

So, the best choice is not to replace all plastic with glass or biodegradable ones, but rather:

a. Making reusable systems bigger in the HoReCa and tourism industries (glasses, bottles, cutlery).
b. Making it easier to separate and recycle materials, especially PET and HDPE.
c. Setting up deposit-return systems for glass and plastic drink containers.
d. Helping with campaigns to raise awareness and make sure they are socially acceptable.

This combined method takes into account three things:

1. In terms of money: higher costs for capital, but long-term savings and income from recyclable materials.
2. Environmentally: Better at stopping leaks and greenhouse gas emissions.
3. Socially: Communities and businesses will be okay with it if there are incentives and eco-labeling.

Using only glass or biodegradable plastics in Albania right now would be expensive and not very good for the environment.

8. Recommendations and action plan

8.1.Short and long-term measures

In the short term, cities in the Shkumbini basin should focus on doing things that work quickly and earn the trust of the people. These include: increasing the number of places where trash is picked up in rural areas; giving out color-coded bins for plastic, paper, and organic waste; starting campaigns to raise awareness in schools and communities; and getting the HoReCa sector involved by making voluntary agreements to cut down on single-use plastics. Cleaning up the banks of rivers, with help from NGOs and local businesses, is another way to get quick wins. It makes the environment much better and gets people to get involved.

To make sure that things last, structural changes are needed in the long run. These include setting up regional materials recovery facilities (MRFs), composting facilities for organic and biodegradable waste, and slowly adding deposit-return systems (DRS) for drink containers. Over time, municipalities should switch to cost-reflective tariffs to make their finances more stable. They should also make sure that low-income households can afford the tariffs by giving them targeted subsidies. Albania wants to adopt EU standards on the circular economy and waste management as part of its EU accession process. These are also long-term measures that need to be followed. When done together, these things will both stop plastic from leaking right away and change the way we handle waste in a way that is more sustainable.

8.2.Public policies needed

Policies that the government makes are very important for making it easier to cut down on plastic use. The EU Directive on Single-Use Plastics (Directive (EU) 2019/904) should be put into effect by national law by getting rid of specific plastic items like straws, cutlery, and small bottles. A strong Extended Producer Responsibility (EPR) program should be put in place that makes plastic packaging producers and importers pay for collection and recycling systems. This will help local governments save money and make sure that polluters pay for the costs that their products cause. To make reusable and biodegradable products more affordable, the government should use different VAT rates or tax breaks. Policies should also encourage green procurement

in public institutions by making it mandatory for schools, hospitals, and ministries to cut down on single-use plastics in their daily operations. Lastly, the principles of the EU waste hierarchy should be followed more closely. This means that prevention and reuse should come first, followed by recycling, and landfilling should be the last option. These kinds of policies give the country a clear direction, get people to invest, and change their behavior. Without strong public policies, city programs could become disjointed and lack funding. So, Albania should include cutting down on plastic in its plans for the climate, health, and the circular economy.

8.3.The role of municipalities, NGOs and the private sector

Municipalities are the first line of defense in waste management. They are in charge of collecting trash, giving people access to landfills, and getting people involved in their communities. Their job should include making the collection area bigger, making the service better, and putting money into sorting stations. Cities should also build trust by making sure that tariffs reflect the quality of service and show real improvements. But they can't do it by themselves. NGOs help by spreading the word, getting volunteers to help, and testing new ways to help. Milieukontakt Albania and INCA are two groups that have already shown how NGO-led campaigns in HoReCa can cut down on plastic waste and change how businesses work in the Shkumbini basin. NGOs can also keep an eye on things and make sure that municipal and national implementation is done right. The private sector, especially the HoReCa and tourism industries, has a chance and a duty. Businesses can cut down on their plastic waste by using reusable items, joining eco-labeling programs, and helping with clean-up efforts. Packaging makers and importers should follow EPR rules by helping pay for some of the recycling infrastructure. Also, when these three groups—municipalities, NGOs, and businesses—work together, they form a governance triangle where resources, awareness, and accountability all help each other.

8.4.Monitoring and evaluation of progress

Monitoring and evaluation (M&E) are important for keeping an eye on how well plastic reduction measures are working and changing strategies as needed. Cities and towns should set baseline indicators, like the number of illegal landfills, the amount of plastic collected separately, and the percentage of households that are separating their trash. Regular surveys of the riverbanks, like the ETMI monitoring in 2025, should be made a part of the process to find out how much plastic is in every 100 meters of riverbank. This gives direct proof that the changes

are stopping the Shkumbin from leaking. The Ministry of Environment should keep a clear database of plastic packaging that is put on the market, collected, recycled, and leaked at the national level, following EU reporting standards. Independent audits by NGOs and research institutes can check the accuracy of municipal data and make sure it is reliable. Annual "plastic scorecards" that show progress can help build trust and get people to participate. Finally, international donors who are helping Albania with waste management should tie their funding to results that can be measured. This will make sure that money spent on infrastructure and education leads to real reductions in pollution. Albania can show that it is making progress toward EU alignment and protect Shkumbini and the Adriatic Sea with a strong M&E system.

Conclusions and recommendations

The study of plastic pollution in the Shkumbin River Basin shows that the problem is both structural and behavioral. This is because Albania's waste management system is weak and people tend to buy things that are easy to use instead of things that are good for the environment. ETMI's (2025) and the BeMed+ initiative's (2024) baseline surveys found that over 70% of the trash that can be seen along the river is plastic. This includes PET bottles, LDPE bags, food packaging, and disposable items used in the HoReCa industry. This number alone is a clear sign that plastic is the most common type of waste. This is bad for the river's ecosystem, the health of the people who live nearby, and the Adriatic Sea, which the Shkumbin flows into. Because these materials last a long time and break down into microplastics, the costs of doing nothing add up over decades, hurting ecosystems, public health systems, and local economies that depend on agriculture and tourism. One of the most important things this study found is that the way cities currently handle their trash isn't good enough to stop plastic from leaking. Coverage is still not complete, especially in rural and mountainous areas like Prrenjasi and Librazhdi, where collection services are not always available and people often throw away their trash in ways that are not official. Even in Elbasan, which has the best infrastructure in the basin, there are still gaps in service coverage in peri-urban areas and weak law enforcement that let a lot of plastic slip through the cracks. Because there are no transfer stations and they have to rely on long-distance transport to get to regional landfills, municipalities downstream like Peqin and Rrogozhina are having a lot of trouble. This makes things more expensive and less efficient. Divjaka is at the mouth of the Adriatic River and gets a lot of trash from upstream. This makes pollution worse on its beaches and wetlands. These weaknesses show that plastic leakage is not an isolated problem, but rather a direct result of problems with the whole system in the basin. The financial analysis makes this structural flaw even more clear. Municipal budgets are mostly made up of operating costs. Collection and transport alone account for 70–90% of waste management costs. These costs are higher because of old collection fleets, uneven disposal patterns, and the lack of local sorting stations, which means that municipalities have to take mixed waste straight to the landfill. The tariffs are still too low to cover these costs. They usually only cover 50% to 70% of the costs, and the rest is paid for by the city's budgets. This

doesn't leave much room for investing in infrastructure like transfer stations, materials recovery facilities (MRFs), or composting plants. Projects funded by donations have given temporary equipment or pilot interventions, but they have not set up a way to keep the money coming in. In this situation, plastic keeps getting out of the system, and the costs of not doing anything—like environmental damage, lost tourism, and health risks—aren't included in municipal or national budgets.

Not doing anything has especially bad effects on the environment and society. Plastic waste harms coastal habitats, makes soil less fertile, blocks irrigation channels, and threatens biodiversity by getting stuck in animals' mouths and eating them. Microplastics that come from breaking down plastic get into aquatic food webs and end up in the mouths of people. Studies from around the world have already found microplastics in human blood, placenta, and feces. This has raised concerns about long-term health effects that could range from endocrine disruption to respiratory inflammation. For people who live along the Shkumbini, these risks are made worse by the presence of sanitary plastics like diapers and wet wipes, which make people more likely to get sick and make the area less pleasant to live in. People who pay for waste disposal but still see unmanaged waste question the fairness and legitimacy of municipal governance. This makes people less trusting of institutions. There is a big difference between rural areas, which get the least services, and urban areas, which are often the most polluted and suffer the most from it.

We looked at many different ways to cut down on plastic pollution. Under deposit-return and reuse systems, replacing plastic with glass is better for the environment, but it costs a lot of money and is hard to do in single-use models. Biodegradable plastics make things look better and help the environment in the long run, but they need industrial composting plants to reach their full potential, which Albania does not have right now. On the other hand, reusable systems like refillable bottles, eco-friendly tableware, and textile bags are much better for the environment. Studies have shown that when people use them all the time, they can cut down on plastic waste by up to 90%. These systems cost more to set up, but they save money in the long run and are perfect for Albania's HoReCa and tourism industries, where they can give businesses an edge by using eco-labeling and sustainability branding. In addition to this, better source separation and recycling are needed to get recyclable materials like PET and HDPE, which will

reduce the need for landfills and make money from the materials that are recovered. Evidence from EU Member States shows that separate collection and MRFs are necessary to reach recycling rates above 40%, which is much higher than Albania's current rate of less than 10%.

The HoReCa and tourism sectors came out as important areas for action. The Low Plastic Zone project found that these sectors are responsible for more than 70% of the plastic that flows through the businesses that were watched. The sector can play a big role in Albania's plastic transition by using reusable systems, using less PET, and getting involved in eco-certification programs. Policies that are based on tourism, like banning SUPs in protected areas, setting up seasonal deposit-return systems, and working with NGOs on clean-up campaigns, can quickly cut down on visible pollution and make Albania a more appealing place to visit for eco-friendly reasons.

It's also very important for people in the community to be aware and educated. Policies alone can't force people to change their behavior; they need ongoing education, visible improvements in services, and incentives to participate. Schools are very important because they teach kids about the environment early on. NGOs are also important because they give people a place to volunteer and try out new awareness campaigns. Social media can help these efforts, but campaigns need to be ongoing and part of bigger plans, not just one-time events. Linking awareness to service delivery is key to building citizen trust. For example, when people see that their separated plastics are being collected and recycled, participation rates go up a lot. Infrastructure is still the most important part of all interventions. Albania can't close the plastic loop without modern collection fleets, the right bins, transfer stations, sorting facilities, and recycling plants. Investing in composting facilities is just as important for getting rid of organic waste and biodegradable plastics. These infrastructures cost a lot of money up front, but they save money and help the environment in the long run. To pay for their work, they will need a mix of municipal budgets, cost-reflective tariffs, national subsidies, donor support, and Extended Producer Responsibility (EPR) payments from plastic packaging producers and importers. For a circular economy to work, these funding streams need to be in sync.

When different options were compared based on cost-benefit criteria, reusable systems with better recycling infrastructure were found to be the best choice. In terms of money, they balance higher initial costs with savings and income from material recovery over time. In terms of the

environment, they cut down on plastic leakage and greenhouse gas emissions the most. In terms of social impact, they fit with what people want when it comes to eco-friendly options, especially in HoReCa and tourism. Targeted awareness campaigns could help people change their habits. On the other hand, using only glass or biodegradable plastics would be too expensive and not as effective at stopping leaks in Albania right now.

Based on these findings, the recommendations and action plan stress a phased approach. In the short term, cities should increase the number of places where people can drop off their trash, run campaigns to raise awareness, and get HoReCa businesses to sign voluntary agreements to cut down on plastic. In the long run, systemic changes are needed, such as return-deposit schemes, building MRFs and composting plants, changing tariffs, and following EU circular economy policies. The EU Single-Use Plastics Directive should be put into effect by public policies, and EPR should be put into effect. There should also be tax breaks for products that can be reused or broken down. While NGOs raise awareness and businesses cut down on their plastic use, municipalities should focus on improving service delivery and building trust. To keep track of progress, there should be monitoring and evaluation frameworks that use indicators like the amount of plastic on riverbanks, recycling rates, and citizen involvement. The primary conclusion is that plastic pollution in the Shkumbin River constitutes not only an environmental issue but also a challenge for governance and development. It shows that there are problems with how cities get money, how they build things, how they get people involved, and how they put policies into action. To deal with it, everyone, from families to cities, businesses to the national government, needs to work together. The costs of not doing anything—damage to the environment, health risks, and lost money—are much higher than the costs of doing something and investing. Albania can turn the Shkumbini basin into a model of sustainable waste management, cut down on its contribution to Mediterranean marine litter, and meet EU standards with the right interventions. The chance is not only to clean up a river, but also to change the way society, the economy, and the environment work together so that they are more circular and strong in the future.

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