Urban Waste: Challenges and Opportunities in Tourism Destinations

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Abstract

Waste can be observed as an ecological problem, but it can also be approached as a resource used to manufacture new goods. The European Union has set high goals in waste management in its legal framework. The Republic of Croatia, as a member of the EU, will have to respect the set requirements. The main aim of this paper is to analyse waste management in counties across Croatia with special emphasis on the cities and municipalities in the Opatija Riviera area, as well as to monitor the amount of urban waste generated by tourism.

The Opatija Riviera is the study area of this research as the inhabitants and tourists in cities generate more and more urban waste, which is closely connected to unsustainable patterns of consumption and production. The authors use different methods in the paper such as analysis of the existing condition, observation, and the accumulation, processing and interpretation of secondary data. The main source of data are statistical reports and reports on the business conducted by municipal companies. The research question is whether an increase in tourism indicators affects an increase in waste in a tourism destination.

The authors indicate towards a need to change consumption and production in order for citizens to generate less waste, while at the same time using waste as a resource in the process of circular economy. Inadequate waste management contributes to environmental pollution, air pollution and the intensification of climate change. The results show that the analysed tourism destinations do not record an increase in total waste despite an increase in tourism indicators. The paper proves that the observed units of local self-government are more actively adhering to EU regulations pertaining to waste management. The paper's contribution lies in the knowledge that waste in cities has three different values in terms of ecology and economy – raw materials, energy and the environment. In the scientific sense the paper contributes to existing literature, while in the practical sense the paper advises decision-makers in units of local self-government that tourist cities in the Opatija Riviera area need to promptly implement the circular management model, undergo a digital transformation and implement smart solutions. All of these projects fall within the scope of the European Union's next financial period (2021-2027), which additionally shows just how important these issues have become. The paper further contributes by presenting and proposing solutions to numerous challenges, as well as emphasizing the presented tourist destinations as examples of good practices.

Keywords: *urban waste, circular economy, tourism destination, city*

Introduction

Waste can be observed as an ecological problem, but it can also be approached as a resource used to manufacture new goods. The European Union has set high goals in waste management in its legal framework – to recycle at least 55% of municipal waste by 2025, 60% by 2030, and this goal is set to go up to 65% by the year 2035[1]. The Republic of Croatia, as a member of the EU, will have to respect the set requirements. The Croatian Act on Sustainable Waste Management was adopted in early 2020 and it aims to organize the entire waste management system, starting from the very beginnings of raising awareness of waste management[2]. The provisions of this Act prescribe the entire waste management

system, including order of priority of waste management, strategic and programming documents for waste management, the aims, principles and methods of waste management, facilities and locations for waste management, transportation of waste across borders, obligations and jurisdiction in waste management, waste management as an economic activity, inspection and supervision of waste management, and the information system for waste management. In terms of strategic documents, the Croatian Strategy for Waste Management defines the framework for Croatia to reduce the amount of generated waste, and to sustainably manage generated waste[3]. Following the Strategy, Croatia adopted two more plans for waste management, one for the period from 2007 to 2015[4], and one for the period from 2017 to 2022[5]. They are implementation plans for the Strategy. The Strategy defines the management of different types of waste in Croatia. The basic aim is to achieve an all-encompassing waste management system in accordance with European standards for the purpose of reducing waste generation as much as possible.

Pursuant to the Strategy, counties, in collaboration with municipalities and cities, must establish county centres for waste management, and complete the remediation and closure of landfills in accordance with the Plan for Waste Management. Units of local self-government (municipalities and cities) must organize the collection and safe disposal of municipal waste until the landfills are closed. They must ensure separate collection of secondary raw materials and biowaste, and transport such waste to a transhipment facility[3, 5].

Only two centres for waste management have been built by 2021, one in Primorje-Gorski Kotar County and one in Istarska County. There is still a lack of recycling yards, sorting stations, composting stations and recycling centres, waste generation has not been reduced, and the price of municipal services has not yet achieved economic levels, i.e., the one who generates waste does not yet get charged in proportion with the amount waste they themselves have generated[6]. Since waste management in Croatia is lagging behind EU standards [7,8,9, 10] the aim of this paper is to explore the status of waste management in one part of the Primorje-Gorski Kotar County, i.e., in the units of local self-government in the Opatija Riviera area. These municipalities and cities have been selected as research targets because they are famous tourist destinations, and this paper aims to contribute to discovering a solution for waste as a challenge. The main aim of this paper is to analyse waste management in counties across Croatia with special emphasis on the cities and municipalities in the Opatija Riviera area, as well as to monitor the amount of urban waste generated by tourism. The research question is whether an increase in tourism indicators also affects an increase in waste in tourism destinations.

The authors conclude that the issue of waste management is not necessarily dependent on tourism indicators, but that the greatest challenge in Croatia is to educate the people, and that the regulations on waste management are not completely implemented which causes the entire waste management system to not function fully. The amount of waste is on the rise on the national level, and the infrastructure for waste disposal does not mirror this increase.

The paper is divided into four chapters. An overview of literature follows this introduction, providing an overview of the relationship between tourism and waste management. In the chapter Municipial waste in the Republic of Croatia tackles the analysis of data on the level of the Republic of Croatia with special emphasis on the amount of municipal waste generated by tourism in relation to total waste generated. The research is presented in chapter Challenges and opportunities in a tourism destination, detailing the explored challenges and options for waste management in the selected tourist destinations. After the conclusion the authors describe the limitations of this paper and present the literature used.

Literature review

Environmental pollution is one of the greatest issues of the 21st century, and waste is noted as one of the leading causes. Waste is any matter or object that an owner discards, or plans or must discard[2]. It is divided into hazardous, non-hazardous and inert waste. Waste management encompasses waste collection, transportation, treatment, as well as monitoring of those activities and measures taken on site following waste treatment[11]. Municipal waste management is a deeply complex process, and the entire process needs to be well-planned to ensure high quality waste management[12].

Given UN Sustainable Development goal 12 that articulates the need for responsible production, the contribution of tourism and hospitality service providers to sustainable solid waste management practices is important for sustainable development policies and thus requires investigation[13]. The rapid development of the tourism industry has a direct impact on the increase in the amount of solid waste in tourism areas, and has a negative impact on the environment, namely in the form of higher operational costs, pollution due to litter and contaminated water, and a reduction in the touristic value of otherwise attractive locations[14,15,16]. When discussing locations, the authors place special emphasis on cities and municipalities as tourist destinations in this paper, as developing infrastructure leads to more tourists, which in turn results in more waste[17,18,19,20]. The effect of tourism on waste generation is significant and is on the rise every year[19]. Tourism has become one of the most important industries in recent decades. In 2019 there was a total of 1.46 billion international tourist arrivals generating 1.481 billion USD in international tourism receipts. This shows the importance of tourism in the economy[21], as it accounts for around 10.4% of the global GDP[22]. Rapid development of tourism in coastal areas leads to an increase in waste generated by tourists during their stay[23,24,25]. Tourism can sustain high levels of employment and income, but the sector is a source of environmental and health impacts[26]. One of the most important issues is the generation of solid municipal waste, and it has been noted that tourists do not care much for the amount of waste they generate on their vacations[27]. The case of Menorca showed that on average, a 1% increase in tourist population in Menorca causes an overall MSW increase of 0.282% and that each additional tourist generates 1.31 kg/day, while each additional resident generates 1.48 kg/day[28]. Mengiseny states that an increase in the number of tourists increases the amount of waste by 30% as a consequence of more tourist and visitor arrivals[29]. This is why we need forward thinking when it comes to understanding the connection between tourism and responsibility in tourist destinations, and we have to work on raising awareness about environmental sustainability[30]. Many authors explored the relationship between tourism and the amount of waste generated, and concluded that there is an interconnection, that tourism is indeed a key driver of waste generation, which raises concerns about extra costs and capabilities of waste management systems[31]. Greco, Cenciarelli and Allegrini[32] researched how tourism activities increase the waste collection costs of separated waste and of residual waste. In some regions, generation of municipal waste by a tourist can amount to double that of a resident [47].

The estimates for separately collected recyclables show that an increase of 1% in the tourist population causes an increase of 0.232% of municipal solid waste. In 2013, Croatia recycled 15% of its municipal waste (by weight). The rate is two times lower than the EU average (32%) and more than four times lower than the EU target for 2030 (65%). So far, Croatia does not have a well-elaborated and detailed waste management plan to meet recycling and material recovery targets, but efforts are currently being made to address this problem, as detailed in the new waste management plan for the Republic of Croatia 2017-2022[33]. Šverko Grdić et al.[34] showed that the higher the GDP, the higher the waste generation per capita, while Runko Luttenberger[35] states that significant resources have been invested in waste management, but that the Croatian legal framework is not sufficiently implemented[36,35]. It is necessary to reduce the negative environmental impact on the national, regional and local levels, and one of the solutions is a transition from a linear to circular economy[34], which involves reusing materials[37,38]. In the continuation, the authors analyse the amounts of municipal waste per county in Croatia, and ultimately analyse the amounts of municipal waste per selected tourist destination.

Municipal waste in the Republic of Croatia

Municipal waste is waste generated in a household, and is similar to household waste in nature and composition, except manufacturing waste and waste generated by agriculture and forestry. In order to properly classify waste, the Ministry of Economy and Sustainable Development issued a catalogue titled „Guidelines and glossary for defining waste in accordance with the Waste Catalogue“[39]. Data governance concerning municipal waste, as well as registering collected data into the Environmental Pollution Register (CNPEPR) is prescribed by the Act on Sustainable Waste Management, Regulation on Waste Management and Regulation on the Environmental Pollution Register.

Municipal waste management

1,811,617 tonnes of municipal waste were generated in Croatia in 2019. Of that amount, 75% (1,372,358 tonnes) was collected in the organization of units of local self-government, and the rest pertains to amounts collected within the scope of the national system for special categories of waste, regulated by the Environmental Protection and Energy Efficiency Fund (FZOEU). This remaining waste concerns waste generated by service activities (batteries, packaging, cardboard, paper, waste cooking oil, etc.), exported municipal waste, and an estimation for the population not encompassed by organized waste collection. Out of the total amount of municipal waste generated in 2019, 59% was landfilled, 30% was sent to recycling, i.e., any process that results in using waste for a useful purpose, such as when waste replaces other materials that would have to be used otherwise, or waste prepared specifically to fit that purpose. The final 11% not mentioned in the previous sentence pertains to other processes, i.e., facilities for mechanical biological waste treatment (MBT), where around 150 thousand tonnes of waste were distributed. A small amount pertains to temporarily warehoused waste or waste treated by specific processing methods. According to the Plan for Waste Management of the Republic of Croatia 2017-2022, the goal is to reduce the total amount of produced and/or generated municipal waste by 5% in 2022 compared to 2015 when the total amount of generated waste was 1,653,918 tonnes. It is evident from data presented that this goal has so far not been achieved, as the amount of municipal waste generated in Croatia has increased each year, rising by 157,699 in 2019 compared to 2015, which is an increase of 13%. In order to achieve the goals laid out in the Plan for Waste Management of the Republic of Croatia, it is necessary to additionally encourage and stimulate already existing activities focused on preventing waste generation.

When it comes to recycling municipal waste in 2019, there was an increase in the amount of waste directly sent to recycling. The data for 2019 shows that 82% of separated municipal waste was intended for recycling, while the rest (typically bulky waste) was taken to landfills where a part of it was also likely recycled. Looking at municipal waste disposal, it should be noted that 1,072,727 tonnes of municipal waste was landfilled in 2019, amounting to 59% of municipal waste, which is 7% less than the previous year. The Plan of Waste Management of the Republic of Croatia states that one of the goals is to reduce municipal waste landfilling to 25% by the year 2022.

Amount of collected municipal waste in the period from 2014 to 2019

As previously stated, 1,811,617 tonnes of municipal waste were generated in 2019. Of that amount, the Environmental Pollution Registered recorded 1,372,358 tonnes registered via forms for public service providers and forms for recycling yards, and 49,433 tonnes registered via forms for merchants (Report on municipal waste for 2019, p. 27). Table 1 shows data for total amount of municipal waste per county for 2014 and 2019.

Table 1 shows that the average amount of waste per capita in Croatia in 2019 was 423 kg, and in 2014 it was 382 kg. The City of Zagreb as a county has the highest percentage of municipal waste compared to other counties, and it sits at 20%. It is followed by the Split-Dalmatia County at 16%, Primorje-Gorski Kotar County at 10% and Istria County at 7%. It is important to note that the City of Zagreb also has the largest population compared to other counties. If we calculate average annual growth from this table, we notice that Međimurje County is at the forefront with a growth of 9.3%. In order to better understand the situation, it should be noted that this county also records the lowest amounts of waste collected per capita. Međimurje County has developed a culture of rational waste generation and contemporary recycling. The following counties also show a higher average annual growth rate: Primorje-Gorski Kotar at 4.4% and Split-Dalmatia at 4.2%. These two counties are coastal destinations that attract a large number of tourists. This is evident from looking at tourism results, when it comes to total tourism overnight stays, the Primorje-Gorski Kotar County is at 21%, and Split-Dalmatia is at 25%. This data is directly tied to the research question – does an increase in tourism indicators negatively impact the amount of generated waste? Two counties display the lowest amount of municipal waste compared to all others – Požega-Slavonia and Virovitica-Podravina, both at only 1%, but those two counties also have the lowest population. The average annual growth of generated municipal waste is 0.9% in the Požega-Slavonia County and 0.8% in the Virovitica-Podravina County. In the next section we focus on details of municipal waste generated by tourism.

Table 1: Total amount of municipal waste per county in 2014 and 2019 [40]

Count	2014			2019		
	Total amount of generated municipal waste	Share per county	Amount of waste per capita (kg/capita)	Total amount of generated municipal waste	Share per county	Amount of waste per capita (kg/capita)
Zadar	102,802	6.3%	605	112,196	6%	660
Primorje-Gorski Kotar	153,056	9.4%	517	190,079	10%	642
Istria	137,959	8.4%	651	132,701	7%	638
Split-Dalmatia	229,406	14%	518	281,599	16%	619
Dubrovnik-Neretva	70,373	4.3%	575	73,227	4%	597
Lika-Senj	24,596	1.5%	490	27,846	2%	547
Šibenik-Knin	53,319	3.3%	488	58,984	3%	539
City of Zagreb	306,096	18.7%	387	306,167	20%	456
Međimurje	24,794	1.5%	223	38,666	2%	340
Karlovac	46,884	2.9%	367	43,612	2%	338
Zagreb County	84,306	5.2%	267	98,161	5%	309
Osijek-Baranja	83,571	5.1%	274	91,080	5%	299
Virovitica-Podravina	24,334	1.5%	291	25,318	1%	298
Vukovar-Srijem	64,179	3.9%	365	48,561	4%	271
Koprivnica-Križevci	27,211	1.7%	241	30,821	2%	267
Sisak-Moslavina	46,981	2.9%	287	43,811	2%	254
Brod-Posavina	44,961	2.8%	284	39,500	2%	249
Bjelovar-Bilogora	30,112	1.8%	253	28,256	2%	236
Krapina-Zagorje	29,945	1.8%	234	31,362	2%	236
Varaždin	37,084	2.3%	229	39,514	2%	225
Požega-Slavonia	15,394	0.9%	231	16,157	1%	207
TOTAL	**1,637,371**	**100%**	**382**	**1,811,617**	**100%**	**423**

Municipal waste generated by tourism

According to the Report on Municipal Waste for 2019, there is an increase in the amount of municipal waste generated from tourist activities. This negative increase comes as a consequence of an increase in tourist overnight stays. Back in 2014, the amount of municipal waste from tourism was 88,884 tonnes, which increased up to 171,505 tonnes in 2019[40].

Table 2 shows the amount of municipal waste from tourism per county, the share of each county in the total amount and the number of recorded overnight stays in 2014 and 2019. The highest amount of waste from tourism in 2019 was recorded in the Istria County (41,038 tonnes), followed by the Primorje-Gorski Kotar County (34,567 tonnes) and then Split-Dalmatia and Zadar counties. The lowest amount of waste was recorded in the Požega-Slavonia County and Koprivnica-Križevci County – 37 tonnes. The main difference is because tourism is concentrated on the coast, so the coastal areas also have more municipal waste from tourism. Looking at average annual growth of generated municipal waste, the counties that show highest increase are the Zagreb County (28.6%), Međimurje County (28.6%), Bjelovar-Bilogora (26.5%) and Požega-Slavonia. When it comes to overnight stays, the highest average annual growth is recorded in the Zagreb County (19.5%), Bjelovar-Bilogora (16.2%), Karlovac (13.6%) and Međimurje (12.1%). The growth rates indicate towards a correlation between the increase in generated waste and overnight stays.

Table 2: Amount of municipal waste from tourism per county in 2014 and 2019 [40]

Year	2014			2019		
County	Amount of municipal waste from tourism		Recorded overnight stays	Amount of municipal waste from tourism		Recorded overnight stays
	(tonnes)	Share		(tonnes)	Share	
Istria	28,239	31.8%	19,545,303	41,038	24.0%	26,388,645
Primorje-Gorski Kotar	15,535	17.5%	12,212,423	34,567	20.2%	15,314,671
Split-Dalmatia	15,627	17.6%	12,134,612	34,357	20.0%	17,966,287
Zadar	10,666	12.0%	7,184,150	24,627	14.4%	9,868,704
Dubrovnik-Neretva	8,180	9.3%	5,883,802	14,165	8.3%	8,333,783
Šibenik-Knin	5,458	6.1%	4,552,929	10,765	6.3%	5,549,445
Lika-Senj	2,422	2.7%	2,030,496	5,605	3.2%	2,856,171
The City of Zagreb	1,692	1.9%	1,602,420	3,865	2.3%	2,638,962
Karlovac	328	0.4%	331,126	781	0.5%	626,231
Krapina-Zagorje	129	0.1%	210,253	306	0.2%	386,985
Osijek-Baranja	113	0.1%	150,466	256	0.1%	217,692
Zagreb County	68	0.08%	93,143	239	0.1%	225,561
Međimurje	66	0.07%	111,217	232	0.1%	196,922
Sisak-Moslavina	57	0.06%	76,232	148	0.09%	95,372
Vukovar-Srijem	81	0.09%	83,159	148	0.09%	134,308
Varaždin	67	0.08%	117,008	146	0.09%	184,409
Bjelovar-Bilogora	25	0.03%	36,614	81	0.05%	77,513
Brod-Posavina	32	0.04%	40,668	61	0.04%	60,030
Virovitica-Podravina	25	0.03%	31,626	43	0.03%	44,744
Koprivnica-Križevci	20	0.02%	31,568	37	0.02%	35,010
Požega-Slavonia	13	0.02%	24,733	37	0.02%	41,486
TOTAL	**88,844**	**100**	**66,483,948**	**171,505**	**100%**	**91,242,931**

This table answers the research question whether an increase in the number of tourists causes an increase in municipal waste generated. In the following chapter, the authors further explore the situation in micro-destinations, specifically in the Opatija, Lovran and Mošćenička Draga units of local self-government in order to analyse waste management and to provide possible solutions.

Challenges and opportunities in a tourism destination (the research)

Following the analysis per county, we take a look at the comparison and analysis of the amount of municipal waste generated by tourist arrivals and overnight stays in select tourism destinations. The Primorje-Gorski Kotar County was shown to be second in the amount of generated municipal waste, only surpassed by the City of Zagreb. A further analysis of the relationship between waste and tourism indicators is therefore worth pursuing.

Study area

The analysis encompasses the Opatija Riviera area, specifically micro-destinations Opatija, Lovran and Mošćenička Draga. These tourism destinations were also selected as units of local self-government – Opatija is a city as it has 11,659 inhabitants[41] and Lovran and Mošćenička Draga are municipalities. It is important to know how to manage waste on the local level of governance, with the aim of waste management adhering to principles of sustainability.

Figure 1: Research area [42]

The analysed locations are well-known tourism destinations in the Primorje-Gorski Kotar County, and the aim was to analyse how tourism-related numbers affect waste generation. The most common guests in the area come from Germany and Austria, countries that have developed waste management systems. The authors further explore whether the demographic structure of tourists (country of origin) affects waste generation and whether tourists apply an environmental and waste management mindset in the analysed destinations.

Methodology

The authors use different methods in the paper such as analysis of the existing condition, observation, and the accumulation, processing and interpretation of secondary data. The main sources of data are national statistical reports and reports on the business conducted by municipal companies. This includes the annual reports of the Komunalac ltd. municipal company for the period from 2013 to 2018, as well as tourism indicators available on the Croatian Bureau of Statistics portal. Unfortunately, there is no detailed data on generated and collected waste in Croatia, so this was the only data the authors had at their disposal. Additionally, the subject of waste management has become prominent when Croatia joined the European Union, so the available data is fairly limited in temporal scope. It was therefore not possible to design an econometric model that would potentially present more realistic data.

Results and discussion

The results of the research are shown in the tables in the continuation with a written data analysis. The results show that the data on collected separated waste is increasing, but there is also a significant discrepancy in results depending on the unit of local self-government. Evidence was found to support that the selected units of local self-government are increasingly in compliance with EU regulations concerning waste management. Furthermore, the results of the economic analysis indicate that the overnight stays and tourist arrivals in the three selected destinations do not affect municipal waste generation as much as the local population does.

The City of Opatija has recorded a drop in collected municipal waste over the years. In 2013, a total of 6,341 tonnes of waste was collected, 80% of which was mixed municipal waste. The following year saw a 9% increase in collected waste. Opatija has a population of around 12 thousand, and based on the amount of waste in the year 2018, it puts it at 2.37 tonnes per capita, which indicates towards a need to improve the quality of waste management. When looking at average annual changes, it can be seen that the total amount of generated waste has decreased by 4.6%, which is very good news. The only type of waste that is on the rise in Opatija is residual waste from street cleaning. This type of waste is definitely impacted by tourist activities in the area.

Table 3: Types of collected municipal waste in Opatija from 2013 to 2018 (tonnes) [43]

Type of waste	2013	2014	2015	2016	2017	2018	Average annual growth rate 2013/2018
Mixed municipal waste (t)	5,127	5,698	5,156	4,401	5,498	4,770	-1.43%
Bulky municipal waste (t)	628	802	480	607	903	169	-23.1%
Biodegradable waste (t)	422	375	116	135	70	11	-48.2%
Waste from street cleaning (t)	71	47	30	38	41	92	5.1%
Other non-biodegradable waste (t)	124	81	46	41	54	14	-35.4%
Marketplace waste (t)	40	39	37	35	37	-	-1.9%
TOTAL	**6,412**	**7,042**	**5,865**	**5,275**	**6,603**	**5,056**	**-4.6%**

The municipality of Lovran did not record a decrease in collected waste through this six-year period. A larger increase of mixed municipal waste, 15%, was recorded in 2016 compared to the previous year. Lovran also recorded the highest amount of bulky waste collected, 309 tonnes, in the year 2017, but there was a significant decrease of 78% the following year. One reason for this change was the opening of a recycling yard in the municipality. When looking at average annual changes, the data shows that the total amount of generated waste decreased by 0.76% over the observed period. Mixed municipal waste comprises 96% of all waste in the observed period, with an average annual increase of 2.4%, which is not good. It is necessary to take certain measures to ensure a decrease in the amount of generated mixed municipal waste.

Table 4: Types of collected municipal waste in the municipality of Lovran from 2013 to 2018 [43]

Type of waste	2013	2014	2015	2016	2017	2018	Average annual growth rate 2013/2018
Mixed municipal waste (t)	1,853	1,786	1,876	2,172	2,265	2,090	2.4%
Bulky municipal waste (t)	239	264	202	181	309	68	-22.2%
Biodegradable waste (t)	98	47	53	74	40	3	-50.2%
Waste from street cleaning (t)	0	11	24	28	32	0	-
Other non-biodegradable waste (t)	41	54	61	42	43	10	-24.6%
Marketplace waste (t)	25	23	20	20	22	-	-2.5%
TOTAL	**2,256**	**2,185**	**2,236**	**2,517**	**2,711**	**2,171**	**-0.76%**

A special system was installed for municipal waste collection in the area of Mošćenička Draga. It involves so-called eco-islands and bins where the locals can dispose of their household waste using a keycard that unlocks the eco-island, which also enables more efficient tracking of generated waste. Looking at the analysis presented in Table 5, Mošćenička Draga significantly reduced the amount of collected municipal waste over the observed six-year period. The largest amount of collected waste was recorded in 2014, a total of 1,371 tonnes, while the last observed year saw a decrease of 64%. Mošćenička Draga can therefore be used as an example of best practices when it comes to waste management. This is evident from the average annual change – the total amount of generated waste was reduced by 14.6% in the observed period. Mixed municipal waste comprises 97% of the total generated waste in this municipality, but in the observed period it shows an average annual decrease of 13%, which is great. Mošćenička Draga can further serve as a great example for others how to reduce the amount of generated municipal waste.

Table 5: Types of collected municipal waste in the municipality of Mošćenička Draga from 2013 to 2018 [43]

Type of waste	2013	2014	2015	2016	2017	2018	Average annual growth rate 2013/2018
Mixed municipal waste (t)	954	1,168	1,170	976	522	475	-13%
Bulky municipal waste (t)	99	167	114	120	272	12	-34.4%
Biodegradable waste (t)	18	33	33	45	18	1	-44%
Waste from street cleaning (t)	0	0	0	-	-	0	-
Other non-biodegradable waste (t)	7	3	3	3	1	0	-
Marketplace waste (t)	0	0	-	-	-	-	-
TOTAL	**1,078**	**1,371**	**1,320**	**1,144**	**813**	**488**	**-14.6%**

In the continuation we provide an analysis of the total amount of waste generated in combination with tourism indicators in the area of Opatija, Lovran and Mošćenička Draga. In the literature overview we cited sources stating that an increase in the number of tourists causes an increase in generated waste. However, in our further analysis, we see that tourist arrivals and overnight stays in the selected tourism destinations do not have to necessarily cause an increase in generated waste.

The data in Table 6 shows that an increase in tourist arrivals and overnight stays in the city of Opatija does not cause an increase the amount of waste, in fact, the amount of waste is declining. The average annual growth of tourist arrivals is 2.6%, tourist overnight stays 1.9%, and yet the amount of generated waste showed an average drop of 3.94%. One explanation may be found in the fact that the tourists arriving in Opatija fall within the scope of inbound tourism from developed countries (Germany, Austria, Italy) that have a developed waste management system so tourists adhere to these principles while on vacation as well. It could also be a result of efforts to improve waste management by the units of local self-government. When looking at overnight stays, most overnight stays were recorded from tourists from Germany, Italy, Austria and Czechia. The highest amount of waste generated was recorded in 2008 (7,608 tonnes), which is also the year when tourist arrivals and overnight stays started increasing. The lowest amount of generated waste was recorded in 2019 (4,886) tonnes, which is 36% less than in 2008. The average amount of waste generated in Opatija over the observed 11-year period is 6,922 tonnes. The average amount of tourist overnight stays is 1,238,890 and 394,047 tourist arrivals. **According to the data, it is evident that tourists do not affect waste generation, but that it is necessary to engage the local population in order to achieve systematic waste management.**

Table 6: Analysis of total generated waste with tourist arrivals and overnight stays in the City of Opatija 2008 – 2019 [41]

Observed year	Total amount of generated waste	Tourist arrivals	Tourist overnight stays
2008	7,608	316,987	1,040,046
2009	7,279	305,230	991,055
2010	6,468	316,406	1,024,347
2011	6,868	327,701	1,055,539
2012	6,060	329,693	1,067,445
2013	6,502	348,931	1,016,041
2014	7,073	368,989	1,135,676
2015	5,953	393,244	1,219,538
2016	5,407	395,781	1,089,818
2017	6,793	404,300	1,361,009
2018	5,247	404,661	1,350,061
2019	4,886	422,601	1,277,210
Average annual change	**-3.94%**	**2.6%**	**1.9%**

Table 7 shows the total amount of waste generated alongside tourist arrivals and overnight stay from 2008 to 2019 in the area of the municipality of Lovran. The data shows that the total amount of generated was has decreased, while the amount of tourist arrivals and tourist overnight stays has increased. The lowest amount of waste was recorded in 2018 (2,172 tonnes), and that year shows only a slightly lower amount of tourist arrivals than the previous year which is highest on record. The average amount of waste generated in the observed period was 2,568 tonnes. Despite an increase in the number of tourists in the observed period, the data shows that the average annual amount of generated waste decreased by 0.48%, which is a very good indicator.

Table 7: Analysis of total generated waste with tourist arrivals and overnight stay in the municipality of Lovran from 2008 to 2019

Observed year	Total amount of generated waste	Tourist arrivals	Tourist overnight stays
2008	2,519	47,481	188,684
2009	2,346	59,514	237,461
2010	2,334	62,380	235,805
2011	2,262	64,730	249,138
2012	2,242	66,714	257,196
2013	2,305	73,400	274,259
2014	2,184	80,942	293,214
2015	2,221	83,126	309,400
2016	2,537	93,516	271,492
2017	2,744	100,850	291,581
2018	2,172	99,325	294,106
2019	2,389	99,946	297,774
Average annual change	**-0.48%**	**7.0%**	**4.2%**

Source: authors' design according to data from 41

Table 8 shows the total generated waste alongside tourist arrivals and overnight stay from 2008 to 2019 in the area of the municipality of Mošćenička Draga. The highest amount of generated waste was recorded in 2014 (1,401 tonnes). It is interesting to note that in 2018 Mošćenička Draga recorded the lowest amount of generated waste (523,59 tonnes), and simultaneously the highest amount of tourist arrivals and overnight stays. The average amount of generated waste in the observed period is 1,136 tonnes, while the average amount of tourist arrivals is 49,033, and 283,552 tourist overnight stays.

Out of the three observed destinations, Mošćenička Draga has the most successful decrease in the amount of waste throughout the observed period.

Table 8: Analysis of total generated waste with tourist arrivals and overnight stays in the municipality of Mošćenička Draga from 2008 to 2019

Observed year	Total amount of generated waste	Tourist arrivals	Tourist overnight stays
2008	1,070	35,201	173,472
2009	1,122	38,491	186,509
2010	1,049	38,491	185,440
2011	1,108	40,450	205,133
2012	1,107	44,099	203,596
2013	1,105	44,820	218,698
2014	1,401	42,422	293,214
2015	1,336	47,526	309,400
2016	1,167	50,123	339,057
2017	869	53,294	369,443
2018	523	54,624	373,863
2019	643	49,822	261,256
Average annual change	**-4.52%**	**3.2%**	**3.8%**

Source: authors' design according to data from 41

The authors propose measures to be taken in order to reduce waste on the local or national level, including options to reuse products or increase the life cycle of a product for the purpose of preventing waste generation. **It is necessary to develop a system for sustainable management of municipal waste in line with the principles of circular economy, which is a very important goal for both EU members and non-EU countries[44].** Strategic planning of sustainable waste management is a great challenge[45]. The following steps also need to be taken:

- Recycling (any recycling process through which waste materials are reprocessed into products, materials or substances for its original or any other purpose, except using waste for energy, i.e., processing waste into materials used as fuel or as material for backfilling).
- Preparation for reuse (recycling processes through which products or parts of products that have become waste are examined, cleaned or repaired, and prepared for reuse without additional processing).
- Implementation of the circular economy model.
- Implementation of smart solutions and business digitalization.
- Implementation of the zero-waste concept. The zero-waste concept emphasizes the 3 Es (efficiency, economics and ethics), instead of the 3 Rs (recycling, reducing and reusing), which were the core of the integrated waste management concept proposed in 1990[46].
- Other recycling processes such as energy recycling and waste disposal.

In order to improve waste management in tourist destinations, the authors propose a schema for participatory engagement of all stakeholders at a destination. The responsibility does not lie solely with tourism subjects, it lies with all stakeholders from the economy, as well as scientific and teaching institutions. By connecting the economy, science and the public sector, we develop the triple helix model that is necessary to solve the challenges of waste management in a tourist destination. All stakeholders have to transform from passive consumers to active participants, they have to think globally about the issue of waste management, but also act and get engaged on the local level. Such a new concept of circular economy, where resources are used in all phases of the process, have a positive impact on both tourists and the local population. This creates a new way of thinking about the issues and it connects the stakeholders in order to facilitate a new eco/green lifestyle.

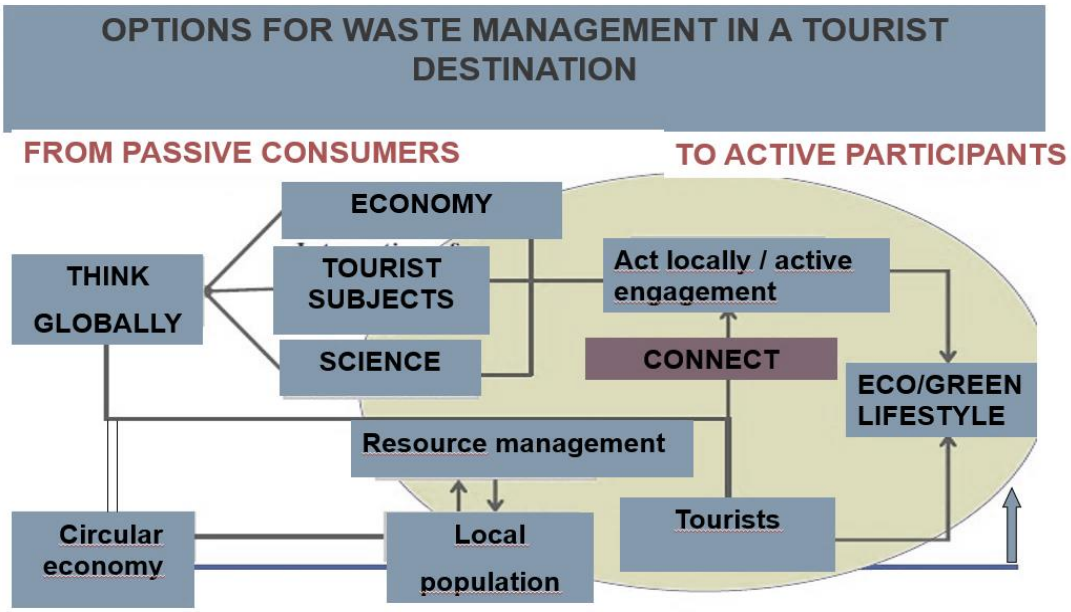

Figure 2: Options for waste management in a tourist destination
Source: authors

In order to reduce the amount of generated waste, in the future it is necessary to additionally strengthen existing measures and activities for preventing waste generation. Furthermore, if required, new measures and programmes should be introduced, but ensuring that there are no disruptions to the quality of life of the inhabitants and tourists visiting tourist destinations.

Conclusions and limitations

The total amount of municipal waste generated in Croatia in 2019 was 1,811,617 tonnes. This number can be characterized as negative because considering the fact that the above number for 2019 is 10% higher than what it was in 2015 (1,653,918 tonnes).

Such an increase is not in line with the Plan for Waste Management of the Republic of Croatia, which aims to reduce the amount of generated municipal waste by 5% from the amount recorded in 2015. Furthermore, collection of separated waste was supposed to be at 44% in 2019, but it fell short of the mark and only got up to 37%. These negative trends prompted an analysis of the situation per county, and the Primorje-Gorski Kotar County was selected as the second highest in amount of municipal waste. An overview of existing research by foreign authors revealed that some of them reached the conclusion that an increase in the amount of waste was caused by increased tourism activity. Our analysis of select tourism destinations, however, found that it is, in fact, the local population that has the greatest effect on increasing municipal waste. An increase in the number of overnight stays and arrivals in the analysed tourism destinations did not cause an increase in the amount of waste. It can therefore be concluded that the structure of tourists, in the sense of where they come from, also plays a role in the analysed data. If tourists arrive from countries with a developed waste management system, then their pro-environmental behaviour extends to their vacation, meaning that they display positive behaviour towards the environment because they are used to it. The analysed municipalities and city can thus serve as examples of good practices.

Taking into account the conducted analysis, the research problem was explained through the findings indicating that tourist arrivals and overnight stays in the area of the Opatija Riviera do not cause an increase in the amount of waste generated. The amount of waste is more closely tied to the local population, which means that the tourists visiting the area, whose numbers have greatly increased over time, are better educated and more informed about waste management. In light of that, the local population, companies and stakeholders have to focus more on proper waste management in the area of the Opatija Riviera. They also have to pursue a sustainable model of how municipal and other types of waste are generated and used.

This paper has many limitations, including the research methodology, so the authors propose a regression analysis or panel analysis for the future, spanning larger time series with higher data frequency. Another recommendation is to conduct an in-depth analysis per county or at least encompass a larger area. Tourists and/or the local population could also be included through questionnaires. Despite all limitations, however, in the scientific sense the paper contributes to existing literature, while in the practical sense the paper advises decision-makers in units of local self-government that tourist destinations in the Opatija Riviera area need to promptly implement the circular management model, undergo a digital transformation and implement smart solutions. All of these projects fall within the scope of the European Union's next financial period (2021 – 2027), which additionally shows just how important these issues have become. The paper further contributes by presenting and proposing solutions to numerous challenges, as well as emphasizing examples of good practices.

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Komunální odpady: výzvy a příležitosti v cestovních destinacích

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Abstrakt

Odpad lze vnímat jako problém životního prostředí, ale lze k němu také přistupovat jako ke zdroji využívanému k výrobě nového zboží. Evropská unie si ve svém právním rámci stanovila vysoké cíle v odpadovém hospodářství. Chorvatská republika jako člen EU bude muset stanovené požadavky respektovat. Hlavním cílem tohoto příspěvku je analyzovat nakládání s odpady v okresech po celém Chorvatsku se zvláštním důrazem na města a obce v oblasti Opatijské riviéry, a také sledovat množství komunálního odpadu produkovaného cestovním ruchem.

Opatijská riviéra je studijní oblastí tohoto výzkumu, protože obyvatelé a turisté ve městech vytvářejí stále více městského odpadu, který je úzce spojen s neudržitelnými modely spotřeby a výroby. Autoři v příspěvku používají různé metody, jako je analýza stávajícího stavu, pozorování a shromažďování, zpracování a interpretace sekundárních dat. Hlavním zdrojem dat jsou statistické výkazy a výkazy o hospodaření městských společností. Výzkumnou otázkou je, zda nárůst ukazatelů cestovního ruchu ovlivňuje nárůst odpadu v destinacích cestovního ruchu.

Autoři poukazují na potřebu změnit spotřebu a výrobu tak, aby občané produkovali méně odpadu a zároveň využívali odpad jako zdroj v procesu oběhového hospodářství. Nedostatečné nakládání s odpady přispívá ke znečištění životního prostředí, znečištění ovzduší a zintenzivnění klimatických změn. Výsledky ukazují, že analyzované destinace cestovního ruchu nezaznamenávají nárůst celkového odpadu i přes nárůst ukazatelů cestovního ruchu.

Příspěvek dokazuje, že složky sledované místní samosprávou vedou k většímu dodržování předpisů EU týkajících se odpadového hospodářství. Přínos příspěvku spočívá v poznání, že odpad ve městech má z hlediska ekologie a ekonomiky tři různé hodnoty – druhotné suroviny, energie a životní prostředí. Ve vědeckém smyslu článek přispívá k existující literatuře, zatímco v praktickém smyslu článek doporučuje osobám s rozhodovací pravomocí v místní samosprávě, že turistická města v oblasti Opatijské riviéry musí urychleně zavést model oběhového hospodářství, projít digitální transformací a implementovat tzv. „chytrá“ řešení. Všechny tyto projekty spadají do rámce stávajícího finančního období Evropské unie (2021 – 2027), což navíc poukazuje na důležitost těchto otázek. Příspěvek dále přispívá tím, že představuje a navrhuje řešení mnoha výzev, stejně jako zdůrazňuje prezentované turistické destinace jako příklady dobré praxe.

Klíčová slova: *komunální odpad, oběhové hospodářství, destinace cestovního ruchu, město*