



Application of Environmental Indicators of Sustainable Tourism in City Omiš

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Abstract: *This work elaborates on the applicability of environmental indicators of sustainable tourism CROSTO at the destination of the city Omiš (Croatia). Criteria of availability, reliability, clarity and feasibility were considered. Tourism share in energy consumption, water consumption, waste and wastewater generation, as well as the number of eco-certified firms, were analyzed. Findings suggested that CROSTO indicators are applicable for sustainable destination management in the city Omiš. However, additional efforts are indispensable in order to improve their availability and visibility. Finally, although a certain level of environmental sustainability of tourism activities in the city Omiš was detected, further improvements are required.*

1. INTRODUCTION

Tourism nowadays is a leading economic sector in Croatia, and city Omiš is also aligned with such a trend. The seasonality of tourism activities is pronounced in city Omiš since the most attractive factors are geographical location and natural beauties (sun, sea and sand). Such trends create pressures on natural resources, water supply, electricity and waste management systems. On the other hand, [Kružić \(2004\)](#) points out that such pressures may be diminished by adequate public infrastructure. Additional pressures are formed since tourism activities usually take place within a narrow coastal strip ([Vojnović, 2014](#)). Therefore, a careful consideration of its impacts and externalities is needed. For that reason, [Kozić and Mikulić \(2011\)](#) suggest implementing the principles of sustainability in tourism management.

Burtland's commission, „Our Common Future (1987) defines sustainable development as a development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” ([United Nations, 1987, paragraph 27](#)). Different authors further operationalized and adapted the initial definition to a specific research context ([Drljača, 2012](#); [Smolčić Jurdana, 2003](#)). In this context, [Costanza \(2020\)](#) points out that the influence of natural capital on sustainable human well-being is not straightforward, but it requires interactions with other three types of capital: social, human and built capital.

The World Tourism Organization defines sustainable tourism as “tourism that takes full account of its future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities” ([World Tourism Organization, 2005, p. 13](#) in [World Tourism Organization, 2022, p. 15](#)).

In order to support the development of sustainable tourism, the Croatian institute of tourism developed a system of sustainable tourism indicators CROSTO (Croatian Sustainable Tourism

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Observatory) based on the relevant UNWTO methodology which provides a set of sustainable tourism indicators further modifiable depending on specific needs (Klarin, 2017).

This research aims to investigate the current relationship between tourism and the environment concerning water and electricity consumption, and waste and wastewater generation by applying CROSTO indicators in city Omiš. Relevant data availability is examined to consider further monitoring of sustainable tourism management in the destination. It is further elaborated if the selected CROSTO indicators are applicable in the city Omiš at all. Finally, the seasonality character of resource use and the application of eco-friendly certification are considered.

The methodology of CROSTO with respect to data collection is applied. Required secondary data were collected and criteria of availability, reliability, predictivity, clarity and measurement feasibility were taken into account. For the matter of tractability, only CROASTO environmental indicators were considered to evaluate the existing scale of tourism impact on the environment in city Omiš. Data of HEP (HEP Group), Vodoopskrba grada Omiša (Water utility company of city Omiš), Turistička zajednica (Tourist Board) and waste management company Peovica were used to construct the following environmental indicators of sustainable tourism:

1. Tourist energy consumption over resident energy consumption (by overnight stay);
2. Water consumption over resident water consumption (by overnight stay);
3. Percentage of wastewater treated by at least second level prior to discharge (by overnight stay);
4. Communal waste generation by tourists over communal waste generation by residents (by overnight stay);
5. The share of tourism enterprises that apply voluntary eco-friendly certification schemes.

The findings of this research will contribute to the knowledge about sustainable tourism management in Croatian coastal tourism destinations at the municipality level.

2. SUSTAINABLE TOURISM

As pointed out by World Tourism Organization (2023) „Tourism can directly or indirectly contribute to all 17 goals of the SDGs“. Tourism is explicitly mentioned in Target 8.9. which refers to sustainable economic growth, Target 12.b on sustainable consumption and production, Target 14.7. on sustainable use of oceans and marine resources (Table 1).

Table 1. Targets of SDG where sustainable tourism is explicitly mentioned

SDG	8. Inclusive and sustainable economic growth
Target	8.9. “by 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products”
SDG	12. Sustainable consumption and production
Target	12.b. “develop and implement tools to monitor sustainable development impacts for sustainable tourism which creates jobs, promotes local culture and products”
SDG	The sustainable use of oceans and marine resources
Target	14.7: “by 2030 increase the economic benefits to SIDS and LDCs from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture, and tourism”

Source: World Tourism Organization, 2023

As it is noted, Target 12.b. specifically refers to monitoring sustainable tourism impacts. One of the suggestions is to consider already developed tools of Tourism Satellite Account (TSA)

and the System of Environmental-Economic Accounts, as well as the Statistical Framework for Measuring the Sustainability of Tourism (World Tourism Organization, 2023, p. 207).

Smolčić Judrana (2003, p. 15) lists four spheres of sustainability: environmental, social, economic and technological. Angelevska-Najdevska and Rakicevik (2012, in Mičetić Fabić, 2017, p. 27) list the next sustainability principles: environmental, social, cultural and economic, while Čavlek (2011) lists even eleven of them. Sustainable development implies that three types do not decrease. Environmental sustainability refers to the preservation of natural capital.

Sustainable tourism indicators are discussed in the remaining part of the paper. They can be defined as „empirical, quantitative and qualitative measurements and evaluations used to detect state and represent valuable information for the creation of development plans and decisions related to tourism“ (Blažević et al., 2013, p. 148). Črnjar and Črnjar (2009) point out the following good properties of tourism indicators: specific, measurable, usable, flexible, available and effective. Dresner (2008, p. 28) mentions that indicators can follow the logical of the DPSIR framework that there are four groups of indicators related to pressures, state, impact and responses (Črnjar & Črnjar, 2009, p. 105) while Vojnović (2013) develops a set of sustainability indicators customized for the specific research aims which consist of three groups: environmental, economic and social indicators.

European Commission suggests seven steps of sustainable tourism indicators implementation applicable to ETIS (The European Tourism Indicator System, 2016):

1. awareness raising,
2. development of the destination profile,
3. establishment of the stakeholder workgroup,
4. identification of roles and responsibilities,
5. data collection and processing,
6. analysis of results,
7. enabling further development and continuous monitoring.

Table 2. Overview of the basic CROSTO indicators by categories

Category	Indicator
Social	Number of tourist overnights by a hundred residents
	Share of destination residents who are satisfied with tourism
	Share of tourist who are satisfied with their overall experience in a destination
	Percentage of repeated/permanent tourists in a destination
Economic	Number of tourists overnight stay in the destination
	Direct employment in tourism as a share of the total employment
	Percentage annual bruto occupancy of tourist commercial accommodation
	Average daily tourist consumption in Euros
Environmental	Tourist energy consumption over resident energy consumption (by overnight stay)
	Water consumption over resident water consumption (by overnight stay)
	Percentage of wastewater treated by at least second level prior to discharge (by overnight stay)
	Communal waste generation by tourists over communal waste generation by residents (by overnight stay)
	The share of tourism enterprises that apply voluntary eco-friendly certification schemes
Spatial	Share of destination non-construction area occupied by facilities for catering and tourism
	Number of beds in the household per km ² of the total built-up area of the construction area of the settlement

Source: CROSTO, n.d.

Sustainable tourism indicators proceed from principles presented in Agenda 21 as well as from the work of UNWTO (Mičetić Fabić, 2017, p. 77). CROSTO is a Croatian observatory for sustainable tourism development that developed a manual with sustainable tourism indicators in 2016 which are based on ETIS presented in Table 2.

This work contributes to the previous work by assessing the possibility of implementing CROSTO environmental indicators in city Omiš where July, August and September belong to peak tourist season due to the focus on 3S tourism.

3. APPLICABILITY OF CROSTO ENVIRONMENTAL INDICATORS TO MEASURE TOURISM SUSTAINABILITY IN CITY OMIŠ

This part presents the results of the application of the CROSTO environmental indicators to city Omiš. Data needed for this study were obtained from the following sources: Croatian Bureau of Statistics, Tourist Board of City Omiš, public utility companies, and Croatian financial agency FINA. The following CROSTO environmental indicators were calculated. The monthly data were analyzed for two months: January and August. The monitored values usually reach their minimums in January and maximums in August. The instructions of the CROSTO manual were applied and adjusted to the local level to calculate the intended indicators. The short-run period of measurement would not allow for drawing a conclusion about environmental sustainability in the city Omiš.

3.1. Tourist Energy Consumption over Resident Energy Consumption (By Overnight Stay)

The following data were used:

- Total final energy consumption in MWh in January,
- Total final energy consumption in MWh in August,
- Total number of realized tourist nights in January,
- Total number of realized tourist nights in August,
- Population.

Electricity consumption data were obtained from Croatian public electricity supplier HEP, while the data about tourist overnight stays were obtained from the Tourist Board of City Omiš. Furthermore, only the information about commercial tourist overnight stays was applied due to the unreliability of the datasets about non-commercial accommodation.

Table 3. Tourist energy consumption over resident energy consumption

Tourist energy consumption over resident energy consumption (by overnight stay) = (MWh by tourist overnight stay) / (MWh by resident overnight stay)				
Year	2019	2020	2021	2022
GWh by tourist overnight stay	0,0040	0,0042	0,0046	0,0044
GWh by resident overnight stay	0,01587	0,0132	0,0150	0,0144
Energy consumption ratio between tourists and residents	0,25	0,32	0,30	0,3014

Source: Own calculations

Due to the constraints in data collection, the electricity consumption for city Omiš was estimated by applying a rate of 60% (based on the population share) of electricity consumption of the whole distributive area which includes local governmental units Omiš, Dugi Rat, Zadvarje and

Šestanovac. The following formula was applied following the detailed CROSTO methodology for the calculation of the indicators and the results are presented in Table 3.

3.2. Water Consumption over Resident Water Consumption (By Overnight Stay)

Water resources play a very important role in the quality of the tourism supply, but they are under pressure due to climate change, in particular in the sensitive karstic area of the Croatian coast. Apart from significant losses in water supply systems, tourism seasonality represents additional pressure on water supply infrastructure, in particular in small tourist destinations such as Omiš.

Public provider Vodovod d.o.o. supplies Omiš with water from the water source Vrilo and river Cetina. The hinterland area of the city Omiš is supplied by water systems of cities Sinj, Split, Makarska and source Studenac.

The following indicators were used to calculate the relevant indicator:

- Total final water consumption in January,
- Total final water consumption in August,
- Total number of overnight stays in January,
- Total number of overnight stays in August,
- Number of residents.

The following formula was applied following the detailed CROSTO methodology for calculation of the indicators and the results are presented in Table 4.

Table 4. Water consumption over resident water consumption

Water consumption over resident water consumption (by overnight stay) = (Water volume by tourist overnight stay) / (Water volume by resident overnight stay)				
Year	2019	2020	2021	2022
Liter by tourist overnight stays	0,42	0,53	0,46	0,44
Liter by resident overnight stays	0,13	0,12	0,14	0,14
Water consumption ratio between tourists and residents	3,10	4,46	3,29	3,08

Source: Own calculations

The calculated indicators demonstrate, except for 2020, that the water consumption of a tourist is 3 times larger than the water consumption of a resident.

3.3. Percentage of Wastewater Treated by at Least Second Level Prior to Discharge (By Overnight Stay)

Wastewater management systems are under high pressure during summer months due to tourism seasonality. This issue is additionally pronounced in destinations with beaches and sea as the main tourist attractions.

The coverage by the water sewage water system in Omiš is only 35%. Part of the reason is also the fact that the part of the space is sparsely populated and thus, the construction of a standard sewage water system is not economically viable. Thus, alternative models of sewage water treatment need to be considered. Public company Vodovod d.o.o. provided the necessary data for the calculation of the corresponding indicators presented in Table 5.

- Untreated water discharge in cubic meters.
- Treated water discharge in cubic meters: first degree, second degree and third degree.
- The share of the population is connected to wastewater purification systems.

Table 5. Percentage of wastewater treated by at least second level prior to discharge

% of waste water treated by at least second level prior to discharge (by overnight stay) = (Water purified to at least 2 nd stage in m ³) / (Discharged waste water in m ³)				
Year	2019	2020	2021	2022
Water purified to at least 2 nd stage in m ³	0	0	0	0
Discharged wastewater in m ³	830.000	710.000	770.000	757.000
% of wastewater treated by at least second level prior to discharge (by overnight stay)	0	0	0	0

Source: Own calculations

There are no communal waste water purification systems to at least 2nd degree installed for now in the administrative area of city Omiš, and thus the value of this indicator was zero for the last four years.

3.4. Communal Waste Generation by Tourists over Communal Waste Generation by Residents (By Overnight Stay)

Communal waste management in Omiš is operated by Peovica d.o.o. which provided the following data needed for the calculation of the relevant indicator presented in Table 6:

- total final waste generation in January,
- total final waste generation in August,
- total number of tourist overnight stays in January,
- total number of tourist overnight stays in August,
- population number.

Table 6. Communal waste generation by tourists over communal waste generation by residents

Communal waste generation by tourists over communal waste generation by residents = (Kg of waste by tourist overnight stay) / (Kg of waste by overnight stay of resident)				
Year	2019	2020	2021	2022
Kg by tourist overnight stays	1,40	1,21	1,34	1,16
Kg by resident overnight stays	0,90	0,91	0,72	0,75
Communal waste generation by tourists over communal waste generation by residents	1,55	1,33	1,86	1,56

Source: Own calculations

Previous analysis indicated that waste generated by tourists during an overnight stay is about 50% larger than waste generated by residents during an overnight stay.

3.5. The Share of Tourism Enterprises That Apply Voluntary Eco-Friendly Certification Schemes

Environmentally friendly certification schemes are designed to enable differentiation of producers or service providers who apply practices in their operations that are not harmful to the environment. Such schemes are developed for various economic activities: agriculture, manufacturing, tourism services, etc. Apart from environmental concerns, also other aspects of sustainability are considered within those schemes. A widely applied environmentally friendly

certification scheme is EU Ecolabel. However, other certification schemes are also relevant in the context of sustainable tourism development in Croatia such as Travelife, Green Key, Eco-Camping, Dalmatia Green and Biosphere Sustainable, etc.

The share of tourism enterprises that apply voluntary eco-friendly certification schemes was calculated by dividing the number of enterprises that apply voluntary certification schemes or environmentally friendly labeling by the total number of tourist enterprises. Due to the lack of official statistics on environmentally friendly certified enterprises in Omiš, only the anecdotal presentation was possible. The total number of firms acting in the sector of accommodation was 55 in Omiš, while there were 41 firms registered as main activity for tourism agency services and reservations (FINA, 2023).

According to anecdotal information, a few tourism services providers applied some type of environmentally friendly certification schemes. Dalmatia Green, a certificate issued by the Association for nature, environment and sustainable development Sunce for small tourist accommodations that apply principles of sustainability, is possessed by three accommodation units: Villa Carica in Mimice, and Apartman Petea and Boutique hotel Villa Dvor in Omiš (Dalmatia Green, n.d.). Hotel Villa Dvor also obtained a Travelife certificate for accommodation.

However, the implementation of systematic monitoring and overview of enterprises that apply voluntary certification schemes or environmentally friendly labeling is required in order to reliably determine their share in the total number of firms related to tourism. Also, as an initial step, it would be necessary to develop procedures for the identification of tourism enterprises. Additionally, as could be noted above, the eco-friendly certificate Dalmatia Green is assigned to accommodation units including family-run apartments which are not included in the official statistics of crafts or firms. Thus, as one of the initial steps, a careful approach to data framing needs to be designed.

Also, the information presented on eco-certified tourism activities in the destination is anecdotal. Instead, firstly, it would be necessary to identify and list potential certification schemes. The next step would involve collection of the official information from the certification bodies about a precise number of firms in city Omiš that possess those certificates at a given moment. Namely, issued certificates are usually valid until specific dates and they are not unlimited. Thus, certificated tourism units may vary from year to year.

To conclude, the information needed for this indicator seems the most heterogeneous and the least standardized. The existing global efforts in sustainable tourism development might suggest that more standardized and globally harmonized approaches might be proposed in the future supporting further methodological development of the relevant indicator.

4. DISCUSSION

The analysis of collected data indicates that the basic environmental CROSTO indicators are generally implementable in city Omiš since public utility companies in general collect raw data which serve as input for the investigated indicators. Limitations were observed concerning the indicator measuring the share of tourism enterprises that apply voluntary eco-friendly certification schemes. Namely, the data collection framework should be further elaborated, firstly in order to provide an adequate definition of the business entities operating in the tourism sector,

and secondly, in order to systematically monitor relevant eco-friendly certification schemes relevant for tourism.

Thus, the existing information database would represent a satisfactory basis for further monitoring of sustainable tourism in city Omiš based on CROSTO indicators. Considerable seasonality in water consumption is observed between January and August. It can be discussed which is the contribution of tourism in the water consumption peaks during the summer. Namely, additional water demand for farming can also contribute to the detected disparities.

While tourists spend about 3 times more water than residents, the main consumers of electric energy were residents according to CROSTO indicators which is interpreted by the dominance of beach tourism which does not require a significant consumption of electric energy. The waste production of tourists is half above the quantity of waste produced by residents.

Application of eco-friendly certification and labels by tourism firms is very low with an exceptional case of Hotel Villa Dvor. On the other hand, the global trends on sustainable business practices (for example CSRD and the EU taxonomy) might as well shift the practices of tourism enterprises operating in the city Omiš. Finally, in line with the new sustainability reporting frameworks for businesses, it may be questioned if the existing indicator can be complemented by additional indicators showing the sustainability practices of tourism enterprises in city Omiš.

This paper adds to the existing knowledge on the application of sustainable tourism indicators at the municipal level. [Marinello et al. \(2023, p. 10\)](#) conducted a systematic literature review and found that only one study of sustainable tourism indicators refers to the municipal level. Those authors also point out that despite a very rich literature on sustainable tourism indicators there is a limited comparability of the results obtained. [McLoughlin et al. \(2020\)](#) applied an ETIS questionnaire to assess the state of tourism in County Clare, Ireland. They find that there is a need for additional improvement of environmental indicators of sustainable tourism.

5. CONCLUSION

The application of sustainable principles in the management of tourism destinations has been considerably advanced since the initial definition of sustainable development in 1987. The methodology for monitoring sustainability in tourism destinations has been considerably advanced in the last decades resulting in systems of indicators related to various dimensions of sustainability. City Omiš is an example of a destination whose strengths rest on natural beauties and preserved local traditions. This paper examined if the environmental CROSTO indicators can be applied in such a case.

This research confirms that there is an appropriate information basis for the calculation of the indicators which indicate that tourists in Omiš contribute considerably more to water consumption and generation of communal waste. The waste water treatment indicator was zero suggesting that Omiš might consider the implementation of waste water purification systems. Also, the data tourism enterprises that apply eco-friendly certification schemes were limited suggesting that further advancement in this area is needed.

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