AIR QUALITY INDICES - CASE STUDY: ENVIRONMENTAL SUSTAINABILITY PILLAR AND ROMANIA'S POSITIONING IN THE EUROPEAN AND GLOBAL CONTEXT

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Abstract

Daily exposure to ambient air pollutants harms human health and the environment. Even though in recent years air quality is a taboo subject discussed and researched by many interested areas, pollution indices often exceed the pollution norms imposed by the authorities in major European cities. In response to these environmental problems, the European Union has created a body of legislation on pollution indicators. On the other hand, World Economic Forum promote the travel tourism competitiveness index (including the pillar of environmental sustainability). The purpose of this paper is to present and analyse the indicators from the environmental sustainability pillar within TTCI (Travel and tourism competitiveness index) and the air pollution indicators, respectively the air quality standards and the pollution norms. As a short result, România exceeds at some indicators and has a lot to improve at the others (Enforcement of environmental regulations).

Key words: Air quality indices; regulations; air pollutants; human health; environment; tourism industry

1. Introduction

Air pollutants stand out in nature through their different action on the human body and the environment [1]. Thus, in nature, pollutants are classified according to different characteristics, such as: chemical composition, persistence in the environment, ability to be transported, reactions, impact on human health and the environment [2]; [3]; [4].

Even though the term environmental pollution has been recognized since industrial revolutions by an important category of people, there are several authors [5]; [6]; [7], [8]; [9], which integrates the term

environmental quality into the quality of natural attractions, thus resulting in qualitative destinations in terms of the environment. The emergence of the term air quality comes with the technologizing of medicine and awareness of health problems related to mass pollution [10]. According to the director of the Clean Air Project, part of the Climate and Clean Energy program at NRDC (The Natural Resources Defence Council) concern that "*the most air pollution comes from energy use and production*" (John Walke) [11]. Therefore, the climate change, human impact, and daily innovation, make the fight against air pollutant's even harder to achieve the worldwide pollution standards [12].

Sustainable development is a dynamic concept, with many dimensions and interpretations, seen as a process of permanent change, very connected to the national and local context, national and local needs and priorities [13].

Understanding and using the word "environment" often tends to be associated with human impact on natural systems [14]. This context differs from the word 'ecological', which can be characterized as a concept of interdependence of elements in a system [15].

The main objective is the analysis of the indicators from the environmental sustainability pillar within TTCI (Travel and tourism competitiveness index) and the air pollution indicators, respectively the air quality standards and the pollution norms.

The second objective is the conceptual evolution of the above-mentioned indicators and the analysis of Romania's competitive position in the international tourism industry [16].

The advantages of data analysis show us Romania's position in a global context in terms of environmental sustainability and the data differences found between the years of biennial reporting.

Given the complexity of the research and the various dimensions of tourism, on the one hand, and the high interest in air quality standardization, we will address an interpretation and analysis of data both qualitatively and quantitatively. Also, as our main contribution to research was to simplify TTCI data and extract correlated indicators of environmental sustainability, thus facilitating the analysis of data for the years studied: 2009, 2011, 2013, 2015, 2017 and finally 2019.

The quantitative approach will verify the research hypotheses, to confirm them in order to exist the relationship between air quality and tourism.

2. Methodology

Environmental sustainability pillar in the tourism industry

Since 2007, the World Economic Forum (WEF) has started formulating indices that analyse the competitiveness of the tourism industry (TTCI) [17].

This system of indicators reports and measures the competitiveness of the major tourist destinations around the world, with the objective of assessing the factors and policies that make it an attractive destination for international tourism.

By hiring tourism leaders, the World Economic Forum aims to conduct an in-depth analysis of the competitiveness of this sector.

Distributed biennially, the Travel and Tourism Competitiveness Report and Index compares the competitiveness of the tourism division of 140 worldwide economies and measures the set of components and arrangements that empower the economic improvement of the "Travel & Tourism

(T&T)" segment, which in turn contributes to a country's financial advancement and tourism competitiveness.

The indicator system was developed in the context of the World Economic Forum Industrial Programmed for Aviation, Travel and Tourism as part of the Platform for Shaping the Future of Travel Mobility. It is undertaken in close collaboration with data gatherers Bloom Consulting, STR Global, the International Air Transport Association (IATA), the International Union for Conservation of Nature (IUCN), the World Tourism Organization (WTW) and the World Travel & Tourism Council (WTTC).

Part of the sub-index of policies and conditions favourable to the tourism sector the environmental sustainability pillar expresses the degree of involvement of each country in the ethical protection of natural resources, in the current context of the major effects of pollution worldwide. The attraction of a location is the extent to which the environment, natural resources and ecosystems are seen by tourists and the conditions under which the tourism industry complies with these important factors.

Air quality standards

According to National Centre for Environmental Health [18], European Environment Agency [19] and World Health Organisation [20]. in March 2021 the most common air pollutants are:

- Gaseous pollutants (e.g., SO_2, CO, NO_2, ozone or volatile organic compounds)
- Persistent organic pollutants (e.g., insecticides, pesticides, dioxins).
- Toxic heavy metals (e.g., lead, mercury).
- Particulate matter (including PM2,5 and PM10, respectively, known as coarse and fine particulate matter, the most recently discovered air pollutants)

The specific air quality index, in short "specific index", is a system for coding the recorded concentrations for each of the following pollutants monitored. World Health Organizations (WHO) released the first air quality guideline in 2000 [21].

The selected EU standards and the most recent World Health Organization (WHO) guidelines are summarized in the table no.1, including the maximum concentration on specific period.

Table 1- Air quality standards / specific period

Pollutant	Concentration	Period
PM 2.5	10 µg/m3	1 year
	25 µg/m3	24 hours
PM 10	20 µg/m3	1 year
	50 µg/m3	24 hours
SO2	350 µg/m3	1 hour
	125 µg/m3	24 hours
NO2	40 µg/m3	1 year
	200 µg/m3	1 hour
CO	10 mg/m3	Max. 8 hours/day
Lead (Pb)	0.5 µg/m3	1 year
Ozone	120 µg/m3	Max. 8 hour/day
Arsenic (As)	6 ng/m3	1 year
Cadmium (Cd)	5 ng/m3	1 year
Nickel (Ni)	20 ng/m3	1 year
Polycyclic Aromatic Hydrocarbons	1 ng/m3	1 year

Source: Made by author according to the European Environmental Agency

The TTCI indicators, especially the indicators of the environmental sustainability pillar and the air quality standards have the role of highlighting the possibility of a competitive ranking area / country on the tourist market. The use in the analysis and research of the above-mentioned indicators, presents the possibility to be correlated together with other macroeconomic indicators and specific to the tourism industry, to create a hypothesis rarely found in tourism: tourists prefer destinations that enjoy higher air quality compared to others.

3. Results and discussion

Europe remains the most competitive region in terms of tourism. Europe is home to six of the top 10 economies with scores and has some of the best cultural resources in the world, leading infrastructure, especially for land, port and tourist infrastructure.

The region also has the best favourable policies and conditions applicable to the tourism sector. Despite its history and 'oldness' in the market, the region was also the most favourable region in the 2017 report, being at the top of price competitiveness, air transport infrastructure and ICT promptitude. While Western, Southern and Northern Europe remain the competitive core of the region, the Balkan regions and the sub-regions of Eastern Europe and Eurasia recorded the highest average increase in the TTCI score.

Since 2007, Romania has been included in the reports on the system of indicators of tourist competitiveness. According to the data analysed, Romania ranks in the middle of the ranking in each report carried out. However, according to Table 2 we can see a major increase from the 2017 report, where Romania ranks 68th, to a 56th place ranking, while all countries/economies want to grow or remain at the top of the ranking.

Table 2- Evolution of Romania and the countries analysed in the ranking of the system of indicators of tourist competitiveness

Year	2007	2009	2011	2013	2015	2017	2019
Countries	124	133	139	140	141	136	140
Position	63	66	63	68	66	68	56

Part of the sub-index of policies and conditions favourable to the tourism sector the environmental sustainability pillar expresses the degree of involvement of each country in the ethical protection of natural resources in the current context of the major effects of pollution worldwide (ANM) .The attraction of a location is the extent to which the environment, natural resources and ecosystems are seen by tourists and the conditions under which the tourism industry complies with these important factors.

The 10 indicators (and a short description) that make up the Tourism Sustainability Pillar can be found in the table below.

Table 3 Environmental Sustainability Pillar Indicators and Their Description

Name	Description
Stringency of environmental regulations	The emphasis on the reuse of resources in a 'circular' economy and the number of wastes to reach 0.
Enforcement of environmental regulations	Involvement of government and local authorities in the implementation of proposed environmental regulations and the application of sanctions where they are not respected.
Sustainability of travel and tourism industry development	Development and modelling of the industry with the aim of protecting natural resources and the material base of the industry.
Particulate matter (PM2,5) concentration	PM2.5 are tiny particles in the air that reduce visibility and make the air blurry when levels are high. Exposure to fine particles can cause short-term health effects such as eye, nose, throat and lung irritation, cough, sneezing, runny nose and shortness of breath.
Environmental treaty ratification	International agreement of 29 environmental treaties that should be applied in each country
Baseline water stress	Water stress affects the ratio of total water use to the annual total available water
Threatened species	Lists endangered animals in a region/country considering the authorities' measures to protect them
Forest cover change	Represents the measure/percentage in which old forests are rejuvenated. This indicator also includes the restoration of forest areas after massive falls.
Wastewater treatment	It is a concern for the environment from many perspectives. First it is necessary to have water treatment

	systems, then to encourage companies to use water and not least to stimulate responsible water consumption among tourists
Fish stock status	Fish stocks

For a detailed analysis of these 10 indicators, we can see Romania's current position on tourist competitiveness in the 2019 WEF report [22]. According to the information also specified in table 4 on Environmental Sustainability Indicators, the score obtained, the ranking position, the average value and the highest ranked countries, we see a better positioning for the indicator on " Environmental treaty ratification " (score 25/27, heading 27/140). The lowest ranked was the " Sustainability of travel and tourism industry development " indicator well below average (heading 113/140). There is also an indicator with no data being shaved, namely 'Live fish stock'.

Table 4 Environmental Sustainability Pillar Indicators – Report Romania 2019

Index component	Value	Rank 1/140	Best performer
Environmental sustainability	**4.4**	**48**	**Switzerland**
Stringency of environmental regulations	4.5	45	Finland
Enforcement of environmental regulations	3.3	103	Finland
Sustainability of travel and tourism industry development	3.5	113	Lesotho
Particulate matter (PM2,5) concentration	16.1	102	Mauritius
Environmental treaty ratification	25	27	Multiple
Baseline water stress	1.3	60	Multiple
Threatened species	5.9	73	Luxembourg
Forest cover change	0.0	38	Seychelles
Wastewater treatment	22.8	58	Multiples
Fish stock status	n/a	n/a	Yemen

The evolution of the Environmental Sustainability Pillar on Romania's reports in the system of indicators of tourist competitiveness began from the 2009 report. For the first three reports, the pillar contains only 7 relevant indicators, with the current 10 indicators to be updated from 2015.
According to table 5, in 2009 Romania ranked 6th in the ranking in terms of the indicator on "Concentration of fine particles". The insufficiency of the data thus ranks Romania in the primary positions in the first reports [23]. Thus, the relevant data on Fine Particle Concentration will only be considered in the 2015-2019 reports.

Table 5. Environmental Sustainability Pillar Indicators – Report Romania 2009

Index component	Rank/133
Stringency of environmental regulations	60
Enforcement of environmental regulations	67
Sustainability of travel and tourism industry development	121
Carbon dioxide emissions	71
Particulate matter concentration	6
Threatened species	62
Environmental treaty rectification	34

Table 6 looks at the same 7 pillars and we can see an increase in the 'Carbon Emissions' indicator from heading 71 in 2009 to heading 74 in 2011 [24].

Table 6 Environmental Sustainability Pillar Indicators – Report Romania 2011

Index component	Rank/139
Stringency of environmental regulations	71
Enforcement of environmental regulations	88
Sustainability of travel and tourism industry development	118
Carbon dioxide emissions	74
Particulate matter concentration	7
Threatened species	61
Environmental treaty rectification	30

The 2013 report [25] (Table 7) finds Romania from the perspective of the "Environmental Sustainability" pillar at 58th position, where Romania ranks 128/140 in the indicator of "Sustainability of the development of the tourism industry".

Table 7 Environmental Sustainability Pillar Indicators – Report Romania 2013

Index component	Score	Rank/139
Environmental sustainability	**4.7**	**48**
Stringency of environmental regulations	3.2	109
Enforcement of environmental regulations	3.0	101
Sustainability of travel and tourism industry development	3.2	129
Carbon dioxide emissions (mil tons/capita)	4.4	74
Particulate matter concentration (ug/m^3)	14.2	13
Threatened species (%)	4.8	66
Environmental treaty rectification (0-25)	22	20

Starting with the 2015 report [26], the 10-indicator variant is being switched to, as is also found in Figure 3.5. Analysing the data, Romania appears in this report

at position 46 from the perspective of this pillar, 12 positions ranked better than in the 2013 report.

Table 8 Environmental Sustainability Pillar Indicators - Report Romania 2015

Index component	Value	Rank 1/136
Environmental sustainability	**4.4**	**46**
Stringency of environmental regulations	3.8	90
Enforcement of environmental regulations	3.7	77
Sustainability of travel and tourism industry development	3.4	122
Particulate matter (PM2,5) concentration	14.9	124
Environmental treaty ratification	22	28
Baseline water stress	0.8	44
Threatened species	4.8	60
Forest cover change	1.0	35
Wastewater treatment	13.1	71
Fish stock status	0.0	6

According to 2017's report (table 9), the WEF proceeds with 10 indicators also included in the 2019. Analysing the data, between the two reports, we see a better positioning of Romania from the perspective of this pillar (43 -2017, 48-2019) [27].

Compared to the latest report (table 4), we can see a difference according to the position of Romania in the Environmental sustainability pillar, in special with the Particular matter (2.5) index. According to those reports, Romania increased the pollution with PM 2.5, from 11.9 ug/m^3 in 2017 to 16.1 in 2019.

Another important aspect to mention is the Sustainability of travel and tourism industry development index, which show a progressive ranking, from 121st position in 2009 to 113st in 2019.

Table 9 Environmental Sustainability Pillar Indicators - Report Romania 2017

Index component	Value	Rank 1/136
Environmental sustainability	**4.4**	**43**
Stringency of environmental regulations	3.8	79
Enforcement of environmental regulations	3.3	98
Sustainability of travel and tourism industry development	2.8	130
Particulate matter (PM2,5) concentration	11.9	111
Environmental treaty ratification	25	26
Baseline water stress	1.3	58
Threatened species	6.2	70
Forest cover change	0.0	40
Wastewater treatment	15.4	61
Fish stock status	0.0	5

4. Conclusion

The social and environmental problems imposed on contemporary society in recent times are proving to be a great challenge for all economies. Environmental protection becomes an essential prerequisite for achieving sustainable competitive advantage and an integral part of the proactive management of the tourism industry.

Although the term air quality is often analysed by public health specialists and environmental analysts, existing studies show little attention to the influence of these quality indicators on the tourism industry [28]

Of the existing studies to analyse competitiveness in tourism, only a small part presents and analyses an interdependent relationship between air quality and strategic / competitive positioning of destinations [29], [30], [31] with lower air pollution rates, or so-called environmental competitiveness [32], [33], [34].

The analysis of the data regarding the studied indicators shows us Romania's position in the global context. A better position in the ranking, offers Romania a better strategic competitive position on the tourism industry market. Basically, these data can be used both by public authorities, to obtain better results in the following reports, and by private companies that can use this data to promote Romania as a sustainable tourist destination. Even the lack of data in some fields such as: forest cover change, or fish stock status; they can create a starting field for collecting data from the field and transmitting it for future reports.

The sustainable development and strategic positioning of Romania can represent a huge potential for the tourism sector and the growth of economies at the national level. Thus, emerging economies will contribute large proportions of travellers to this global trend and most national destinations can become more and more desirable by tourists, thus increasing the quality of the tourist products offered.

The main objective of the next papers is to study, analyse and present existing research and different approaches of the authors based on the topic "Air quality and its influence on the tourism industry", analysing both the terms of air quality related to the tourism industry and health also publishes the effects of pollution on the health of the pawns of this industry, tourists. According to the Global Sustainable Tourism Council and Booking's Sustainable Travel Report in 2019, 70% of travellers around the world said that "*they would be more likely to book accommodation, knowing that it is environmentally friendly and in a sustainable environment, regardless of whether the expenses are higher*"[11].

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