„Dunărea de Jos" University of Galați
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ABSTRACT
DOCTORATE THESIS

Implementation of an integrated management in coastal areas by applying the principles of sustainable development

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CONTENT

INTRODUCTION

General context

The European Union has set the goal of becoming a smart, competitive, and equitable economy by 2020. The maritime sector provides opportunities for creativity, economic development, and job creation that can help achieve this goal. The 'Limassol Declaration,' adopted in October 2012 by European maritime ministers, aims to support the Europe 2020 strategy by providing a solid maritime foundation. As stated by the Commission, this working proposal is intended to be an integral part of the desire to improve Europe's blue economy expressed in the communication 'Blue Growth: Prospects for Sustainable Growth of Recreational Ports.'

However, increased use of marine and aquatic areas, as well as the impact on coastal and maritime infrastructure, as well as the atmosphere, natural hazards, and erosion, are all under threat. Coastal and aquatic habitats require integrated and consistent management to ensure their long-term development and protection for future generations. In general, we mean a public framework for evaluating and organizing the spatial and temporal distribution of human activities in maritime areas in order to achieve fiscal, environmental, and social goals through integrated coastal zone management.

The primary goal of marine coastal zone management is to create a common denominator of industrial plans and policies for the use of maritime and coastal zones for various purposes.

Integrated coastal zone management is a tool for the organized management of all policy mechanisms relating to coastal areas in order to promote the sustainable development of coastal and marine areas.

The EU is also a signatory to the Barcelona Convention, which in March 2011 adopted a protocol on integrated coastal region management. This Protocol imposes an obligation on the Member States surrounding the Mediterranean Sea to incorporate coastal management. Marine spatial planning and adaptive coastal zone control are complementary tools. They cross geographical areas in the Member States' coastal and territorial waters, where maritime strategic planning plans follow current human activities and determine the best spatial evolution in the future, while coordinated coastal management strategies ensure integrated control of these human activities. They work together to improve the architecture and management of the interface between the seas and the coastal zones.

STATE OF PLAY OF RESEARCH IN THE FIELD OF COASTAL ZONE MANAGEMENT

Coastal management as a strategic management system

Strategic management is defined as the evaluation, planning and implementation process designed to maintain or improve competitive [1]advantage. The evaluation process shall cover the assessment of external and internal environments. Planning involves the development of business models, corporate direction, competitive tactics, international strategy, acquisitions and collaborative actions. The implementation phase requires leadership to build the appropriate organizational structure, develop the management culture, control strategic processes and lead the organization through ethical corporate governance [2].

The coastal zone has an important social, economic and environmental significance. Various results show that 50% of the developed population of the world lives less than 1 km from the coast [3], while 60% of the world's population lives less than 60 km from the coast. The World Coastal Conference considers that "coastal zones" are areas that account for less than 15% of the Earth's surface, and coastal areas are the main places where people live. The existence of certain activities in coastal areas is necessary or beneficial and these activities should be encouraged. Individual activities in various sectors of activity often appear in competition and confrontation with others or exclude them completely. The success of the balance of the area is increasingly doubtful, since in relation to the basic requirements of protecting resources that are rapidly diminishing or altering, the coastal areas are close to reaching the capacity of bearability, andthe capacity to mitigate and adapt to new challenges is extremely limited [4]. The diversification and increase in the number of marine and coastal activities have expanded and increased the use and demand for the territory, causing problems related to environmental damage, including coastal erosion and marine protection, habitat loss, pollution and biodiversity removal. Given global warming and how certain coastlines will respond to the chaos caused, potential sea level rise is causing more and more of these problems. There are a variety of human activities on the shores of the world, although they seem to cause relatively local problems, in general, the interaction between human use and natural processes has begun to generate extensive coastal problems, and as a result, effective coastal shores are a necessary emergency in many parts of the world.

The European Union's coastline stretches over an area of over 58,000 km and supports 50% of the richest and most important ecological regions in Europe. The census shows that large-scale urbanization is on the rise, and European cities can be expanded directly or conveniently in the coastal zone. This has given rise to many unbearable tensions among the population in coastal areas [5].

SYNTHETIC RESENTATION OF THE THESIS

In order to efficiently analyze the coastal area, we have identified the significant activities that take place in this area, activities that have been divided according to their specificity, in economic activities, social activities and environmental protection activities. For each of the identified activities, an indicator was calculated which was analysed by its interaction with the other indicators. This analysis aims to develop a customized management model for the coastal zone, a model that can identify the pressures and threats that some activities that take place in the area have on the others. The analyzed model is based on an analysis of PESTEL factors (political, economic, socio-cultural, technological, environmental and legal). In the scientific literature, these analyses take various forms, depending on the factors analyzed, such as PEST (political, economic, socio-cultural, technological) and STEPE (sociocultural, technological, economic, political and environmental). [45]

The PEST analysis describes a framework of macro-environmental factors used in the environmental scanning component in strategic management. It is part of an external analysis when conducting a strategic analysis or conducting market research and provides an overview of the different macro-environmental factors to be taken into account. It is a strategic tool for understanding the growth or decline of the market, the position of the business, the potential and direction of operations.

Even if the political factors have a great importance on the development of a region, through the decisions taken at the governmental or regional level, we have chosen that in the studied cases not to analyze these decisions that have a pronounced subjectivity character. The influence of politics can affect economic development, social well-being, influence the quality of the environment, promote or diminish the emergence or implementation of new technologies. This factor can be analyzed both as a factor of progress but also as a risk factor that can make an area vulnerable. In the calculation of the political factor, several indicators are used, such as bureaucracy, level of corruption, freedom of the press, multi-partyism, free elections. The reports analyzed by the author of this work, which come from the United Nations, the World Bank, the European Central Bank, Unicef and the European Union, contain enough information about the political factor that places Romania and Ireland as states that meet their criteria for political efficiency and the rule of law. We also looked at the legislative provisions in the field of education, anti-trust, labour, discrimination, data protection, environmental and pollution protection, health and safety, competition regulation, tax policy (tax rates and incentives), intellectual property (copyright, patents), consumer protection and e-commerce. Regarding the technological factors, they were analyzed as indicators within the economic factor.

As mentioned before, the multi-criteria analysis model used in this situation was based on the type of PESTEL analysis. It should be borne in mind that each coastal zone has its specific characteristics. It is also necessary to validate the created model in time, by periodically conducting multi-criteria analyses, since a change in time in the values of the analyzed factors is possible. A detailed and short-range analysis can provide a clear model framework by identifying and mitigating potential vulnerabilities arising from pressures of existing factors in the coastal zone.

Figure II.5 shows the necessary steps to perform a type of PESTEL analysis. [46]

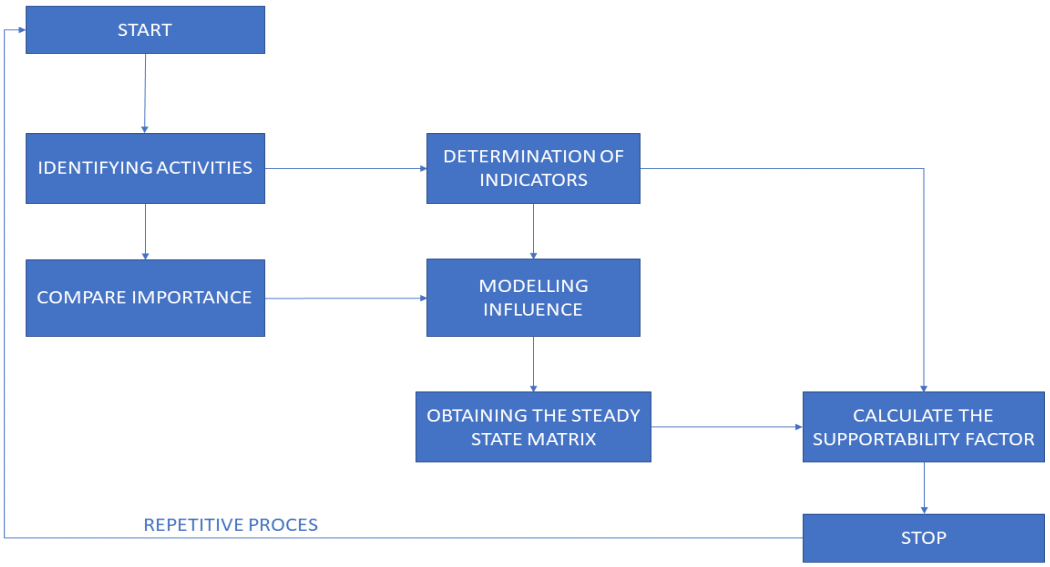

Figure II.5. General framework of the PESTEL analysis (Political, Economic, Socio-cultural, Technological, Environmental Protection and Legislative)

Source: author

The use of monte carlo method in the multifactorial analysis of coastal indicators

The multifactorial analysis of the coastal area on the Romanian Black Sea shore aims to establish the framework in which the activities in the analyzed area are carried out, to identify pressures that arise as a result of natural or human activities, pressures that can make the area vulnerable in the short, medium or long term. What we set out to do, instead, is to show which of the activities generates pressure and which activities bear this pressure. For this we used a statistical sampling technique to obtain a probabilistic approximation of the solution of a model, similar as in the case of monte carlo simulation. The simulation we are talking about combines probability distributions based on existing relationships in models by testing several combinations of input variables and storing the results for display. [47]

The term "Monte-Carlo Method" is used to refer to two different techniques. The first technique consists of evaluating integrals defined by the use of random variables. The objective is to calculate

$$\int_a^b F(x)\,dx$$

(where x can be a vector), estimating the expression

$$\int_a^b [F(x)/p(x)]\,p(x)\,dx,$$

where p(x) is the density function of the random variable defined on [a,b]. In this case, the initial problem is transformed into that of estimating the average of F(x)/p(x). This can be solved by generating random values for p(x) and then by calculating the mean of F(x)/p(x). [48]

The second meaning of the "Monte–Carlo method"involves the replacement of a real phenomenon with astatisticalexperience, which will be studied with the help of modern computing techniques. The random variables that intervene in the model are generatedwith the torul-calculaterby appropriateprocedures. In order to obtain an accurate image of the evolution of the phenomenon or process studied, the random variables must be estimated with as little deviation as possible in relation to those that occur in reality and the experiment must be repeated a conveniently large number of times, in order to highlightthe main features of themodeled phenomenon. [27]

The use of this method does not necessarily require the knowledge of the exact relations between the quantities to be estimated, but it is sufficient to highlight the complex of conditions in the presence of which the respective experiment takes place.

Analysis of supportability

The simple identification of the indicators in the case of the 3 factors proposed for analysis (economic, social and environmental factors) is not, from my point of view, sufficient to carry out an efficient analysis to be the basis of a model for the Eforie coastal area. By identifying the interaction between the factors, one can show the dependence of some of the activities on the others, as well as the areas where the interaction of these activities causes conflicts that can lead to the vulnerability of the coastal zone (Figure II.6). [46] [30] [13]

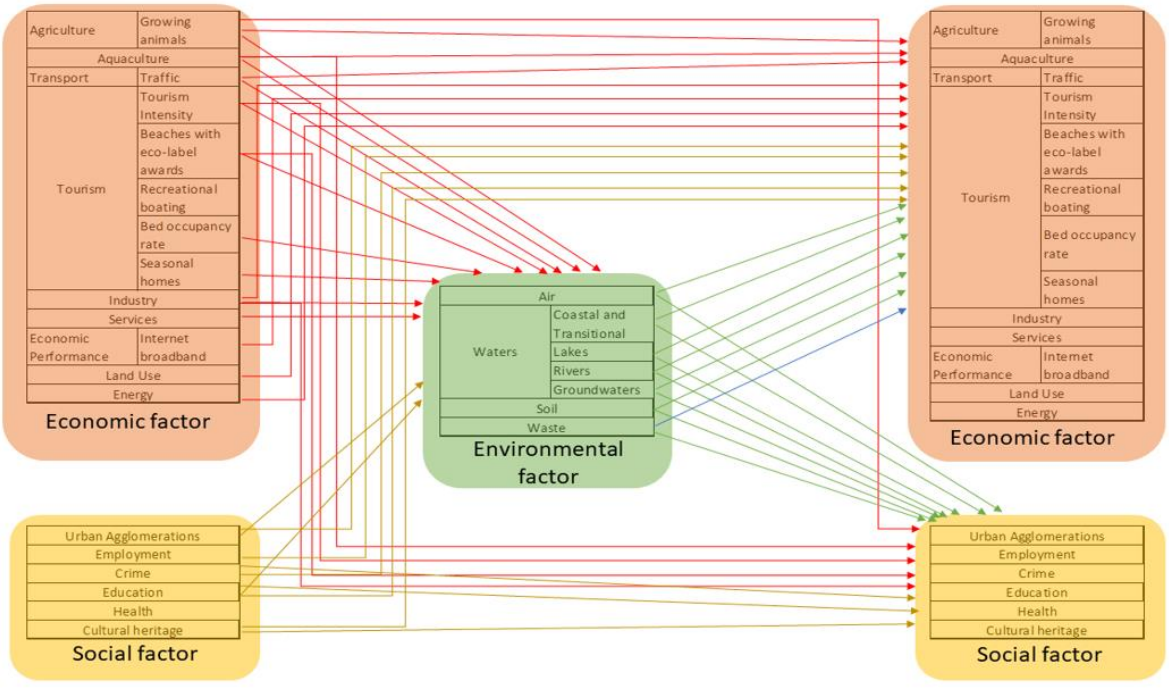

Figure II.6. Interaction between indicators proposed for analysis
Source: author's contribution

To see how much the interaction between these indicators of the analyzed factors means as a value, we used the notion of an affordability factor. The affordability factor is the framework by which one of the activities can affect another task. For activities that do not interact with each other or interact in an insignificant way, the affordability factor has been set to zero. For activities that have a significant or destructive effect on the others, the

bearability factor has been determined as negative, on a scale from zero to minus five, depending on the greater or lesser impact between activities. Also, if one activity had a positive effect on the other, the affordability factor was also positively established on a scale of zero to five. The impact was established on the basis of existing data from official sources. The allocation of these values was empirical, based on the data collected in the area, and also on similar studies carried out by various researchers or competent authorities in the field.

The object of the bearability analysis is to establish the context of the socio-economic and medium conditions against which investment measures will be introduced or the medium or long-term evolution of an analyzed situation. These conditions will effectively determine whether or not the proposed improvements will be bearable for the community and, in particular, for vulnerable social strata.

The calculation of the rate of affordability is made according to the following formula:

$$R_s = \frac{i\,(ep)}{i\,(sp)}$$

Where R_s indicates the rate of affordability, i (ep) represents the indicator that exerts pressure, and i (sp) is the indicator that supports pressure.

In the examples below we will also use the calculation of the general bearability index, according to the following formula:

$$Isg = \frac{\sum Rs}{n * Is}$$

where isg represents the general bearability index, Rs indicates the rate of affordability of the analyzed indicators, n represents the total number of indicators and Is represents the analyzed indicators. Similarly, the bearability index can be calculated on each factor. [30]

Strategic management as a planning process for coastal management systems

Strategic management is that component of an organization that targets medium and long-term development goals. The components of strategic management relate to the following aspects:

Strategic planning that relates to the process of identifying and evaluating resources and responsibilities, taking into account a certain time frame

Strategic change or transformational change that has the role of creating a new organizational environment that is much more competitive and sustainable than the previous one

Continuous improvement is the process that streamlines the relational activities between various internal or external actors of the organizational environment

The adaptive strategy is a strategy designed at organizational level to be able to keep up with the changes in the external environment of the organization

Michael Porter (1990) showed what are the determining factors of the adaptive strategy, which depends on the importance of development as well as the cultivation of a geographical concentration of existing resources, as well as the balance between the activities of the existing sectors in the area. (Figure II.7) [49]

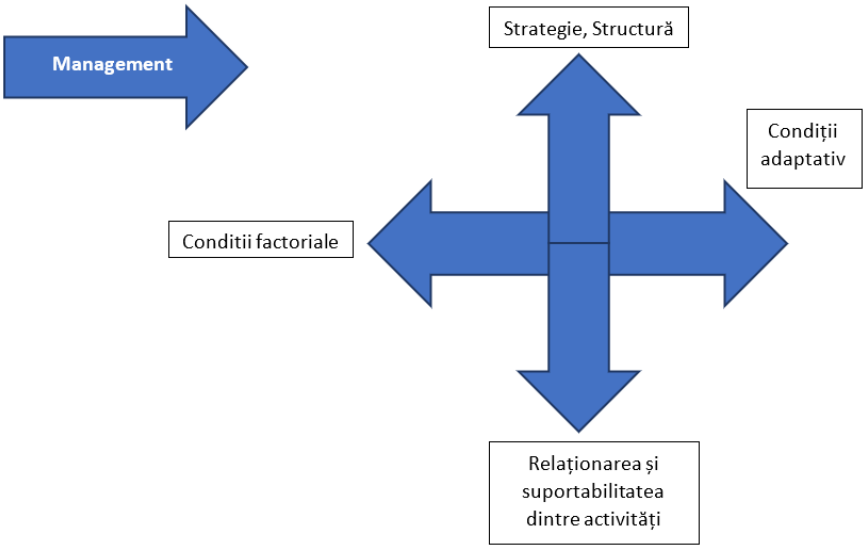

Figure II.7. Porter's diamond for adaptive strategy
Source: Porter, 2008

Implementation of a strategic management

Strategic implementation

Strategic implementation organises the structure and systems for the strategic management of a coastal area. The most important part is the design of an appropriate organisational structure, given the complexity of the coastal system. [50] A formal hierarchy of responsibilities is an organizational feature. This feature allows decision-making in a coherent and centralized way. [51]

Functional structure

The functional structure represents the division of activities into specialized activities, such as economic, social and environmental protection activities. This specialisation is necessary in order for entities operating in the coastal zone to develop expertise in order to be able to carry out their activity effectively. As a general system, the separated parts must be efficiently coordinated by an aggregator center; the structure is hierarchical, since the center at the top of the organization manages the overall design of the transformation.

Organizational processes

An organizational process is a sequence of tasks to achieve a goal proposed to be achieved in the coastal zone. Classically, processes are understood as functional cross-sectional informal activities that cross the vertical and hierarchical structure of an organization. The hierarchical structure provides a stable administrative framework, and the processes represent the organizational activity within that framework. Following Japanese practice, a new vision of business processes has emerged - that they should be organized around attracting customer requirements, rather than pushed from top to bottom by planners and specialist designers. For the management of business processes, processes decide, from the bottom up, the things required from specialists. However, the deployment of a higher-level strategy still requires coordination between functional areas.

Inter-functional activities

Many coastal planners argue that managing multifunctional objectives in their functional areas is a key strategic resource. This has been compared to the making of canvas, which involves crossing a horizontal feature over a vertical warp to achieve a strong kept fabric: the functional areas of an organization are the features and functionality centrally organized committees act as warp by conducting periodic reviews of the management of strategic objectives in functional areas. [52]

McKinsey's 7S framework

Systems are formal frameworks, documented codes, policies and procedures that condition routines and normal ways of working. They are important for the hierarchical structure as they clarify the responsibilities and reporting procedures. The boundaries of the system span large parts of an organization and have interconnected components that work together. A "systemic" way of thinking implies that people will see the whole picture, while in a functional organization from top to bottom there is always the danger of under-optimization. A systemic approach to strategic management is to adopt a holistic vision of an organization's activities and provide an integrative concept framework for guiding strategic decisions. The best known is McKinsey's 7S framework. [53]The setting was introduced by Tom Peters and Robert Waterman in their bestselling book *In Search of Excellence* (1982). Looking at an organization as a whole, seven factors are important to bring about change, but their essence is that they are interconnected (see Figure II.8).

1. Strategy: actions that an organization plans in response to or anticipation to changes in the external environment
2. Structure: the organisation that divides the tasks and ensures their coordination
3. Systems: processes, procedures, formal and informal
4. Style: The perception that a leadership team creates about itself in the organization
5. Staff: socializing managers in terms of what the business is
6. about
7. Skills: characterizing the organization in terms of what it does best, its dominant attributes or capabilities
8. Common values (or superordinated goals): the fundamental beliefs or ideas around which an organization is built

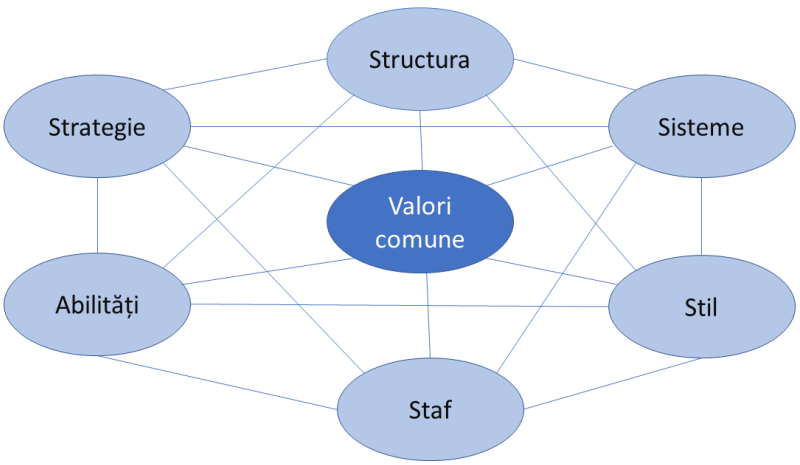

Figure II.8. McKinsey's 7S Framework: Organizing for Interconnectivity
Source: Peters & Waterman, 1982

Determination of the coastal management model for the Eforie – Romania case study

Eforie coastal management model

The approach to coastal research is, in fact, a multidisciplinary approach, and the complexity of coastal management is already known by the disciplines dealing with spatial planning. The interaction between the natural and the anthropogenic environment, on the one hand, but also the interaction between land and sea calls into question a number of risks and imposes a series of limits for an effective planning of activities in the area. The adoption of a strategic management for an integrated approach to the pressures developing in the coastal area seems to be the most appropriate solution for a long-term development of the area of interaction between land and sea. At EU level, this integrated approach to coastal zone management is particularly important in a context where coastal areas measuring around 68 000 km in more than 20 member countries. Despite this importance, there are a number of limitations in streamlining this type of integrated approach, namely:

- Inadequate forecasting systems (too extensive or inaccurate);
- Lack of integrated governance between maritime and coastal areas;
- Problems of organization of authority;
- Inertia in the public sector in adopting systemic solutions in the medium and long term;
- Lack of comparable local information systems;

From this perspective, the system is also volatile due to the way of planning and tries to simplify complex problems. The introduction of integrated coastal zone management or maritime spatial planning (MSP) and climate planning (CPP) instruments appears to be solutions to address existing interactions in the coastal area.

It is also true that anthropogenic pressures, increasingly accentuated in recent years, leave deep and visible traces on the environment. Concepts such as "sustainable development", "climate change", "environmental protection", "integrated management" are increasingly used by scientists but also by coastal planners. The integration of products and services, the understanding of their importance, the sustainable management of resources and the preservation of traditions are other elements that are taken into account when considering an area in the vicinity of the seas or oceans. In fact, the main point of analysis of most macroeconomic and social strategies is represented by the combination of economic and social factors with the components of the environment. It represents the pillar of strategic management within the multi-criteria analyses carried out both at the micro level, of a company, but also at macro level, at local, regional, sectoral, national or international level.

Description of the area

The present study refers to a multicriterial analysis of the coastal area of eforie area, located in the south-eastern part of Romania. Eforie is made up of two resorts (Eforie Sud and Eforie Nord). The village is located on the seaside strip between the Black Sea and Lake Techirghiol, at a distance of about 15 km from Constanta. The population is about 10 000 inhabitants. The city is mainly touristic, being known as the oldest spa resort on the Romanian Black Sea coast. The town is bordered to the north by the commune of Agigea,

to the south by the commune of Tuzla, to the east by the Black Sea, and to the west by the Lake Techirghiol (Figure VI.4).

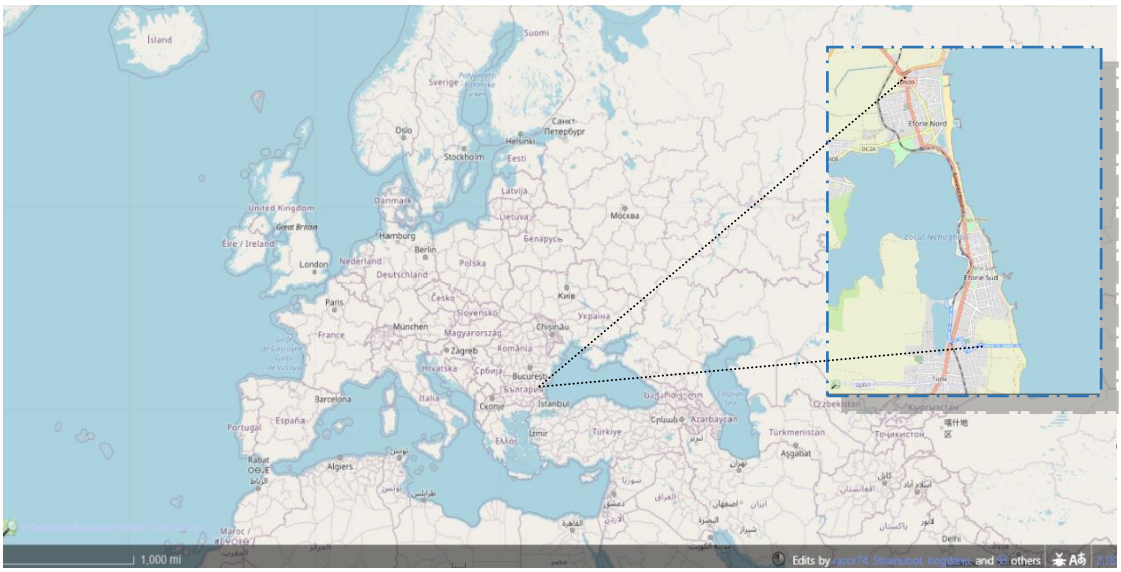

Figure VI.4. The geographical position of Eforie

Source: Openstreetmap.org image processed by the author

The climate is of continental-marine type, characterized by hot and dry summers and slightly cold winters, but often marked by strong blizzards. The temperatures of the area are much moderate by the presence of the sea, huge reservoir of thermal inertia, thus subsiding the excessive heat in summer and raising the average temperature in winter. Thus, the average annual temperature is 11.1 ° C. Atmospheric precipitation is below the level of 398 liters / sqm of water per year, which makes this land one of the areas poor in precipitation in Romania.

The orientation towards the east ensures an average of 300 hours of sunshine per month in summer and 2189 hours of sunshine annually, so well above the limit of the localities in Europe, located at the same altitude. The water of the Black Sea has a concentration of 15.5 grams per liter of mineral salts. The sea is complemented by a generous beach, completely devoid of tides, which maintains in good condition the fine sand on the beach and on the seabed. Winds have a high degree of instability both in direction and speed, with no regular winds. Winds in sector N, NE, NW account for 40.3% of the annual total, compared to 33.8% in the southern sector. These directions also record the highest average annual speeds of up to 7.4 m/s. The relief of the area is typical of an area with marine abrasion terraces, formed by covering the gravels of sarmatic structure with a thick layer of loess and is part of the Topraisar Plateau. The resources of the subsoil are of the type of limestone deposits of Jurassia age. [90]

Being on the road between Constanta and Mangalia, the city of Eforie is easily accessible both by road and by rail, both localities having a railway station and a bus stop. The nearest airport is Mihail Kogalniceanu Airport located 28km from Constanta, for air transport.

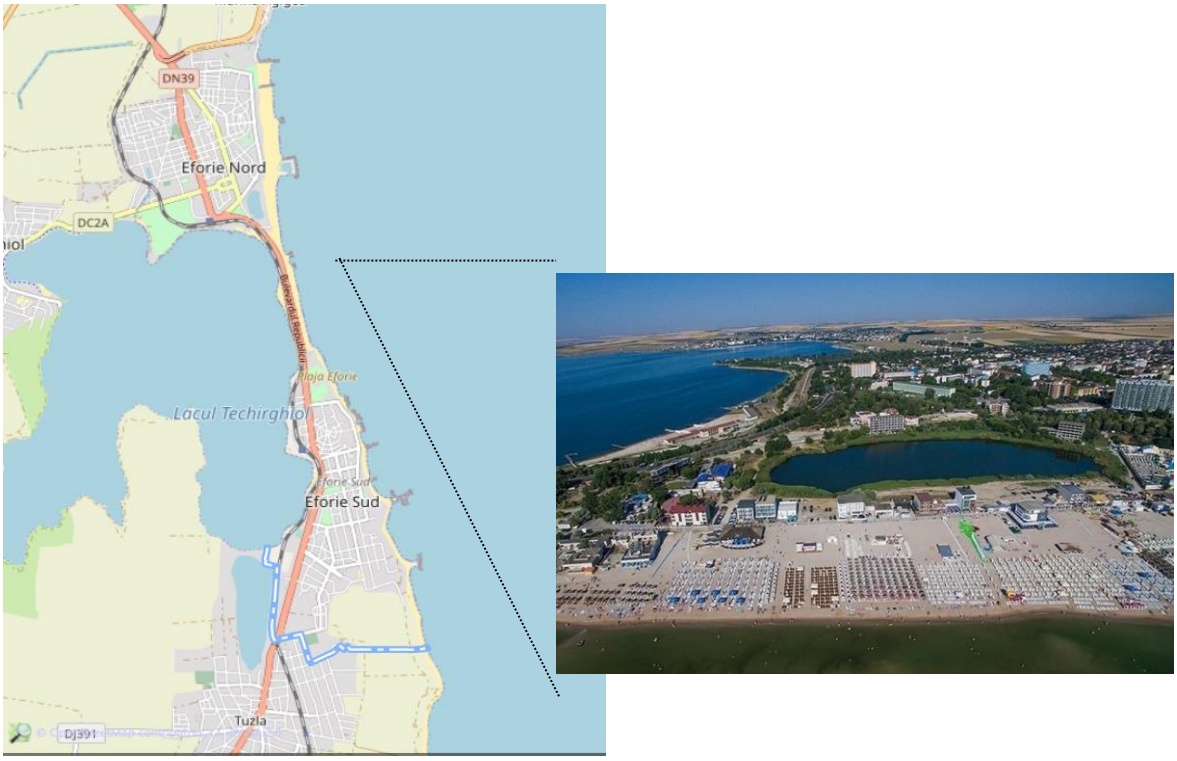

Figura VI.5. Teritoriul orașului Eforie
Sursa: Openstreetmap.org imagine procesată de autor

On the territory of Eforie city, about 750 economic agents operate, their main occupation is tourism, the city being dotted with hotels, restaurants and villas, with a concentrated activity in the period June-September, as can be seen in Figure VI.5. Also in Eforie city there are agents who carry out permanent activities of public catering, bar, minimarket, pharmacy, supply of various materials, building materials, construction works and interior design, transport, treatment, spa. [90]

Results obtained

The interaction between activities taking place in the coastal zone has been defined with the generic term land-sea interaction, a term used in the context of marine planning and management in coastal areas. As we have already mentioned, the analysis carried out in this work was carried out taking into account economic, social and environmental factors. For example, this type of interaction may include, but at the same time is not limited to, the flow of contaminants produced as a result of an agricultural activity from a terrestrial surface to a body of groundwater or surface that is in contact with the waters of the coastal zone. It represents an economic-environmental interaction, but it can also be of the medium-economic type when the quality of bathing water in the coastal zone affects summer tourism. It is necessary to know that the same factor can exert an impact on other factors, but at the same time receive the impact of other factors.

The integration of activities and coherence in the management of the coastal area is based on the arrangement of marine and terrestrial space. These are important and should be achieved through policies, plans and decisions of local and national authorities. In the framework of integrated coastal zone management, a close link is needed between most of the activities that have been analyzed, whether they take place on the shore or in

the marine environment. Some activities such as coastal tourism, port activities, have expanded their scope into the sea. Those interactions should be identified and mapped to assess their cumulative impact and potential conflicts and synergies.

In the tables below (Tables VI.4 to VI.6), we have established the mode of interaction between the activities of the three factors analyzed, namely the economic factor, the social factor and the environmental factor. In this table, the factors that were pressure generators were described in rows, and the factors that bore pressure were presented in the columns. As can be seen, most of the pressures were created by economic factors, and environmental factors absorbed most of the pressures.

As regards the quantification of the indicators in the table above, the impact between the indicators can be ascertained by the interaction between the proposed factors. In order to establish the values, it was taken into account that the activities that have not affected each other or that interact in an insignificant way have zero value. The pressures exerted by one activity on another had a positive or negative impact, depending on the impact exerted, and the value was on a threshold between minus five and five. A value at the absolute minimum is actually the maximum point at which one activity can withstand the pressures of another activity. The evaluation was based on data obtained from various sources. The aggregation of data from different fields of analysis shall be carried out using measurements corresponding to the calculation rules and standards existing in the respective field. In case of insufficient or inconclusive data, aggregations should be treated as approximations of unknown totals or mean values. Aggregation rules are intended to produce estimates for a constant set of data from one period to another and for all indicators.

Table VI.4. Pressure on economic indicators

		Economic factor												
		Agriculture	Aquaculture	Traffic	Tourism Intensity	Eco-label & sustainable tourism	Recreational boating	Bed occupancy rate	Seasonal homes	Industry	Services	Internet broadband	Land Use	Energy
Economic factor	Agriculture		-3	0	0	0	0	0	0	1	2	0	1	0
	Fishing /	0		0	1	0	0	0	0	1	4	0	2	-1
	Traffic	-1	-1		-2	-3	-1	0	0	-1	-3	0	-1	0
	Tourism Intensity	-2	-3	-3		-3	2	5	3	2	4	-2	-1	-3
	Eco-label & sustainable tourism	2	4	3	3		2	2	2	2	3	1	2	2
	Recreational boating	0	-3	0	1	1		2	2	1	3	0	0	0
	Bed occupancy rate	0	0	1	2	-1	0		2	0	2	2	2	-2
	Seasonal homes	0	0	0	2	1	2	2		0	2	1	2	-2
	Industry	0	0	-1	1	-1	0	1	1		1	-1	-1	-2
	Services	2	2	1	2	2	2	2	1	1		1	0	-2
	Internet broadband	0	0	0	0	0	0	1	0	2	2		0	0
	Land Use	-1	-1	0	0	0	0	0	0	1	2	0		0
	Energy	1	0	0	0	0	0	0	0	3	3	0	0	
Environmental factor	Air	1	1	0	3	4	2	2	2	0	1	0	0	0
	Coastal and Transitional Waters	0	2	0	2	3	3	2	2	1	2	0	0	0
	Lakes	2	0	0	2	2	1	2	2	1	3	0	0	0
	Rivers	0	0	0	0	0	0	0	0	0	0	0	0	0
	Groundwaters	2	3	0	0	0	0	0	0	1	0	0	1	0
	Biodiversity	2	2	3	2	5	3	2	2	3	2	0	3	3
	Soil	5	1	0	0	2	0	0	0	0	1	0	3	0
	Waste	-1	-2	0	-3	-5	-2	-2	-2	-1	-3	0	0	1
Social factor	Urban Agglomerations	-1	-2	-3	2	-2	2	2	3	4	4	4	3	4
	Employment	1	1	-2	2	2	2	2	2	5	5	0	0	0
	Crime	-1	-1	-3	-3	-3	-2	-1	-1	-2	-3	0	0	0
	Education	2	2	1	2	5	2	2	2	4	4	2	3	2
	Health	1	1	2	4	5	2	3	3	3	4	2	2	2
	Cultural heritage	1	2	1	3	4	2	2	2	1	2	1	3	1

Source: author's contribution

Table VI.5. Pressure on environmental indicators

		Environmental factor							
		Air	Coastal and Transitional Waters	Lakes	Rivers	Groundwaters	Biodiversity	Soil	Waste
Economic factor	Agriculture	0	0	-3	0	-3	-4	-2	-2
	Fishing /	-1	-3	0	0	0	-4	-1	-2
	Traffic	-3	-2	0	0	0	-4	-1	0
	Tourism Intensity	-3	-4	-3	-2	-2	-5	-3	-4
	Eco-label &	3	2	3	2	2	2	1	3
	Recreational	0	-2	-2	0	0	-2	0	-2
	Bed occupancy rate	0	0	0	0	0	-1	-1	-2
	Seasonal homes	-1	0	0	0	-1	-2	-2	-1
	Industry	-2	-2	0	0	-2	-2	-2	-1
	Services	-1	-1	-1	-1	-1	-1	-1	-3
	Internet broadband	0	0	0	0	0	0	0	0
	Land Use	0	0	0	0	0	0	1	0
	Energy	0	0	0	0	0	0	0	0
Environmental factor	Air		1	1	1	0	3	1	0
	Coastal and	0		1	0	0	3	2	1
	Lakes	0	1		0	0	3	1	1
	Rivers	0	0	0		0	0	0	0
	Groundwaters	0	3	3	2		3	3	0
	Biodiversity	4	3	3	3	3		3	3
	Soil	0	0	0	0	2	4		0
	Waste	-3	-3	-3	-3	-2	-5	-3	
Social factor	Urban	-3	-2	-2	-2	-2	-5	-3	-3
	Employment	0	0	0	0	0	0	0	-2
	Crime	-1	-1	-1	-1	-1	-2	-1	-1
	Education	3	2	2	2	2	4	2	3
	Health	2	2	2	2	1	3	1	2
	Cultural heritage	2	2	2	2	2	3	2	2

Source: author's contribution

Table Vi.6. Pressure on social indicators

		Social factor					
		Urban Agglomerations	Employment	Crime	Education	Health	Cultural heritage
Economic factor	Agriculture	0	1	0	0	-1	1
	Fishing /	0	1	0	2		3
	Traffic	-3	-2	-1	0	-3	-2
	Tourism Intensity	-4	3	-3	2	-3	-1
	Eco-label &	2	2	3	3	2	4
	Recreational	0	1	0	2	1	2
	Bed occupancy rate	-2	2	2	0	-1	-2
	Seasonal homes	-2	2	-2	0	-1	1
	Industry	-1	2	0	2	-1	-1
	Services	-2	3	-2	2	-1	1
	Internet broadband	0	2	1	3	2	1
	Land Use	3	2	1	1	2	3
	Energy	2	2	1	2	2	1
Environmental factor	Air	3	-2	0	2	5	2
	Coastal and	0	1	0	3	2	3
	Lakes	3	2	0	3	5	4
	Rivers	0	0	0	0	0	0
	Groundwaters	0	0	0	1	2	0
	Biodiversity	4	-3	0	3	3	4
	Soil	0	0	0	1	1	2
	Waste	0	0	-2	-3	-5	-4
Social factor	Urban		4	-3	3	-4	-2
	Employment	-2		2	3	-1	0
	Crime	-2	-2		-3	-2	-2
	Education	4	4	3		4	5
	Health	2	2	1	3		2
	Cultural heritage	2	1	4	4	2	

Source: author's contribution

In Table VI.7 we averaged the activities by sector of activity, and in Figures VI.6 and VI.7 we have a graphical representation for the agricultural/fisheries and transport/traffic indicators.

Table VI.7. Pressure exerted by group of activities

		Economic factor						Environmental factor					Social factor					
		Agriculture / Fishing	Traffic	Tourism	Industry	Services	Energy	Air	Waters	Biodiversity	Soil	Waste	Urban Agglomerations	Employment	Crime	Education	Health	Cultural heritage
Economic factor	Agriculture / Fishing	-0.75	0	0.1	1	1.5	-0.5	-0.5	-1.125	-4	-1.5	-2	0	1	0	1	0	2
	Transport / Traffic	-1	-2	-1.2	-1	-1.33	0	-3	-0.5	-4	-1	0	-3	-2	-1	0	-3	-2
	Tourism	-0.2	0.20	1.28	1.00	1.13	-1.00	-0.20	-0.35	-1.60	-1.00	-1.20	-1.20	2.00	0.00	1.40	-0.40	0.80
	Industry	0	-1	0.4	1	-0.33	-2	-2	-1	-2	-2	-1	-1	2	0	2	-0.4	-1
	Services	0.33	0.33	0.662	1.33	0.55	-0.66	-0.33	-0.33	-0.33	-0.33	-1	0.33	2.33	0	2	1.2	1.66
	Energy	0.5	0	0	3	1	0	0	0	0	0	0	2	2	1	2	2	1
Environmental factor	Air	1	0	2.6	0	0.33	0	0	0.75	3	1	0	3	-2	0	2	5	2
	Waters	1.125	0	1.05	0.75	0.5	0	0	0.625	2.25	1.5	0.5	0.75	0.75	0	1.75	2.25	1.75
	Biodiversity	2	3	2.8	3	1.66	3	4	3	2	3	3	4	-3	0	3	3	4
	Soil	3	0	0.4	0	1.33	0	0	0.5	4	0	0	0	0	0	1	1	2
	Waste	-1.5	0	-2.8	-1	-1	1	-3	-2.75	-5	-3	0	0	0	-2	-3	-5	-4
Social factor	Urban Agglomerations	-1.5	-3	1.4	4	3.66	4	-3	-2	-5	-3	-3	-2	4	-3	3	-4	-2
	Employment	1	-2	2	5	1.66	0	0	0	0	0	-2	-2	1	2	3	-1	0
	Crime	-1	-3	-3	-2	-1	0	-1	-1	-2	-1	-1	-2	-2	-2	-3	-2	-2
	Education	2	1	2.6	4	3	2	3	2	4	2	3	4	4	3	2	4	5
	Health	1	2	3.4	3	2.66	2	2	1.75	3	1	2	2	2	1	3	0	2
	Cultural heritage	1.5	1	2.6	1	2	1	2	2	3	2	2	2	1	4	4	2	0

Source: author's contribution

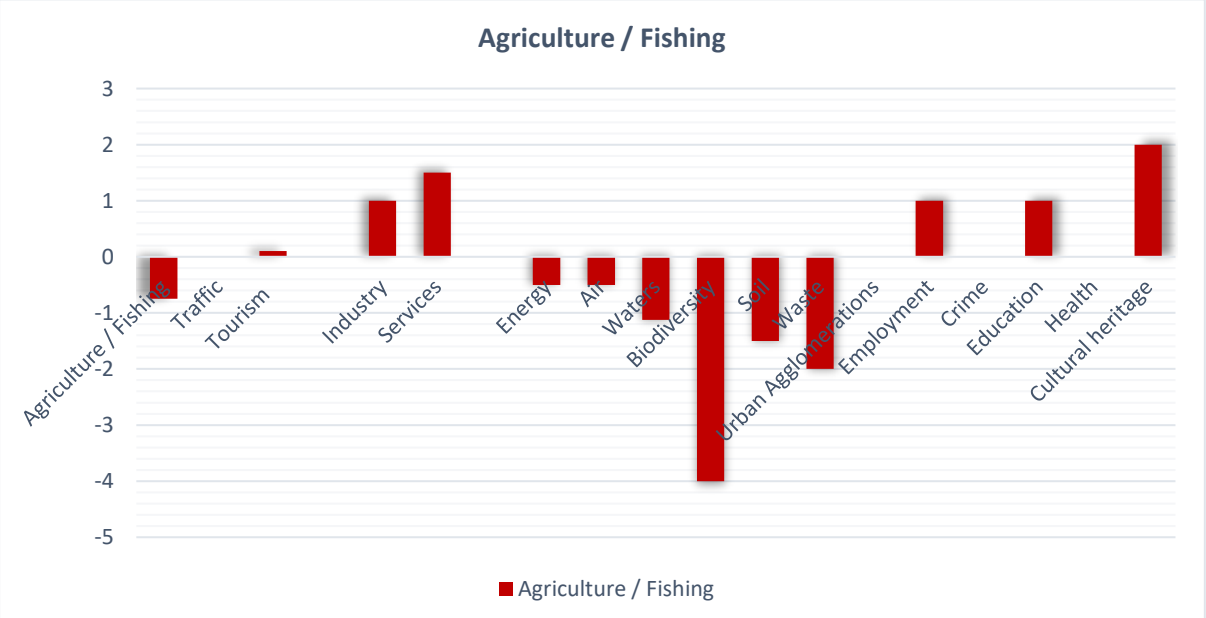

Figure VI.6. Graphical representation of the Agriculture/Fisheries indicator on the other indicators

Source: author's contribution

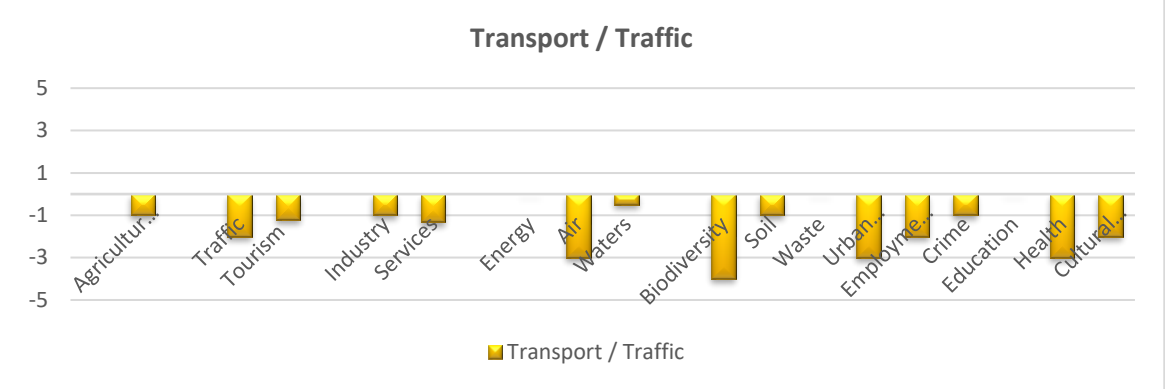

Figure VI.7. Graphical representation of the Transport/Traffic indicator on the other indicators

Source: author's contribution

In Table VI.8 we have calculated the affordability factor.

Table VI.8. Calculation of the bearability factor

		Economic factor	Environmental factor	Social factor
Economic factor	Agriculture	0.0833	-1.7500	0.1667
	Fishing /	0.5833	-1.3750	1.0000
	Traffic	-1.0833	-1.2500	-1.8333
	Tourism Intensity	-0.0833	-3.2500	-1.0000
	Eco-label & sustainable tourism	2.3333	2.2500	2.6667
	Recreational boating	0.5833	-1.0000	1.0000
	Bed occupancy rate	0.6667	-0.5000	-0.1667
	Seasonal homes	0.8333	-0.8750	-0.3333
	Industry	-0.1667	-1.3750	0.1667
	Services	1.1667	-1.2500	0.1667
	Internet broadband	0.4167	0.0000	1.5000
	Land Use	0.0833	0.1250	2.0000
	Energy	0.5833	0.0000	1.6667
Environmental factor	Air	1.3333	0.8750	1.6667
	Coastal and Transitional Waters	1.4167	0.8750	1.5000
	Lakes	1.2500	0.7500	2.8333
	Rivers	0.0000	0.0000	0.0000
	Groundwaters	0.5833	1.7500	0.5000
	Biodiversity	2.6667	2.7500	1.8333
	Soil	1.0000	0.7500	0.6667
	Waste	-1.6667	-2.7500	-2.3333
Social factor	Urban Agglomerations	1.6667	-2.7500	-0.3333
	Employment	1.6667	-0.2500	0.3333
	Crime	-1.6667	-1.1250	-1.8333
	Education	2.7500	2.5000	3.3333
	Health	2.8333	1.8750	1.6667
	Cultural heritage	2.0833	2.1250	2.1667

Source: author's contribution

Figure VI.8 shows the dynamics of the works in Eforie divided into three large areas (Eforie Nord, Eforie Centru and Eforie Sud).

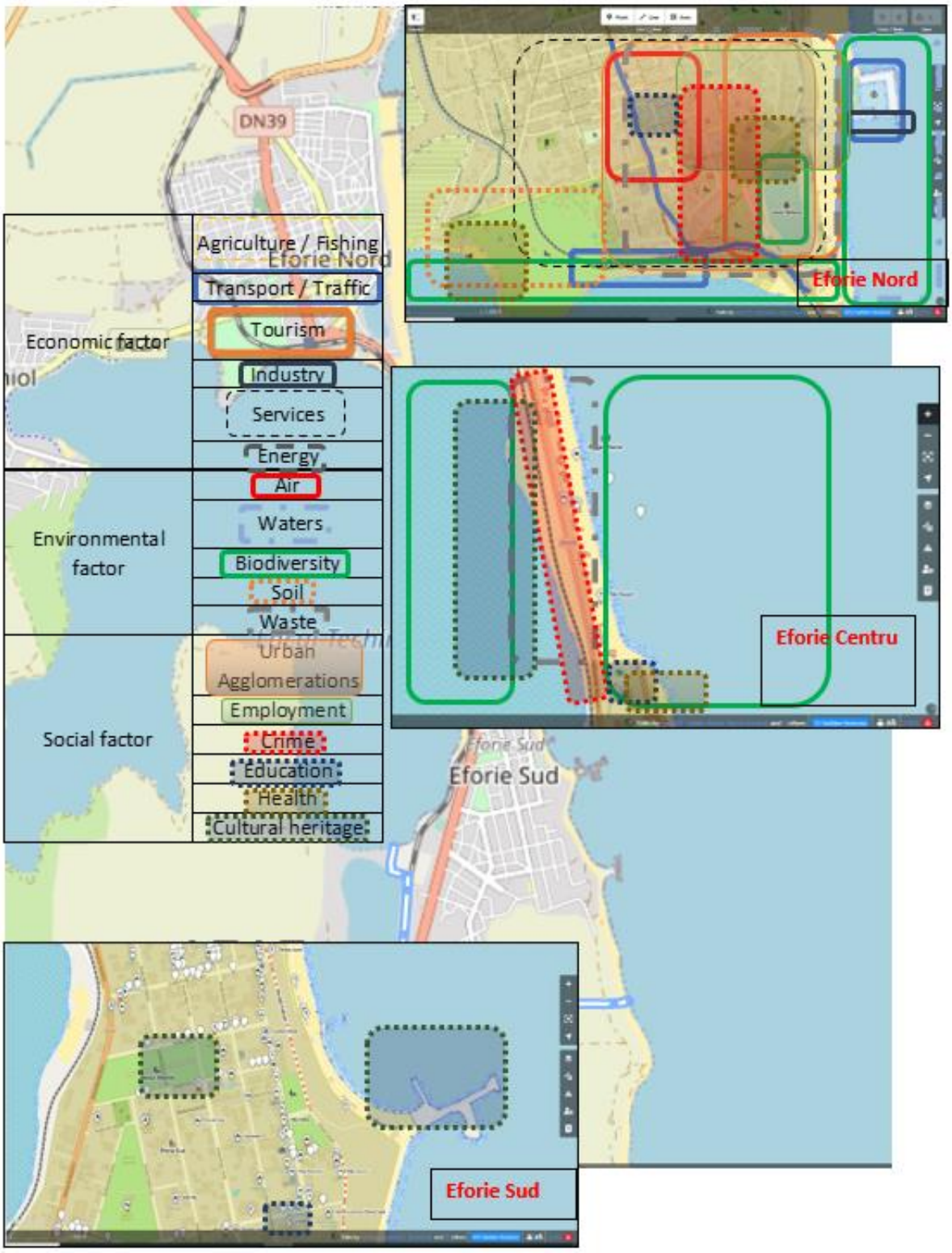

Figure VI.8. Interaction between existing activities in eforie area
Source: Openstreetmap.org, image processed by the author

Discussions

The objective of coastal management is to maximize the benefits offered by the coastal zone and to minimize the conflicts and harmful effects of some activities on others This paper aims to find a management model that, on the one hand, can be applied to the peculiarities of the Eforie area and, on the other hand, can be applied to other coastal areas. The analysis started from the particularities of the analyzed area, using a matrix of economic, social and environmental factors, to which other factors of the PESTEL analysis can be added (i.e. political, legislative and technological factors).

It is absolutely necessary to validate the new model over time. Periodically, with the help of a multi-criteria analysis, the validation of the model will show possible changes in the analyzed factors. Local, regional, national and international plans and strategies should be integrated into the analysis. Using a holistic perspective, the model avoids traditional sectoral interconnections between coastal systems and uses integrated management approaches.

The interaction and relationship between the activities proposed for this analysis are very important, because in some cases it can have a positive effect, and in other situations, the effect may be predominantly negative or does not exist. Especially in the event of a negative effect it is necessary to establish the threshold at which the negative effect becomes a vulnerability that can lead to a disaster. In the previously published papers that were part of the preparation of the author's doctoral thesis, we developed a tool that we called the bearability factor.

This tool is useful to determine the degree of affordability of an activity in relation to another activity existing in the coastal zone. In general, an ideal situation is a constant situation in which the analyzed indicators keep in balance and have a generally positive or neutral effect on each other. It is known, however, that in the theory of integrated coastal zone [104] [105]management, there are numerous situations of conflicts between activities. And maybe it's natural to have such conflicts; for example, in coastal areas there are tourism activities, but also protected areas that require measures to protect against human activities. [106]Our aim is not to eliminate coastal activities, just because they have a negative effect on the others, but to see how all these activities can coexist. Therefore, by establishing a bearability factor, we will see how long one of the existing activities and the pressure of the others can withstand, and what is the threshold of vulnerable coastal zone. . As mentioned before, when determining the bearability factor, it was established that if the activities would not affect each other or would be insignificant, they would have a zero value. Also, depending on the pressures it exerts, the value of the activity indicator can have a positive or negative impact, and the value will be between minus five and five. If the impact of one task on the other task is negative, it means that pressure is affecting a task. A set value of −5 is actually the maximum in which one activity can withstand the pressures of other activities. Above this value, the activity can no longer exist in that area. For example, an excessive tourist activity can lead to the destruction of habitats and, implicitly, to the disappearance of species in the protected area. In this case, the interaction between excessive tourism and the environmental factor (soil, water) can be -5.

The allocation of the value scale between −5 and +5 is not accidental; it is mainly based on the theory of risk analysis. A risk assessment consists, in our case, in studying the probability that the activity will reach a satisfactory / unsatisfactory performance. In this context, probability must be interpreted as an index in which a value of +5 represents a

complete certainty that a positive prediction will be confirmed, a value of −5 is the certainty that a negative prediction will be confirmed, and intermediate values can be identified for any situation between the two extremes. The probability tool was used as an assessment tool. Values of this magnitude can be generated by the experience of specialists in the field who analyze these situations. The probability thresholds reflect the decision-makers' perception of the uncertainty with which the identified risks may be associated. In some of the activities analysed, a qualitative assessment is required, while in others a quantitative assessment is required.

This theory was initiated by a Monte Carlo [107][108] analysis, developed in the 1940s, and is a computerized method that uses statistical sampling techniques to obtain a probabilistic approximation with the solution of a model. In this context, the simulation consists of the process of approximating the model results by repetitive random applications of the model algorithm. Monte Carlo simulation combines probability distributions based on existing relationships in models by testing multiple combinations of input variables and storing results for display. The relevance of this method is that the results are often graphs of probability distributions or cumulative probability distributions of output variables, such as total cost or completion dates. These results allow the complete and objective measurement of the different risks. In addition to multicriterial analysis (MCA), several statistical techniques can be used to assess project risks, such as PERT (repeated program evaluation technique), sensitivity analysis, and decision tree analysis. [61] [109]

As regards the sources used, they were mainly based on official reports or analytical studies in the area. The data on the quality of the environmental factors were obtained mainly from the Environmental Protection Agency and the data on the coastal area were extracted from the Coastal Zone Master plan and the adjacent documents, elaborated by the Water Basin Administration. Also, the Management Plan of the Dobrogea Litoral Hydrographi Basin provides extensive data on the existing pressures on the terrestrial and surface waters, as well as the transition waters and the marine waters in the area of the Romanian Black Sea coast.

Also, the online database of the Eforie City Hall provided us with current data on a number of factors analyzed in this work. The research institutes in the area as well as a series of open source scientific papers have given us the opportunity to obtain valuable information for our research.

Conclusions to the analysis of coastal management in Eforie area (Romania)

The application of some elements based on the PESTEL analysis aimed at determining the interactions between the existing activities in the coastal zone, especially between environmental activities and social and economic activities.

The strategic analysis of the Eforie Area on the Black Sea shore has identified a model in which the existing activities, as well as the pressures that arise as a result of the natural or anthropogenic factors of these activities, can make the analyzed area vulnerable in the short, medium and long term. The multi-criteria analysis model used in the coastal zone of Eforie identified the relevant forces that exerted pressure on this coastal and marine zone. Improving the quality of environmental factors, in particular groundwater quality, is a clear objective for authorities in the medium and long term. Also, the diversification of economic activities and, in particular, the identification of new economic activities in the area under review will provide an aspect of sustainability. However, in order to develop this area, the degradation of coastal ecosystems needs to be mitigated, providing a common

framework for managing multisectoral activities and maintaining options for future uses of coastal resources. The application of this model will create a multisectoral perspective and approach that takes into account all sectoral and stakeholder interests and addresses economic, social, environmental and environmental issues.

Quantifying these activities with the help of the bearability factor shows us even more clearly how much the pressure is on one or another activity and where this pressure comes from.

This allows for an integrated and multifactorial assessment of a situation, being a tool to support decision-makers at local, regional or national level. Of course, the model can be developed by introducing several indicators or by directing indicators to a certain aspect to be analyzed, for example a structural project or a future investment. Also, when calculating the bearability factor, calculation thresholds may be established on the basis of statistical data or data collected from the field, on the interaction between them.-

It should also be made clear that, in order for a model to be as viable as possible, the quality of the data collected, as well as the timeliness of this data, is very important. The use of data from different periods can lead to the development of different models. Also, the calibration of the model can be done over time by constantly updating the entered data.

However, it is not always possible to accurately quantify all the proposed indicators. Often they have certain ambiguities in their structure. Thus, this multifactorial analysis will be further developed in future research, also taking into account unpleasant experiences in measuring these indicators.

Design and implementation of an integrated management system in the Romanian coastal area by analyzing the touristic activity in Constanta

Introduction to tourism activity

The touristic activity in Constanta is considered to be one of the main economic activities of the city, being a traditional activity and having strong social implications in the community. The geographical location of the city on the Black Sea shore, the number of sunny days and the low beaches are an attraction for both locals and tourists. However, the touristic activity has a seasonal character, not being correlated with other activities that take place in the city. In this paper we intend to make an analysis of the management of the touristic activity, by relating it to economic, social and environmental indicators that take place in Constanta. We also aim to generate a model based on the data currently existing.

6.7.2 Area of study

Even if tourism is an important activity at county level, according to the information received from the city halls (figure VI.16), it is predominantly present at the localities located on the Black Sea shore in Constanta County. [90]

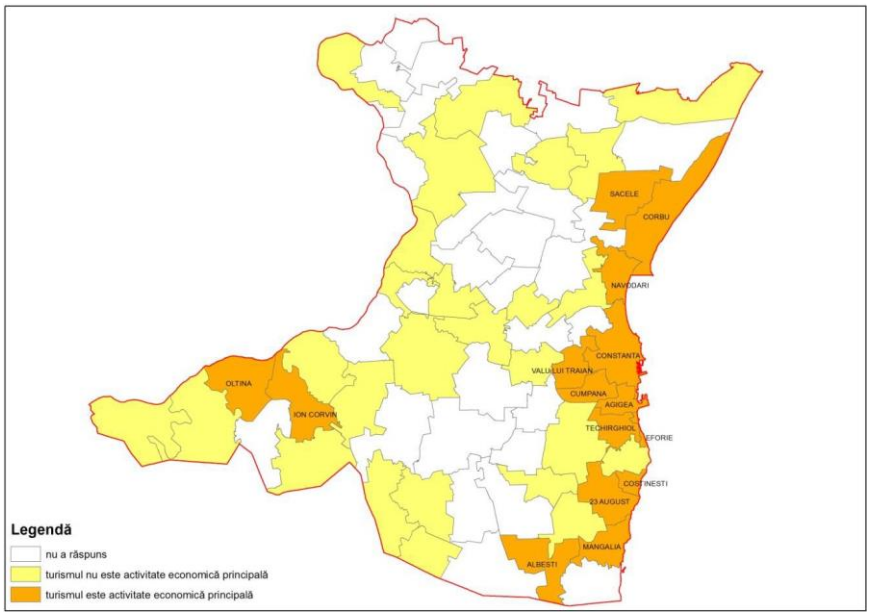

Figure VI.16. Localities in Constanţa County where tourism is considered a main economic activity

Source: author's contribution

According to the information provided by the National Institute of Statistics, the total turnover resulting from the activities carried out by hotels, other accommodation facilities, restaurants and tourist agencies in 2017 it amounted to 1,541,559,560 lei, which represented 3.4% of the total figure of the fields of activity in Constanta County. Between 2013 and 2017, the turnover of tourism activities increased by 56.7%, given that the total turnover at county level almost stagnated. Thus, if in 2013 this type of business held 2.2% of the turnover, now it has reached 3.4%. (Table VI.12) [64]

Table VI.12. Turnover of active companies in Constanta County, in the period 2013 – 2017 (million lei)

	2013	2014	2015	2016	2017	2018	2019
Total fields of activity	51702	50768	50408	48319	52551	57674	64103
HRA* domain	971	1041	1339	1450	1570	1851	2345

** Hotels, other accommodation facilities, Restaurants and Travel Agencies*

Source: data processed by the author from the statistical *yearbook of Constanta County 2020*

Touristic structure

The development of tourism is favored by the existence of possibilities for tourists to stay. That is why the accommodation capacity most conditions the volume of tourist flows in a certain area or tourist resort.

Considering its physical and geographical qualities, the Romanian seaside has enjoyed over time a special attention, the area benefiting during 1965-1980 from the largest investments in touristic reception structures. Under these conditions, Constanta became the county with the largest number of structures and the largest number of accommodation places in the country.

According to the data provided by the National Institute of Statistics (for 2018), at the level of Constanta County, 834 units were opened (9.9% of the national total) with a total of 84,891 accommodation places (24.0% of the national total). (Table VI.13) [64]

Table VI.13. The evolution of the accommodation capacity at the level of Constanta County and for the total country

Nor	Constanţa County			Romania			% of total Romania		
	Properties	Places existent	places in Service	Properties	Places existent	places in Service	Properties	Places existent	places in Service
2012	738	84.690	10.656.862	5821	301.109	74.135.614	12,7%	28,1%	14,4%
2013	745	85.756	9.979.198	6009	305.707	77.028.488	12,4%	28,1%	13,0%
2014	746	87.496	10.618.068	6130	311.288	77.676.817	12,2%	28,1%	13,7%
2015	755	87.848	11.059.024	6821	328.313	81.872.539	11,1%	26,8%	13,5%
2016	761	85.285	10.149.109	6946	328.888	83.323.220	11,0%	25,9%	12,2%
2017	838	84.157	10.448.065	7905	343.720	87.655.762	10,6%	24,5%	11,9%
2018	834	84.891	10.376.230	8449	353.308	87.796.861	9,9%	24,0%	11,8%
18/12	+13,0%	+0,2%	-2,6%	+45,1%	+17,3%	+18,4%			

Source: data processed by the AUTHOR INS, Tempo-online database (http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table)

According to the official data provided by the National Institute of Statistics, in the last 7 years the following situation is observed regarding the accommodation capacity in Constanta County:

1. the number of accommodation structures increased slightly, with 13.0% more units at the level of 2018 than in 2012;
2. the number of existing accommodation has remained at a somewhat constant level;
3. the accommodation capacity in operation (number of seats-days) decreased by 2.0% in 2018 compared to 2012.

The situation can be explained by the fact that the new structures, although more numerous, are still of much small size (pensions, villas), compared to the large units that have exited the tourist circuit for various reasons (campsites, camps, hotels). In addition, the reduction in the accommodation capacity in operation is also due to the reduction of the tourist season, which has made the accommodation units, and especially the large hotels in the tourist resorts, to be open from year to year for an increasingly short period of time. The average period of operation of the accommodation structures in Constanta County decreased in the analyzed range from 125.8 days in 2012 to 124 days in 2017. By comparison, the national average is about 255 days.

There is a big difference between the existing data in the database of the ESI and the data provided by the Ministry of Tourism. [64]According to the latter (December 2018), in Constanta County there are 1807 touristic accommodation structures with accommodation functions, with a total of 122,262 places. Compared to the total country, it is found that Constanta County owns 13.4% of the total number of accommodation structures and 27.2% of the number of accommodation places, from this point of view Constanta County, and especially the coastal area of the county, being the most important tourist destination in the country. (Figures VI.17, VI.18 and Table VI.14).

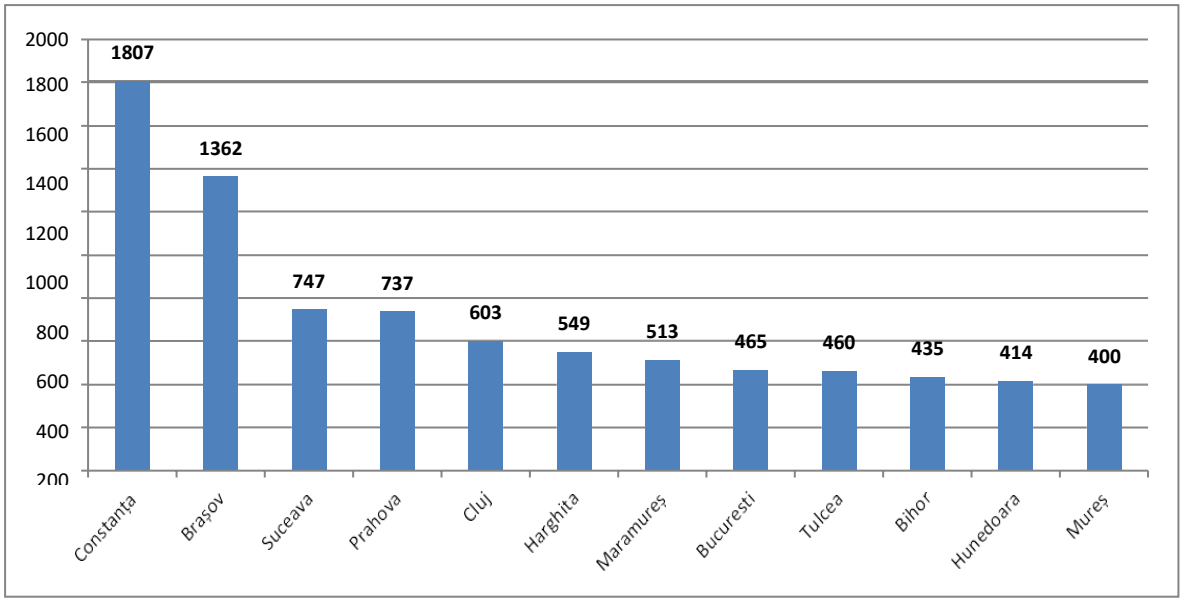

Figure VI.17. Number of tourist accommodation establishments, by county (Dec. 2018)
Source: Ministry of Tourism, Tourist accommodation establishments classified (http://turism.gov.ro/web/autorizare-turism/)

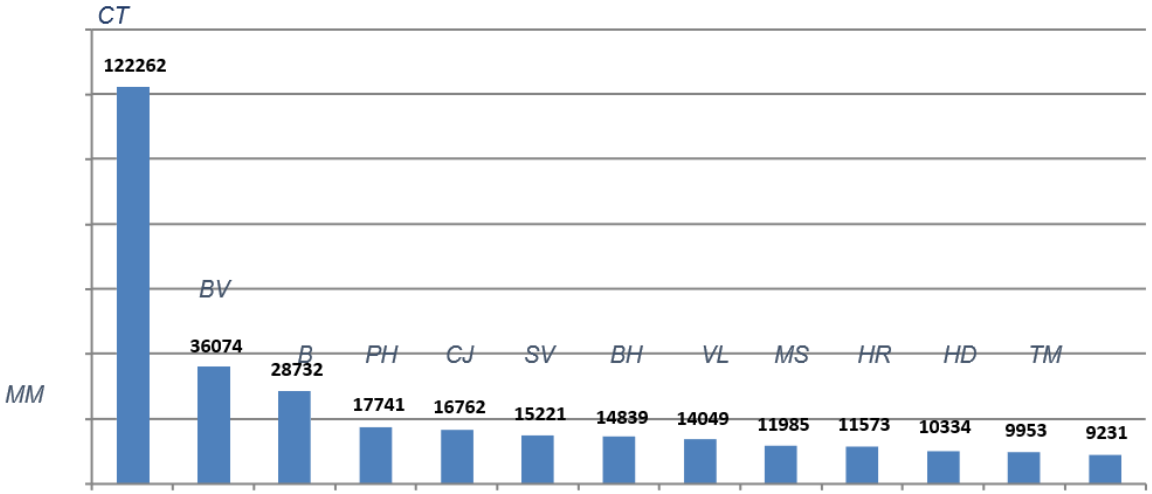

Figure VI.18. Number of accommodation places by county (December 2018)
Source: Ministry of Tourism, Tourist accommodation establishments classified (http://turism.gov.ro/web/autorizare-turism/)

Table VI.14. Accommodation capacity in Constanţa County, by localities (December 2018)

Populated places	Accommodation structures		Accommodation	
	number	Weight	number	Weight
Constanta	309	17.1%	28.396	23.2%
Constanta	87	4.8%	3.519	2.9%
Mamaia	222	12.3%	24.877	20.3%
Mangalia	258	14.3%	32.904	26.9%
Mangalia	29	1.6%	1.683	1.4%
Cape Aurora	7	0.4%	2.184	1.8%
Jupiter	36	2.0%	5.848	4.8%
Neptune-Olympus	88	4.9%	9441	7.7%
Saturn	40	2.2%	6.438	5.3%

Populated places	Accommodation structures		Accommodation	
	number	Weight	number	Weight
Venus	58	3.2%	7.310	6.0%
Eforie	431	23.9%	23.857	19.5%
Eforie Nord	318	17.6%	17.795	14.6%
Eforie Sud	113	6.3%	6.062	5.0%
Costinesti	355	19.6%	15.850	13.0%
Limanu	127	7.0%	4.177	3.4%
May 2	38	2.1%	1.047	0.9%
Vama Veche	88	4.9%	3.084	2.5%
Limanu	1	0.1%	46	0.0%
Nets	226	12.5%	13.114	10.7%
Techirghiol	28	1.5%	1.390	1.1%
other localities	73	4.0%	2.574	2.1%
adamclisi	1	0.1%	30	0.0%
Agigea	10	0.6%	204	0.2%
Aliman	2	0.1%	28	0.0%
Baneasa	1	0.1%	20	0.0%
Cernavoda	4	0.2%	142	0.1%
Cobadin	1	0.1%	10	0.0%
Cross	1	0.1%	54	0.0%
Cummings	1	0.1%	18	0.0%
Lipnita	2	0.1%	42	0.0%
Light	1	0.1%	59	0.0%
Medgidia	6	0.3%	188	0.2%
Mihail Kogălniceanu	1	0.1%	36	0.0%
Oltina	1	0.1%	16	0.0%
Island	3	0.2%	74	0.1%
Ovid	3	0.2%	63	0.1%
Saligny	1	0.1%	12	0.0%
Seimeni	1	0.1%	32	0.0%
23 August	20	1.1%	1.314	1.1%
Carlos	13	0.7%	232	0.2%
TOTAL	1.807	100%	122.262	100%

Source: Ministry of Tourism database *(http://turism.gov.ro/web/autorizare-turism/) – processed data*

The main resorts on the Romanian Black Sea coast by number of accommodation places are: Mamaia (24,877, 20.3% of the number of places), Eforie Nord (17,795, 14.6%), Costineşti (15,850, 13.0%), Năvodari (13,114, 10.7%), Neptune (9,441, 7.7%), Venus (7,310, 6.0%), Saturn (6,438, 5.3%), Eforie Sud (6,062, 5.0%), Jupiter (5,848, 4.8%). [64]

Quantitative analysis of the touristic activity in Constanta

Taking into account the above presented in the methodology chapter, in figure VI.19 we can see the evolution of passenger transport in Constanta city on scenario 1 (without mass tourism) and scenario 2 (with mass tourism). One can clearly see the difference in the efficiency of public passenger transport in the months when tourists are present on the

coast. At this point, we can say that local policies should focus on encouraging local people to make greater use of public transport, so that public transport activity is more efficient in the low-season months as well. This indicator represents a situation in which mass tourism is a positive factor in the development of the local community.

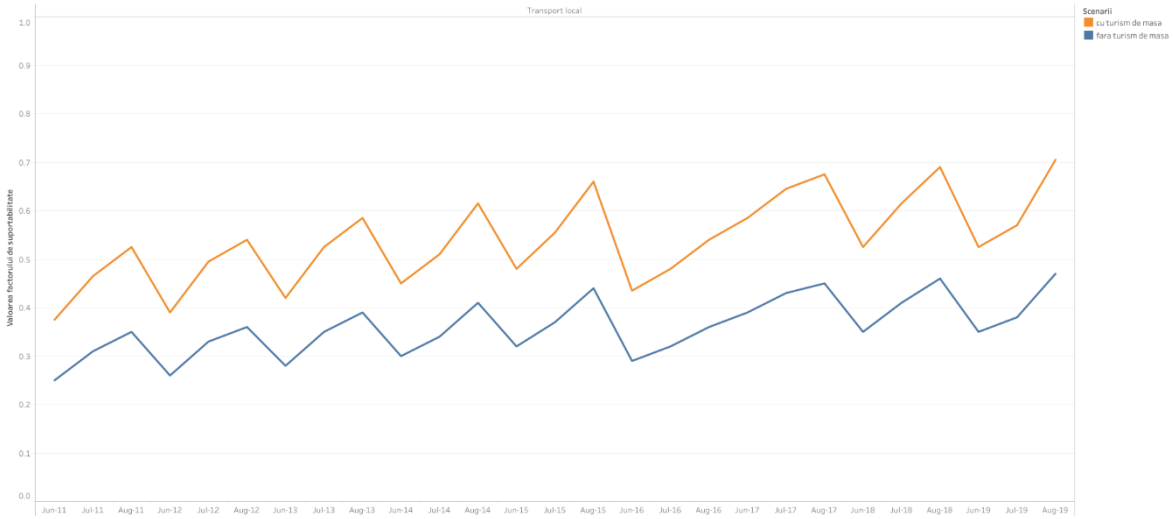

Figure VI.19. Local transport activity in the two phases
Source: author's contribution

Making a projection of local transport until 2050 (figure VI.20) it can be seen that, on the current data introduces into the system, the hypothesis of mass tourism is more beneficial, reaching an optimal around 2039, while the hypothesis without mass tourism reaches an optimal of 0.84 out of 1 at the level of 2050. It is clear that the trend is increasing in both scenarios, and the optimization of this activity is within the reach of the authorities who can take measures that can stimulate this indicator.

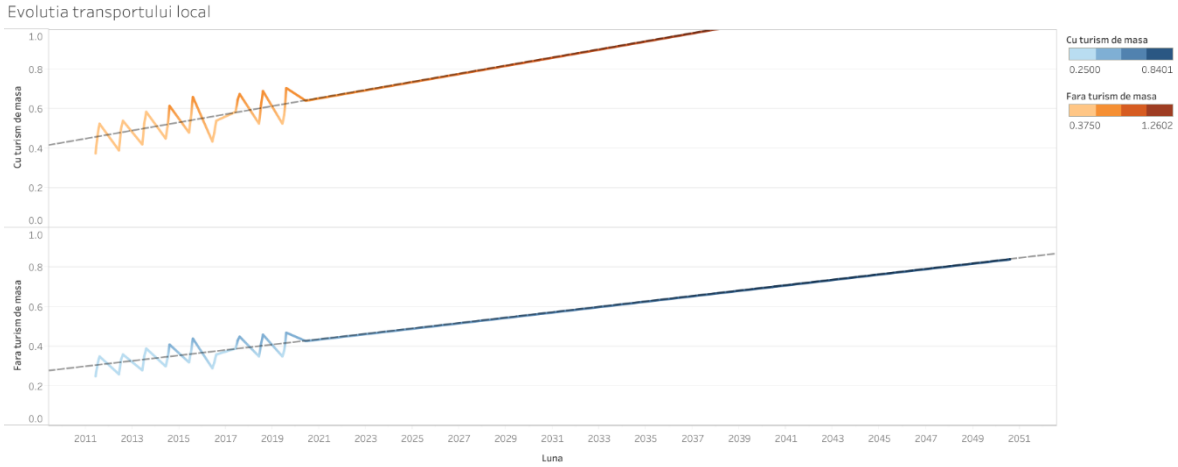

Figure VI.20. Forecast of local transport activity by 2050
Source: author's contribution

Identically, we have extended the analysis of the economic (Figure VI.21 and VI.22) social (figure VI.23) and environmental (figure VI.24) factors, taking into account the two scenarios, the one with mass tourism and the one without mass tourism.

Figure VI.21. Analysis of the indicators of the economic factor for the scenario without mass tourism

Source: author's contribution

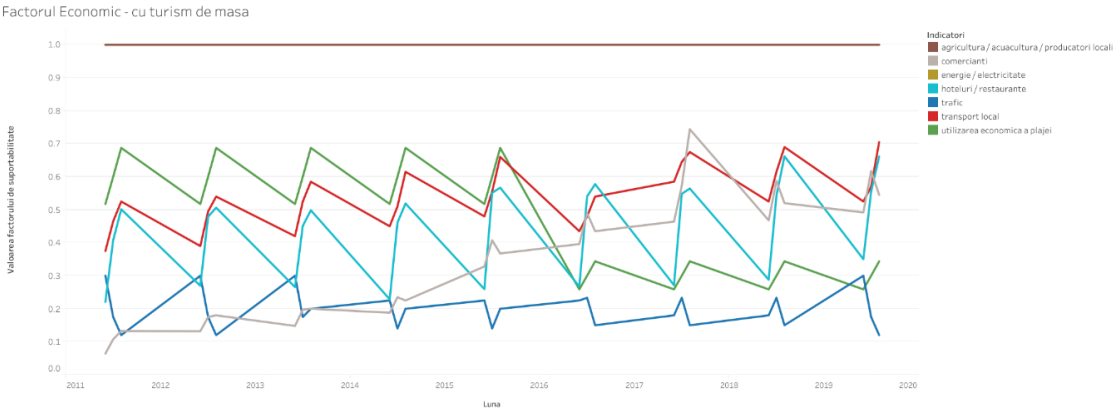

Figure VI.22. Analysis of the indicators of the economic factor for the scenario with mass tourism

Source: author's contribution

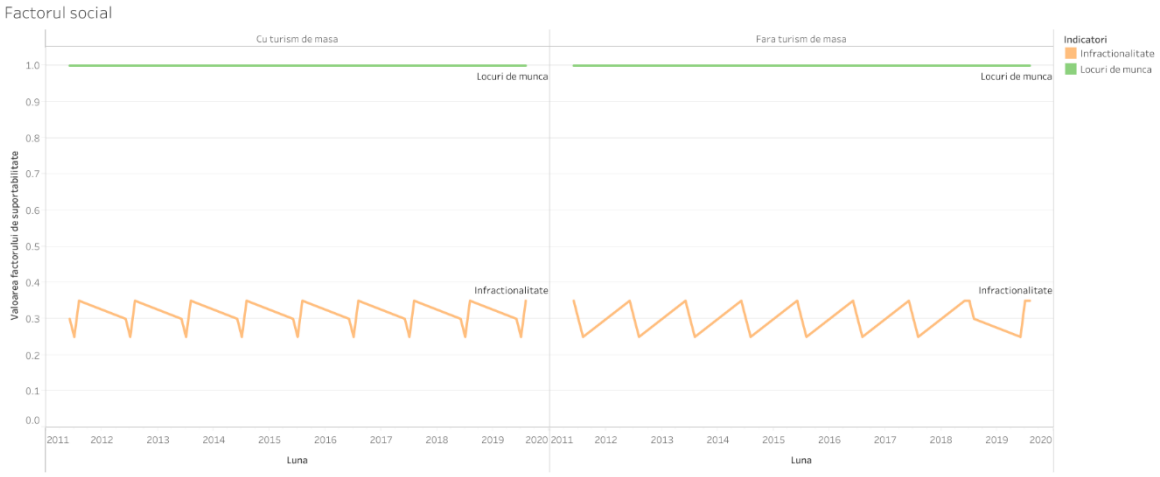

Figure VI.23. Analysis of the indicators of the social factor for the two scenarios

Source: author's contribution

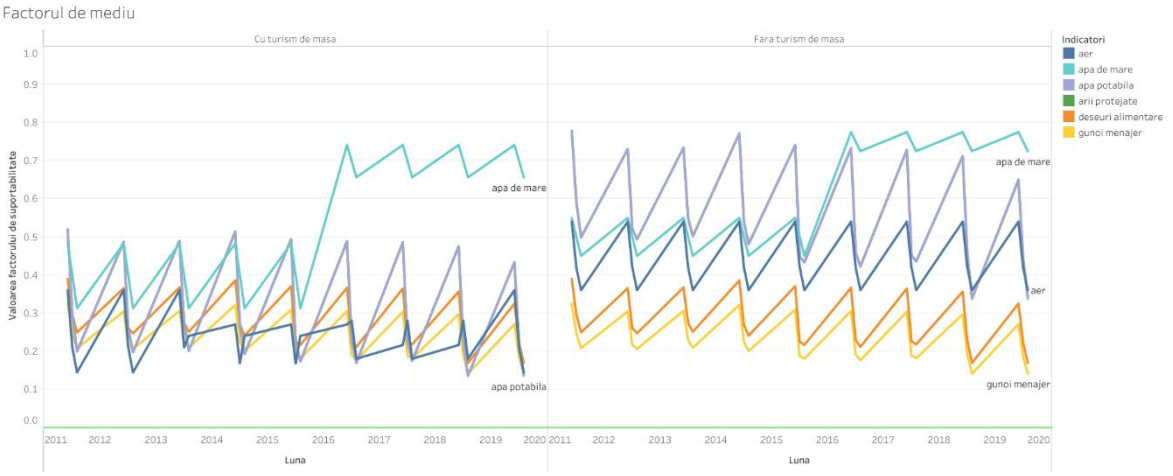

Figure VI.24. Analysis of the indicators of the environmental factor for the two scenarios
Source: author's contribution

The evolution of the indicators is oscillating, with peaks especially in August of each year, this month being the most dynamic. In the case of the analyzed economic factor, several relevant indicators were taken into account, such as the consumption of local products from agricultural sources or aquaculture, the activity of retailers in the public food, the activity of the hotel and restaurant sector, local transport and traffic, electricity consumption but also the economic use of the beach. This last indicator was introduced because, according to the existing studies and strategies, the main destination of coastal tourism is the beach, and the Romanian state has invested considerable sums in this objective. The optimal economic use of the beach was calculated in relation to the number of tourists and locals who use the surface of the beach. There are criteria established both by the national legislation and by the international standards regarding the optimal area required for a tourist on the beach, which is 4 square meters. In these conditions, the optimal economic use of the beach represented for us that the beach must be suitable as an area for the existing number of visitors, a beach with too small or too large area having negative effects on the tourist activity.

In the case of the social factor, we analyzed only two indicators, namely labor force and crime in the summer season. As I mentioned before, analyzing the data provided by the institute of statistics, but also relying on other studies and interviews with stakeholders, we found that the labor force used is especially the one relocated from the city between the units of the same operator or the labor force that comes from other localities. As for crime, it has high values in the summer season, but quite constant from one year to the next.

In the case of the environmental factor, we took into account the air quality, which was mainly related to the increased traffic existing on the coast in the summer season, the amount of waste produced (food and general), the quality of the bathing water, the quantity and quality of drinking water and the impact of tourists on protected areas. Regarding the amount of waste produced, the data was taken from the county's waste management plan, which shows a significant increase (on average by 30%) in the amount of waste in the summer season, waste that is produced by tourists. Also, the institute of statistics makes an annual report of food waste and shows what is the amount of food that a Romanian wastes each year. Regarding the quality of the bathing water, the analyses of the Public Health Directorate reported annually to the European Commission show that the condition of the bathing water was in optimal parameters, being at moderate, good and very good statuses. Also, one thing that improved the quality of the bathing water was the lower

usability of the beach. It is obvious, however, that although, statistically, things are positive, more detailed analyses are needed regarding this parameter, given the multiple cases of pollution and discomfort reported in recent years. But these things are not the subject of this work. As for the protected areas, within the radius of Constanta, the most significant protected area is Lake Siutghiol, which is a protected area of avifaunistica, and the ecological activity in this area is carried out especially in winter for migratory birds. The influence of tourist activity during the summer season is insignificant, and that is why the indicator does not have very low values. We did not analyze in this paper the degree of urbanization in the protected area, because we considered that the touristic activity during the summer does not significantly influence the wintering activity of the migratory birds.

By achieving an average of the indicators of the economic factor (figure VI.25) between 2011 and 2019, it can be seen that although, initially, the activity of mass tourism was more beneficial, in the middle of the period the situation changes and, the activity without mass tourism becomes the better option for the community. A projection of this trend until the year 2050 (Figure VI.26) shows us that both options are good for the community from an economic point of view, because the trend is of growth, only that in the case of the option without mass tourism, the growth is more pronounced, reaching an optimal around 2048, while in the other option, the optimum is expected after 2055.

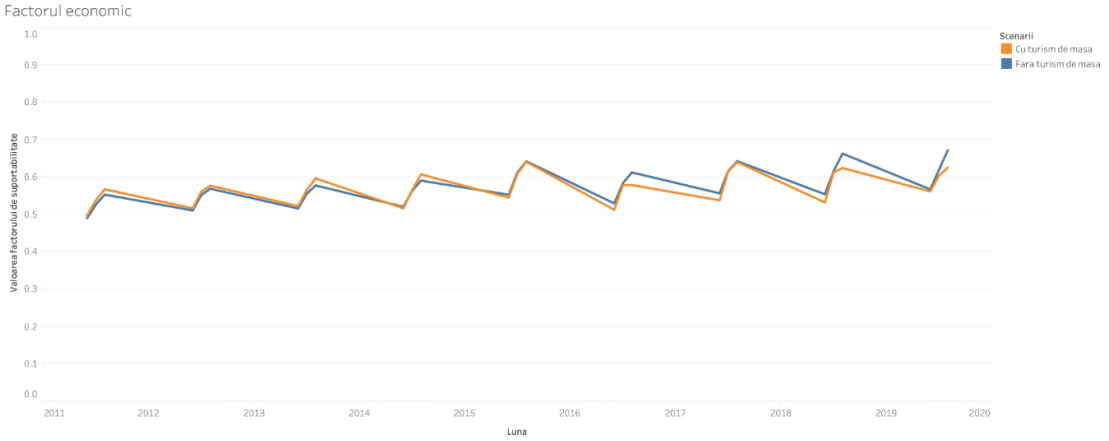

Figure VI.25. Analysis of the indicators of the economic factor averages for the two scenarios

Source: author's contribution

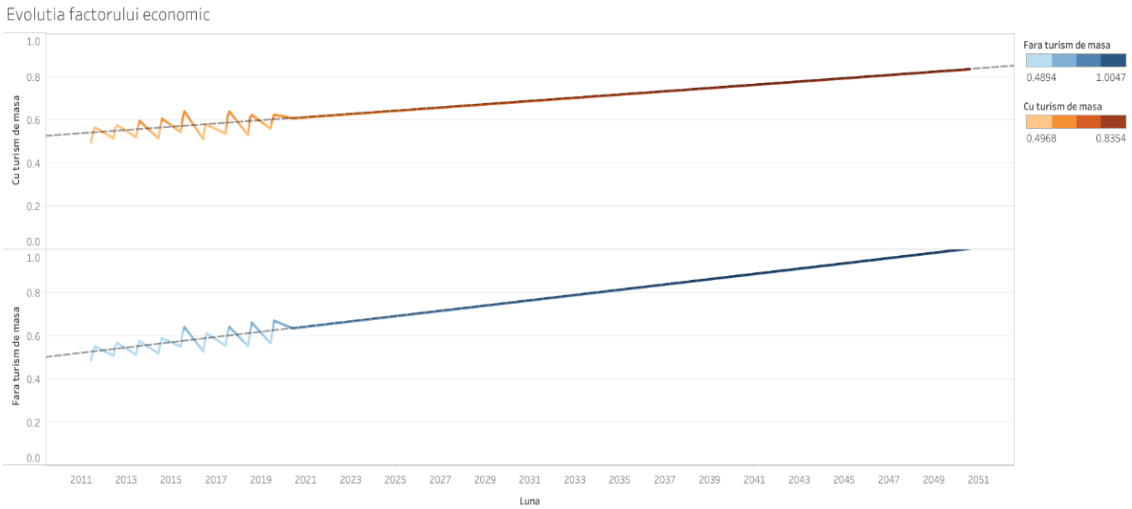

Figure VI.26. Forecast of the economic factor until 2050

Source: author's contribution

We have done a similar analysis in terms of the social factor. If in the analyzed period 2011-2019 we observe an interlacing of the two scenarios (Figure VI.27), the situation becomes more interesting in terms of the forecasts of the two scenarios. The best option proves in this situation also the one without mass tourism, the value being higher in 2050 compared to the value of the scenario with mass tourism. By contrast, the trend is decreasing in terms of the option without mass tourism while the option with mass tourism is increasing (Figure VI.28). It is expected that between 2050 and 2060, there will be a change between the two options in terms of benefits to the community. This analysis of the social factor gives some arguments to planners and public policymakers to choose one scenario or another according to the development directions of the community. At the same time, the analysis can be improved by introducing other social indicators such as education, access to culture, health, etc.

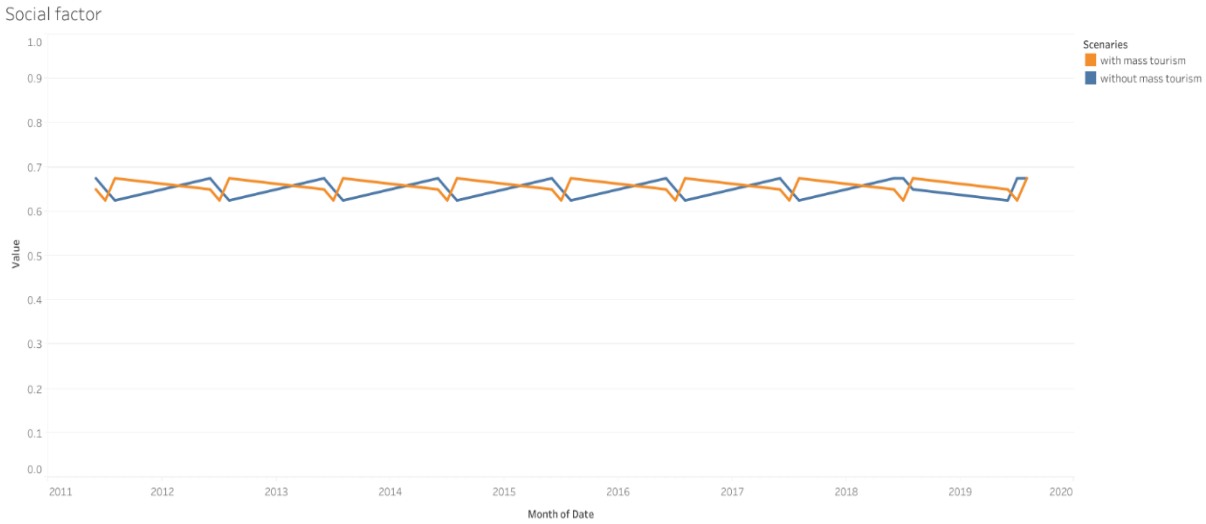

Figure VI.27. Analysis of the indicators of the social factor averages for the two scenarios
Source: author's contribution

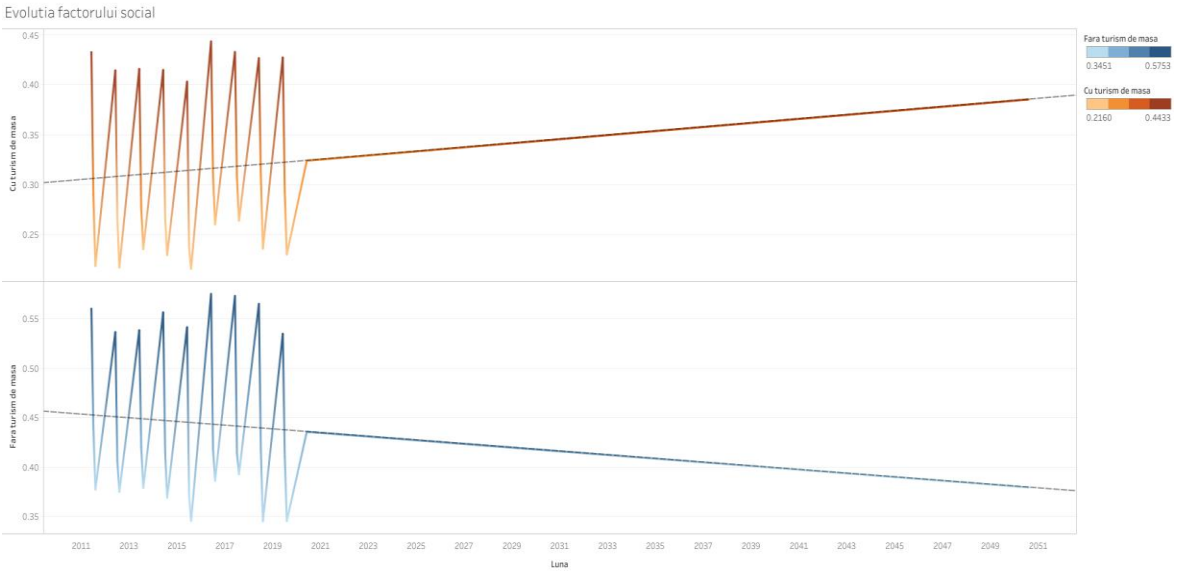

Figure VI.28. Forecast of the social factor until 2050
Source: author's contribution

As regards the environmental factor, the analysis of the averages of the proposed indicators for the period 2011-2019 (Figure VI.29) shows, as expected, the scenario without mass tourism has values higher than the scenario with mass tourism. The forecast until 2050 is especially interesting in terms of trends, the trend without mass tourism being slightly decreasing and the trend with mass tourism being increasing (figure VI.30). However, the main option remains that without mass tourism, and if the current conditions are preserved, even after 2050 the option without mass tourism is the best scenario for the community.

Figure VI.29. Analysis of the environmental factor average indicators for the two scenarios
Source: author's contribution

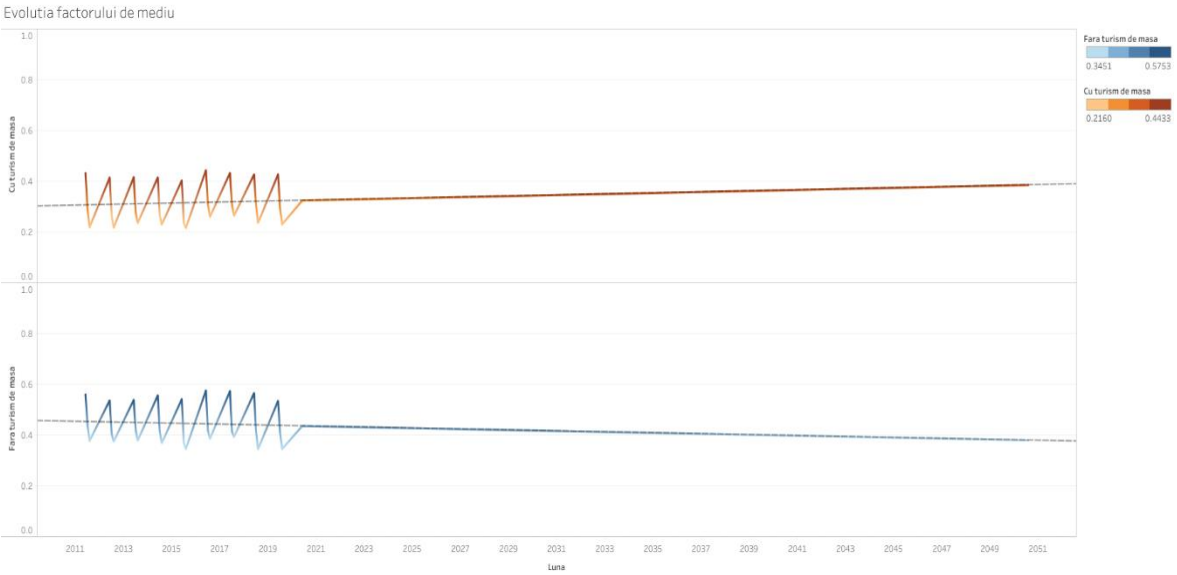

Figure VI.30. Forecast of the average factor until 2050
Source: author's contribution

The last part of the analysis made was achieved by determining the average of the two scenarios on all the proposed factors (economic, social and environmental). As can be seen in Figure VI.31, in the period 2011-2019, the scenario without mass tourism has values

superior to the scenario with mass tourism. This shows that the option used so far has not been the most suitable for the community. As regards the projection of the two scenarios by 2050, trends are increasing in both situations (Figure VI.32). A faster growth is in the case of the scenario without mass tourism, but the difference is not very large between the two scenarios. This situation is a challenge for decision-makers to seek to improve local policies according to the path they want to choose for community development.

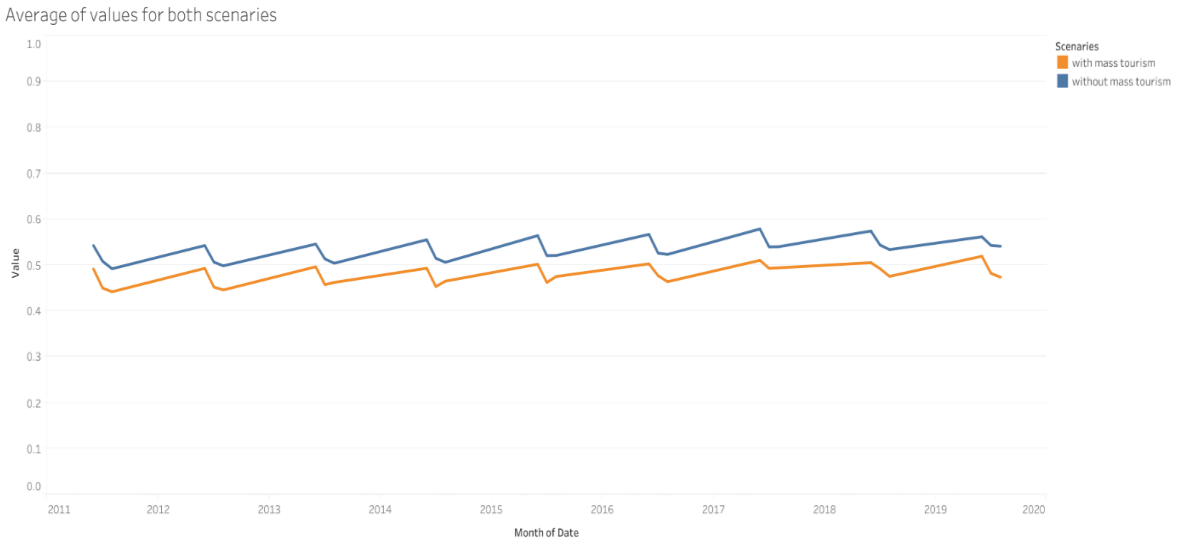

Figure VI.31. Analysis of indicator averages for the two scenarios
Source: author's contribution

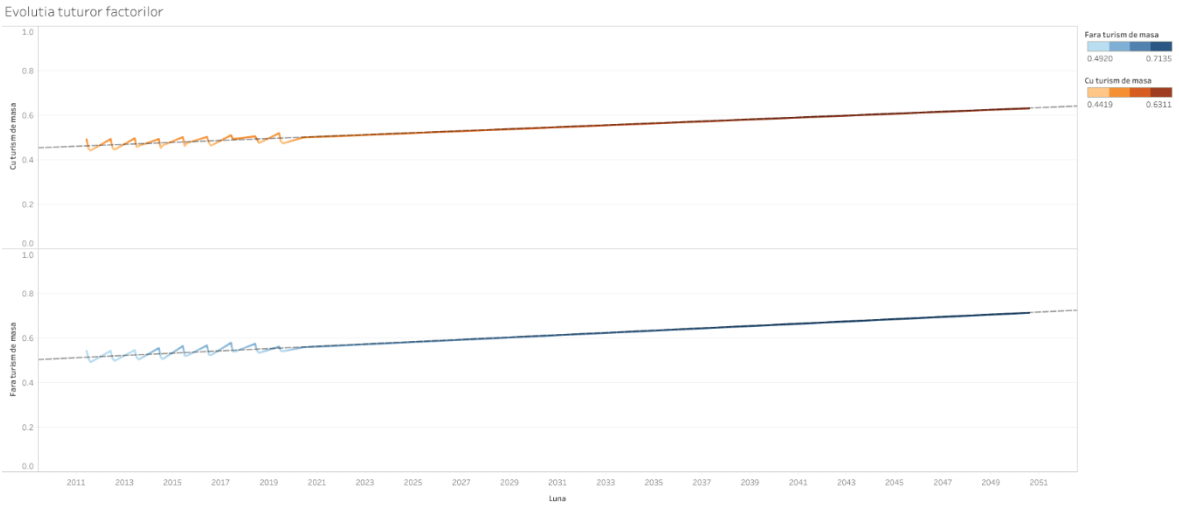

Figure VI.32. Forecast of the average indicators for the two scenarios until 2050
Source: author's contribution

The multicriteria analysis of the mass tourism management model in relation to the impact on the local community in Constanta is a complex tool that can help develop the locality's policies. The scenarios considered may or may not prove viable depending on the pressures exerted by various activities on other activities that take place in the community. The quality and consistency of the data used in this analysis is very important. Also, the correct identification of indicators and the interrelationship between them is a significant process in carrying out a correct analysis. Last but not least, determining the calculation

coefficient for the analyzed activity is important, since bringing to the same basis the data from various activities is a challenge in identifying a viable model.

In the case analyzed in this paper, we started from the hypothesis that the number of tourists coming to a locality has a significant impact on the local community. Although, apparently, it is considered that from an economic point of view, mass tourism is beneficial, however, it can be noted that this form of tourism has a negative impact on some economic and environmental indicators, and often the positive impact is insignificant. This does not mean that a community cannot aim to use mass tourism as a form of tourism. It's just that in these cases, they have to identify the activities under pressure and take those measures that relax the relationships between the activities.

CONCLUSIONS, LIMITS AND FUTURE DIRECTIONS OF RESEARCH

Discussions on doctoral thesis studies

The objective of effective coastal management is to maximize the benefits offered by the coastal zone and to minimize the conflicts and harmful effects of some activities on others. The present work aims to find a management model that can be applied to the peculiarities of coastal areas. The analysis started from the particularities of the analyzed areas (Constanta, Eforie, Kinvara), using a matrix of economic, social and environmental activities, taking into account, however, all the other factors of the PESTEL analysis (i.e. the political, legislative and technological factors).

The analyzed cases showed an existing situation at a certain time, and it is absolutely necessary to validate the new model over time. Periodically, with the help of a multi-criteria analysis, the validation of the model will show possible changes in the analyzed factors. Local, regional, national and international plans and strategies should be integrated into the analysis. Using a holistic perspective, the model avoids traditional sectoral interconnections between coastal systems and uses integrated management approaches.

The interaction and relationship between the activities proposed for this analysis are very important, because in some cases it can have a positive effect, and in other situations, the effect may be predominantly negative or does not exist. Especially in the event of a negative effect it is necessary to establish the threshold at which the negative effect becomes a vulnerability that can lead to a disaster. In the previously published papers that were part of the preparation of the author's doctoral thesis, we developed a tool that we called the bearability factor.

This tool is useful to determine the degree of affordability of an activity in relation to another activity existing in the coastal zone. In general, an ideal situation is a constant situation in which the analyzed indicators keep in balance and have a generally positive or neutral effect on each other. It is known, however, that in the theory of integrated coastal zone management, there are numerous situations of conflicts between activities. And maybe it's natural to have such conflicts; for example, in coastal areas there are tourism activities, but also protected areas that require measures to protect against human activities. Therefore, by establishing a bearability factor, we will see how long one of the

existing activities and the pressure of the others can withstand, and what is the threshold of vulnerable coastal zone.

This theory was initiated by a Monte Carlo analysis, developed in the 1940s, and is a computerized method that uses statistical sampling techniques to obtain a probabilistic approximation with the solution of a model. In this context, the simulation consists of the process of approximating the model results by repetitive random applications of the model algorithm. Monte Carlo simulation combines probability distributions based on existing relationships in models by testing multiple combinations of input variables and storing results for display. The relevance of this method is that the results are often graphs of probability distributions or cumulative probability distributions of output variables, such as total cost or completion dates. These results allow the complete and objective measurement of the different risks. In addition to multicriterial analysis (MCA), several statistical techniques can be used to assess project risks, such as PERT (repeated program evaluation technique), sensitivity analysis, and decision tree analysis.

Personal contributions

In the following is presented the contribution of the PhD student to the realization of the doctoral research. In chapter 1, ***The current state of research in the field of coastal zone management,*** an analysis of the integrated coastal zone management framework was carried out, considering both theoretical concepts and concrete aspects of the coastal management system in Europe and the Black Sea region. The contribution of the PhD student was to synthesize and analyze all these documents, in order to create a clear and coherent framework regarding the coastal management system.

Chapter 2 ***Theoretical and methodological considerations regarding the integrated management of the coastal zone*** considered the analysis of the methods and tools used to carry out the research. The PhD student made an enumeration of these methods and tools tried to describe how they were applied on the multicriterial analysis of the coastal zone. An important part of the chapter was allocated to the study of the implementation of strategic management. As a planning process in coastal management.

In Chapter 3, ***Sustainable development in the coastal zone – support for an integrated coastal strategy,*** the PhD student made the transition to the concepts of sustainable development and their relationship with coastal areas. Also, in this chapter was approached the interdisciplinarity of the research carried out within this doctoral thesis.

Chapter 4, ***Tools and methods for designing a coastal management model,*** is the chapter that links strategic management in coastal areas to sustainable development. This part of the thesis was necessary to explain the complexity of the multicriterial analysis process that is applied in coastal areas.

In chapter 5, ***The analysis of the Romanian coastal zone through the prism of sustainable development,*** the characteristics of the natural and anthropogenic systems of the Romanian coastal zone were analyzed. The PhD student made, among other things, an assessment of the main existing economic activities and made a socio-economic evaluation of the analyzed field.

The coastal sustainability analysis was carried out in Chapter 6, entitled ***Analysis and impact of the integrated management model on the coastal zone respecting the principles of sustainable development.*** Here the coastal models of Romania and Ireland have been considered, identifying the main problems faced by coastal areas. The practical application of multicriterial analysis methods and tools is also presented in this chapter, in which coastal management models are analyzed for the Eforie and Constanta (Romania)

and Kinvara Bay (Ireland) areas. The identification of the analyzed activities, the data collection, the creation of sustainable models was carried out by the PhD student.

Research ethics

Throughout my phd research I have complied with all the recommendations of academic ethics. After we started the steps related to the research, we took several necessary ethical actions to ensure that all employees in the pre-university system were interested in participating in the research, and also to make them trust that we will not disclose any information about their identity and also that they can give up the study at any time. We also complied with the requirement of analyzing and discussing the results of the research, without making comments related to a particular respondent participating in this study.

Prospects for further development

The coastal management model can be seen as a conscious or evolutionary path in the form of a goal or vision. This includes an explicit or implicit definition of the long-term objectives of the decision-makers managing coastal areas. Planning generally focuses on how the environment will develop. Community development will have to be done on the basis of future possibilities, then finding what can be done and how it is hoped to be done based on strategic dynamics. These scenarios are based on a realistic vision of how a number of key interconnected factors will improve the climate of the area under review.

Depending on the sustainability policy choices of managers, the future will depend on the path they choose. Managers can see their coastal management model as a transformative environment in which basic economic, social and political changes allow businesses and people to progress.

Situational opinions or "predictive intelligence" offered by future analyses and research are expected to help managers see the "future." They obviously do not know the future, but today they have to make strategic choices based on predictions for the future. Taking into account this management challenge, the planning strategies and program options followed by the development strategy will strongly determine the future that we will eventually achieve.

Depending on the extent to which policymakers want to influence the future and the expected predictability of the environment, they have four basic options. First, they will want to adopt predictive and planning methods and develop strategies based on plans that they believe they offer more or less. Secondly, by improving skills, they can adopt agile strategies and increase operational flexibility. In situations where leaders do not expect future development to be predictable, the coastal management model developed in this work allows them to quickly identify and respond to sudden changes. Third, organizations should take a more proactive approach, in which they deliberately define the desired vision in the macro environment. Finally, the development of the coastal zone and its preparation to face climate change is not a separate goal, but a partnership involving various stakeholders. All this should actively participate in the progressive efforts for a prosperous social ecology and an economic future. This includes the joint definition of a common vision and the design of an organised strategic response.

In view of the above, the author proposes three major directions of development of the coastal management model, namely:

1. Validation of the existing model by extended application and in areas other than those analyzed in this work
2. Digitizing the model, by using digital applications that analyze and provide a prediction with a much higher accuracy of the model.
3. Linking the model to new development trends, such as the introduction of new models of analysis on sea level rise or models for reducing carbon emissions

All these aspects will be developed by the PhD student in a subsequent postdoctoral research.

Dissemination of research results in the academic and scientific environment

Articles presenting original scientific contributions, in extenso, published in a journal rated Web of Science with impact factor >0

1. Anton Iulia Alina, Rusu Liliana, **Anton Catalin**, Nearshore wave dynamics at Mangalia beach simulated by spectral models, MDPI Journal of Marine Science and Engineering, 2019, 7(7), 206; https://doi.org/10.3390/jmse7070206, ISSN: 2077-1312, **Impact Factor: 2.458, AIS 0.430**
   https://www-webofscience-com.am.e-nformation.ro/wos/woscc/full-record/WOS:000478581900018
2. **Catalin Anton,** Carmen Gasparotti, Eugen Rusu, Implementation of a Coastal Management Model at Kinvara Bay in the North Atlantic Ocean, MDPI Journal of Marine Science and Engineering, 2020, **8**(2), 71; https://doi.org/10.3390/jmse8020071, ISSN: 2077-1312, **Impact Factor: 2.458, AIS 0.430**
   https://www-webofscience-com.am.e-nformation.ro/wos/woscc/full-record/WOS:000519244200042

Articles presenting original scientific contributions, in extenso, published in a peer-reviewed journal Web of Science without an impact factor

1. **Anton Catalin**, Micu Angela Eliza, Rusu Eugen, Multi-Criteria Analysis of the Mass Tourism Management Model Related to the Impact on the Local Community in Constanta City (Romania), MDPI **Inventions** 2021**, 6**(3)**,** 46**;** ISSN: 2411-5134, Citescore 3.6
   https://doi.org/10.3390/inventions6030046,

   https://www-webofscience-com.am.e-nformation.ro/wos/woscc/full-record/WOS:000700674900001
2. Panaitescu Mariana, **Anton Catalin,** Viorel Fanel Panaitescu, Iulia Alina Anton, Mihaela Turof, New solutions to protect the Romanian coastline, Proceedings Volume 10977, Advanced Topics in Optoelectronics, Microelectronics, and Nanotechnologies IX; 109772A (2018) https://doi.org/10.1117/12.2322487
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Articles/studies published in the volumes of international conferences indexate Web of Science

1. **Anton Catalin,** Gasparotti Carmen, Rusu Eugen, A Challenge for the Inland Navigation - A Connection between the Baltic and the Black Seas, Proceedings of Conference: International Conferences on Traffic and Transport Engineering, ICTTE Belgrade 2018, ISBN 978-86-916153-4-5, pag.175-186
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Articles presenting original scientific contributions, in extenso, published in an indexed journal in recognized international databases

1. **Catalin Anton,** Gasparotti Carmen, Anton Iulia Alina, Rusu Eugen, Approach to the analysis and evaluation of the strategic intervention options in the Romanian coastal zone taking into account economic, social and environmental factors, International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM, Book number: 5.3, SGEM Series: International Multidisciplinary Scientific GeoConference-SGEM, Pages: 67-74, DOI: 10.5593/sgem2018/5.3/S28.009, EID: 2-s2.0-85058875096, July, 2018, ISBN: 978-619-7408-48-5, ISSN: 1314-2704
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2. **Anton Catalin,** Gasparotti Carmen, Rusu Eugen, Identification of the economic pressure on environmental factors in the Romanian coastal zone-case study Eforie, International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM, Book number: 5.3, SGEM Series: International Multidisciplinary Scientific GeoConference-SGEM, Pages: 461-468, DOI: 10.5593/sgem2018/5.3/S28.009, EID: 2-s2.0-85058875096, July, 2018, ISBN: 978-619-7408-48-5, ISSN: 1314-2704
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%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jrnl%3d18446116%26AN%3d126178617

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5. **Anton Catalin**, Gasparotti Carmen, Rusu Eugen, Introducing the Blue Economy concept in the Romanian nearshore, Risk in Contemporary Economy, Dunarea de Jos University of Galati, Faculty of Economics and Business Administration, 2018, pages 281-289.
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6. **Anton Catalin,** Gasparotti Carmen, Raileanu Alina Beatrice, Rusu Eugen, Towards integrated management and planning in the Romanian Black Sea coastal zones, Acta Universitatis Danubius. Oeconomica Journal, Vol 13, No 5 (2017), pag. 59-71
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