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Tourism destination management involves the coordination of economic, socio-cultural, environmental and geographical elements within a designated tourism area.

Traditional research in tourism destination management has tended to use a reductionist approach in order to monitor certain flow variables, like visitor arrivals and expenditures. This approach has shown some limitations, as tourism development has a decisive influence on many elements within a destination, reinforcing the need for a holistic understanding of the tourism development process.

In this paper, it is proposed that a Systems Dynamics model is an advantageous choice to the understanding and management of tourism destinations, because it integrates social, environmental, economic, geographical and other variables. A Management Flight Simulator, makes it possible to experiment with management strategies and observe the impacts of those strategies over time upon the system's components, facilitating the efforts made by stakeholders in the destination to achieve desired levels of sustainability. In this way, the model aims to contribute to a deeper understanding of the tourism system's complexity and to provide the tourism destination's management with a tool for strategic decision making based on a fair representation of the real system.

The model was built in accordance with a theory of the tourism system's dynamics<sup>1</sup>, hypothesized and tested using primary and secondary sources. This theory led to the conceptualisation of the dynamic model (MODISTUR), based on the Systems Dynamics methodology, which was made operative through Forreter's diagrams and differential equations.

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<sup>1</sup> in Serra, F. (2003)

To test the model's structural consistency and behaviour, the Portuguese region of Algarve (a well known tourism destination) was used as the field of study. In the Algarve, tourism has been, for the last 30 years, an alternative to the hard life of agriculture and fishing. It is evident that this region has favourable natural resources and its inhabitants have accepted tourism with no hostility (although with varying levels of tolerance), adapting to the circumstances and taking advantage of business and work opportunities. In the process, the coastal landscape and, surprisingly, that of the undeveloped interior, have suffered dramatic changes; the first one due to high urbanization levels and the second, due to human desertification and the abandon of traditional activities, like agriculture.

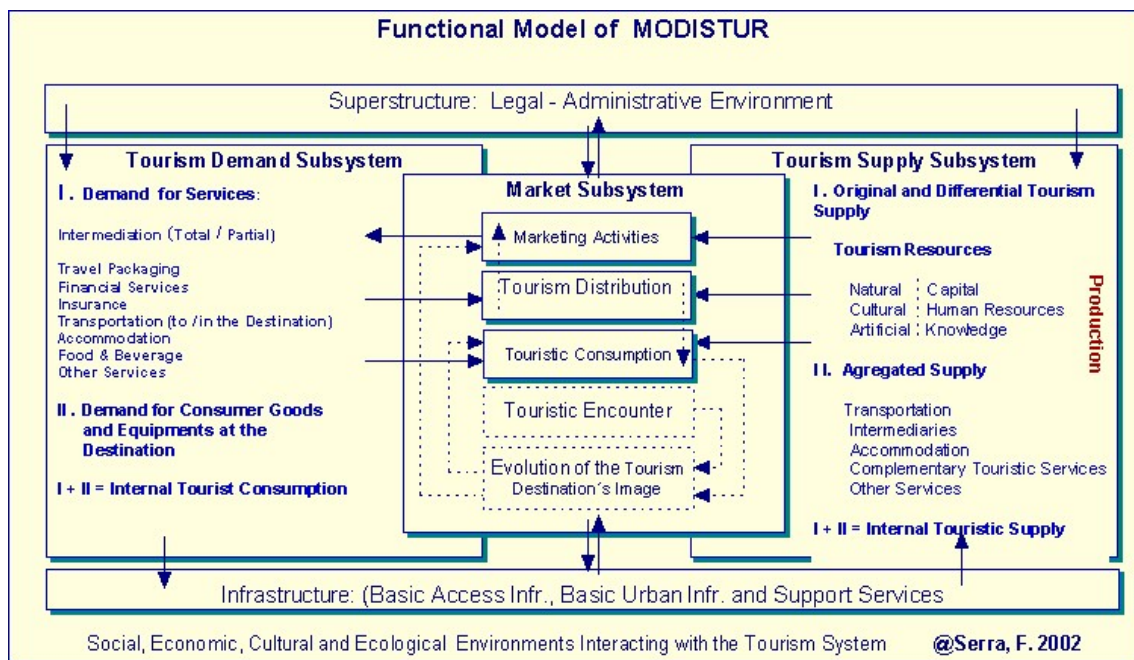
These dynamics led, by the end of the 1980s, to the rethinking of the region's development pattern, specially in regard to construction and to the worsening of environmental conditions. From then on, a variety of plans have been implemented and some most needed infrastructures have been built, mainly during the 1990s.

At the beginning of the new millennium, tourism has definitively become the largely dominant activity in the region, a fact that worries some policy makers at regional and national level, for its potentially negative impacts and its dependence on exogenous variables that determine, or greatly influence, international tourist flows.

One issue that emerges is the relationship between tourism development and the environment. Conflict arises because the environment is both a factor of production and a source of attraction for tourists. As an economic activity, tourism is almost unique in the sense that no other "industry" has this systemic relationship with the environment. The relationship between tourism development and the environment is both extractive and aesthetic. Tourists require good supplies of local resources and local produce as basic ingredients of their tourism experience – which can be extracted only from the tourist destination they visit. Certain tourism systems are also dependent on the environment to provide an aesthetically pleasing amenity to the tourists in the form of mountain vistas, appealing marine environments for diving and other natural settings for the enjoyment of tourism-related activities. These activities could be viewed as non-extractive in cases where tourism activities do not degrade the environmental amenity provided to tourists.

This interdependence illustrates the need for a systems approach to the management of economic and environmental resources concerning development options. From a destination perspective, the main elements to consider in tourism development are natural resources, accessibility, transportation, attractions, support services, promotion and information. These supply-side components of tourism are usually referred to, as the *functioning system*, in that a change in one component will cause influence the behaviour of many others. For instance, a change in air transport accessibility to a destination will have an impact on demand for tourist services and attractions, as well as in the need for promotion and information.

**Figure 1: A conceptual representation of the functional tourism system**



Source: own elaboration

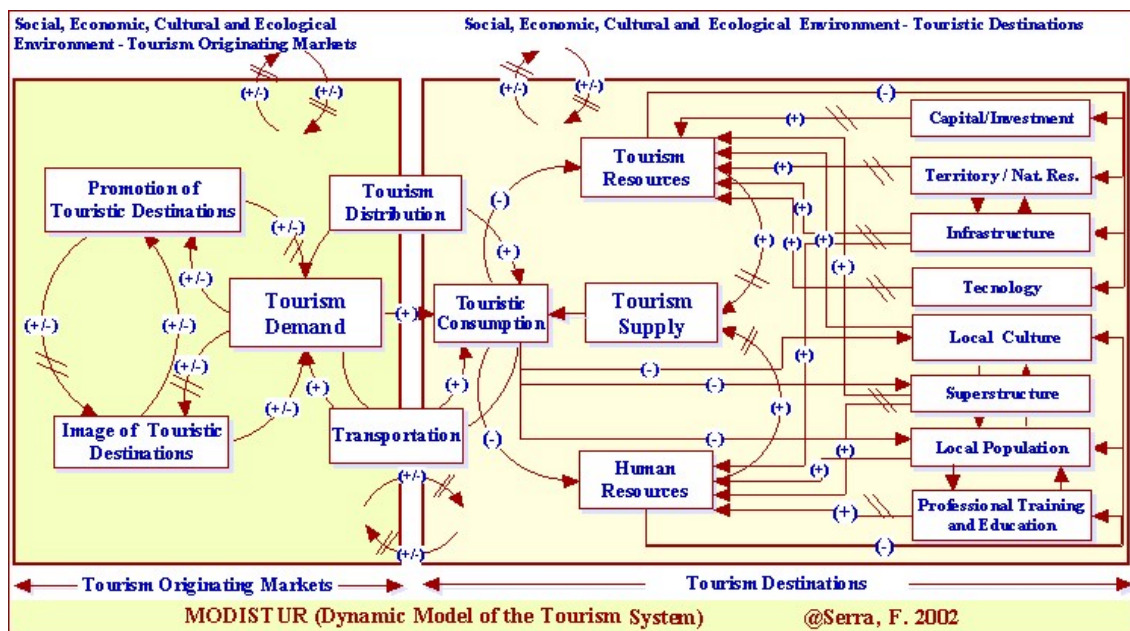
This view of tourism as a functioning system has major implications for tourism planners and destination managers in the public and private sectors. It is important to recognize that tourism is not only realized through material flows, but mainly through *personal interrelations* (Sessa, 1988). Once this human element is introduced into the study of tourism, the limitations of existing mono-disciplinary approaches (economic, geographical, managerial, anthropological, etc.) become clear.

## SYSTEMS THINKING ABOUT TOURISM

In the late 1960s it was recognized that the principles of general systems theory could be applied to a broad range of scientific disciplines, paving the way to a more conceptual approach that can accommodate qualitative as well as quantitative factors.

Systems thinkers are committed to a *holistic* understanding of phenomena (Jackson, 1993), in contrast with the *reductionist* approach that has prevailed in the thinking of social sciences in many disciplines (including tourism) whereby breaking down the problem into its component parts has been the common approach.

**Figure 2: Conceptual Systems Dynamics model of the tourism system**



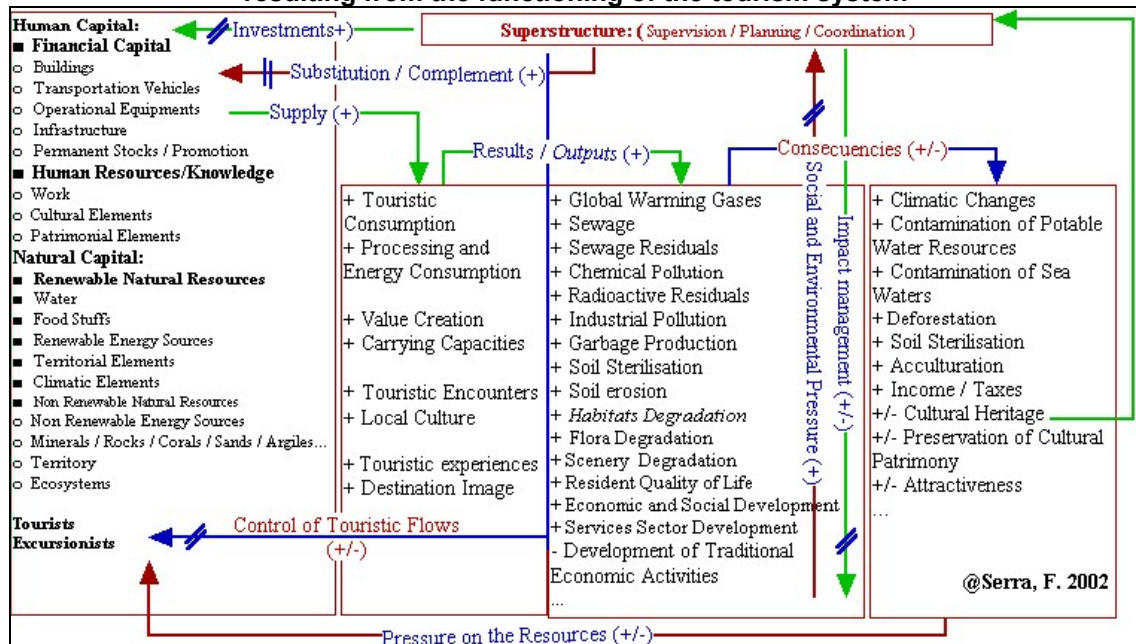
Source: own elaboration

The literature, to this date, has been concerned with analysing the results of tourism development, rather than understanding the process that transforms economic, social and environmental structures, in regard to tourism activities. This may be partly due to the single sector approach that has characterized research and analysis of the tourism phenomenon, disregarding the more fundamental factors that underlie the functioning of tourism as a system.

This is particularly relevant to small regions where the system as a whole can be modelled in better controlled limits and the relationships between the variables within the model can be more clearly defined.

The consideration of feedback in the system, where change in one module affects change in another, which in turn influences the first one, is an important innovation of the systems approach. There are many positive and negative feedback loops yet to be identified in the population / environment / tourism development interaction and this is an important task: one that will provide a useful framework for tourism systems research in the future.

**Figure 3: Conceptual Diagram of Inputs, Energy Processing, Outputs and Consequences resulting from the functioning of the tourism system**



Source: own elaboration

Table 1: Interaction Matrix of the Various Subsystems of the Tourism System

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1											↙											
2								↙			↙					↙						
3	↙				↙			↙								↙			↙			
4		↙						↙								↙	↙	↙	↙			
5	↙						↙	↙								↙		↙	↙			
6	↙				↙													↙				
7			↙		↙										↙			↙				
8	↙															↙		↙				
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13						↙		↙		↙												
14	↙			↙	↙				↙						↙			↙				
15	↙				↙	↙	↙											↙	↙			
16	↙				↙		↙	↙							↙					↙		
17	↙	↙													↙				↙			
18	↙				↙		↙			↙					↙						↙	
19	↙						↙			↙					↙	↙		↙			↙	
20		↙				↙		↙	↙	↙			↙		↙				↙			
21																			↙			
22	↙													↙								

↙ = Direction of the Interaction

Module Codes

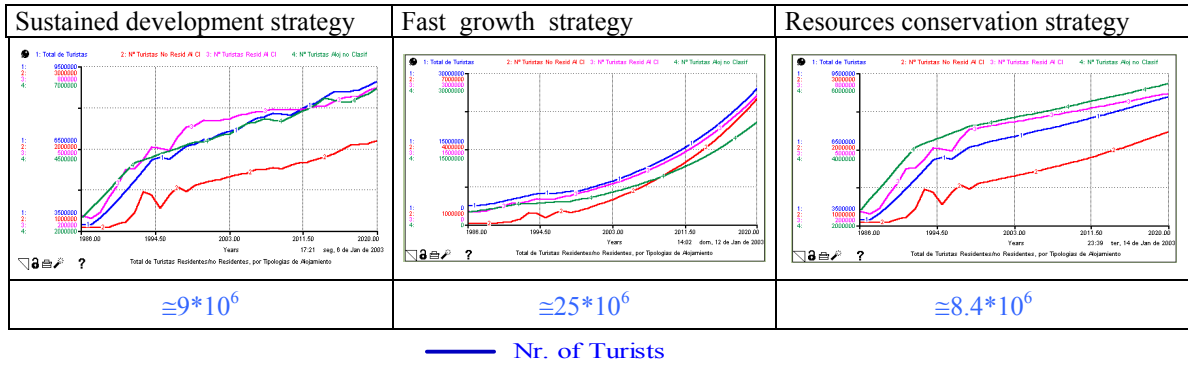
1	Tourism Generating Markets	12	Quality of the Tourist's Experience
2	Resources (Natural & Artificial)	13	Innovation & Technology
3	Tourism Supporting Services	14	Tourism Destination Marketing
4	Carrying Capacity	15	Accommodation Supply
5	Seasonality	16	Public Investments with impact on Tourism
6	Tourism Revenues	17	State of the Local Culture
7	Tourism Related Private Investments	18	Other Facilities Supply
8	Environmental Quality & Impacts	19	Population & Human Resources
9	Security at the Destination	20	Economic & Social Development
10	Public Tourism Administration	21	Economic Impacts of Tourism
11	Unpredictable Events affecting Tourism	22	Determinants of Tourism Demand

Source: own elaboration

The following, are some results of the simulation exercise regarding strategic options relative to the Algarve, whereby we can visualise the effects of strategic options on tourism growth, upon certain variables that condition the tourist's experience in the destination.

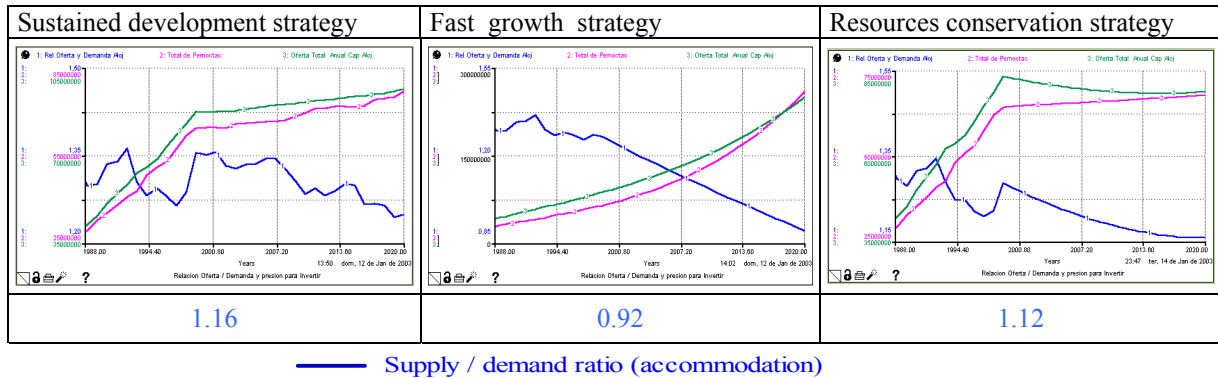
**Figure 4: Comparison of Results – Nr. of Tourists**

(1986 - 2020)



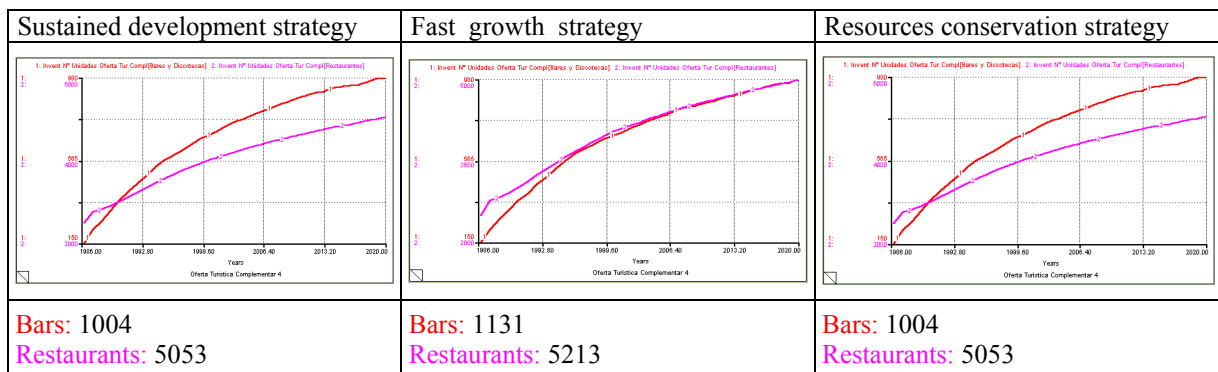
**Figure 5: Comparison of Results – supply/demand ratio (Accommodation)**

(1986 - 2020)



**Figure 6: Comparison of Results – Nr. of Restaurants and Bars**

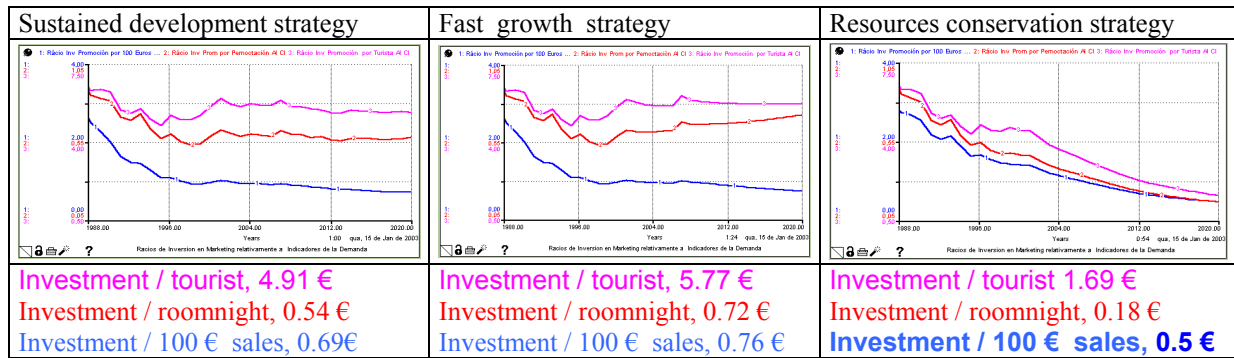
(1986 - 2020)





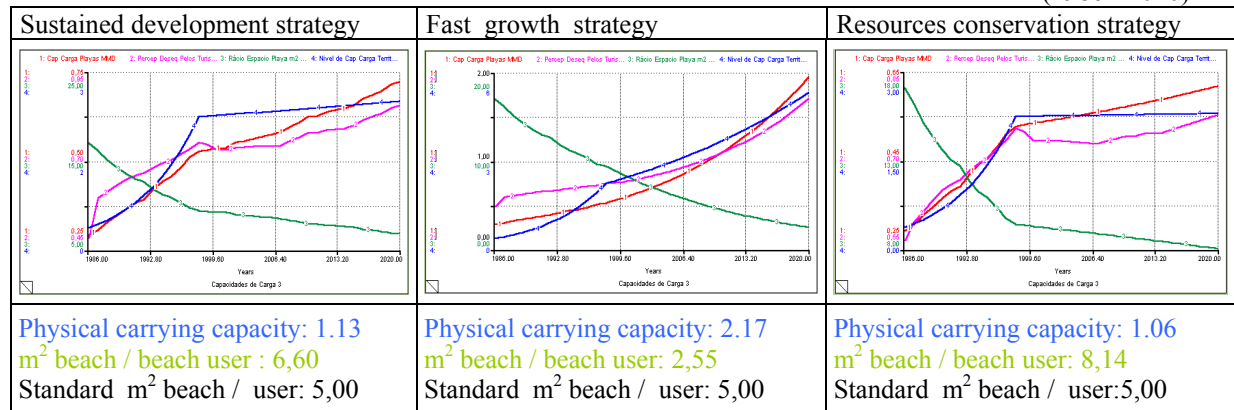
**Figure 7: Comparison of Results – Promotion efficiency indicators**

(1986 - 2020)



**Figure 8: Comparison of Results – evolution of carrying capacities**

(1986 - 2020)



**Figure 9: Comparison of Results – global carrying capacities (indicators)**

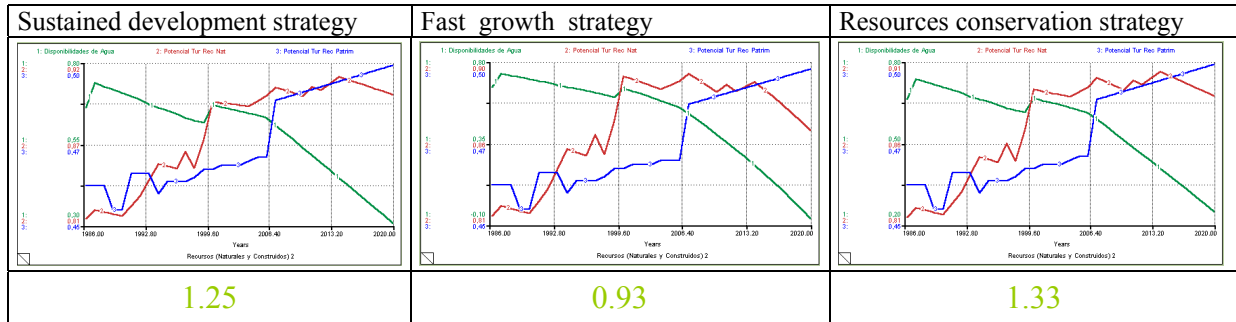
(1986 - 2020)

Sustained development strategy	Fast growth strategy	Resources conservation strategy
Global carrying capacity: 0.97	Global carrying capacity: 1.61	Global carrying capacity: 0.97
Social carrying capacity: 0.70	Social carrying capacity: 0.98	Social carrying capacity: 0.67
Biological carrying capacity: 1.08	Biological carrying capacity: 1.70	Biological carrying capacity: 0.91



Figure 10: Comparison of Results – availability of water resources

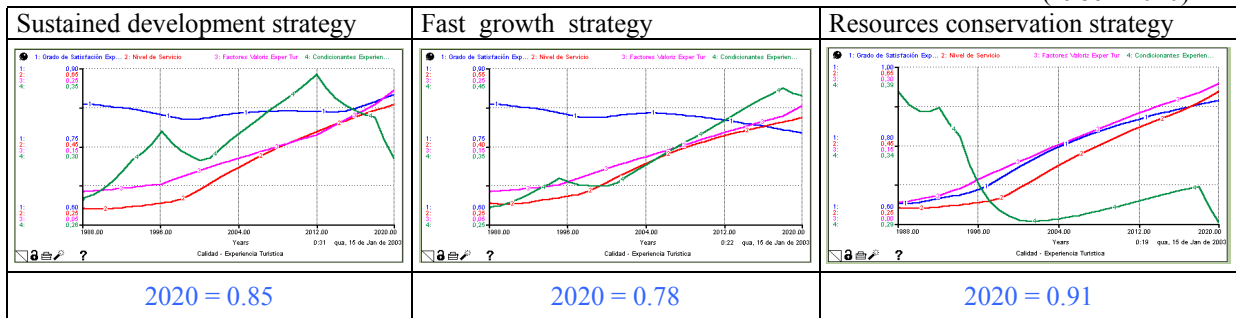
(1986 - 2020)



— water availability

Figure 11: Comparison of results – evolution of the tourist’s satisfaction with the experience

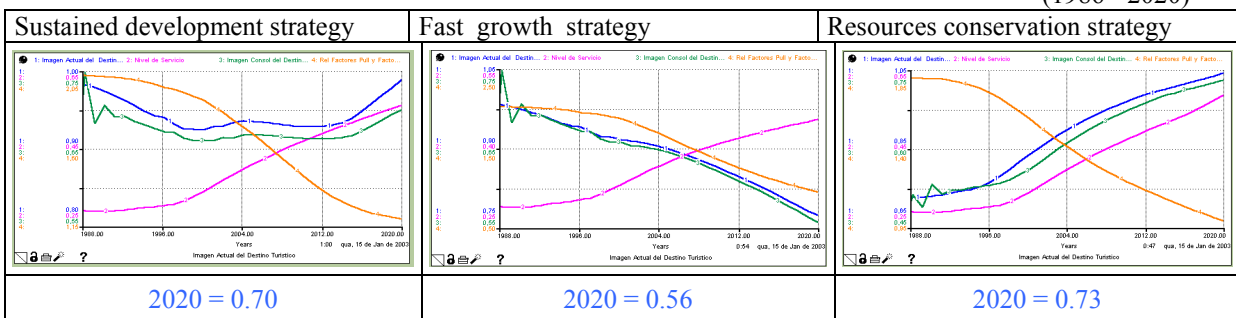
(1986 - 2020)



— Tourist's Satisfaction with the Experience

Figure 12: Comparison of results – evolution of the destination’s image

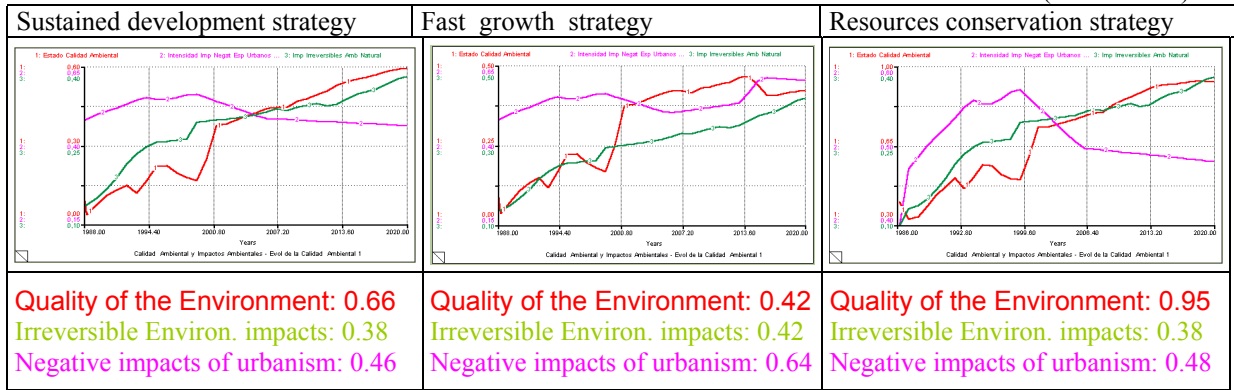
(1986 - 2020)



— Destination Image (transient)

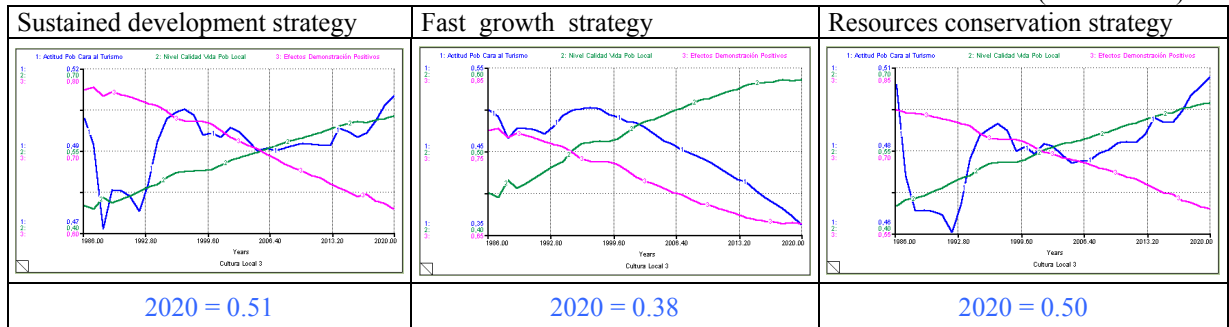
**Figure13: Comparison of results – evolution of environmental variables**

(1986 - 2020)



**Figure14: Comparison of results – evolution of the attitude of residents towards tourism**

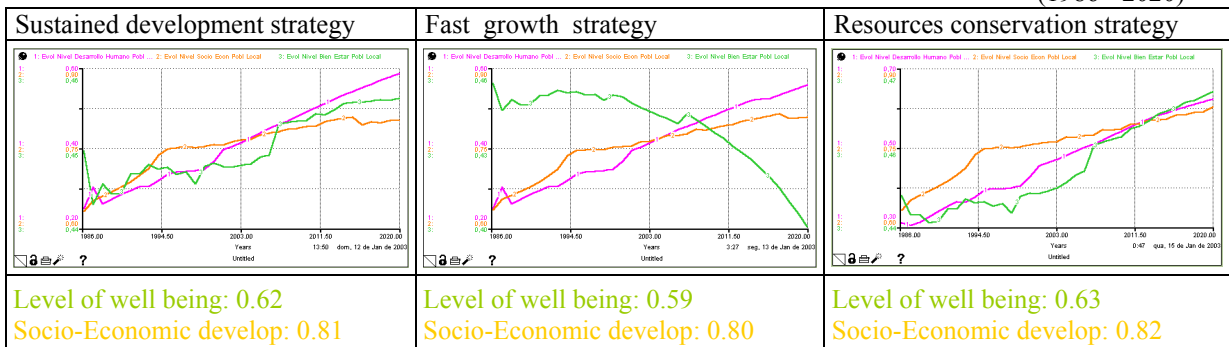
(1986 - 2020)



— Attitude of the residents

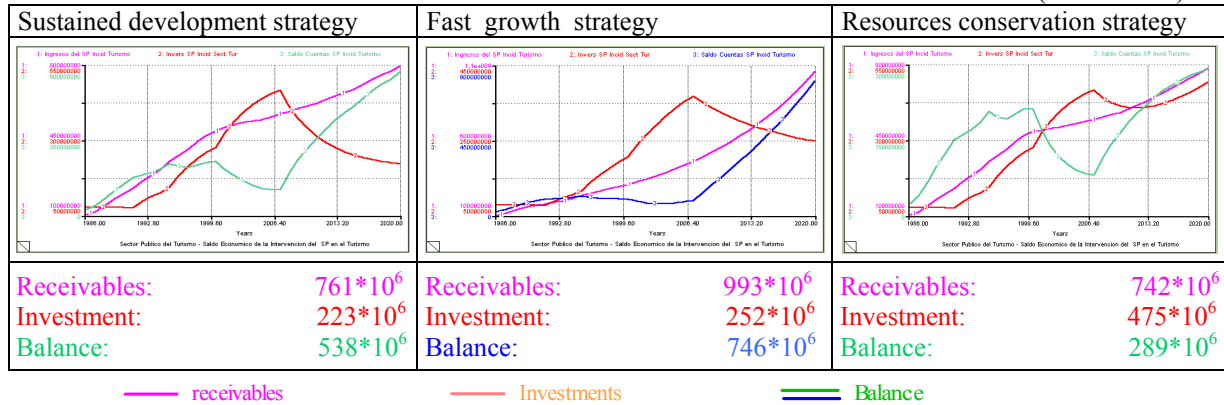
**Figure 15: Comparison of results – Resident's quality of life**

(1986 - 2020)



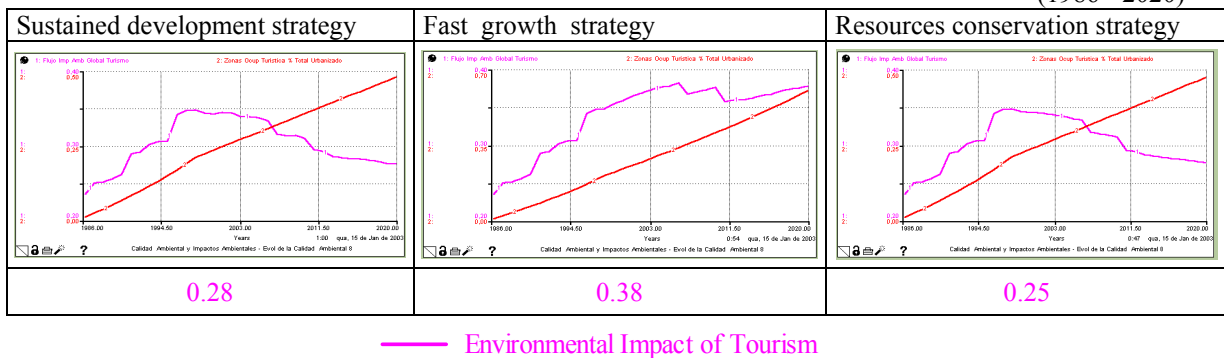
**Figure 16: Financial balance of the public sector involvement in tourism development**

(1986 - 2020)



**Figure17: Comparison of results – Environmental impact of tourism (relative to total impacts)**

(1986 - 2020)



Other variables, as the typology of accommodation, the variety and availability of support services, as well as prices, are equally important for the quality of the destination and have been included in MODISTUR. A more complete perception can be formed by observing the interactive presentation.

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