ESTUDOS II

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ESTUDOS II

Cidadania, Instituições e Património

Economia e Desenvolvimento Regional

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Gestão e Apoio à Decisão

Modelos Aplicados à Economia e à Gestão

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Tourism and sustainable development: Algarve (Loulé) case study

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Resumo

A partir do conceito de Desenvolvimento Sustentável, o objectivo deste estudo é o de tentar operacionalizá-lo, tendo como objecto de estudo o concelho de Loulé, um dos mais representativos do turismo da região do Algarve.

Neste conceito está implícito o desafio de criar as condições para ir ao encontro das necessidades e aspirações das pessoas envolvidas, no presente e no futuro.

Na realidade, desde o despertar da consciência dos decisores até à criação de oportunidades de política para o Desenvolvimento Sustentável há um grande fosso que é preciso avaliar para se poder posteriormente reduzir e eventualmente transpor.

A linha mestra deste estudo é o desenvolvimento que se apresenta como um conceito global e pluridisciplinar e por esse facto considera-se que a abordagem mais correcta será a abordagem sistémica que, considerando o turismo como um instrumento do desenvolvimento, permita identificar vários cenários de desenvolvimento para a realidade em estudo.

Atendendo à complexidade e amplitude de questões que engloba o conceito de D.S., com particular ênfase para o sistema de valores a ele subjacente, procura seguir-se uma metodologia que englobe quer os aspectos qualitativos quer os aspectos quantitativos do D.S. e que permita operacionalizar o conceito a uma escala local.

A metodologia proposta neste trabalho, baseada na dinâmica de sistemas, tem a grande vantagem de poder ser aplicada de uma forma transparente e interactiva, com possibilidade de actualização constante de dados por forma a melhorar a compreensão do comportamento do sistema em estudo, não esquecendo no entanto as partes que o constituem.

Palavras-chave: Desenvolvimento Sustentável; Desenvolvimento Turístico Sustentável; Abordagem Sistémica; Modelização; Dinâmica de Sistemas; Escala Local de Operacionalização.

Abstract

The main purpose of this study is to make Sustainable Development (S.D.) become operative. The target chosen is Loulé municipality in Algarve.

The guideline of this research is the development, as a global and multidisciplinary concept. Therefore, considering the literature, it is thought that the most correct approach will be the systemic one.

In this way tourism is considered to be a development tool that allows the identification of various scenarios for the reality under analysis.

Considering the complexity and variety of questions arising from the S.D. concept with particular emphasis on its intrinsic value system, we try to look for a methodology that can include both, the qualitative and quantitative aspects of S.D. and permit the concept to become effective at a local scale.

The proposed methodology based on dynamic of systems has the possible advantage to be applied in a clear and interactive way with the possibility of updating data or other elements in order to improve the understanding of the system under analysis and its main parts.

Keywords: Sustainable Development; Sustainable Tourism Development; Systemic Approach; Modelling; Dynamic System Model; Local Scale.

1. Introduction

The concept of Sustainable Development (S.D.) has been largely accepted but also largely discussed in terms of difficulties and aspects that permit this concept to become effective.

Sustainable Development implies the challenge of creating the required conditions to meet the involved people´s needs and desires at present and in future. (WCED,1987).

Bearing in mind this challenge, the problem studied in this paper is:

From the decision maker´s awareness to the creation of political opportunities for S.D., there is a big gap that is necessary to be evaluated in order to reduce or, if possible, overcome in the near future.

Indeed, the research and political debate about S.D. is very recent (W.C.E.D.,1987). This means some consensus but also a clear lack of guidanceThrough this concept of S.D. it is intended to balance economic, social and environmental objectives and to consider anthropocentric and ecocentric aspects.

(Lopes, 1984:19; Nijkamp and Bergh 1991:13; Bergh, 1991:8; Sharpley, 2000:4-8)

Some authors consider this concept extremely simple in its essence and extremely complex in practice.

(Blowers, 1992:25-28; Correia, 1992:5)

However, the complexity of the (S.D.) concept, being a strong restriction, can't obstruct its application.

(Clark, Trejo and Allen, 1995:67,73)In terms of Regional Sustainable Development, some authors have been studying models with an effective focus (case study of Greek Islands or Mexico).

(Nijkamp and Bergh, 1991:11; Nijkamp and Giaoutzi, 1993:14-17; Kandelaars, 2000:708)

It is this research line that is followed with the study of a model that allows the S.D. concept to become effective at a local scale (Loulé Council). This is one of the most representative tourism municipalities in the Algarve region.

What is then the relation between Sustainable Tourism Development (S.T.D.) and Sustainable Development (S.D.) ?

The state of the art about this issue seems to lead to a relative consensus about the need to integrate S.T.D. in the S.D. strategy.

(Hunter, 1995:160; Butler, 1999:49; Sharpley, 2000:3,9; Silva and Perna, 2002:2-4)

The conceptual model considered in this paper follows this integration as well as a systemic approach based on dynamic of systems and multidisciplinary approach.

Therefore, based on the literature, this paper adds to the discussion through this systemic approach and its specific focus upon Loulé council (local scale).

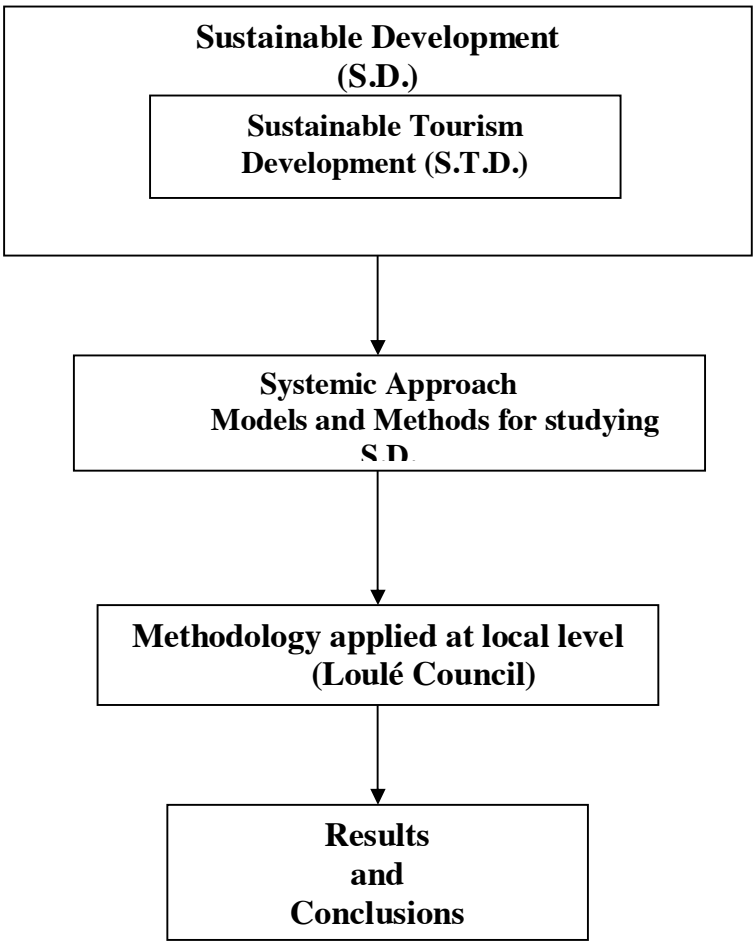


Figure 1- Conceptual model
Source: Louro, M.F.(2004).

2. Methodology

"The main benefit of the models for the study of Sustainable Development is the contribution for a better observation of dynamic attributes of environmental and economic systems."

(Bergh, 1991:15-16)

"Differences in Model approaches must not be seen as inconsistent but as a complement because it's impossible to consider just one model structure."

(Bergh and Hofkes, 1998:7-11)

In this study it is intended to follow these and other authors suggestions and use scientific tools in order to allow the S.D. concept to become effective at local scale.

(Forrester, 1961:23,44,49; Le Moigne, 1983:22,58,73; Nijkamp and Bergh, 1991:11; Nijkamp and Giaoutzi, 1993:15; Aracil and Gordillo 1997:19,20; Bergh and Hofkes, 1998:7-11; Graaf, Musters and Keurs, 1999:22,30,36)

The adopted methodology is in part the one proposed by Graaf, Musters and Keurs (1999:112-125) who defend the connection among several concepts and methods in order to consider a new model for S.D.

This methodology considers five phases, which in short are:

Figure 2- Summary of the important aspects of the five phases of information-gathering.

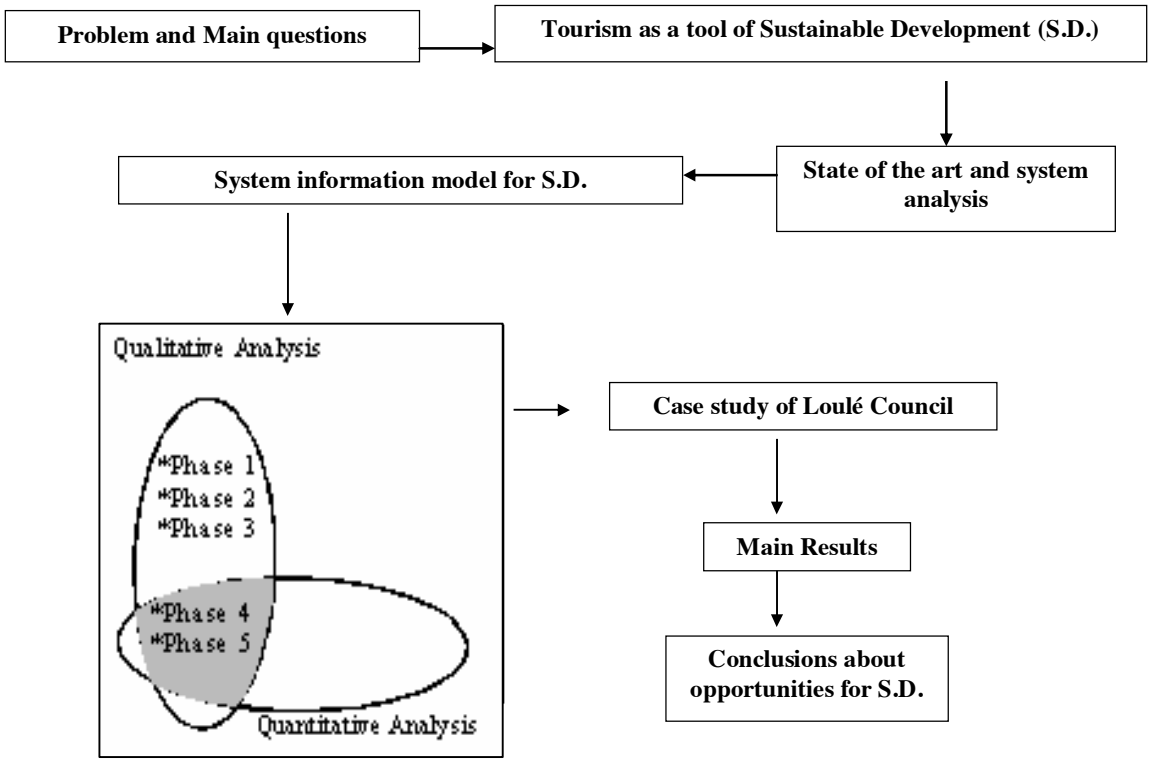
Phase: Aspects	**Phase 1 Start up**	**Phase 2 Defining socio-environment**	**Phase 3 Selecting the valued system characteristic**	**Phase 4 Measuring the resource state**	**Phase 5 Exploring development opportunities**
Aims/ Decisions	**Start a sustainable development procedure?**	**Define the system boundaries, time and spatial scale and type of actor,**	**Assess valuable characteristics of the system**	**Measure available resource state and its present use**	**Assess perspective modification of use and resource space**
Informa-tion for next phase	**Work plan: . overall objective . spectrum of choices .restrictions /constraints**	**Defined system Preliminary list of: . people involved . their interests**	**Valued system characteristics Preliminary list of quantified needs and wants**	**Present resource state: . present use and problems . present (un)used resources**	**Development challenges: . type of modifications . feasible value space of designed area**

Source: Graaf et *al*. (1999)

For studying the problem and main questions, tourism comes as a tool of Sustainable Development.It is considered a system approach in which S.D. model is included.

This one contains qualitative analysis (phases one to five) and quantitative analysis (phases four and five).With this system information model it is intended to create development opportunities for the reality under study.

Figure 3- Methodologic Model



Source: Louro,M.F.(2004)

In the scope of qualitative analysis the main actors in Loulé Council Development were identified for inquiry purpose.

(Representative of the Municipality and other Institutions, local Association, N.G.O´s...)

The inquiry guide was adopted from Guide for Local Planners - W.T.O.(1993) and for research finding the content analysis was considered.

Quantitative analysis included in phases four and five of the adopted methodology is based on dynamic of systems and is aimed at finding answers to:

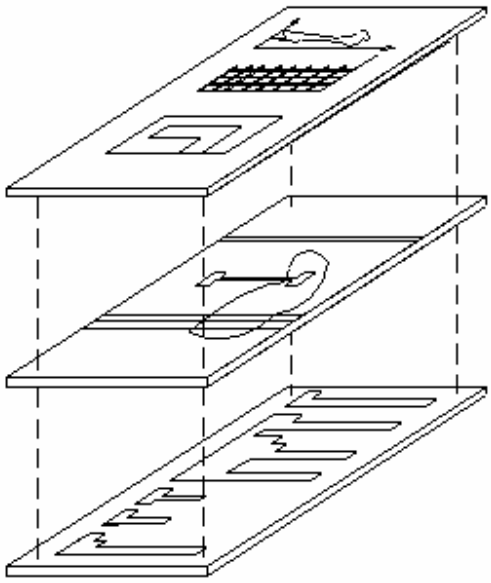
A better understanding of the effects of tourism in Loulé Council.

An explanation of the interaction among parts of the studied system.

The dynamic model gives a vision of the relation between structure and behaviour of the system under study.

The structure of the dynamic of systems model has three main levels,as shown in figure 4.

Figure 4- Dynamic of Systems Model



Source: Adaptation of Van den Belt *et al.* (2000)

The diagram of systems (medium level) represents the interactions among five sectores considered in the model and indicates the dynamic organization principle of "story" case study (hypothesis)

These hypotheses are:

- A high growth of tourism in council will cause great damage upon environment.
- Beach quality depends on public efforts, being sea water quality represented in the model by blue flag effect.
- Population and tourists affect sea water quality and this one affects the number of tourists.
- Remaining Economic Activities sector receives the effects of touristic demand.

Each sector contains the most representative variables (exogenous and endogenous) and the model simulates real system under study and helps to understand the relations between the structure and behaviour of this system.

Lower level of the model makes explicit mathematical relations among variables considered in each sector (Appendix) and is corresponding to the diagram of systems (medium level).

There are three types of variables considered in the model: stock;flow and auxiliary.(figure 5)

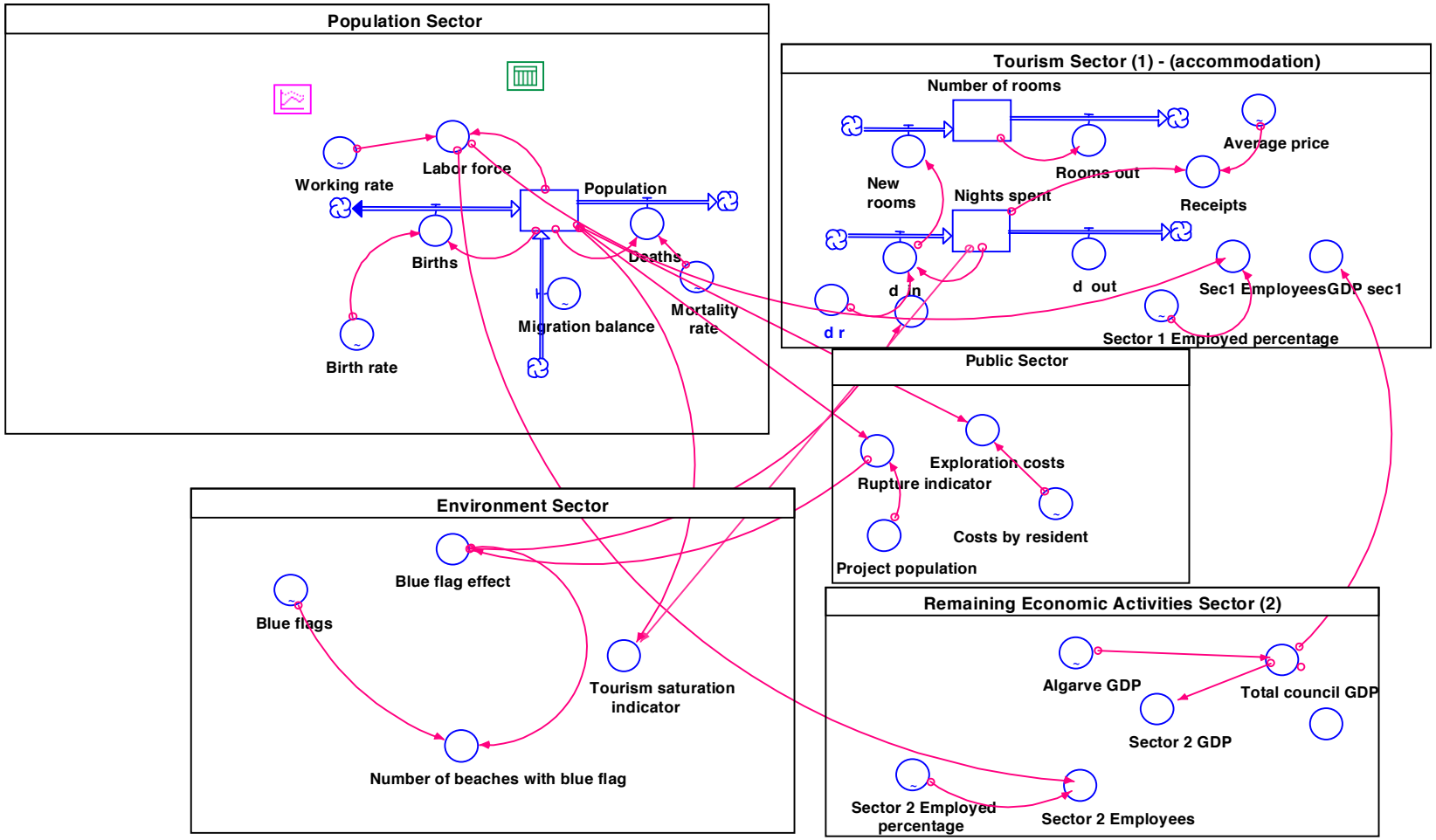
Difference equations refer to the stock variables and include their "in and out flows" as represented in the diagram of systems (figure 6).

Figure 5- Types of variables

Sector	Variables	Type of Variables	Classification
- Population	• Population	Stock	Exogenous
	• Birth rate	Auxiliary	Exogenous
	• Mortality rate	Auxiliary	Exogenous
	• Migration balance	Flow	Exogenous
	• Births	Flow	Exogenous
	• Deaths	Flow	Exogenous
	• Labor force	Auxiliary	Endogenous
-Environment	• Blue flags	Auxiliary	Exogenous
	• Blue flag effect	Auxiliary	Endogenous
	• Tourism saturation indicator	Auxiliary	Endogenous
- Tourism(1) (accommoda-tion)	• Nights spent	Stock	Exogenous
	• Number of rooms	Stock	Exogenous
	• G.D.P. sec.1	Auxiliary	Exogenous
	• Average price	Auxiliary	Exogenous
	• Sec.1 employees	Auxiliary	Endogenous
- Remaining economic activities (2)	• Sec.2 employees	Auxiliary	Endogenous
	• G.D.P. sec.2	Auxiliary	Exogenous
	• Total council G.D.P.	Auxiliary	Exogenous
- Public	• Exploration costs	Auxiliary	Exogenous
	• Costs by resident	Auxiliary	Exogenous
	• R.W.T.P. foreseen population	Auxiliary	Exogenous
	• Rupture indicator	Auxiliary	Endogenous

Source: Louro,M.F.(2004)

Diagram of Systems



Source: Louro, M. F. (2004)

Figure 6: Diagram of systems

For the scenario analysis (upper level of the dynamic of systems model- figure 4) the exogenous variable - number of rooms - was considered as a notable one.

The political variable considered in the model is the investment of the Municipality in the bulding and reinforcement of Residual Water Treatment.

The assumptions are:

- In peak season, the present population is 2,2 x resident population.
- Consideration of a rupture indicator of Residual Water Treatment Plants (R.W.T.P.).

$$\text{Rupture indicator (R.I)} = \frac{\text{seasonality increased population}}{\text{Foreseen population}}$$

This indicator has implications in the blue flag effect:

If R.I < 0,8 the blue flag effect =1
If R.I ≥ 0,8 the blue flag effect =0

- Consideration of a tourism saturation indicator (People/km^2) (T.S.I.).

$$\text{T.S.I} = \frac{\text{PSV + Resident Population}}{\text{Area}}$$

PSV= Peak season visitors.
Scenario hypotheses are:
Hypothesis one - Trend scenario

If the annual growth rate of the number of rooms variable is about 1,6%,the political variable will have a ligth increase and the rupture indicator (R.W.T.P.) will be near its edge.

Hypothesis two - High growth scenario

If the annual growth rate of the number of rooms variable is about 5%, the political variable will intensively grow and the rupture indicator(R.W.T.P.) will overcome its critical entrance.

Hypothesis three - Levelled - off scenario

If the annual growth rate of the number of rooms variable is about 1%, the political variable will assume minor value and the rupture indicator (R.W.T.P.) will not have critical value.

These scenarios were tested through the simulation algorithm (using Stella package) and the main results obtained are summarized in the next section- quantitative analysis.

3. Main results

Having in mind the applied methodology and its phases (qualitative and quantitative analysis), the main results are summarized as follows:

- Phase 1

Figure 7- Aspects of phase one of information-gathering.

Phase / Aspects	Start-up
Information for next phase	**General objectives:** - Improving quality of life through: • Attenuation of seasonality. • Employee qualification. • Improvement of infra-structure. • Increased value of tradition and local culture. • Improvement of environmental quality and environmental awareness. **Possible choice** • Research and discussion about tourism effects in Loulé Council and in Algarve region. • Need for partnership to accomplish regulation about natural places and protected areas. • Need for partnership to make regional and local planning. • Incentive to the cultural preservation and community identity. **Weaknesses:** • Trade and tourism as dominant activities with loss of importance in agriculture. • Seasonality. • Employees' low qualification. • Weak infra-structures in rural areas and protected areas. **Threats:** • Human pressure on coastal area with an isolated and less inhabited inland. • Negative environmental impacts resulting from the need of planning. • Negative value impacts caused by visitors on young residents. • Problems with immigrant communities.

Source: Louro, M.F.(2004)

- Phase 2

Figure 8 - Phase two of information-gathering

Phase / Aspects	**Defining socio-environmental system**
Information for next phase	**Characteristics** • In natural definition of Loulé council areas, the hill and neighbouring area represent 50% and the coastline represents 12%. The "barrocal" represents the remainder. • Loulé council is representative in demographic terms (1st in resident population in the Algarve region - 2001 census) but with a low inland population density. • Tourism growth contributes to the settlement of new population for working and living. • Tourism and commerce are dominant economic activities and agriculture has been decreasing along the time. **Problems** • Tourism growth has been causing economic and social unbalances among natural areas of the council. • Inland population is getting older and the youngest people choose the coastline to live and work. • Sazonality in tourism activity. • Low qualification of working population. • Infra-strutures are not conceived according to the population needs or to the environmental capacity. • Health and safety conditions don´t meet the population needs **Potentialities** • Beyond "sun and sea" tourism product, Loulé council has other potentialities: Classified natural places ("Rocha da Pena"; "Fonte Benémola" and "Ria Formosa"). Sports and cultural activities. Cultural and Historic heritage. Gastronomy and handicraft.

Source: Louro,M.F.(2004)

- Phase 3

Figure 9-Phase three of information-gathering

Phase / Aspect	Selecting value system characteristics
Information for next phase	**Value system characteristics:** • Loulé council hill area still without representative environmental impact as opposed to the coastline impacts. • Valuable culture and traditions. The interaction among residents and tourists is seen as a positive aspect to recover original traditions and to change cultural experiences. • Economic benefits from touristic activities don´t correspond to the population expectations. **Needs** • Difficulties in basic services (water,sanitation,transport,health,safety) specially refering to the inland area. • Planning needs for adequate infra-structures. **Desires** • Sensitization actions for stakeholders education about sustainable tourism, environment and community relations. • Promotion of resource preservation by recovering habitats, stakeholders awareness and fiscalization about the legislation compliance in sensible areas. • Partnerships among stakeholders for environmental preservation.

Source: Louro,M.F.(2004)

- Phase 4

Measuring the resource state

Concerning the quantitive analysis (phase 4), its objective is to determine the resource state and present use.

The obtained results confirm the hypotheses as in the high growth scenario the rupture indicator will overcome its critical edge in 2006. Also, in this scenario, tourism saturation indicator reveals high values, which means congestion.

This has environmental consequences represented in the model by the blue flag effect (non obtained - logical value zero).

Population and tourists quality of life will be affected.

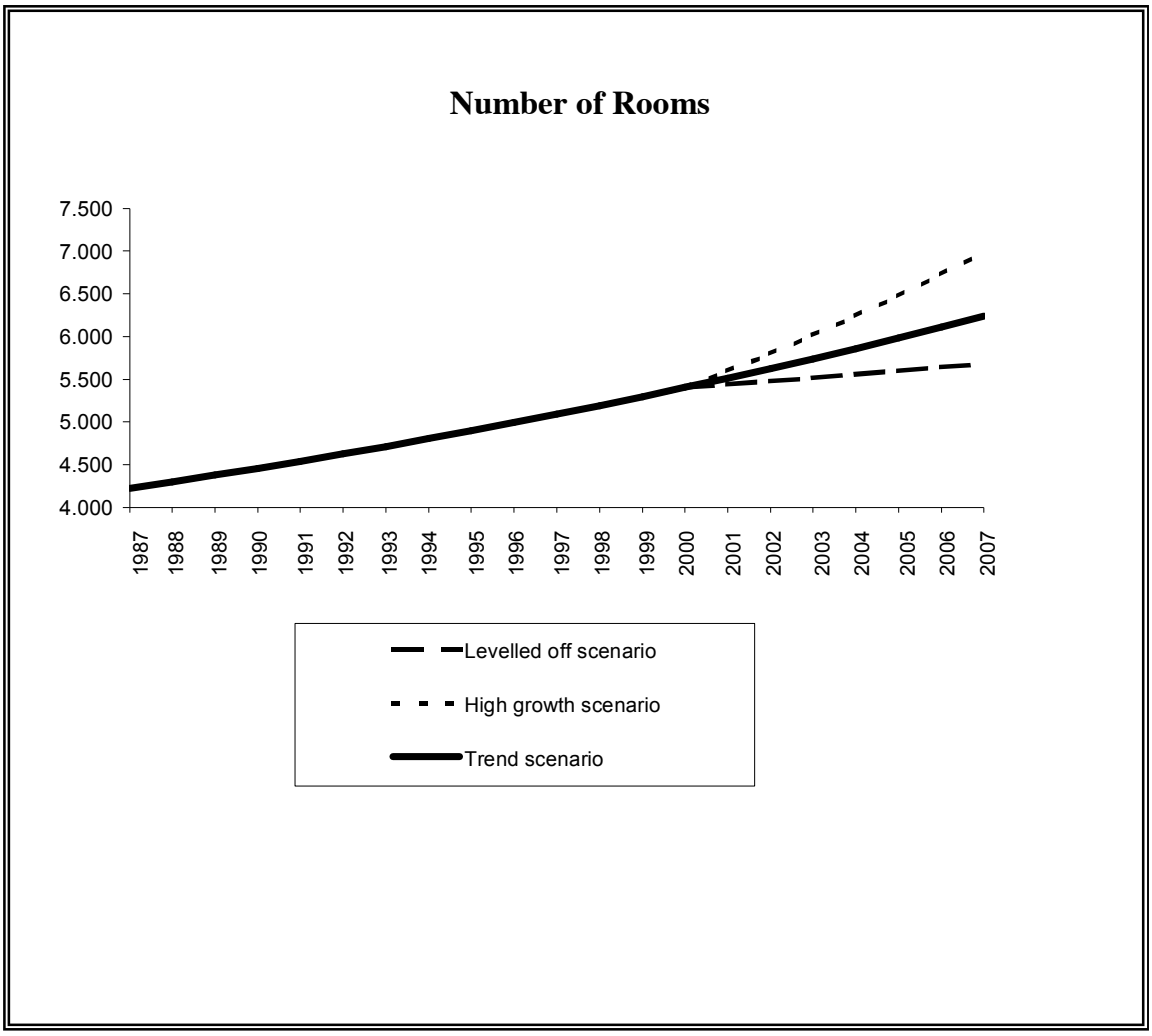
Trend scenario is a feasible scenario assuming the compatibility among considered environmental variables and economic variables related with economic Loulé council growth.

Levelled-off scenario reveals a desirable scenario in the assumptions of the model considering environmental preservation and people well-being.

However this is the least dynamic in economic terms.

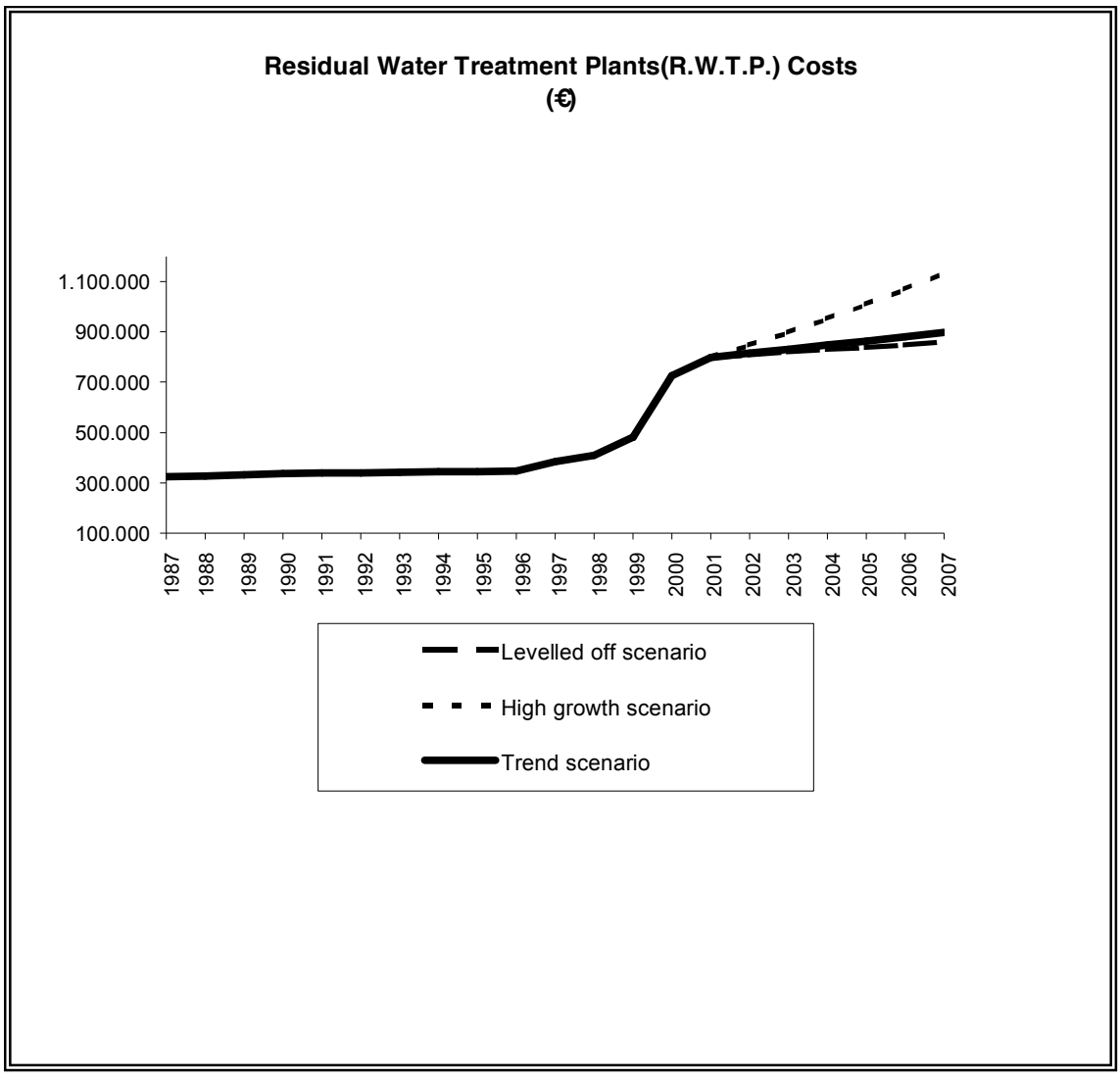
The scenario results from dynamic model are represented in the following figures (10 to 15).

Figure 10- Number of rooms - scenario results for Loulé council



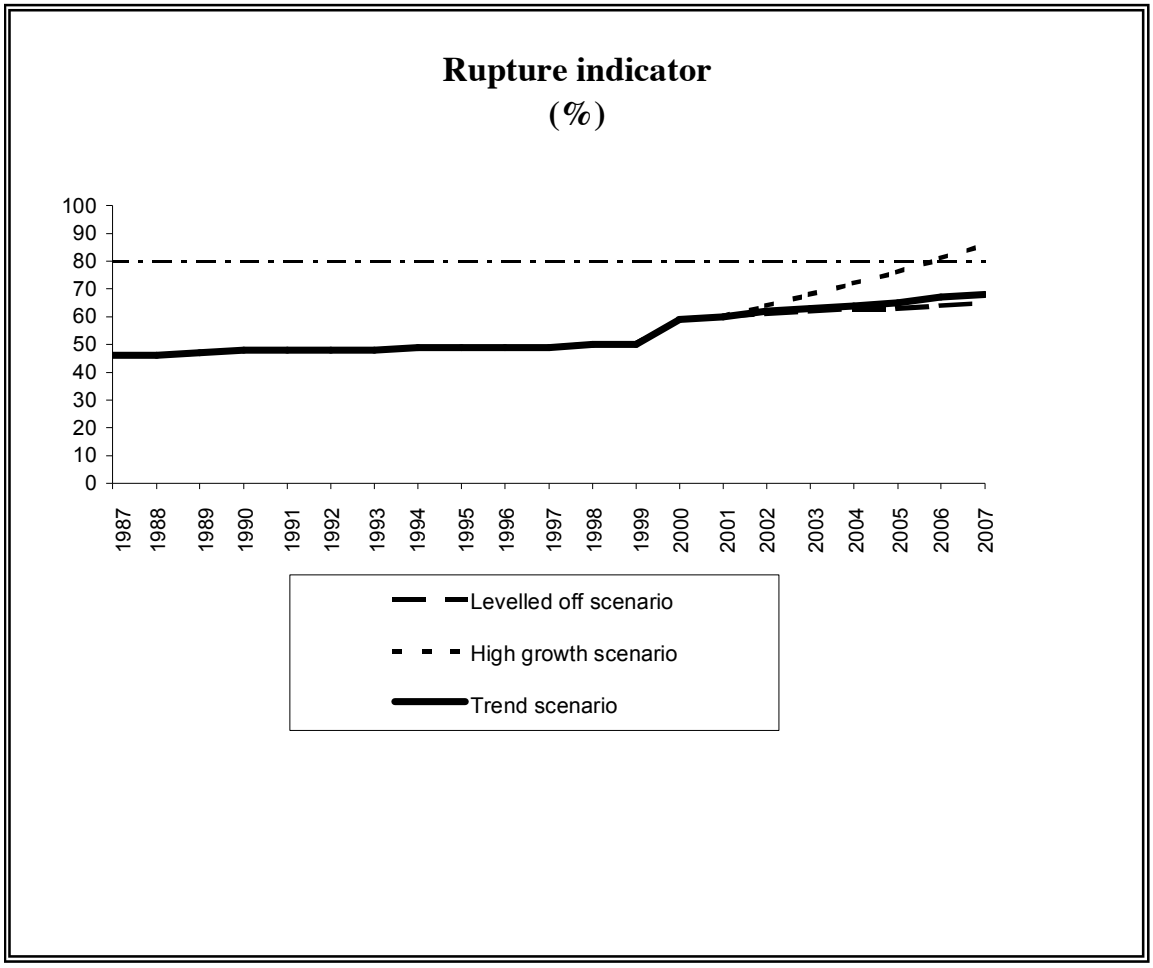
Source: Louro,M.F.(2004)

Figure 11- Residual water treatmeant costs- scenario results for Loulé council



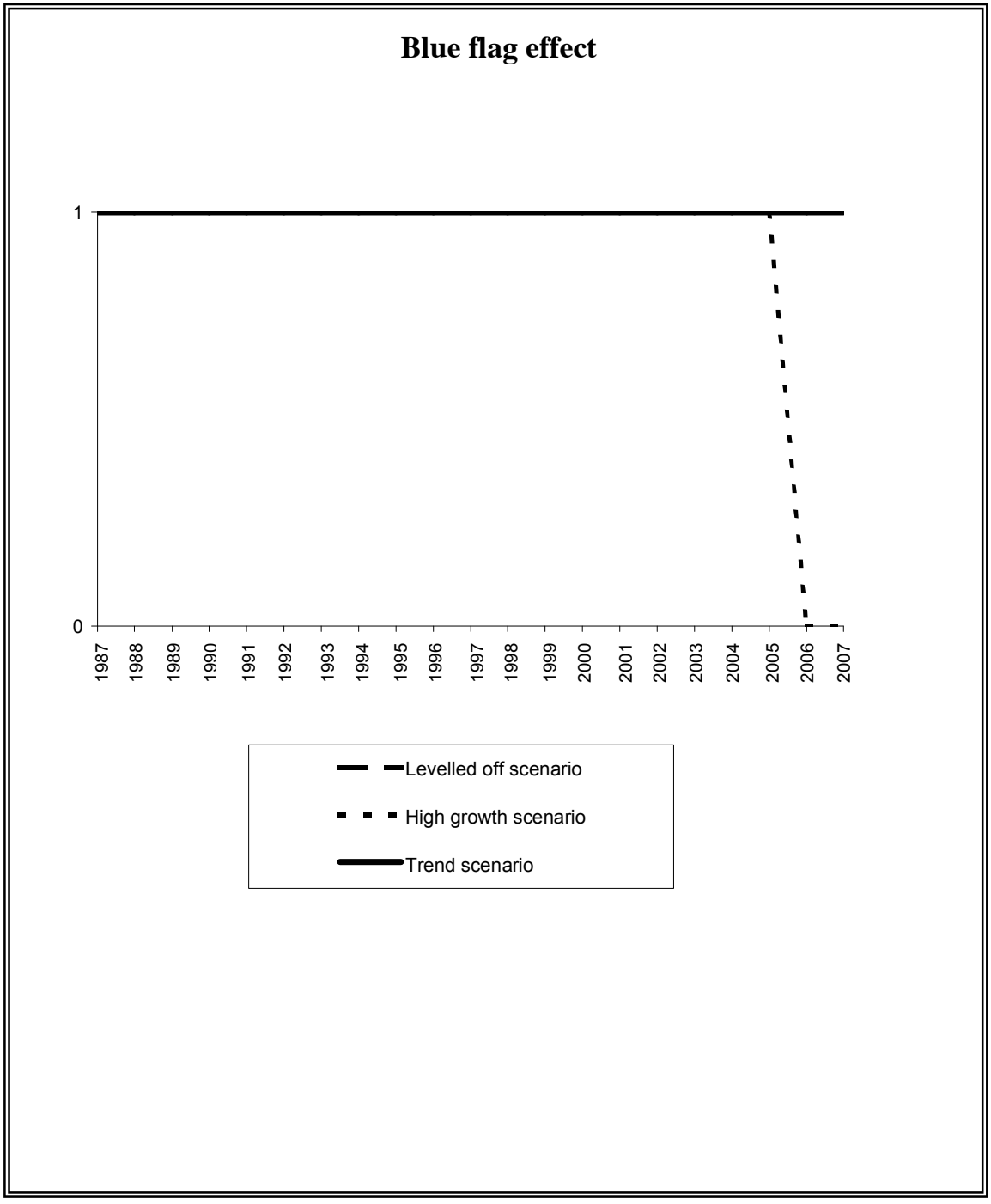
Source: Louro,M.F.(2004)

Figure 12- Rupture indicator percentage -scenario results for Loulé council



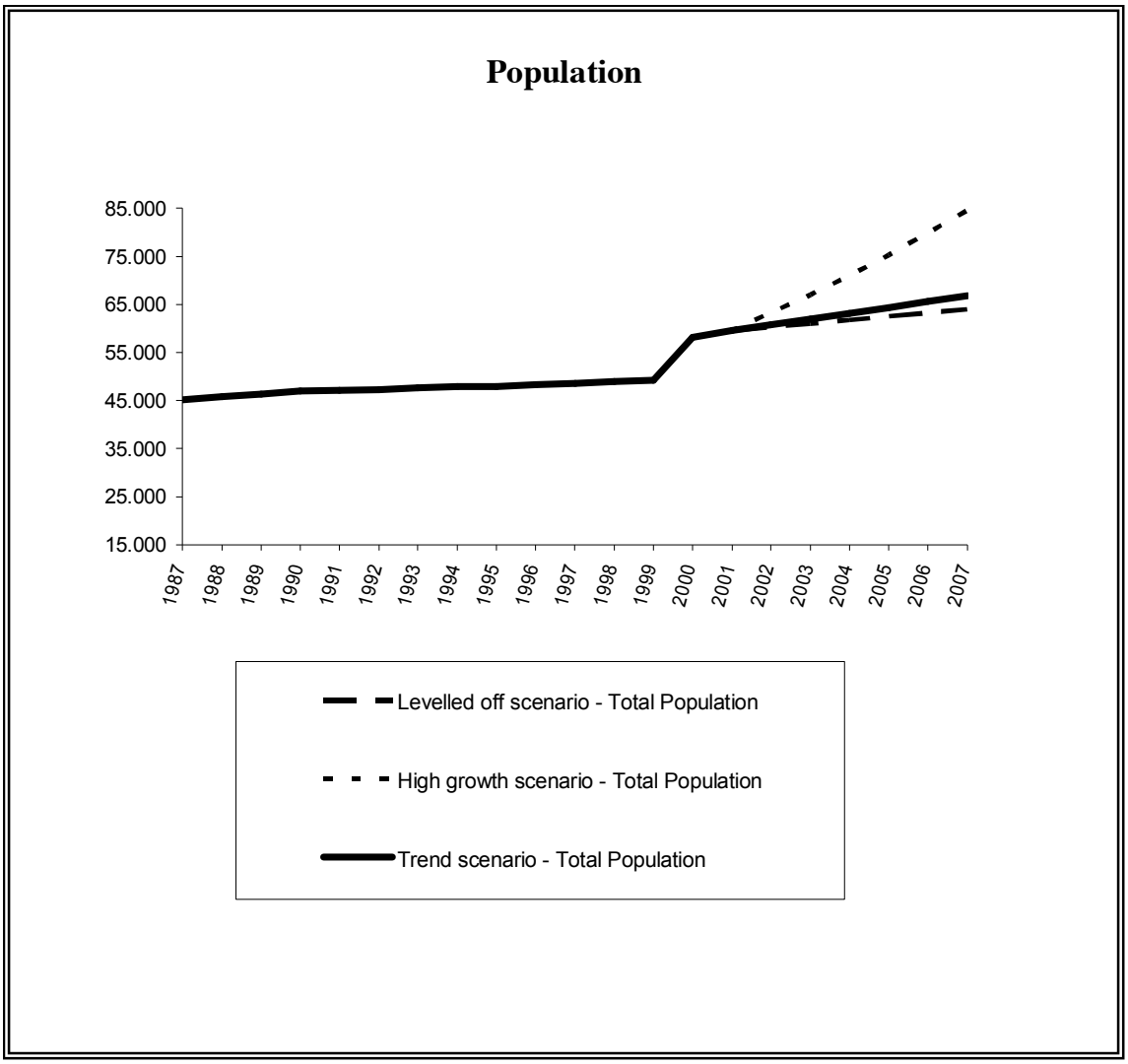
Source: Louro,M.F.(2004)

Figure 13- Blue flag effect logical values- scenario results for Loulé council



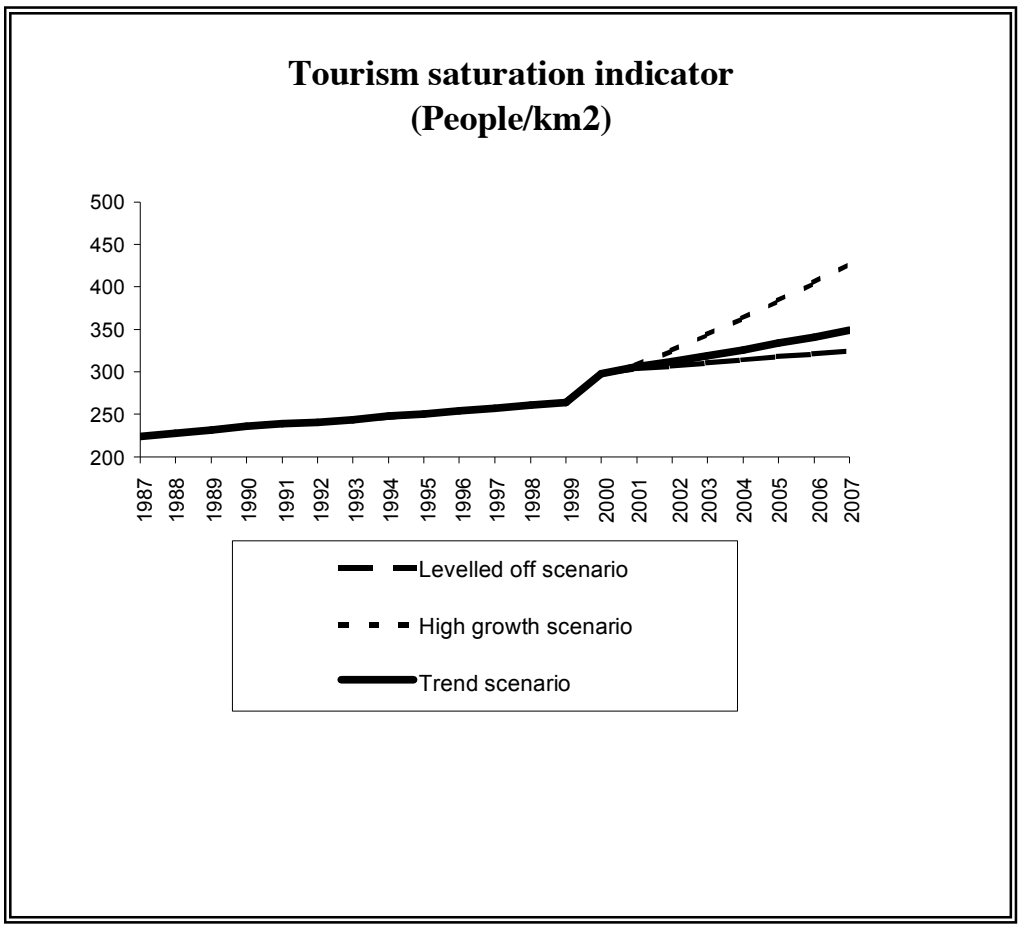
Source: Louro,M.F.(2004)

Figure 14- Population -scenario results for Loulé council



Source: Louro,M.F.(2004)

Figure 15- Tourism saturation indicator -scenario results for Loulé council



Source: Louro,M.F.(2004)

- Phase 5

Figure 16- Phase five of information-gathering

Exploring development opportunities

Development challenges

- **Sensible space:**

- Need for sustainable, controlled and balanced use of still available natural resources.
- Need for studying the regeneration capacity of the resource, case by case, as environmental cost of negligent management of the resources will not be available for future generations.
- Overuse of public infra-structures forced by seasonality provokes maintenance problems.
- Need for reinforced investment to compensate this overuse.
- Need for an integrated urban and tourist planning.
- Need for partnership to obtain quality and sustainable projects

-**Type of changes:**

- Inland still has great potential for a sustainable model.
- Tourist products that can be developed are related with nature and traditions.
- These products must be developed with residents` involvement and attention to the environment.
- Cooperation between public and private sector is crucial to the partnership for Sustainable Development.
- Stakeholders' general worry about an effective coordination of that cooperation between sectors.
- Stakeholders' general worry about the absence of the essential development model.
- Great emphasis on the University role in all this process.

Source: Louro,M.F.(2004)

4. Conclusions

Considering the studied problem above, the main **conclusions** are:

- Some sensitivity by stakeholders to the issues of Sustainable Development but also some lack of knowledge about its problems
- Need for coordinated action by all stakeholders to reach S.D..
- Need for new mechanisms that assure a decision-making process for S.D..
- Possible application of a methodology which contains qualitative and quantitative aspects of S.D..

This methodology could be a support to the decision-making process because:

- Facilitates a systemic and interdisciplinary vision of the studied reality.
- Makes possible the discussion and partnership among stakeholders.
- Makes possible different scenarios for the reality under study.
- Facilitates an interactive application with the possibility to include new data or new elements.

Some limitations of this study were:

- Need for an interdisciplinary team for a better application of the proposed methodology.
- Lack of data, that implies reformulation of some sectors of the model namely in the environment sector.
- Scarce knowledge about new relations considered among some variables of the model.
- Information difficulties related with questionnary answers.

We seek to demonstrate in this study that:

- The type of information, management and participation of the main actors are fundamental aspects to the creation of opportunities for Sustainable Development.
- The Development needs partnerships in order to obtain more sustainable projects.
- The tourism may be a tool of S.D. if it is totally included in the objectives of S.D..
- The involvement and responsibility of all stakeholders mean a gain for everyone and solidarity to the future generations.

References

Aracil, J.; Gordillo, F. (1997) *Dinâmica de Sistemas*, Alianza Editorial.

Bergh, J.; Hofkes, M. (Editors) (1998) – *Theory and Implementation of Economic Models for Sustainable Development* – Kluwer Academic Publishers

Bergh, J. (1991) *Dynamic Models for Sustainable Development*, Amsterdam, Thesis Publishers.

Blowers, A. (1992) *Sustainable Urban Development: the political prospects*, in Sustainable Development and Urban Forum European Research in Regional Science – E.R.R.S.- M. J. Breheny Editor.

Butler, R. (1999) *Tourism, natural resources and remote areas*, A.P.D.R. – XII Summer Institute of the European Regional Science Association (Julho)

Clark, N.; Trejo, P.; Allen, P. (1995) *Evolutionary Dynamics and Sustainable Development*: *A Systems approach*, Edward Edgar Publishing.

Correia M. (1992)- *Homo-Sapiens: Uma Espécie em Extinção*, II forum ecologista, Lisboa (30-31 Maio).

D.G.T. *Preços médios por dormida Algarve*, 1987-2001.

Forrester, J. (1961) *Industrial Dynamics*, Pegasus.

Graaf, H.; Musters, C.; Keurs W. (1999) *Regional Opportunities for Sustainable Development – Theory, Methods and Applications*, Kluwer Academic Publishers.

INE, Anuários Estatísticos da região do Algarve 1994-1999;2000.

Hunter, C. (1995) On the Need to Re-Conceptualise Sustainable Tourism *Journal of Sustainable Tourism*, vol. 3, nº 3.

Kandelaars, P. (2000) *Tourism in the Yucatan Peninsula, Mexico: Modelling its Interactions with the Population and the Environment*, XII Summer Institute of the European Regional Science Association.

Le Moigne, J. (1983) *La theórie du système général*, PUF.

Lopes, A. (1984) *Desenvolvimento Regional - Problemática, Teoria e Modelos*, Fundação Calouste Gulbenkian.

Louro ,M.F. (2004) *Turismo e Desenvolvimento Sustentável: Uma Aplicação à Escala Local. O Caso do Concelho de Loulé,* Tese de Doutoramento, Faculdade de Economia, Universidade do Algarve.

Nijkamp, P.; Bergh J. (1991) Operationalizing Sustainable Development Dynamic Ecological Economic Models, *Ecological Economics*, 4. Amsterdam.

Nijkamp, P.; Giaoutzi, M. (1993) *Decision Support Models for Regional Sustainable Development*, England, Avebury.

Sharpley, R. (2000) Tourism and Sustainable Development: Exploring the Theoretical Divide, *Journal of Sustainable Tourism, vol.8, nº1,*

Silva, J.; Perna F. (2002) *Turismo e Desenvolvimento Auto-sustentado*, Compêndio de Economia Regional, A.P.D.R.

Van den Belt, M.; Videira, N.; Antunes, P.; Santos, R.; Gamito, S. (2000) *Modelação Participada na Ria Formosa, Fundação do Mar e Fundação Luso-Americana para o Desenvolvimento*.

W.C.E.D.(1987) *Our Common Future*, Oxford University Press.

Appendix

High growth scenario equations

Note: In this appendix are represented the mathematical relations among variables considered in each sector of the model. Those relations are only referring to high growth scenario as an example of a greater effect upon environment (considered in the model through Rupture indicator, Tourism saturation indicator and blue flag effect).

- "Public sector"

exploration costs = Population * exploration costs by resident

Rup_ind = 2.2*population/foreseen population

Foreseen population = 216780

Source: Author´s calculation based on Loulé Municipality´s data

Medium exploration costs :

(€/inhabitant)

(1987, 7.17), (1988, 7.17), (1989, 7.17), (1990, 7.17), (1991, 7.17), (1992, 7.17), (1993, 7.17), (1994, 7.17), (1995, 7.17), (1996, 7.17), (1997, 7.90), (1998, 8.34), (1999, 9.75), (2000, 12.5), (2001, 13.4), (2002, 13.4), (2003, 13.4), (2004, 13.4), (2005, 13.4), (2006, 13.4), (2007, 13.4)

Source: Author´s calculation based on Loulé Municipality´s data.

- "Tourism Sector" (1) - (accommodation)

Nights spent(t) = nights spent(t - dt) + (d__in - d__out) * dt

Inicial number of nights spent (1987) = 1469553

Source: INE (National Statistics Office- yearly data as from 1994)

IN:

d__in = nights spent*d_r

OUT:

d__out = 0

Number of rooms(t) = number of rooms(t - dt) + (new rooms - rooms_out) * dt

Inicial number of rooms (1987) = 4220

Source: INE (National Statistics Office- yearly data as from 1994).

IN:

New rooms = d__in/540.5

(540,5 relates night spent increase with bedrooms increase)

OUT:

rooms_out = 0.0*number of rooms

d_r=IF(TIME>=2000) THEN(0.05) ELSE(0.0281)

sec_1 employees = labor force*sec1_ employed percentage

G.D.P_sec1 =0.1205* total_council GDP

receipts = average price*nights spent

Impact on tourism (n^r of years) = 1*blue flag effect

sec1_ employed percentage: (1987, 0.07), (1988, 0.07), (1989, 0.07), (1990, 0.07), (1991, 0.07), (1992, 0.07), (1993, 0.07), (1994, 0.108), (1995, 0.105), (1996, 0.126), (1997, 0.145), (1998, 0.126), (1999, 0.163), (2000, 0.12), (2001, 0.12), (2002, 0.12), (2003, 0.12), (2004, 0.12), (2005, 0.12), (2006, 0.12), (2007, 0.12)

Source: INE (National Statistics Office-people at work in societies by territory)

Average price:

(€/Nights spent)

(1987, 21.6), (1988, 23.3), (1989, 22.1), (1990, 21.4), (1991, 19.1), (1992, 19.6), (1993, 18.8), (1994, 18.1), (1995, 17.6), (1996, 18.1), (1997, 18.1), (1998, 18.6), (1999, 18.4), (2000, 20.6), (2001, 23.5), (2002, 23.5), (2003, 23.5), (2004, 23.5), (2005, 23.5), (2006, 23.5), (2007, 23.5)

Source: Author´s calculation based on the spent night average price- Algarve INE/DGT (Tourism Board)

- "Environment Sector"

Blue flag effect = IF(Ind_rup>=0.8)THEN(0)

ELSE(Ind_rup<0.8)=(1)

TurSatInd = (.416*nights spent/90+.3496*population)/100.96

N^{r} of beaches with blue flag = blue flag effect*blue flags

N^{r} of blue flags:

(Note: Zero means non obtained blue flag).

(1987, 5.00), (1988, 5.00), (1989, 5.00), (1990, 5.00), (1991, 5.00), (1992, 0.00), (1993, 6.00), (1994, 6.00), (1995, 5.00), (1996, 5.00), (1997, 5.00), (1998, 5.00), (1999, 6.00), (2000, 6.00), (2001, 6.00), (2002, 6.00), (2003, 6.00), (2004, 6.00), (2005, 6.00), (2006, 6.00), (2007, 6.00)

Source :Loulé Municipality - Department for the Environment and Urban Services

- "Population Sector"

population(t) = population(t - dt) + (births + migration balance- deaths) * dt

Inicial population (1987) = 45230

Source: INE (National Statistics Office- Resident population forecasts)

IN:

births = birth rate*population

Migration balance :

(1987, 546), (1988, 668), (1989, 547), (1990, 270), (1991, 129), (1992, 418), (1993, 337), (1994, 210), (1995, 457), (1996, 417), (1997, 451), (1998, 304), (1999, 8958), (2000, 1473), (2001, 3575), (2002, 3789), (2003, 4017), (2004, 4258), (2005, 4513), (2006, 4784), (2007, 0.00)

Source: Author´s calculation based on population and demographic indicators (INE).

OUT:

deaths = mortality rate*population

labor force = population*working rate

Working rate:

(Note: from 1987 to 1991 was assumed the value of 1991)

(1987, 0.408), (1988, 0.408), (1989, 0.408), (1990, 0.408), (1991, 0.408), (1992, 0.415), (1993, 0.423), (1994, 0.43), (1995, 0.438), (1996, 0.446), (1997, 0.454), (1998, 0.462), (1999, 0.471), (2000, 0.479), (2001, 0.488), (2002, 0.496), (2003, 0.505), (2004, 0.514), (2005, 0.524), (2006, 0.533), (2007, 0.543)

Source: INE –2001 Census, and author´s calculation for the other years

Mortality rate :

(1987, 0.013), (1988, 0.013), (1989, 0.013), (1990, 0.014), (1991, 0.0148), (1992, 0.0139), (1993, 0.0139), (1994, 0.0129), (1995, 0.0145), (1996, 0.0136), (1997, 0.0136), (1998, 0.013), (1999, 0.013), (2000, 0.0127), (2001, 0.012), (2002, 0.012), (2003, 0.012), (2004, 0.012), (2005, 0.012), (2006, 0.012), (2007, 0.012)

Source: INE- Demography and author´s calculation from 1987 to 1990.

Birth rate :

(1987, 0.012), (1988, 0.013), (1989, 0.014), (1990, 0.012), (1991, 0.013), (1992, 0.0133), (1993, 0.0127), (1994, 0.0112), (1995, 0.0108), (1996, 0.0118), (1997, 0.0119), (1998, 0.012), (1999, 0.0117), (2000, 0.0122), (2001, 0.0122), (2002, 0.012), (2003, 0.012), (2004, 0.012), (2005, 0.012), (2006, 0.012), (2007, 0.0122)

Source: INE – Demography and author´s calculation from 1987 to 1990.

- "Remaining economic activities sector"

sec_2 employees = labor force * sec_2 employed percentage

sec_2 GDP = .8795*Total council GDP

Total council GDP = .132*GDPAlgarve

Fiscal revenue = .036*GDP Total council GDP

sec_2 employed percentage:

(1987, 0.93), (1988, 0.93), (1989, 0.93), (1990, 0.93), (1991, 0.93), (1992, 0.93), (1993, 0.93), (1994, 0.892), (1995, 0.895), (1996, 0.874), (1997, 0.855), (1998, 0.874), (1999, 0.837), (2000, 0.88), (2001, 0.88), (2002, 0.88), (2003, 0.88), (2004, 0.88), (2005, 0.88), (2006, 0.88), (2007, 0.88)

Source: INE (National Statistics Office- People at work in societies by territory/councils)

GDP Algarve :

(Million €- GDP)

(1987, 3213), (1988, 3213), (1989, 3213), (1990, 3213), (1991, 3276), (1992, 3410), (1993, 3161), (1994, 3090), (1995, 3152), (1996, 3105), (1997, 3238), (1998, 3607), (1999, 3974), (2000, 3974), (2001, 3974), (2002, 3974), (2003, 3974), (2004, 3974), (2005, 3974), (2006, 3974), (2007, 3974)

Source: Author´s calculation based on INE´s yearly information, Regional Accounts data.