TOWARDS A HOLISTIC ANALYSIS OF TOURISM SECTOR IN TUNISIA: A SYSTEM DYNAMICS APPROACH

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Abstract
Tourism is a complex and dynamic industry. It involves several sectors, components and engages a variety of stakeholders, who have conflicting goals, which can make planning for tourism sector a challenging task. This study aims to investigate the role of system thinking to develop a participatory model for tourism sector in Tunisia. System dynamics offers a global understanding of the sector and helps analysing tourism policies. This paper proposes a system dynamics-based tourism model that can be used to analyse the potential problems and understand the causal interactions within the tourism sector in Tunisia. The model focuses on the complex interactions between three sustainability sectors that capture the dynamics of the tourism industry in Tunisia. Reviewing literature, analysing the current tourism strategy and group model building helped identifying the elements of the system, as well as the different interactions between them. The developed causal loop diagram represents the basis for further investigations, mainly simulating the tourism sector under different policy alternatives. The simulation results will be used in a further research to help policy makers achieving economic Sociocultural and environmental sustainability.

Keywords: Policy, System thinking, Tourism sector

Introduction
Several researches have shown that tourism is a complex and dynamic industry. Tourism involves a variety of stakeholders who has divers objectives and orientations, with several interacting components that form the tourism sector. Therefore, to achieve sustainability tourism industry should be tackled as a whole system. This research attempts to use the system dynamics as a methodology to deal with complexity and improve the sustainability of the tourism sector in Tunisia.

The complex and dynamic nature of tourism sector in Tunisia and the necessity to focus on the three sustainability pillars while planning for the tourism industry, has encouraged the conception of a System Dynamics (SD) model for the tourism sector in Tunisia, with the aim to be used by policy makers. In fact, system dynamics helps dealing with complex systems, developing a global view of the system, identifying the different interactions between the systems' elements, and underlining the environmental, economic and sociocultural challenges related to policies made for a specific system(Senge 1980; Senge & Forrester 1980; Sterman 1984; Barlas 1996). Furthermore, system dynamics represents a platform were diverse stakeholders can interact and communicate, in order to make an enhanced participatory decision-making(Van Mai & Maani 2010). The purpose of this research is to develop a SD model for the tourism sector in Tunisia, that helps analysing the interactions between the different components of the industry, the model can be used for analysing the future behaviour of the sector under different alternative policies.

1. The concept of system dynamics
System dynamics is a simplified representation of the real system, it allows identifying the behaviour of the decision parameters under different situations.

SD modelling process has been developed in the early 1950s, a growing number of methodologies was developed during 1960s and 1970s (Smith & van Ackere 2002). It has been used for analysing environmental sustainability, economic problems and social systems, etc. (Forrester & Forrester 1971). System dynamics has been applied in various field including Social life, anthropology, environment, engineering, linguistics, etc.

It has been also shown that system dynamics have been used a lot for business policy and strategic planning (Roberts 1978). dThe aim behind system dynamic modelling is to provide sound policy recommendations through increasing the understanding of the existing behaviour of the system and/or suggesting ways to enhance the existing system.

So far, no system dynamics model for the tourism sector in Tunisia has been developed to date. This research proposes a SD model for the tourism sector that combines the economic, environmental and social aspects of

tourism developments. In addition to the economic elements the model integrates the non-economic determinants of tourism demand in Tunisia, which will help tourism professionals to improve the economic efficiency of the industry.

2. The Dynamic Behaviour of the tourism sector in Tunisia: A System Dynamics Approach
This study aims to develop an innovative model for tourism sector in Tunisia that involves economic, social and environmental dimensions of the tourism industry in Tunisia, and helps evaluating the different impacts of policy options in a further step.
The aim behind developing a system dynamics model for tourism industry in Tunisia is to replicate the dynamic behaviour of he tourism system. The SD model can be used to assess the simulated system under different scenarios (change in policies).
Following (A. Ford 2000), The steps used for developing and simulating the system dynamics model are described in figure 1.

The Steps of modelling

Step 1. A is for Acquainted: Get Acquainted with the system
Step2. B is for Be Specific: Be Specific about the dynamic problem
Step3. C is for Construct: Construct the stock and flow diagram
Step4.D is for Draw: Draw the causal loop Diagram
Step5. E is for Estimate: Estimate the Parameter Values
Step6. R is for Run: Run the model to get the reference mode
Step7: S is for Sensitivity: Conduct Sensitivity analysis
Sep8: T is for Test: Test the impact of policies

Source: Ford 2000

Fig1: System dynamics modelling steps

This paper only discusses the fourth step in the context of modelling the tourism sector in Tunisia.

The model developed using System dynamics is based on software "Vensime"[1], SD is ideal for identifying linkages, feedbacks, synergies and impacts of the tourism policies.
The system dynamics model aids developing a representation of the reality (or a part of the reality, since a model cannot include all the elements of the real system).
According to (Qudrat-Ullah 2005a) "The appeal of SD models in the analysis of policy and managerial issues is due to their ability to link observable patterns of behaviour of a system to micro level structure and decision making process". System dynamics represents a powerful basis for investigating the structure of the tourism industry, the behaviour of stakeholders operating in the industry, and for examining the future alternatives and policies related to the tourism sector in Tunisia.

3. Model Boundaries
The identification of the models boundaries is one of the most challenging steps in the system dynamics modelling process. According to (Barlas 2007), the model boundaries should be enough wide in order to provide a full image about the dynamic structure of the sector. Contrary to this opinion, (Burcu Dumbar 2009) suggested that, the model boundaries should be enough narrow to provide an efficient and exact outputs that are easy to control policy makers (Burcu Dumbar 2009).
The parameters that should be used to establish the model are mainly: local sectoral variables reflecting the tourism situation in Tunisia, interactions of the tourism industry with other sectors significant for the development of the tourism industry and elements reflecting the current tourism strategy in Tunisia. Furthermore, The model boundary allows defining not only the internal variables (strictly related to the tourism activity) but also the external variables (variables that relate the system to its environment).
The model boundaries for this study were identified after a Group Model Building (GMB)[2], organised in April 2016. Representatives from the ministry of tourism and the ministry of environment NGO's (actively involved in

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[1] An open source software used for system dynamics modelling.

the tourism sector, representatives from the National tourism office, travel agents and hotel managers; participated in the Model Building Group. It is important to notice that in addition to the GMB, extensive literature review has been used for the development of the model elements.

In addition to identifying model boundaries, the GMB helped identifying the dynamic problem and the feedback loops (CLD).

Variables that affect the sector but cannot be controlled by the tourism planners such as " terrorism", "climate change", " level of international competition" are out of the boundary of the system dynamics model.

The model boundaries can be identified according to the variable nature (endogenous, exogenous and excluded variables) and the temporal boundaries (Trimble 2016). Several techniques has been proposed to identify the distinction between endogenous, exogenous and excluded variables; such as, the Model Boundary Chart identified by (Sterman 2000), and the bulls eyes diagram proposed by Andrew Ford (2009). In the context of this research the nature of parameters included in the model is identified during the Group Modelling Session through open discussions. Temporal boundaries can be detected by asking the following questions " How far in the future should we consider? How far back in the past lie the roots of the problem?" Sterman (2000). The temporal boundaries are more important for the simulation step. The model will be simulated over a period of twenty-four years, from 2001 to 2025, this period have been selected because some data are not available before 2001; 2025 have been selected as a final date for the simulation period, because the tourism strategy in Tunisia is valid up to 2025[3]. Due to the complexity of the approach, it is important to start the analysis with a formal model that helps understanding the dynamic interactions between the elements of the tourism industry in Tunisia.

4. The general model structure

This research develops an integrated model of Tunisia that represents the dynamic interactions between the economic, environmental and socio-cultural impacts of the sector. This model will be used in a further step for running simulations.

Three sub models were developed to formulate the SD model that visualises the factors generating the tourism development. The model includes the following subsystems:

The economic sub model: It involves the employment, tourism spending and other economic factors.

The environment sub model: This sub model involves tourism activity implications including pollution, water consumption, etc.

The socio-cultural sub model: This sub model includes the different social, cultural and environmental attractions, in addition to the infrastructure and tourist facilities, the elements that decrease the attractiveness of the country as a tourism destination, etc.

Analysing the feedbacks between the different elements that shape the tourism sector, and their potential impacts on the economic, the ecological as well as the sociocultural aspect is the focus of this modelling process.

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[2] Consists on developing a common model that involve several stockholders, in order to a achieve a participatory decision making

[3] The current tourism strategy 'tourism vision 3+1' begins in 2013. According to tourism authorities the implementation of the strategy requires from 7 to 10 years, this period assumed to be extended by 2 to 5 years because of the events occurred after the revolution.

Fig2: General overview on the drivers of the
tourism system in Tunisia

Source: author
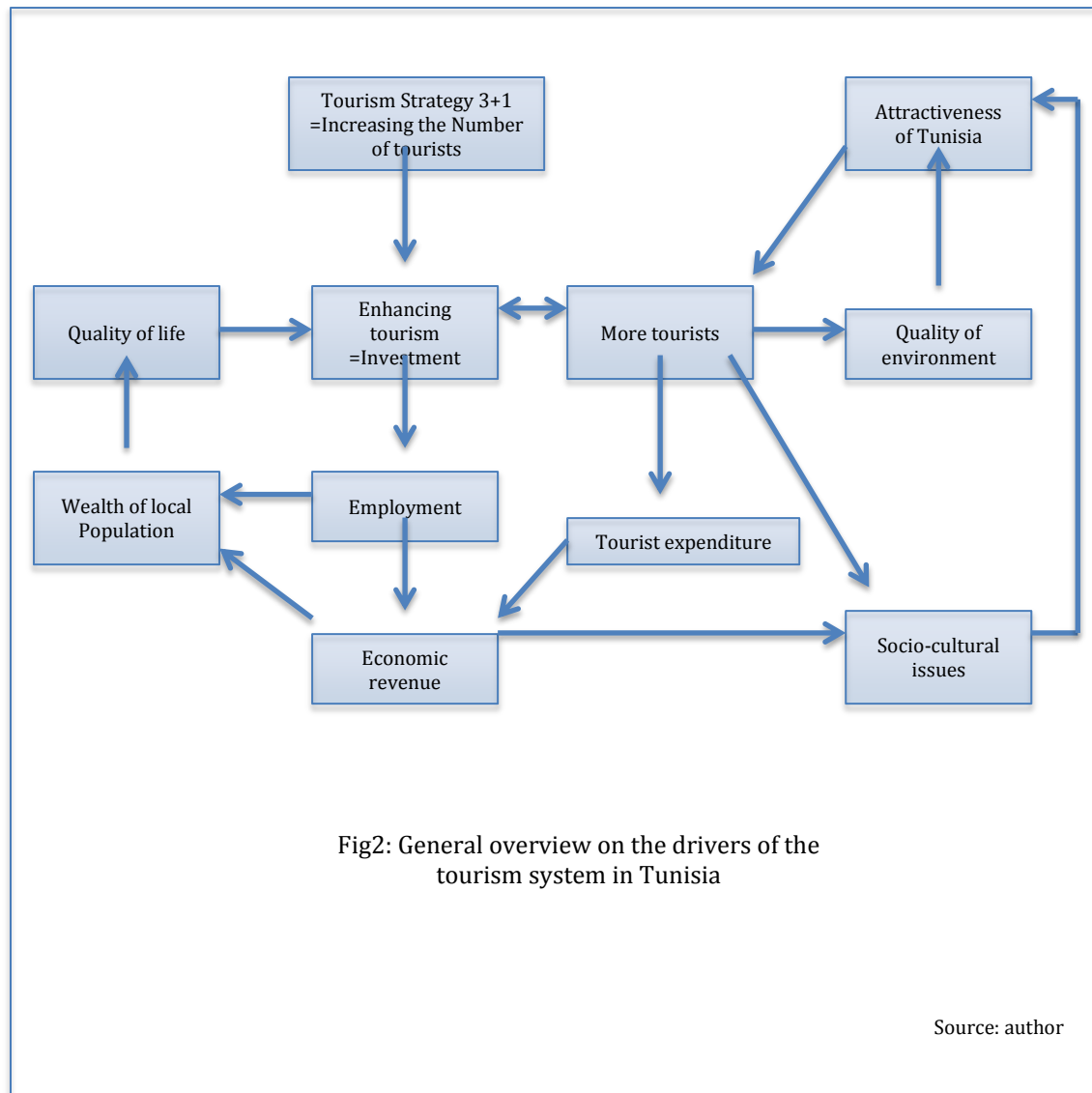
The model seeks to show the drivers of the tourism development in Tunisia, and the
implications of the sector, as well as the potential positive and negative impacts on the
sustainability pillars (economic, environmental and sociocultural). The model seeks to show the drivers of the
tourism development in the country and the implications of the sector. It begins with the drivers of the tourism
development in the country, and the implications of the sector on the different sustainability pillars. It starts with
the tourism strategy 3+1 that aims to attract more tourists, and increases tourism investments. More tourists and
more tourism investments will not only generate more economic revenues for the government, but also
increasing the wealth for people, which will raise the social wellbeing and improve the quality of life.
Nevertheless, Attracting more tourists will decrease the quality of the physical environment (congestion, coastal
degradation, overexploitation of resources, and the deterioration of the quality of bathing water threaten
sustainability and long-term tourism competitiveness), that will reduce the attractiveness of the destination and
then receiving less tourists. In the other hand, attracting more tourists will positively affect the socio-cultural
aspects (improving the quality of education, decreasing poverty, improving infrastructure, etc.), but will also
cause socio-cultural issues including (standardisation and commercialisation of local culture, increasing the rate
of crimes, child labour, etc.).

5. Model conceptualization: Causal loops diagram

SD modelling starts with the 'conceptualization' of the dynamic problem and conceptualization policy issues
that can be represented by the CLD and then with the development of a 'quantitative computer simulation
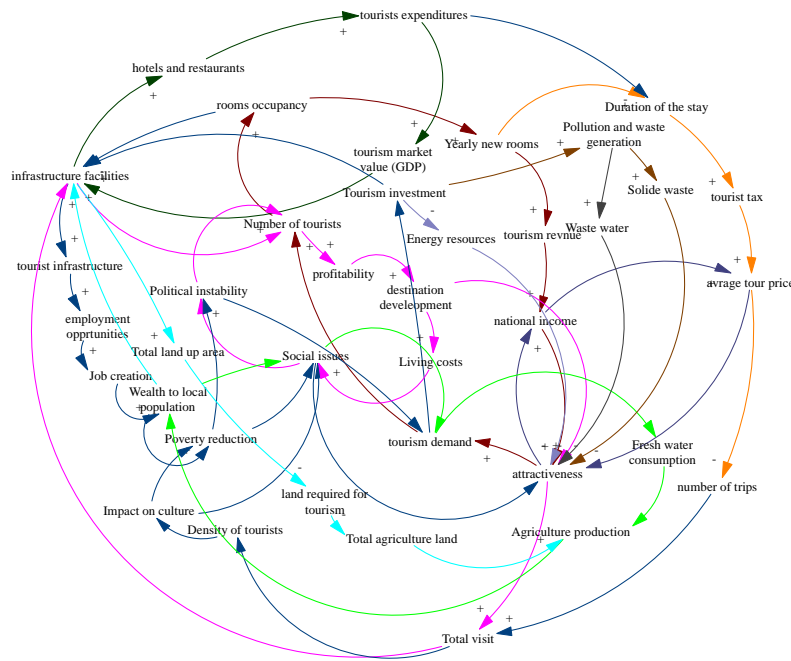model' represented by the SFD (Jay W. Forrester 1961).

Fig 3: Causal Loop Diagram of the tourism sector in Tunisia

Source: Author

In the context of this research, the causal loop diagram developed for the tourism sector in Tunisia has been developed based on two stages, which are reviewing the literature and group model building, where a preliminary list of variables to be included in the model has been discussed with a group of stakeholders.

After discussions during the GMB, some changes were made on the model by removing or including new elements or through amending the connections between the variable. The result of the GMB was the development of a causal loop diagram that integrates different point of views of stakeholders. The model's components have been selected after identifying the different domain, which covers all tourism related aspects (selecting the domains is out of the scope of this research). These aspects can be grouped into three major sectors; the economic performance of the tourism industry in Tunisia, the environmental sector including the elements related to the natural resources and all types of pollution and the socio-cultural sector is related to the local population's wealth and living standard.

The current tourism vision aims to maximise the economic benefits from the tourism activity. Attracting more tourists will create positive feedback loops on the number of tourists, but respectively the increase in tourists' number will decrease the quality of the environment. The availability of natural resources will be decreased because of the increased tourism investments; therefore negative feedback loop will be set up for the stock natural resources.

Conclusion

The use of systems thinking presents an ideal tool that supports complex policy decision. A dynamic model for the tourism sector in Tunisia is presented in this study. The developed SD model, that corresponds to the causal loop diagram, does not focus on simulating the future behaviour of the tourism sector, it rather aims to study the feedback loops and the interrelationships between the different elements of the tourism sector. The major limitation of this research is that the developed system could not include all the elements relevant to the tourism sector in Tunisia, due to time and data limitations. The CLP diagram, build in the context of this research, will be converted to a Stock and flow diagram, Which will be used to convert the future behaviour of the tourism sector in Tunisia under different scenarios. Therefore, the simulation results presents a basis on which policy makers can make their decisions regarding the tourism development strategies.

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Biography

Salma Halioui is a Ph.D. student with particular interests in Tourism Management, Environmental Economics, Climate Change, Strategic Environmental Assessment, Tourism management, Corporate Finance and Political Connections and Strategic planning. Prior to being enrolled at BTU Cottbus-Senftenberg, Germany as a PhD Student; she worked as a teaching assistant at Sup-Tec Private University in Sousse, Tunisia. She holds a master's degree in finance from the IHEC Sousse, Tunisia.