Improving tourism destination governance: a complexity science approach

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Abstract

Purpose – *The growing interest in complexity science as a framework for understanding social and economic systems has had, in recent times, an influence on the study of tourism destinations. This paper aims to describe this approach and discuss its theoretical and methodological implications in terms of destination governance.*

Design/methodology/approach – *Traditional research has adopted a reductionist approach to modelling tourist destinations: variables and relationships are embedded in simplified linear models that explain observed phenomena and allow implications for management or forecasting of future behaviours. In comparison, this paper adopts an adaptive management approach. Rather than imposing lines of action to force the evolutionary path of a system, the effect of different management actions are modelled, producing experimental results that provide information about the system that is being managed, and used to refine strategies and governance styles. Complex systems provide a theoretical framework in which this adaptive philosophy is naturally embedded. After a brief overview of the complexity framework, the paper discusses its validity and applicability to the study of tourism systems by using a set of network analysis methods and numerical simulations.*

Findings – *This paper discusses a new perspective useful for the study of tourism destination governance, providing insights into its organisational structure and dynamic behaviour.*

Originality/value – *The paper proposes a philosophy and practical toolset to analyse and understand a tourism destination and the relationships between its stakeholders. It discusses the implications of this new approach with regard to the governance methods.*

Keywords *Tourism, Quantitative methods, Qualitative methods*

Paper type *Conceptual paper*

1. Introduction: on governance and management of tourism destinations

A tourism destination is an important unit of analysis albeit difficult to define (Haywood, 1986), but may be considered as a cluster of interrelated stakeholders embedded in a social network (Scott *et al.*, 2008a). Such a network of stakeholders interacts, jointly meeting visitor needs and producing the experience that the travellers consume. These destination stakeholders include accommodation businesses, attractions, tour companies, and others providing commercial services; government agencies and tourism offices as well as representatives of the local community. The interaction of these stakeholders is complex, dynamic, and subject to external shocks. The basic premise of tourism destination management is that through cooperative planning and organisational activities, the effectiveness of these joint interactions can be improved to the benefit of individual stakeholders. Governance is a concept which refers to relationships between multiple stakeholders and how they interact with one another. It involves how stakeholders determine, implement and evaluate the rules for their interaction (Beritelli *et al.*, 2007). Thus differences in the governance arrangements of tourism destinations may be presumed to lead to differences in the effectiveness of joint stakeholder interactions and hence to improvements in destination competitiveness (Beaumont and Dredge, 2010).

This paper adopts a complex adaptive systems philosophy, as well as a network approach to the definition and analysis of the relationships on which stakeholder governance effectiveness is based. It adopts a network paradigm, which is grounded in the idea that it is the whole destination network that is a useful unit of analysis rather than simply the individual stakeholder. Network governance ''involves a select, persistent, and structured set of autonomous firms (as well as non-profit agencies) engaged in creating products or services based on implicit and open-ended contracts to adapt to environmental contingencies and to coordinate and safeguard exchanges. These contracts are socially – not legally-binding'' (Jones *et al.*, 1997, p. 914). This network then has structural properties that characterise the interactions of the group of stakeholders, and these properties appear useful in understanding destination governance and how it can be improved. In this paper, several of the properties of such networks are discussed and related to issues of destination governance. The aim is to establish the key concepts involved in the study of network governance, provide examples of the usefulness of these concepts in illuminating aspects of existing destination governance networks, and provide some thoughts on how simulations of a network may improve information about how to improve the effectiveness of network governance arrangements.

In modelling a destination as an entity subject to network governance, the governance system may be considered as the tool by which the destination adapts to change. However, we must also recognise that an important characterising feature of the dynamics of a destination system is its complexity. While others have noted this complexity in how a destination changes (Faulkner and Russell, 1997, 2001; McKercher, 1999; Russell and Faulkner, 1999), they have typically used a complex systems approach as the means of analysing the destination, which is not particularly useful for simulation of destination dynamics. This is because there is a lack of agreement of the components of such systems, and information about how they interact.

The approach adopted by the authors is that this complexity is not a problem that confounds the study of destinations and their governance but instead directs attention to the tools and analysis techniques that may be used to address this complexity. In this paper the nodes of the network and their relationships provide the elements, on which a model is based and for which a variety of pre-existing tools and heuristics are available to model their interaction. The rest of this paper is dedicated to the analysis of this complex network approach as a means of informing the theory and practice of managing a tourism destination and improving its governance.

2. Tourism destinations as complex systems

The depiction of a tourism destination as complex is quite common. However, the definition of complexity is an unresolved issue and many different proposals have been made for its characterisation and measurement. No common consensus exists, but, following many scholars such as Levin (2003), a system can be defined complex when it comprises a (normally rather large) number of elements that are interacting in an interdependent way. The relations between the components are typically non-linear and, although they may be relatively simple at a local level, they build up in a dynamic and non-predictable way, generating behaviours and structures not derivable as a straightforward composition of the local features.

A complex adaptive system, then, is one continuously interacting with the external environment, and able to dynamically maintain its integrity and function. The composite result of internal and external relations generates dynamic adjustments of the structure and the behaviour. In some cases the system is able to resist large shocks without dramatic modifications of itself or of its evolutionary path. For destinations, we posit that the governance system is a mechanism for adapting to change and maintaining integrity and function. Thus, in terms of the destination lifecycle model provided by Butler (1980, 2001), it is the governance system that determines whether a destination will undergo regeneration or stagnation (Agarwal, 1999; Noakes, 2002). By determining the properties of the destination

network and how they change, it may be possible to make the system more efficient or robust.

Under some conditions, a complex system may exhibit periods of stability, and during these periods, the system possesses inertia. Therefore, it is possible to predict future conditions based on past trends as is traditionally done in tourism studies using methods to forecast visitors, destination evolution, outcomes, and effects of external inputs (Andersen and Sornette, 2005). Outside these stable periods, the standard analytic tools used to forecast destination conditions are of little help. In the study of such complex systems outside of equilibrium, one of the few possible methods for obtaining measurable outcomes is to build a simulation model which, nowadays, is a numerical computerised model.

2.1 The approach of complex system science

Most of the works discussing a complexity approach to the study of a tourism destination have analysed the issue from a qualitative point of view. They have discussed possible structural and dynamic characteristics by identifying classes of elements and their relationships (McKercher, 1999) or the dynamic and serendipitous development of destinations and the role of some specific component in favouring economic growth (Faulkner and Vikulov, 2001; Russell and Faulkner, 2004; Scott and Laws, 2005; Tinsley and Lynch, 2001). Most recently, some authors have begun to apply quantitative methods to assess the characteristics of a destination (Baggio, 2008). This is an important point. Even if the complexity of a system can be assessed in a qualitative way and the characteristics are easily identifiable, measuring complexity is important as it provides the opportunity for modelling and simulation.

The social sciences have an established tradition of using modelling (Inbar and Stoll, 1972) and the performance of these techniques is good, provided some basic requirements are met: a solid conceptual model and the limitation to the particular circumstances for which the simulations are run (Küppers and Lenhard, 2005; Schmid, 2005). Within such conditions, simulations can be effective and efficient in reproducing different types of processes and may be considered a valuable aid in decision making (Axelrod, 2006; Stauffer, 2003).

An objection to this modelling approach is that it is an oversimplification of the actions and interactions of social actors (whether they be individuals or groups of individuals). Researchers have addressed this issue, first of all by producing important and reliable outcomes in many fields; as well as by clearly specifying the boundaries and the limits of these methods (Henrickson and McKelvey, 2002). Single actors are obviously much more complex than it is assumed in models, but, by using a numerical simulation we are able to understand the mean (statistical) behaviour of the system, although not the peculiarities of single elements or actors (Majorana, 1942).

One important theoretical framework in which investigations of complex networks are embedded is the set of theories known as statistical physics; one of the fundamental fields of physics, and which uses statistical methods for addressing problems. The main result, and power, of this approach is in the development of two important concepts: universality and scaling (Amaral and Ottino, 2004), and on the basis of these concepts it is feasible to use statistical physics techniques to examine social world problems.

Many systems exhibit global properties that are independent of the specific form of their constituents. Typical examples are the weather, flocks of birds, or financial markets. This suggests the hypothesis that universal laws or results may also show up in other types of complex systems, whether they be social, economic or biological. The concept of universality in statistical physics and complex systems has the basic objective of capturing the essence of different properties and classifying them into distinct classes allowing the use of results and models derived in known situations to new areas. The scaling hypothesis, provides the idea that a set of relations, called scaling laws, may help in characterising the singular behaviour of a system and its critical transitions.

Thus, similarities between different phenomena may be signs of the existence of common underlying law or principle, mainly when they are found in the functions of elements in

different systems or between systems' structures (Gentner, 2002; Krieger, 2005; Wigner, 1960). This is a form of argument by analogy that has potential abuses (Daniel, 1955) but is also claimed to be fundamental to provide insights into concrete problems (Nagel, 1961) and lead to development of new disciplinary fields. Statistical physics laws and methods applied to the study of a socio-economic system can thus be justified if the quantitative techniques used are deeply and strongly rooted in sound and accepted qualitative interpretation of the phenomena described (Castellano *et al.*, 2009).

Many possibilities exist to use formal methods to study a complex system and analytical as well as simulation models have been developed using nonlinear dynamics and agent-based modelling. Here we focus on using the recently developed methods of network science (Amaral and Ottino, 2004) and provide some basic introduction to these methods below.

2.2 Network studies of tourism destinations

Complex systems can be understood when represented mathematically as graphs (Mitchell, 2006). They are modelled as N individual elements or agents, called nodes, and K connections between them called edges or links. The edges of a graph can be undirected or directed, that is symmetric associations between nodes, or causal relation-ships between them. Edges can also be assigned a weight denoting some kind of strength in the relationship (cost, speed, intensity of contacts etc.). A number of properties of networks have been found to reflect real world characteristics; for example the density of links (actual number of links compared to total number of possible links), related to the cohesiveness of a group, an important property in determining cooperative behaviour. Some studies of the network properties of tourism destinations have been performed, and the destination examined found to have low density of connections (Baggio *et al.*, 2010; da Fontoura Costa and Baggio, 2009; Scott *et al.* 2008b). This is an important (even if partial) result, because the definite identification of weaknesses in the cohesiveness of the destination can be addressed by policy and management interventions. The relationships that form a value-creation system allow the identification of differences in the measures of inter-organisational cohesion in different settings (Scott *et al.* 2008a). It also has an important managerial implication: the network approach emphasises the need for a destination to be a collaborative environment.

The level of collaboration may also be estimated using the clustering coefficient of the destination network. In the case of Elba island, a well known Italian ''summer'' destination, for instance, the clustering coefficient has been found to be very low (Baggio, 2007; da Fontoura Costa and Baggio, 2009). The normalised version of the metric can be loosely interpreted as the average probability a stakeholder has to be involved in some kind of collaborative group or the average probability to find collaborative groups in the destination. This low level of collaboration is in agreement with finding from more traditional studies (Pechlaner *et al.*, 2003).

A modularity analysis can also help understand these issues. A module, or community, in a network is a group of nodes having denser links between them than towards other parts of the network. This effect can be measured with a modularity coefficient Q, a quality index for clusters defined by the difference between the fraction of links connecting nodes in a community and its expected value when the distribution of links is random. The modularity coefficient can be calculated for a predetermined partitioning of the network into modules, or by using a stochastic algorithm which will find the subdivision maximising Q for the given network (Clauset *et al.*, 2004; Girvan and Newman, 2002). In a destination, traditionally, we may divide the stakeholders into communities by type of business (hotels, restaurants, attractions, intermediaries etc.) of by geographic location. In the case of Elba, Q has been measured in this way and compared with the value obtained after having used a stochastic algorithm (Baggio *et al.*, 2010; da Fontoura Costa and Baggio, 2009). The results tell us that the modularity of the network is very low, which was expected, and that Q calculated from the algorithm is significantly higher than the others. This means that our system has, although not extensive or significant, a distinct modular structure.

Network methods have also been used to identify the important members in a destination; those who can make the most important contributions to the growth of tourism activities, and to destination governance. A comparison between the perceived importance of organisations in a destination and their network characteristics allows establishment of a set of metrics able to describe this feature. It has been found that the key stakeholders are located in the core of the network, and form an elite seen as more salient than the peripheral stakeholders. This implies that the governance of a destination is controlled by a limited number of entities and is further confirmation of the necessity of creating cohesive inter-organisational networks for the production of integrated tourism experiences (Cooper *et al.*, 2009). As may be expected, public stakeholders are important elements in destination networks (Presenza and Cipollina, 2009) as they possess critical resources, have the highest centrality and hold the greatest legitimacy and power over others (Timur and Getz, 2008).

After consideration of the use of network techniques to analysis the characteristics of destinations, let us now turn to the more challenging problem of modelling possible changes to a destination system.

3. Modelling of a tourism system to improve governance

Governing a complex destination system also means finding the way to direct a complex system which, almost by definition, is quite unmanageable. It therefore calls for an adaptive approach, rather than a rigid deterministic, authoritarian style. It may require the adoption of strong rules, but it definitely needs the flexibility for changing them dynamically, reacting quickly to all the changes that may occur in the destination or in the external environment. The proposal of using adaptive styles when dealing with such systems stems out of the work of 1970s ecologists (Holling, 1978).

The method suggests an experimental path to governance and builds on the idea of exploring alternative possibilities, implementing some of them, monitoring the outcomes, testing the predictions and learning which one best allows the achievement of the objectives. The results of the actions are then used to improve knowledge and adjust subsequent activities. This approach has been adopted in different situations, including tourism systems, with encouraging results (Agostinho and Teixeira de Castro, 2003).

Networked organisations experience systemic effects and impacts resulting in both expected and unanticipated properties. The resilience of the system, the degree to which it is capable of absorbing shocks without dramatically modifying its structure or behaviours is a key aspect in a complex system's evolution (Walker *et al.*, 2004). Deep transformations can be faced in a resilient system considering that they contain the necessary components for regeneration and reorganisation. Due to their inherent unpredictability, sustainable developments of a socio-economic system cannot be planned in a completely rational manner, but wise governance can improve the capabilities for self-organisation and building capacity for learning and adaptation. To model the behaviour of destinations we need to understand a number of different properties of networks (due to limitations of space these will not be discussed here, a review focused on tourism can be found in Baggio *et al.*, 2010). A complete description of the most important measures which characterise a network can be found in da Fontoura Costa *et al.* (2007) and in one of the several reviews of the mathematical bases of network science (Albert and Barabási, 2002; Boccaletti *et al.*, 2006; Watts, 2004).

An example of modelling destination a complex destination network to provide information for adaptive management relates to flows of knowledge. Information and knowledge flows in a destination network are relevant determinants of the health of the system. Productivity, innovation and growth are strongly influenced by them, and the way in which the spread occurs affects the speed by which individual actors perform and plan their future (Argote and Ingram, 2000). A commonly used way to study the problem is the one based on an analogy with the diffusion of a disease (Hethcote, 2000), but unlike standard epidemiological models, it has been demonstrated that the structure of the network is highly influential in

determining the basic unfolding of the process (López-Pintado, 2008). If we agree that the spread of knowledge and information is a strong determinant for the successful growth of a destination, network analysis and simulation methods provide a useful tool to assess the question and to help a governance body in its policy development activities.

A series of simulations run on a model of a real destination network show, as expected, that the speed of the process vary according to the capacities of the single actors to acquire and spread information. They also show, however, that the increase in speed is much higher when the clustering coefficient of the network is increased by simulating a reconfiguration of the linkages (Baggio and Cooper, 2010) and provides a basis for intervention. Some more modelling coupled with the qualitative estimation of the possible returns might help decisions on which approach, or which mixture of approaches, to adopt and provide sound foundations for the building of scenarios for analysis and discussion by destination stakeholders. When encouraging more cohesive networks, some knowledge of the predisposition to self-organisation of the complex destination system is crucial as forced evolution of a complex adaptive system is, in the long term, destined to fail. The self-organisation characteristics will tend to prevail and the system will revert to its original, natural evolutionary path (Kauffman, 1995; Nicolis and Prigogine, 1977).

A further possibility for use of simulations is its integration with other techniques for adaptive management such as scenario planning. A tourism destination does not only adapt to its environment, but helps to create it (Stacey, 1993, 1996). The success may derive from contradiction as well as consistency. As discussed in this paper, when contingency (direct and linear cause and effect relationships) loses its full validity, long term planning is almost impossible. However, it is still possible to manage and understand complex systems, at least to some extent. Large scale behaviours might still be predictable if it is possible to describe the overall dynamics of the system including the existence of any preferred evolutionary paths. Once these have been identified, it can be possible to determine whether changes in some specific parameter can produce sudden shifts, or at least infer a probability distribution for their occurrence (Hansell *et al.*, 1997). A practical possibility lies in using the methods described in this work as a basis for scenario planning activities.

Scenario planning is a process in which specially constructed stories about the future are used to describe possible images of future settings. The planning process deals with these stories and uses them to analyse possible reactions and outcomes and derive action plans (Lindgren and Bandhold, 2003; Yeoman, 2008). Usually the stories are built after some preliminary investigation grounded in qualitative analysis methods. Then the issues identified are discussed by experts and lines of action are derived (Breukel and Go, 2009). It is rather obvious that in these methods, the possibility to have quantitative information to support the process can be of crucial importance and can give a much sounder foundation to the whole planning process. An extensive set of numerical simulations can be prepared in a tourism destination by using the techniques discussed here and their results, combined with more traditional methods, can be usefully employed to build scenarios to analyse. This combination has already proved to be quite effective when dealing with policy issues in other fields (Bankes, 1993, 2002).

To conclude this discussion, Table I provides a summary of the possible uses of network analysis as tools to help improving governance practices in a destination.

The usage of the methods described in this paper can be sketched as follows. Once the data needed such as the main network metrics along with the knowledge of the destination built on other types of investigations has been collected, a number of potential issues affecting the system can be identified. A series of simulations can then provide support for the construction of possible scenarios, and help in evaluating policy measures to overcome the issues identified and push the system along the desired evolutionary path, leading to improvements in the efficiency and effectiveness of the system.

Table I Applications of network analysis for adaptive destination governance

Governance component	*Evaluate*	*Network measure*
Power and salience	Central actors	Centrality measures (degree, clustering coefficient, betweenness)
Cooperation	How connected stakeholders are	Clustering coefficient modularity
Knowledge management	Flows of information and ideas	Local and global efficiency
Prediction	Predict large scale behaviours	Simulations of addition and deletion of network elements (nodes and links) and evaluation of the effects on dynamic processes
Scenario analysis	Develop simulations based on different scenario parameters	Simulation of dynamic processes using network connections as a substrate and scenario building by modifying network characteristics or process input parameters

4. Concluding remarks

This paper has adopted a complex network analysis approach to the study of tourism destinations and their stakeholders. It has discussed the theoretical basis for this approach and the findings of a number of recent studies that inform issues related to destination governance. Data on which to base tourism network studies can be difficult to obtain and one possibility (Baggio *et al.*, 2010) is the generation of network information based on linkages connecting the web sites belonging to the destination stakeholders. The paper has also discussed a number of implications of the complexity of a tourism destination system such as difficulty in forecasting and the consequent need for adaptive management. A number of techniques and measures have also been presented which demonstrate that there are practical means to analyse networks.

However, despite early indications of the usefulness of this approach, the application of complex network analysis to tourism requires substantial further work before it can be considered proven. More studies need to help in better refining all the methods and in helping the derivation of destination network formation and evolution models. For example, more work is needed in order to evaluate the effects of the superposition of multiple sets of relations between actors and in assessing the extent of their dynamic modifications. In this respect a project to compare the network and governance characteristics between different destinations would appear extremely useful and interesting for both theoretical and practical reasons.

One advantage of the network approach is that it encourages comparative studies and allows the possibility of determining the key factors that differentiate between effective and ineffective governance. The use of network analysis is recommended to tourism researchers and policy makers.

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