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 describes this approach and discusses its theoretical and methodological implications in terms of governance.

Approach Tourism destinations behave as complex adaptive systems consisting of numerous interdependent factors and activities whose relationships are highly nonlinear. Traditional research has adopted a reductionist approach: variables and relationships are embedded in simplified linear models that explain observed phenomena and allow implications for management or forecasting of future behaviours. The limitations of this approach have led several authors to push towards an adaptive management philosophy. Rather than 'imposing' lines of action to force the evolutionary path of a system, different possible approaches are treated as experiments 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. The significance of this line of thought is examined, both in their theoretical and practical implications.

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

Originality and 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.

***Type of paper**:* Conceptual paper

***Keywords**:* tourism destinations; complex systems; network science; interdisciplinary approach; quantitative and qualitative methods.

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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. 2008c). 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. 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.

This paper examines one approach to the definition and analysis of the relationships on which stakeholder governance effectiveness is based. It adopts the network paradigm that 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. This network then has properties that characterise the interactions of the group of stakeholders and these properties therefore would appear useful in understanding destination governance and how it can be improved. In this paper, several of the properties of destination networks are discussed and related to issues of destination governance. Thus understanding the characteristics of a destination network provides information about who is powerful, central to information flows, well connected or excluded and hence allows a deeper understanding of how a destination 'operates' in practice.

Apart from the concepts of networks and governance, this paper also recognises that the complexity of a tourism system is a strong characterising feature. 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. This requires a different approach to the study and to the governance of a destination, as traditional 'linear' or 'directive' methods risk of obtaining unwanted outcomes. 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 Adaptive 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 asLevin (2003), a system can be defined complex when it comprises a certain number (normally rather large) of elements that are interacting in an interdependent way. The relations between the components are typically nonlinear 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 continuously interacting with the external environment. 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, while in other cases a similar system can be completely disrupted by an avalanche originated by an apparently insignificant event. Seemingly random events can act as a catalyst for rapid growth while in other situations similar occurrences do not have recognisable effects. At stages of its life intermediate structures appear spontaneously, and the system self-organises in order to optimise its resources and better cope with external or internal pressures. A complex system is self-similar, it looks like itself at different scales, if magnified or made smaller in an appropriate way (Pavard and Dugdale 2000; Procaccia 1988; Waldrop 1992).

This characterisation adapts well to a wide number of natural and artificial systems. All the more so when considering an exemplary tourism system: a tourism destination. From the recognition of the insufficiency and the untrustworthiness of many prediction and forecasting methods, and of the apparent inexplicability of the large differences in the development paths of apparently similar destinations, a growing strand of literature has realised that unconventional ways to explain tourism development paths are needed (Farrell and Twining-Ward 2004; Faulkner and Valerio 1995). Adoption of the complex systems science framework looks to be especially valid in this respect as it challenges the linear deterministic and reductionist paradigm common n tourism. This reductionist paradigm, consisting in the separation of a tourism system into a number of different components while assuming that the relations between them are stable and static, has been found to be unable to provide meaningful descriptions of destination system and their development outcomes (Faulkner 2000; Faulkner and Russell 1997).

2.1 The Approach of Complex System Science

Most of the works discussing the advantages of applying the 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 2008a). 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 noted above, one of the consequences of the complexity of a system is that in the longer term its dynamic development is essentially unpredictable. However, in 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). However outside these stable periods, the standard analytic tools used to analyse a destination are of little help. In the study of such complex systems, one of the few possible methods for obtaining measurable outcomes is to build a simulation model which, nowadays, is a numerical computerised model.

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).

One objection to this modelling approach is that it is an oversimplifications 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). In essence, the idea of representing social actors as 'particles' subject to simple forces and followed as a whole in their interactions, is not much dissimilar to what, for centuries, has been done when studying social phenomena with statistical tools. Single actors are obviously much more complex than it is assumed in these 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 these investigations are embedded is the set of theories known as statistical physics (or statistical mechanics). This is one of the fundamental fields of physics, and uses statistical methods for addressing physical problems. A wide variety of issues, with an inherently stochastic nature have been treated with these methods. Together they provide a framework for relating the microscopic properties of individual atoms and molecules to the macroscopic properties of materials observed in every day life. For example, it is possible to explain thermodynamics, and thermodynamic properties, as a natural result of these methods (Kittel 2004; Stauffer 2004). The main result, and power, of this approach is in the development of two important concepts: universality and scaling (Amaral and Ottino 2004).

The scaling hypothesis, born in the framework of the study of critical phenomena, has provided the idea that a set of relations, called scaling laws, may help in relating the various critical-point parameters characterising the singular behaviour of a system under certain conditions. In addition to this, 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 arrangements and classifying them into distinct classes allowing the use of results and models derived in known situations to new areas.

In other words, universality and scaling assumptions give us the basis to justify an approach by analogy. Analogical reasoning is well known and often used in the history of science, and, when supported on a sound theoretical basis, makes available to a researcher the lessons found in a wide variety of fields. 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).

Although the idea needs to be taken with caution to avoid potential abuses (Daniel 1955), it has been claimed that theories not showing at least a formal analogy to another system of abstract relations, provide no insights and cannot be applied to concrete problems (Nagel 1961). More than that, analogies may act as initial steps in the development of new disciplinary fields, by helping the organisation of data, evidence, phenomena into organic arrays able to generate new models and theories. High level characteristics of a complex system (symmetries, critical transitions or conservation laws) do not depend on the microscopic details of the system. 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 models have been developed using nonlinear dynamics and agent-based modelling. In the latter a computer program calculates at several points in time, the complicated configurations a system can assume and how these configurations vary when some of the model parameters are changed. Another recently developed method is network science (Amaral and Ottino 2004).

2.2 Elementary mathematics of networks

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 relationships between them. Edges can also be assigned a weight denoting some kind of strength in the relationship (cost, speed, intensity of contacts etc.). Each node in a graph can be characterised in terms of the number of links attached to it, its degree…|?. In a directed graph, it is possible to distinguish between in-degree (number of incoming connections) and out-degree (number of outgoing links). The probability distribution of these quantities is a distinctive feature of the network topology. Random graphs (RN) have a Poissonian (or normal) distribution, whilst scale-free networks (SF) exhibit a power law behavior: $P(k) \sim k^{-\gamma}$. Several complex systems, whether of natural or artificial origin have been found to have such a degree distribution which results in the presence of few nodes with a very large degree (hubs); many with a low number of connections. Other networks, such as transport systems, show an exponentially truncated power law distribution of the form $P(k) \sim k^{-\gamma} e^{k/kc}$. In this case, the probability of highly connected hubs will be greater than in a random graph but smaller than in a scale-free network with a power law degree distribution (Lewis 2009).

Two key metrics, indicating a *small-world* (SW) property, introduced by Watts and Strogatz (1998) are the clustering coefficient *C* and the average path length *L*. The path length is the minimal number of links that must be crossed to form a direct connection between two nodes. The clustering coefficient of a node is a measure of the density of edges that exist between its nearest neighbours. When all the neighbours of a node are fully connected to each other, C will have its maximum normalised value. The average path length and clustering coefficient of the whole graph are estimated simply by averaging L and C for each of the N nodes of the graph. Other important metrics have been devised that may have some technical or conceptual interest. For example, it is possible to define the efficiency of information transmission in a network at a local or global level (Latora and Marchiori 2001), or measure an assortative coefficient, the extent to which nodal degrees are correlated (Newman 2002).

To evaluate and correctly interpret the properties of a real-life network, all its parameters must be compared to some null models. This normally is a graph with the same number of nodes and a random distribution of the edges, or by using the same network of interest, and randomly rewiring the original connections. 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).

3 Network studies of tourism destinations

The use of network science techniques in the investigation of tourism destinations is relatively new. The first applications have dealt with the possibility to use these methods in tourism and with the design of an appropriate methodological path which could provide both theoretical and practical outcomes. A few case studies have shown the feasibility of this approach. A topological characterisation has been performed and main characteristics have been measured. It has been found that a scale-free topology, common to may other systems, is present and that, at least in the destination examined low density of connections, low clusterisation and a negative degree-degree correlation exist (Baggio et al. 2008; da Fontoura Costa and Baggio 2009; Scott et al. 2008a).

This is an important (even if partial) result, because a definite identification of weaknesses in the cohesiveness of the destination can be addressed by policy and management approaches. 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. 2008b). It also has an important managerial implication: the network approach emphasises the need for a destination to be a collaborative environment and the level of collaboration may 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).

Network analysis methods have also been applied to the virtual network of the websites belonging to destination’s stakeholders. The results have allowed a measure of the level of utilisation of advanced communication technologies among the actors in a destination and measure the extent to which they exploit (or waste) resources universally deemed to be crucial for today’s survival in a highly competitive globalised market (Baggio 2007; Baggio and Antonioli Corigliano 2009; Baggio et al. 2007b). This analysis has also found a substantial similarity of the topological characteristics of the real world and corporate website networks and this suggests an important conjecture; that a tourism destination’s webspace can be used to approximate the underlying socio-economic network of the destination (Baggio 2008b). One of the major problems identified in these preliminary studies is the difficulty of gathering a reasonable amount of information on tourism organisations and their interconnections in order to apply the methods. The World Wide Web, it is argued, can provide an efficient and effective way to gather significant samples of networked socio-economic systems to be used for analyses and simulations. By using this hypothesis, a comparison between the networks of destinations considered to be at different development stages (Butler 1980) may allow the correlation, although only at a qualitative level, of the structural evolution of a destination with its evolutionary phase.

Here the analogy between webspace and social networks has allowed the consideration that in early stages of development, existing tourism organisations have not yet connected to others (Baggio et al. 2009; Baggio et al. 2007a). This is because they are competitive or are unaware of the advantages or simply because they have not yet recognised the existence of other stakeholders. Larger organisations or associations, generally responsible for the higher degrees in the network, still have to establish a connection with the newer nodes. In this situation, there exist a limitation in (some of) the nodes’ processing of the information about all the other nodes of the network. As long as these limitations are present, structural differences in the network measures can be detected (Mossa et al. 2002).

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. 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).

One of the advantages of a network representation of a complex system is that it is possible to perform numerical simulations. They allow experiments to be performed in fields where these would not otherwise be feasible for both theoretical and practical reasons. Different configurations can be compared and several dynamic processes simulated in order to better understand how these configurations influence the behaviour of the whole destination system. 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 modularity analysis can help understanding 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. 2009; 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. The topology generated by its degree distribution produces a certain level of self-organisation which, however, goes beyond pre-set differentiations (by geography or type) of the stakeholders.

4 Adaptive governance in a tourism system

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 their structure or behaviours is a key aspect in a complex system's life (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.

The governance of a destination can achieve the benefits generated by tourism if it consists of a process which enhances the positive qualities of the whole system and contributes to the generation of satisfaction among both tourists and the local community by adopting a shared vision (Buhalis 2000; Framke 2002; Kozak 2004; Ritchie and Crouch 2003). These processes are remarkably challenging due to the fragmented nature of the tourism industry and to the conflicts that may arise from different opinions, values and attitudes of the diverse stakeholders. This implies also the necessity of recognising the common elements and of favouring an effective transfer of information among the different destination components (Bramwell and Lane 2000; Font and Ahjem 1999). 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. Since then, it has been adopted in different situations, including tourism systems, with encouraging results (Agostinho and Teixeira de Castro 2003).

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. This combination has already proved to be quite effective when dealing with policy issues in other fields (Bankes 1993, 2002). 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.

5 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 discussed above is the generation of network information based on webspace linkages. 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 discussed 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 application before it can be considered proven. 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. A project to compare the network and governance characteristics between different destinations would appear useful. The use of network analysis is recommended to tourism researchers.

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