Social network analysis: organizational implications in tourism management

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Abstract

Purpose
The aim of this paper is to provide an overview of how quantitative analysis methods have been and can be used to improve the competitiveness of tourism destination. The focus of study is SNA (Social Network Analysis).

Methodology
The research methodology is qualitative and consists of the review literature relevant to this thesis. This methodology is necessary to give an account of the methods and the techniques adopted for the data collection used in other economic sectors.

Findings
SNA is needed to analyse the creation and configuration of communities of practice within destination and to identify possible barriers to effective interaction. Essentially, it is a complex adaptive socio-economic system. It shares many (if not all) of the characteristics usually associated with such entities: non-linear relationships among the components, self-organisation and emergence of organisational structures, robustness to external shocks.

Originality
SNA can help to detect actual expertise and consequently project the potential losses deriving from an inefficient flow of knowledge. In addition, we will be able to define roles in the organisational networks and make an evaluation of informal organisational structures over the formal ones. Traditional organizational theories lack a concrete correspondence with mathematical studies and in this respect, we sought to identify a correspondence.

Pratical implications
This paper provides a view into the network of relationships that may give tourism organisation managers a strong leverage to improve the flow of information and to target opportunities where this flow may have the most impact on regulatory or business activities.

Research limitations
The most important limit of this paper is that all the results presented here don't concern a single case study. Future researches will provide a larger number of cases and examples in order to give the necessary validation to the findings presented here.

Keywords: Complex systems, network science, quantitative methods, network analysis, hospitality, destination management

1. Introduction

The last 50 years have seen a growing interest in tourism network and other research methodologies by the academic world. Having developed into the most predominant sector in world's economy, tourism could not have been ignored by the community of researchers. Explaining the phenomenon of tourism, its effects, its influence and relationships with other sectors of human activity and attempts at forecasting future developments and behaviours have increased in importance with significant numbers of people involved in such research.

The position of researchers in the tourism field is at times difficult. Practitioners of other disciplines charge them with being too soft, too application oriented and of not having been able (yet) to build up a rational and uniform theoretical framework (Hall and Butler,1995; Baggio and Baggio, 2020). On the other hand, people involved in day by day operational activities accuse them of flying too high and wasting time in fooling around with models and conjectures without producing much of practical use in helping with the problems they face. As a very recent field of investigation, tourism is still trying to find a reasonable compromise between these two extremes (Leiper, 2000; Farrell and Twining-Ward, 2004; Tribe, 119; 2005).

The boundaries of the tourism and travel industry are indefinite (Cohen, 1984; Cooper *et al.,* 2005; McIntosh and Goeldner, 1990). Tourism brings together segments from a number of different activities with a wide variety of products and services exhibiting little homogeneity and with different technologies used in the production process. It may be questioned whether it should even be classified as an industry by itself in the traditional sense of manufacturing or trade (Mill and Morrison, 1992; Leiper, 2000; Morrison et al., 2004). Moreover, reflecting changes in wider society, in the last few years tourism has become an extremely dynamic system. Introduction of flexible organisational structures, fast changing customer behaviour and strong impacts from the development of transportation technologies have exerted a formidable pressure on the whole sector (Valeri, 2020).

Many researchers have contributed and are contributing to the growth of knowledge in the tourism domain. They are bringing into the field their multiform and diverse experiences and backgrounds. Geographers, sociologists, economists, mathematicians, ecologists and historians, are all giving their interdisciplinary and multidisciplinary contributions and trying to shape the paradigms that may raise the status of this area of study to an accepted scientific discipline (Echtner and Jamal, 1997; Faulkner and Russell, 1997; Farrell and Twining- Ward, 2004; Tribe, 2005).

In the vast catalogue of expertise that plays a role in this exploration, one was missing so far: physics. In recent years the ideas, concepts and techniques of physics have been applied to different disciplines such as biology, economics and sociology. The results of this interdisciplinary endeavour are interesting and have helped improve the general understanding of these fields. In particular, in the study of economics, physicists are having an increasingly important role and a new 'science' has been born: econophysics (Mantegna and Stanley, 2000).

Since the 17th century many scholars have taken into account the statistical properties of the elements of an economic or a social system to build the theories and models that constitute our current understanding of these (Ball, 2003). More recently, the usage of physical methods has provided important results such as the modelling of crowd behaviour, traffic flows or political elections (Bernardes *et al.,* 2002; Costa Filho *et al.,* 1999), the formation of business alliances and the behaviour of economic markets (Saari, 1995; Sornette, 2003). The application of the most recent developments in the field of complex systems modelling to social systems is also starting to receive "institutional legitimacy".

The characteristics of tourism make it a very difficult subject to define with reasonable accuracy. Terms such as complex, dynamic, networks, information intensive and others are very often used to describe the area (Baggio, 2006; McKercher, 1999; Mill and Morrison, 1992; Werthner and Klein, 1999), so that a characterisation of tourism as a complex dynamic information network business is very likely to be generally accepted without major discussion. These words bring to mind a series of concepts and considerations that form the main subject of this paper.

The present paper is structured in three sections: the first one revolves around the concept of "complexity science". This is a rather recently formed corpus of multidisciplinary methods, and shares with tourism the common characteristic of being vaguely defined, not formalised and with disputed outcomes. Nonetheless, the latest results show enormous possibilities in improving our general understanding of social, economic, biological and technological phenomena. The focal point of the second section is the strategical role of the tourism destination as a complex system, because of its determining function for the definition of governmental plans and for the management of economic, social and environmental impacts that the tourism phenomenon generates. The third section addresses the implications deriving from the application of methods and techniques that the science of networks has developed over the last years to study the performance of a tourism destination.

2. Complexity science: an overview

In natural language, the concept of complexity has several meanings, usually related to the size and number of components in a system. There is still no universally accepted definition, nor a rigorous theoretical formalisation, of complexity. Nonetheless, it is currently a much-investigated research topic. Intuitively we may characterise a complex system as "a system for which it is difficult, if not impossible to reduce the number of parameters or characterising variables without losing its essential global functional properties" (da Fontoura Costa *et al*., 2007). The parts of a complex system interact in a non-linear manner. There are rarely simple cause and effect relationships between elements, and a small stimulus may cause a large effect, or no effect at all. The non-linearity of the interactions among the system's parts generates a series of specific properties that characterise its behaviour as complex.

It is important to highlight the difference between a complicated and complex system. A complicated system is a collection of a number of elements (often very high) whose collective behaviour is the cumulative sum of the individual behaviours. In other words, a complicated system can be decomposed into sub-elements and understood by analysing each of them. On the contrary, a complex system can be understood only by analysing it as a whole, almost independently of the number of parts composing it (Da Fontoura Costa et al., 2007).

A tourism system, involving such economic activity, shares many of these characteristics. The theoretical work in this field is still in its infancy and just a handful of researchers have started to consider the complex systems approach as a more effective framework for understanding the many and different phenomena (Farrell and Twining-Ward, 2004; McKercher, 1999; 2005). Complexity theory offers the hope of being able to understand, for example, how crises, disasters or turbulent changes may influence the sector, or why, after major crises such as 9/11, the tourism sector is able to show a rapid and almost unexpected recovery.

In tourism, one model that explicitly adopts a chaos approach is the one proposed by McKercher. The main components of this system are (McKercher, 1999; 2005): 1) the traveller, who is the essential player in tourism, for without people travelling no tourism would occur; 2) the communication vectors used to connect the traveller to the destination, 3) the considerations or factors that influence the effectiveness of the communication vectors used, 4) the destination or internal tourism community consisting of all businesses involved in tourism at the destination, 5) external tourism agencies (public and private sector) that try to influence tourism, 6) other tourism-related externalities, such as alternative tourism destinations that affect a destination's ability to attract travellers, 7) non-tourism-related externalities, or macro-environmental forces, such as changing political, economic or social conditions, war, natural disaster, that affect people's ability to travel, 8) Outputs from the system both desired and undesired, 9) rogues or chaos makers who can push a system to the edge of chaos.

The model outlines the performance of complex tourism systems by listing the components that may affect tourism on the basis of different potential levels, i.e. national, regional, local and even at an enterprise level. Its assumptions is that the connections between the various components are similar, despite the number of key factors changes depending on the level. This allows the author to offer a scenario suitable to compare the failure of various well thought-out, carefully managed and sustainable tourism development strategies. Thanks to this method, we are also in a position to better realise, even though only at a conceptual level, how the employment of technologies like Internet and their future developments may influence the system (Valeri, 2015; 2019).

The overall picture can be outlined in a number of key concepts detailed hereinafter. We look at a tourism destination as a prototypical tourism subsystem, whose features can be considered to be part of multiple groups (such as those proposed by McKercher, 1999; 2005). These groups are connected with relationships that exhibit a non-linear dynamic behaviour, producing outcomes that cannot be simply explained as 'summing up' the individual characteristics. In the evolution of the system it is possible to find many of the features indicated by Arthur et al. (1997) as portraying a CAS.

A central property of a CAS is the possible emergence of unforeseen properties or structures termed self-organisation. This is one of the most striking features characterising a complex system. A consequence of this is the robustness or resilience of the system to perturbations (or errors); the system is relatively insensitive and has a strong capacity to return to a stable behaviour in the absence of external inputs.

A number of tools have been developed in recent years to cope with the task of describing a complex system. Many of them originate from the work of 19th century scientists, but only modern computational facilities have made them amenable to calculation. In their review, Amaral and Ottino (2004) consider three main classes of analysis tools:

1. nonlinear dynamics,
2. statistical physics,
3. network theory.

Most complex systems can be described as networks of interacting elements. In many cases these interactions lead to global behaviours that are not observable at the level of the single elements and that share the characteristics of emergence typical of a complex system. Moreover, the collective properties of dynamic systems composed of a large number of interconnected parts are strongly influenced by the topology of the connecting network.

3. Social network analysis: approaches and opportunities

The comprehension of complex systems is facilitated when they are rendered in the shape of a diagram that is to say mathematically (Mitchell, 2006). 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.). Depending on the characteristics of the nodes, the edges of a diagram can be classified in two ways: we talk about directed edges if the associations between nodes are symmetric, whereas we refer to undirected edges when the correlations between nodes are casual. To stress the strength in the relation of elements such as cost, urgency, level of contacts, etc., edges can also be given a weight. In order to mirror the actual world properties and features, some network characteristics have been identified. For instance, the density of links (i.e. the real quantity of links measured against the total quantity of possible links), in relation to the compactness of a group, a fundamental characteristic in ascertaining collective behaviours.

A number of researches carried out analyses on the network characteristics of tourism destinations have highlighted that the examined samples have a low degree of connections (Scott *et al.,* 2008; Baggio *et al*., 2010). The result, although uncomplete, are quite significant because, by means of policy and management mediations, we can sort out and definitely identify the vulnerabilities in the compactness of a destination. The interrelations inherent in a value-creation system enable us to identify dissimilarities in the measurement of the level of inter-organisational compactness in different contexts (Scott *et al.,* 2008). At the same time, we are offered another fundamental managerial suggestion, i.e. the network approach highlights the necessity for a destination to be considered as a cooperative context (Tran, et al., 2016; Éber et al., 2018).

A modularity analysis, then, can 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. We can estimate the goodness of the division through a modularity index Q, which is the quality indicator for groups identified by the variance between the ratio of links connecting nodes in a community and its forecast value, in case the links are distributed randomly. Q can be measured either for a given allotment of the network into modules, or by applying a stochastic calculation that will obtain the breakdown maximising Q for the predetermined network (Girvan and Newman, 2002).

In addition, network approaches have been applied to recognise the key stakeholders of a tourism destination, that is to say those players that are able to generate significant added value for the development of tourist business and for the destination management. Comparing the perceived relevance of enterprises in a given destination and their network features enables us to establish a set of metrics capable of describing them.

It has been noted that the key members are usually positioned at the heart of the network, thus creating a sort of inner circle that plays a prominent role compared to the outer stakeholders (Baggio, 2017). This means that the overall control of a tourism destination is governed by a restricted number of organisms, confirming once more the need for a cooperative inter-organisational network able to lead to real integrated tourist practices (Cooper *et al.,* 2005; Valeri, 2019). Not least, public stakeholders can be considered key factors in destination networks for the following reasons: they own fundamental resources, have a core position and are legally the most powerful over other members.

To assess networks and identify their features, we can use a number of measures. The most frequently used can be ordered into two classes: group (or global) and individual (or local) measurements. Below are the most popular and significant (da Fontoura Costa *et al.,* 2007; Scott *et al.,* 2008; Baggio *et al.,* 2010; Tonti and Baggio, 2012):

Group measurements:

1. density: the ratio between the number of connections present and the maximum possible when all network nodes are connected among them;
2. cohesion: the average of the distance among pairs of people in the networks, i.e. the average number of steps along the shortest paths for all possible pairs of network nodes.

Individual measurements:

1. degree centrality: the number of connections each individual has;
2. betweenness centrality: a measurement of how an individual connects others in the network;
3. closeness centrality: proximity of a node to all others, measured as the inverse of the sum of all the distances from the node to all others.

Formal structures are not always sufficiently explicative to comprehend the flow of information in an organisation and how assignments are fulfilled. Actually, the dynamics inherent in organisation mechanisms are determined by the mutual dependence of the community. Such correlations are often so hard to be estimated that we should reconsider the power of "informal structures". Any organisation theoretician would agree that the best procedure for an organisation to achieve target objectives is to look more closely at its internal and external contexts, that is to say where the interventions are distributed. Nevertheless, being the nature of organisation dynamics essentially qualitative, it is invariably and extremely arduous to frame it with quantitative measures.

In this sense, Social Network Analysis (SNA) represents a valuable support to understand both the qualitative and quantitative measures of organisational dynamics. In particular, when referred to organisations, SNA assumes the connotation of Organisational Network Analysis (ONA) (Tichy *et al.,* 1979). Organisational Network Analysis reveals the collaboration tendencies among employees in the working environment and helps to identify possible interventions to solve inefficiencies in the communication process (Burt, 2000; Inkpen and Tsang, 2005).

4. Destination as complex tourism systems

The tourism destination has set itself as a key factor within the tourism management research. Thanks to its features and its evolutionary dynamic, the tourism destination has a fundamental role for the definition of management and development strategies and the comprehension of economic, social and environmental impacts generated by tourism (Framke, 2002; Ritchie and Crouch, 2003; Vanhove, 2005). Naturally, this entails the need of a deep knowledge of the structure of the destination and of the interconnections between its constitutive elements.

When analysing these concepts, one factor seems to stand out with a particular emphasis: the importance of the set of relationships among the different parts of the destination system. This consideration leads one to wonder how the recent developments of what is now known as the "network science" (Watts, 2004) can help improve our knowledge, and whether and how they can provide useful elements for a better and more effective management of the tourist system (Song and Li, 2008).

Many definitions have been proposed to describe a destination. As often happens, there is no general agreement and the different expressions tend to highlight this or that aspect, depending on the aim of the author.

For the purpose of the present work, we can define the tourism destination as a geographically delimited system, where a number of actors operate (businesses, associations, public administrations, etc.) providing travellers and tourists with services and other products. Furthermore, this should ideally happen trying to promote a correct balance between the tourist use of a territory and the respect of its environmental, social and cultural features (Framke, 2002). The set of public and private organisations which operate in the tourist system and the configuration of the ties built among them have been studied and analysed in different ways, usually by means of methodologies deriving from economic and social studies.

Using a systemic approach, the tourism destination can be considered as an example of hospitality belonging to a dynamic complex system. Actually, from a structural perspective a destination can be seen as a system made of a number (usually not a small one) of elements that evolves responding to external and internal stimulation; the relationships bonding the different components can be characterised by well-known non- linear dynamics, frequently described in the relevant literature (Farrell and Twining-Ward, 2004; Faulkner and Russell, 1997).

Phenomena such as the resistance towards external shocks, the spontaneous development of intermediate structures (self-organisation), the sensitiveness to the variation of the initial conditions, the unpredictability of the impact of events even when of minor importance, the difference between the behaviour of the entire system and that of each of its constitutive elements, strongly confirm this interpretation (Baggio, 2008; Hagberg et al., 2008).

In such a framework, as it is well known, the traditional techniques of analysis and forecast have shown big limits (Russell, 2006; Russell and Faulkner, 2004). We can mention many examples of sophisticated methods developed to forecast the trend of tourist phenomena and their relatively low reliability which can be easily explained if the “complexity” is considered as an intrinsic feature of the destination system. Furthermore, this complexity requires a deep rethinking of the managerial or governmental arrangements of the destination.

In a complex system, self-organisation is probably its most striking feature, and this implies that no individual coordinator or manager can completely handle the system behaviour, and that the control is spread over different factors interacting among themselves. Moreover, the nonlinearity of these interactions means that sometimes in a very unpredictable way, small disruptions can cause significant catastrophic effects whilst heavy shocks can be easily absorbed (Levin, 2003).

As said earlier, one of the main characteristics of a tourist system is its network organisation. For this reason, the techniques and analysis methods of complex networks, developed over the last years by a large group of researchers of diverse disciplines, provide an interesting hint for a scientific approach to the study of a tourism destination (Baggio et al., 2010; Baggio, 2017).

5. Social network analysis: simulations

The tourism destination, modelled as a complex network system, is an excellent basis for developing numerical simulations to measure the potential of the established relationships. This methodology is increasingly imposing itself as a tool of support for the analysis and planning of complex social and economic systems, for which it is usually harder to apply techniques that are more traditional (Casanueva *et al*., 2016; Provenzano and Baggio, 2020).

One of the phenomena that most influences the development of a tourism destination is, without any doubt, the spreading of information and knowledge between all actors. Even more, the way this happens has a great impact on possible competitive advantages that a destination and its elements can have and on how actions are planned. A set of simulations can be useful for assessing the efficiency of the phenomenon and for testing the structure capacity of the system by observing its reactions when one of its characteristics is changed (Raisi et al., 2020).

A simple model can be derived from the field of epidemiology. In this, an element of the network can exist in two different states: either prepared to receive the information or already "infected" by it. The transmission happens by contact through the links connecting the nodes. Despite its simplicity, such a model represents a reliable approximation of what happens in reality (Barthélemy *et al.,* 2005). The process can be described as follows: one randomly chosen element of the network starts the process by transmitting the information to one *portion* of its neighbours. Later, at equal time intervals, every infected knot does the same. The process ends when all nodes have been reached (Baggio, 2015).

In carrying out the simulations, two different configurations are commonly used. In the first one, the ability of every actor is used as a parameter of the model, by assigning different abilities according to the dimensional characteristics of the analysed businesses: small, medium or big (Baggio and Baggio, 2020). The second type of simulation tends to verify whether and what influence a change of the topological structure of the network may have on the process. With the method suggested by Maslov and Sneppen (2002), the network can then be modified in order to increase the clustering coefficient while leaving unaltered the distribution of the connections and assess the effects of the modifications.

6. Hospitality implications

Literature has shown that the features of a tourism destination network are similar to those of other natural and artificial systems: in particular, its distribution of degrees follows a power law (Van der Zee and Vanneste, 2015; Casanueva et al., 2016; Baggio, 2017). Nevertheless, some differences seem to have a significant importance. First, when the connectivity of the network is very low and so are the level of local aggregation and the general efficiency of the system. In "tourist" terms, this means a very low level of cooperation among the tourist actors at the expense of the quality of the hospitality. If, as already suggested (Baggio, 2007; Valeri, 2019), clustering and assortativity coefficient are considered, these can be taken into account as quantitative measures of this phenomenon that, however, have to be compared with traditional methods of qualitative research.

A further interesting consideration concerns the network modularity. The network modularity is usually low when natural and traditional subdivisions are considered, i.e. geographically or typologically. However, it has been noted how a certain level of aggregation exists if the network is examined for its intrinsic topological features. This shows that the system still has a certain degree of self-management (typical of a complex system) which, however, leads to the development of informal community structures, which is a phenomenon that can also be observed in other realities (Heidari et al., 2018).

The result of the mathematical simulations applied to the destinations is of fundamental importance as it provides several suggestions to improve the quality of hospitality. In particular, they might represent useful recommendations, such as with the definition of development plans in order to improve different collaborative forms other than pre-established groupings. In this way, the natural inclination of the system could be fulfilled, and further support could be given for the governance activity of complex tourist systems (Farrell and Twining-Ward, 2004).

Despite what has been written, it is deemed necessary to support the assumption that the quantitative analysis of the parameters of the network and of the trend of the dynamic processes must not be considered on its own, but has to be compared with the qualitative analysis of the system and of its components and dynamics. This is the only possible way to correctly interpreter the results and obtain important information to support the governance and management of the destination (Baggio and Mariani, 2019). To this regard, it has been proved that significant levels of clustering can be also found in terms of statistical fluctuations, in the case of networks with causal link distributions and with a limited number of nodes and an established distribution of degrees (Newman, 2003; Newman *et al.,* 2001). Once the model is built and the results have been correctly interpreted, it is possible to conduct several simulations by changing the different parameters and developing various scenarios thus evaluating the related conditions and effects.

7. Concluding remarks

This paper has sought to explain how quantitative research methods are useful to study the evolutionary dynamics of a tourism destination. In particular, it focuses on the benefits of SNA (Social Network Analysis) for the governance and management of a tourism destination. When considered on their own, these methods are undoubtedly intriguing and challenging from an intellectual perspective. The researchers engaged in these fields are well aware that, no matter how sophisticated and efficient they are, quantitative models and theories have little value when not supported by qualitative methodologies. Therefore, quantitative and qualitative research methods must not be considered in conflict but rather they should be treated in symbiosis.

The methods of the network science can be extremely useful and effective to deepen the knowledge of complex systems and their dynamic. Together with the heritage of traditional procedures that have been already developed, they can turn out to be powerful instruments in the implementation of an adaptive approach, which is considered by many to be the only effective way for the guidance of these systems (Baggio, 2008).

The opportunity to use quantitative methods to analyse phenomena and relationships, which up to now could only be addresses mainly with qualitative techniques, opens up new horizons to those who are interested in the study of tourist systems and their governance. Future researches will provide a larger number of cases and examples in order to give the necessary validation to the findings presented here. Obviously, the methods submitted in this paper need additional refinements, both from a theoretical and an applied perspective, however the increasing commitment in the interdisciplinary study of complex systems and networks will provide further insights to be applied to the world of tourism. Among other things, this will be able to contribute to a greater general methodological rigor, which in turn could lead to a better organization of the sometimes-tangled set of ideas, models and theories that characterise today's tourism research. In this aspect the application of the methods of networks science can be the starting point for a deep reconsideration of the domain and provide a bridge able to reduce, if not close, the gap that has brought to a substantial lack of a rational and uniform theoretical structure.

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References

Amaral, L. A. N. and Ottino, J. M. (2004), "Complex networks - Augmenting the framework for the study of complex systems", *The European Physical Journal,* Vol. 38, pp. 147-162.

Arthur, W. B., Durlauf, S. N. and Lane, D. (Eds.), (1997), *The Economy as an Evolving Complex System II*, Reading, MA, Addison-Wesley.

Baggio, J., and Baggio, R. (2020), *Modelling and simulations for tourism and hospitality. An introduction*, Channel View Publications

Baggio, R. (2006), "Complex systems, information technologies and tourism: a network point of view", *Information Technology and Tourism*, Vol. 8, No, 1, pp.15-29.

Baggio, R. (2007), "The Web Graph of a Tourism System", *Physica*, Vol. 379, No. 2, pp. 727-734.

Baggio, R. (2008), "Symptoms of complexity in a tourism system", *Tourism Analysis*, Vol. 13, No. 1, pp. 1-20.

Baggio, R. (2015), Knowledge management and diffusion: the network paradigm. In M. T. McLeod & R. Vaughan (Eds.), Knowledge networks and tourism (pp. 108-125). New York: Routledge.

Baggio, R. (2017), "Network science and tourism – the state of the art", *Tourism Review*, 72(1), 120-131.

Baggio, R., and Mariani, M. (2019), "The relevance of Mixed Methods for Network Analysis in Tourism and Hospitality Research", *International Journal of Contemporary Hospitality Management* (forthcoming, doi: 10.1108/IJCHM-04-2019-0378).

Baggio, R., Scott, N., and Cooper, C. (2010), "Improving tourism destination governance: a complexity science approach", *Tourism Review*, Vol. 65, No 4, pp. 51-60.

Ball, P. (2003), "The Physical Modelling of Human Social Systems", *Complexus*, Vol. 1, pp. 190-206.

Barthélemy, M., Barrat, A., Pastor-Satorras, R., and Vespignani, A. (2005), "Dynamical patterns of epidemic outbreaks in complex heterogeneous networks", *Journal of Theoretical Biology*, Vol. 235, pp. 275-288.

Bernardes, A. T., Stauffer, D., and Kertész, J. (2002), "Election results and the Sznajd model on Barabasi network", *The European Physical Journal B*, Vol. 25, pp. 123-127.

Burt, R. S. (2000), The network structure of social capital. In R. I. Sutton & B. M. Staw (Eds.), Research in Organizational Behavior (Research in Organizational Behavior, Vol. 22, pp. 345- 423). Greenwich, CT: JAI Press.

Casanueva, C., Gallego, Á., and García-Sánchez, M. R. (2016), "Social network analysis in tourism", *Current Issues in Tourism*, Vol. 19, No. 12, pp. 1190–1209.

Cohen, E. (1984), "The Sociology of Tourism: Approaches, Issues, and Findings", *Annual Review of Sociology*, 10, 373-392.

Cooper, C., Fletcher, J., Gilbert, D., Fayall, A., and Wanhill, S. (2005), *Tourism Principles and Practice* (3rd ed.), Pearson Education, Harlow, UK.

Costa Filho, R. N., Almeida, M. P., Andrade, J. S., and Moreira, J. E. (1999), "Scaling behavior in a proportional voting process", *Physical Review* E, 60, 1067-1068.

Da Fontoura Costa, L., Rodrigues, A., Travieso, G., and Villas Boas, P. R. (2007), "Characterization of complex networks: A survey of measurements", *Advances in Physics*, Vol. 56, No. 1, pp. 167-242.

Éber, F. Z., Baggio, R., & Fuchs, M. (2018), "Network analysis of a multi destination region – The case of Halland, South Sweden", *Information Technology and Tourism,* Vol. 20, No. 1-4, pp. 181–188.

Echtner, C. M., and Jamal, T. B. (1997), "The Disciplinary Dilemma of Tourism Studies", *Annals of Tourism Research*, Vol. 24, No. 4, pp. 868-883.

Farrell, B. H., and Twining-Ward, L. (2004), "Reconceptualizing Tourism", *Annals of Tourism Research*, Vol. 31, No. 2, pp. 274-295.

Faulkner, B., and Russell, R. (1997), "Chaos and complexity in tourism: in search of a new perspective", *Pacific Tourism Review*, Vol. 1, pp. 93-102.

Framke, W. (2002), "The Destination as a Concept: A Discussion of the Business-related Perspective versus the Socio-cultural Approach in Tourism Theory", *Scandinavian Journal of Hospitality and Tourism*, Vol. 2, No. 2, pp. 92-108.
Girvan, M., and Newman, M. E. J. (2002), "Community structure in social and biological networks", *Proceedings of the National Academy of the Sciences of the USA*, Vol. 99, pp. 7821-7826.
Hagberg, A. A., Swart, P. J., and Schult, D. A. (2008), Exploring network structure, dynamics, and function using Network. *Proceedings of the 7th Python in Science Conference (SciPy2008), Pasadena, CA (19-24 Aug)*, pp. 11-15.
Hall, C. M., and Butler, R. W. (1995), "In Search of Common Ground: Reflections on Sustainability: Complexity and Process in the Tourism System: A Discussion", *Journal of Sustainable Tourism*, Vol. 3, No. 2, pp. 99-105.
Heidari, A., Yazdani, H. R., Saghafi, F., & Jalilvand, M. R. (2018). A systematic mapping study on tourism business networks. *European Business Review,* Vol. 30, No. 6, pp. 676-706.
Inkpen, A. C., and Tsang, E. W. K. (2005), "Social capital, networks, and knowledge transfer", *Academy of Management Review*, Vol. 30, No. 1, pp. 146-165.
Leiper, N. (2000), "An emerging discipline", *Annals of Tourism Research*, Vol. 27, No. 3, pp. 805-809.
Levin, S. A. (2003), "Complex adaptive systems: Exploring the known, the unknown and the unknowable", *Bulletin of the American Mathematical Society*, Vol. 40, No. 1, pp. 3-19.
Mantegna, R. N., and Stanley, H. E. (2000), *Introduction to Econophysics: Correlations & Complexity in Finance*, Cambridge, University Press Cambridge.
Maslov, S., and K. Sneppen (2002), "Specificity and Stability in Topology of Protein Networks", *Science,* Vol. 3, No. 296: pp. 910-913.
McIntosh, R. W., and Goeldner, C. R. (1990), Tourism: Principles, Practices, Philosophies (6th ed.), John Wiley, New York.
McKercher, B. (1999), "A Chaos Approach to Tourism", *Tourism Management*, 20, pp. 425-434.
McKercher, B. (2005), "Destinations as Products? A Reflection on Butler's Life cycle", *Tourism Recreation Research*, Vol. 30, No. 3, pp. 97-102.
Mill, R. C., and Morrison, A. M. (1992), *The tourism system: an introductory text*, Prentice-Hall, Englewood Cliffs, NJ.
Mitchell, M. (2006), "Complex systems: Network thinking", *Artificial Intelligence*, Vol. 170, No. 18, pp. 1194-1212.
Morrison, A., Lynch, P., and Johns, N. (2004), "International tourism networks", *International Journal of Contemporary Hospitality Management*, Vol. 16, No. 3, pp. 197-202.
Newman, M. E. J. (2003), "The structure and function of complex networks", *SIAM Review*, Vol. 45, pp. 167-256.
Newman, M. E. J., Strogatz, S. H., and Watts, D. J. (2001), "Random graphs with arbitrary degree distributions and their applications", *Physical Review*, Vol. 64, pp. 26 - 118.
Provenzano, D. and Baggio, R. (2020). A complex network analysis of inbound tourism in Sicily. *International Journal of Tourism Research,* (doi: 10.1002/JTR.2343).
Raisi, H., Baggio, R., Barratt-Pugh, L. and Willson, G. (2020). A Network Perspective of Knowledge Transfer in Tourism. *Annals of Tourism Research, 80* (doi: 10.1016/j.annals.2019.102817).
Ritchie, J. R. B., and Crouch, G. I. (2003), *The Competitive Destination: A Sustainable Tourism Perspective*, CABI Publishing, Oxon, UK.
Russell, R. (2006), Chaos theory and managerial approaches. In D. Buhalis and C. Costa (Eds.), Tourism Dynamics, Challenges and Tools: Present and Future Issues (pp. 108-115). Oxford Butterworth-Heinemann.
Russell, R., and Faulkner, B. (2004), "Entrepreneurship, Chaos and the Tourism Area Lifecycle", *Annals of Tourism Research*, Vol. 31, No. 3, pp. 556-579.
Saari, D. G. (1995), "Mathematical Complexity of Simple Economics", *Notices of the American Mathematical Society*, Vol. 42, No. 2, pp. 222-230.
Scott, N., Cooper, C., and Baggio, R. (2008), "Destination Networks - Theory and practice in four Australian cases", *Annals of Tourism Research*, Vol. 35, No. 1, pp. 169-188.
Song, H., and G. Li (2008), "Tourism Demand Modelling and Forecasting - A Review of Recent Research", *Tourism Management* Vol. 29, pp. 203-220.
Sornette, D. (2003), Why Stock Markets Crash. Princeton: Princeton University Press.

Tichy, N. M., Tushman, M. L., and Fombrum, C. (1979), “Social network analysis for organizations”, *Academy of Management Review*, Vol. 4, No. 4, pp. 507-519.
Tonti, S. and Baggio, R. (2012), “Organizational impacts of social network analysis for an italian multinational enterprise”, *Turistica*, Jan -March.
Tran, M. T., Jeeva, A. S., & Pourabedin, Z. (2016). Social network analysis in tourism services distribution channels. *Tourism Management Perspectives,* Vol. 18, pp. 59-67.
Tribe, J. (1997), “The Indiscipline of Tourism”, *Annals of Tourism Research*, Vol. 24, No. 3, pp. 638-657.
Tribe, J. (2005), “New Tourism Research”, *Tourism Recreation Research*, Vol. 30, No. 2, pp. 5-8.
Valeri, M. (2015), “Sustainability development and competitiveness of Rome as a tourist destination”, *Tourism and Hospitality Management*, Vol. 21, No. 2, pp. 203 – 218. https://doi.org/10.20867/thm.21.2.7
Valeri, M. (2016), “Networking and cooperation practices in the Italian tourism business”, *Journal of Tourism, Heritage & Services Marketing* 2(1): 30-35. http://doi.org/10.5281/zenodo.376333.
Valeri, M. (2019), “Co-evolutionary prospects and sustainability”, in (eds), Ratten V, Ramirez Pasillas M, Lundberg M, *Managing Sustainable Innovation*. Routledge (ISBN: 9780367210311).
Valeri, M. (2020), “Blockchain technology: adoption perspectives in tourism”, in (Ed), RATTEN V., *Entrepreneurship and organizational change: Managing innovation and creative capabilities*. Springer (ISBN: 978-3-030-35414-5).
Van der Zee, E., and Vanneste, D. (2015), “Tourism networks unravelled; a review of the literature on networks in tourism management studies”, *Tourism Management Perspectives*, Vol. 15, pp. 46-56.
Vanhove, N. (2005), *Economics of Tourism Destinations*, Elsevier Butterworth- Heinemann, London.
Watts, D. J. (2004), “The "New" Science of Networks”, *Annual Review of Sociology*, 30, pp. 243-270.
Werthner, H., and Klein, S. (1999), *Information technology and tourism - a challenging relationship*, Springer.