Destination events, stability, and turning points of development

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ABSTRACT

This study investigates the effects generated by tourism events and investments to improve destination development (dynamics) and stability (topology). The horizontal visibility graph framework (a technique able to transform a time series into a network) was used. Two hypotheses were tested: the first was the ability of these events and investments to generate a turning point, and the second was their ability to increase the system's stability. The findings are based on a longitudinal analysis of three different destinations in terms of size, type of destination events and investments, and the prevalent market segment. For each case, a daily longitudinal time series was considered, and the empirical evidence confirmed both hypotheses. In the concluding remarks, the theoretical and empirical implications are reported, and some future research avenues are discussed.

Keywords

Multiple case study; Destination events; Network topology; System dynamics; Horizontal visibility graph; Turning point.

1 INTRODUCTION

Destination marketing and management (DMM) is a complex activity primarily involved in the creation of a sustainable competitive advantage (Sainaghi 2006). There are many factors that increase the complexity of this activity, one of which is the fragmented supply of hundreds of actors (Sainaghi, De Carlo, and d'Angella 2018; Sainaghi, Phillips, and d'Angella 2019). This supply fragmentation is a constituent element of the five research streams proposed by Pearce (2014) that have framed and conceptualized a tourism destination: industrial districts, clusters, networks, systems, and social constructs. Network theory appears to be a promising approach to conceptualizing a tourism destination (Baggio, Scott, and Cooper 2010) and to understanding its functioning (Chung et al. 2019). In particular, without reducing the system to its constituent elements, social network analysis provides more valid insights that, in turn, can be used for studying and managing complex systems such as destinations (Baggio and Sainaghi 2011).

In the network approach, a tourism destination is composed of nodes (the actors) and links (the relationships) (Pavlovich 2003). The nodes are local organizations, including private and public bodies (Erkuş-Öztürk 2009), whereas the relationships are a wide range of interactions, such as information, institutional, commercial, family, and ownership interactions (Sainaghi and Baggio 2014). Network theory has revealed some distinctive features of tourism destinations, such as the presence of nonlinear relationships among actors (Laws and Prideaux 2005), the ability of this system to organize itself (Nicolis and Prigogine 1977), the way it reacts to many external causes, and the fact that it shows both robustness and fragility (Lorenz 1963). Some relevant external causes for tourism destinations include variation in macroeconomic variables, economic crises, shocks (such as terroristic attacks), new trends, political instability, changes in competitive threats, and similar exogenous factors (Kosová and Enz 2012; Smeral 2018). Unsurprisingly, this research stream has attracted a considerable amount of research on the tourism industry (van der Zee and Vanneste 2015). However, despite their popularity, many studies are only notionally rooted in network theory and do not properly use the tools developed by this research stream (Casanueva, Gallego, and García-Sánchez 2016). In particular, the adoption of a quantitative approach appears appropriate for exploiting the potentialities of network theory: "[D]eparting from a mathematical conceptualization of the network as a collection of network nodes and ties with a distinguishable structure, this field of studies [network analysis] for the first time departs from *the network as an entity and not a mere concept*" (van der Zee and Vanneste 2015, 53, italics added). In a recent article, Sainaghi and Baggio (2017) analyzed 47 papers rooted in network theory and based on the tourism industry, revealed that the large majority (64%) were qualitative papers.

The network approach has explored two key research questions among others: i) how the system evolves over the years (destination dynamics; Arnaboldi and Spiller 2011; Bhat and Milne 2008; Dredge 2006; Russell and Faulkner 2004), and ii) how stable (or unstable) the destination is; this is also known as system topology (Baggio and Del Chiappa 2013; Bregoli et al. 2016; March and Wilkinson 2009; McLeod, Vaughan, and Edwards 2010; Paget, Dimanche, and Mounet 2010). The system interacts with many internal and external causes and can change and influence the destination evolution and structure (Pavlovich 2014). The network dynamics approach identifies some turning points (Coshall 2010) that are able to move the system into a new phase (Baggio and Sainaghi 2016; Sainaghi and Baggio 2017), whereas system topology investigates the distance to the chaos threshold (McKercher 1999; Russell and Faulkner 2004; Zehrer and Raich 2010).

This study explores the effects generated by some destination events and investments on system dynamics and stability. The study adopts an "ex-ante" approach, exploring the ability of some selected processes to influence the destination system.

2 LITERATURE REVIEW

In this section, three central topics are presented and discussed. The focus of this paper is on destination strategies and their ability to influence system dynamics and topology. The first section explores this topic further. Based on the DMM literature, two relevant processes are identified: event management and new product development. The second section explores in detail the expected effects generated by the two identified destination management processes of system dynamics and topology. Finally, in the third section, the model used in the current study to operationalize the tourism destination as a network system is presented. This framework is called a horizontal visibility graph (HVG).

2.1 DMM strategies

DMM is presented as two separate research topics in some studies (Pike and Page 2014), whereas in others, the boundaries between these two disciplines is considered to be blurred (Laesser and Beritelli 2013). The development of DMM is related to the increasing competition between tourism markets (Choe, Stienmetz, and Fesenmaier 2017). Despite many different approaches, theories, and analytical frameworks, the general goal of DMM is the creation of a sustainable competitive advantage for a tourism destination (Sainaghi 2006). This research stream has attracted a significant number of studies, and several literature reviews have been conducted (Avila-Robinson and Wakabayashi 2018; Fuchs, Höpken, and Lexhagen 2014; Neuhofer, Buhalis, and Ladkin 2012; Pike and Page 2014).

The drivers that destination firms and organizations can implement to create, sustain, and consolidate competitive advantages are numerous and include, among others, destination image and branding; destination competitiveness; destination identity; destination experience and innovation; information, communication, and technology; social media; and sustainable tourism (Armenski, Dwyer, and Pavluković 2018; Avila-Robinson and Wakabayashi 2018). Only "relevant" DMM processes can reasonably generate turning points and/or change the system topology. For this reason, two significant destination management processes are considered in this paper: event management (Getz and Page 2016) and destination investments able to create new product development or to enlarge the local supply. This paper focuses on two tourism events and one destination investment (later presented and discussed) given the relative simplicity of identifying their effects on destination development. In fact, events and new product development generate clear ex-ante and ex-post situations. Of course, these events and investments are interrelated both empirically and theoretically: event management can favor the development of new products, whereas a new product can be launched using an event (Sainaghi 2006; Sainaghi, Phillips and d'Angella 2019; Sainaghi, De Carlo and d'Angella 2018).

Event management is a crucial activity for many tourism destinations (Getz 2008). In fact, these special occasions are able to modify the attracted targets, develop new products, improve the destination's "performance," and reduce the seasonality of the destination (Baum and Hagen 1999; Connell, Page, and Meyer 2015; Getz and Nilsson 2004; Getz and Page 2016). For example, some recent studies confirm the positive effects generated by the Milan Expo on reducing the seasonality of a destination (Sainaghi, Mauri, and d'Angella 2018) and improving the operational performance of local firms (Sainaghi and Mauri 2018; Sainaghi et al. 2018). However, tourism events and festivals can also produce some negative effects; these include, among others, sustainability, social costs, pollution, and health impacts (Collins and Potoglou 2019; Perić 2018).

A second relevant driver is related to new product development carried out by local firms (Cooper and Kleinschmidt 1994; Müller-Stewens and Möller 2017) or carried out at the destination level (Sainaghi 2006). Some recent studies have investigated the process complexity in creating a new product given the large number of stakeholders involved, and, more generally, the difficulties of mobilizing dispersed resources (Sainaghi, De Carlo, and d'Angella 2018; Sainaghi, Phillips, and d'Angella 2019). However, new product development can considerably alter the results of the destination and the associated firms by positively influencing economic sustainability and consolidating competitive advantages.

2.2 Destination dynamics and topology

A destination network is not stable and changes continuously over time (Pavlovich 2014). The factors influencing this evolution can be different and can include both internal and external features, such as the development of new technologies (Baggio and Del Chiappa 2013), changes in customer preferences (Torres, Singh, and Robertson-Ring 2015), economic shocks (Wang, Li, and Wang 2012), and increasing competition (Enz, Canina, and Liu 2008). Therefore, it is not surprising that the destination moves from one state of order into a new phase (Butler 1980). Furthermore, during a precise stage, the system is continuously moving. The two stages are separated by a "turning point," which, in time series analysis, is also called "breaking through" (Coshall 2000). This destination evolution is usually analyzed using an "ex-post" approach, where the researcher first identifies the different phases and then tries to explain the causes, endogenous (such as DMM strategies) and exogenous (external factors), that have generated the turning points (Pavlovich 2003; Russell and Faulkner 2004). This paper adopts an opposing approach, investigating, in three cases, the ability of some events and investments to generate or note a turning point. Previous studies in this field include only a limited number of cases. The quantitative analyses carried out by Sainaghi and Baggio (2017) show that the turning points recorded by a single destination are limited and that only the most relevant DMM strategies or external causes (as previously defined) can change the network dynamics. For example, in the study of Livigno, an alpine resort (Baggio and Sainaghi 2016), only four turning points were identified over the course of 50 years of research. Similarly, in the multiple studies conducted by Sainaghi and Baggio (2017), each destination analyzed usually depicted three or four breakthroughs, despite the longitudinal approach used. In such studies, a destination phase or stage usually encompasses eight to ten years. In the current explorative study, meanwhile, the focus is on relevant (or significant) destination events and investments, as discussed later in the methodology section. The destination system is also influenced by some external causes. The research team cannot control them (as specified in the study limitations). However, the temporal overlapping between the destination events and investments and the turning point is a clear indicator of the efficacy (or inefficiency) of the analyzed destination processes. The following hypothesis suggests the ability of these processes to generate a breakthrough.

Hypothesis 1. The destination events and investments analyzed were able to produce a turning point in the cases considered.

The destination not only changes over time, but different causes are also able to influence its structure (topology). The topology is summarized in three diverse state conditions of the network (Baggio and Klobas 2017). The destination can operate in a stable situation, wherein the system is highly predictable and can be observed using a traditional, linear model (Sainaghi and Baggio 2017). The stability area is described in the literature as a positive situation because the network presents an order state condition that ensures the possibility of implementing current and new strategies (Russell and Faulkner 2004). To use an analogy, when a train system works well, the trains run on time; similarly, the network can efficiently connect different relevant nodes (cities) using the appropriate infrastructure (links). In this situation, new services can be delivered, and the system can attract new investors and clients. However, there is a clear limit on system stability. In fact, excessive order can reduce innovation and favor the replication of the actual situation. This is also suggested in some previous studies in the tourism context. For example, Baggio and Sainaghi argue that "*over-stability* assessed, read through the lenses of complexity science, is a dangerous situation. Seeking a stable equilibrium, although desired by many, is highly disadvantageous for the development of a system" (2011, 854, italics added). Continuing the above analogy, if the train system is too stable (over-stability), it will avoid connecting new, emerging destinations or introducing innovations in the infrastructure. The opposite situation is when the network operates in the chaos, or Lorenz, area (Lorenz 1963). In this disordered situation, linear models are completely inadequate for capturing and predicting network evolution. In the chaos area, the system can collapse; in other words, the destination can disrupt its competitive advantage completely. For this reason, the chaos area is synonymous with negative situations (McKercher 1999). Between order (stability) and disorder (instability), there is an intermediate area called the "chaos threshold" (Miguéns and Mendes 2008). The chaos threshold can be a limited unstable condition, and the system can move up (stability) or down (chaos). For DMOs (Destination Management Organizations) and local firms, system stability is obviously a preferable situation (Baggio 2008), especially if the system operates in a stable area but not one that is so far from the chaos threshold. Previous studies in this field suggest that many destinations operate in this "between area" of the chaos threshold (Baggio and Sainaghi 2011, 2016). We believe that a successful destination event or investment has the ability to move the system from the chaos threshold to a more stable area. Therefore, there are two effects: first, the destination strategy generates a shift of the network topology (short-term effect); second, the destination operates in a more stable state condition for a new stage or phase. The goal of this paper is not to define how long this new phase is; however, previous studies suggest it is eight to ten years long. Based on these considerations, the following hypothesis is formulated.

Hypothesis 2. The destination events and investments analyzed were able to shift the system, moving it to a more stable area in the cases studied.

2.3 The HVG

The complex nature of many artificial and natural systems makes it quite impractical to describe them using analytical representations. One option to study such systems is to record, at time intervals, some observable quantities that can provide a representation of the system's behavior and use this time series to derive insights into the system's structural and dynamic features (Kantz and Schreiber 1997). Clearly, no full understanding of the laws governing the system can be attained by examining only a time series, but the examination can reveal several properties and allow inference of the type of dynamics that generates the observable behavior. Different processes (different systems' dynamical histories), in fact, generate series with different properties.

A stochastic process is a family of random variables that are, in our case, indexed by a time parameter. The variables can be correlated or uncorrelated. In essence, we assume that the time series considered is produced by a stochastic process, find the parameters of a process that would be likely to produce that time series, and then use it as a model for explaining the system (Baggio 2008; Luque et al. 2009). If the process is correlated, the system has some "stability" (stationarity in the series) that allows prediction of future behavior, at least for a certain time window. Complex systems have these properties, and their stability (limited) combined with their dynamicity allows them a "lively" behavior. Known processes of this kind are certain types of Brownian motions. If the variables are uncorrelated, the system has a basic random behavior that precludes any reasonable prediction. A further "category" is that of chaotic systems. These are nonlinear dynamical systems that are highly sensible to their initial conditions and, even though they are deterministic (i.e., they can be described by differential equations), their behavior is completely unpredictable (Bertuglia and Vaio 2005).

The method used in this study was devised for transforming a time series into a network (Lacasa et al. 2008). As some previous studies have shown, the main features of a time series (periodicity, chaoticity, etc.) are captured by algorithms and translated into different topologies of the associated network. Then, the techniques of network science allow the assessment of the main structural characteristics of the network obtained and, therefore, of the system studied. In network science, the most important element providing information on the general topology (structural characteristics) of a network is the statistical distribution of degrees (k: the number of links each node has). In most cases, this degree distribution is highly skewed, exhibiting a long tail and taking the form of an exponential (typically $N(k) \sim e^{-\lambda k}$) or a power law ($N(k) \sim k^{-\lambda}$). In addition to the shape, the exponent λ of the distribution is an important parameter that characterizes the system's topology (Barabási 2016).

The basic functioning of the HVG algorithm is quite simple and is depicted in Figure 1. Each time, a series point is converted into a node of a network graph. Two points are linked if a straight line connects them without intersecting with any intermediate point.

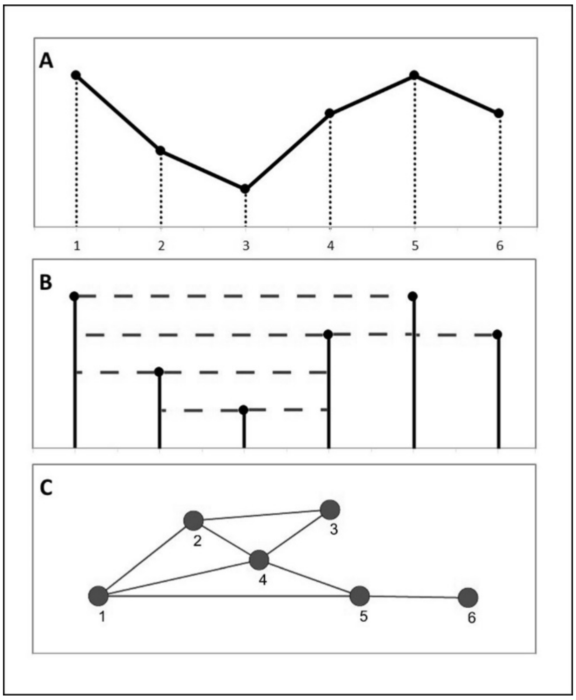

Figure 1. The transformation of a time series into a network using the HVG method

The network obtained can then be analyzed, and the measures calculated. An interesting result of the studies in this area is that it is possible to distinguish between stochastic (correlated or uncorrelated) and chaotic time series. In other words, this method allows us to determine whether the system has a chaotic or stochastic dynamic behavior. The analytical results obtained show that when an exponential degree distribution is found, there is a threshold value of $\lambda_C = \ln(2/3) = 0.404$ that separates the different dynamics. A correlated stochastic series can map into an HVG with an exponential degree distribution that slowly tends to λ_C. In contrast, chaotic series converge on the limiting value from the opposite direction (i.e., for exponents lower than λ_C). Thus, we can use this result as an indicator of the dynamic characteristics of a system that i) will be chaotic for an exponent lower than λ_C; ii) will show a random behavior for $\lambda \approx \lambda_C$; and iii) will be more and more stable for exponent degrees higher than λ_C in the region where $\lambda \gtrapprox \lambda_C$. We consider the system to have complex dynamics, also called *edge of chaos*.

This bridge between time series, dynamic systems, and graph theory allows, with relative ease, the inference of a system's features that would have been derivable with much more complex techniques (nonlinear analyses) and, in certain conditions, the highlighting of features that other methods are not fully able to emphasize, such as changes in the dynamic behavior of the system (e.g., Baggio and Sainaghi 2011). This methodology has had many applications in different domains (Wang et al. 2018) including tourism (Baggio and Sainaghi 2016; Sainaghi and Baggio 2014, 2017).

In our case, this technique allows checking of the topological features of the system before and after a structural break (a turning point) that traditional nonlinear analysis methods are not able to highlight (they only signal the existence of the break). This gives meaning to the expression "turning point."

3 METHODOLOGY

3.1 Destination sample

As previously discussed in the literature review, the current literature is mostly focused on single case studies, reducing generalizability (Eisenhardt 1989). Therefore, the present study is based on multiple case studies. In this field, the key methodological rule is to use polar cases, which involve very different contexts (Halinen and Törnroos 2005). In this paper, three different destinations were chosen, and some of the criteria considered were size, type of destination activity implemented, and segments attracted. The three cases were all Italian destinations, namely Milan, Pinzolo, and Lago d'Iseo. The focus on Italy was justified by the relevance that this country has for international tourism and by the ability of the research team to collect data and gain access to additional information.

Milan is a popular destination attracting more than 11 million overnight visitors per year. It is ranked second after Rome. This city is the second biggest trade-fair destination in Europe. Milan is famous for its relationship with the fashion and design industries. Furthermore, the city is Italy's economic capital, so the business segment plays a crucial role there (Sainaghi and Canali 2011). The event explored was the World Expo 2015—a "mega-event" that attracted roughly 20 million visitors. Pinzolo is a small alpine area specializing in the ski industry during the winter season. Pinzolo is close to Madonna di Campiglio, a larger and more famous destination. In 2011, a ski connection between Pinzolo and Madonna di Campiglio was created. This investment progressively altered the market segment that was attracted. Before the ski connection opened, the area was most often visited by Italian tourists. After the investment, the number of international clients increased significantly, and now international guests are the primary target. The Lago d'Iseo is a small lake located in the north of Italy. In 2016, the artist Christo installed "floating piers," creating some walking connections between some of the places on the lake (Sulzano, Monte Isola, Isola di San Paolo). The floating piers covered an area of 4.5 km and attracted more than 300,000 visitors. The installation remained in place from 18 June to 3 July. These short descriptions clarify the polar situations of the three case studies, thus enhancing the generalizability of the outputs. The selected destination events and investments can be considered endogenous factors, considering the decision made by DMOs and/or local companies to attract, host, and implement these events and new product development strategies (d'Angella, De Carlo, and Sainaghi 2010).

3.2 Data structure

The HVG transforms a time series into a network. For each destination, the research team collected a longitudinal daily series. In the case of Milan, data were used from Smith Travel Research (STR), a company that records daily data from a large sample of rooms. This study focuses on the revenue per available room (RevPAR) for the 2004–2018 period. Many previous studies have also used data from STR (Enz, Peiró-Signes, and Segarra-Oña 2014; Makki, Singh, and Ozturk 2016; Viglia, Minazzi, and Buhalis 2016). Whereas nominal data relies on the face value of currency, real values are corrected for inflation by adjusting them to the same monetary values as of January 2004 (the beginning point of the sample), using monthly Consumer Price Indexes as reported by the Italian Institute of Statistics. Such a method has been proposed in some similar previous studies (e.g., Kosová and Enz 2012). A recent study explored the effect of the Milan Expo on destination stability and on its evolutionary patterns using three metrics (average daily rate [ADR], occupancy, and RevPAR). The authors found that "the three metrics in use present a very similar structure" (Sainaghi and Baggio 2019, 13). However, a possible bias effect can be considered. Before the expo, as would be reasonable, the hotel capacity increased. This could have reduced the performance achieved by hoteliers, generating some system instability. For Pinzolo, given the focus on the ski activity, "passages" were used. A passage, as the name suggests, measures a single use of a ski facility. If a skier uses a skiing facility 12 times a day, then he/she records 12 passages. At the ski area level, this indicator quantifies the total number of skiing facilities used by all ski passes in one day. The relevance of this metric is related to the correlation with revenue and cost structures. Local skiing companies furnished the daily data for the 2000–2018 period. The analysis only focused on the winter season (because during the summer, the ski infrastructure is only occasionally used). Finally, for Lago d'Iseo, given the fact that visitors often move between the different destinations, the research team collected the daily records of the local lake navigation company, covering the 2008–2019 period. This metric is preferable to the overnights or the RevPAR recorded by lodging firms because it also includes day-trippers—a segment relevant to this destination. The three series considered in the study fully satisfied the size suggested for using the HVG approach. In particular, Baggio and Sainaghi argue that "a reasonable size to obtain meaningful results is in the range of a few hundred points. This could correspond to collecting five to ten years of weekly data or twenty to thirty years of monthly data" (2017, 28). For each single destination, the research team collected different types of statistical data but adopted a longitudinal approach. The use of daily data was relevant given the necessity of this method to make an adequate number of observations and capture seasonal patterns.

3.3 Methods

To identify the *turning points or system dynamics*, an analysis of time series characteristics was conducted. We tested the stationarity of the series to check for the existence of structural breaks (system dynamics). The expression "turning point" was used for network analysis, and "structural breaks" was used for time series. In essence, the two concepts are synonymous. A turning point is a change in the dynamics of a system; at that point, in statistical terms, a structural break has occurred in a time series. Turning points are the symptoms of sensible changes in the series trend, or level, and are evidence of dynamic modifications of the system's behavior. To identify the structural breaks, we used the test developed by Lee and Strazicich (2003) based on Lagrange multipliers, which is considered particularly powerful and robust (Colajanni et al. 2018). However, the identification of one or more structural breaks (turning points) in a time series did not tell us anything about the dynamic conditions of the system; it only signaled that something had changed.

The second step focuses on the *system topology* (structural characteristics). The HVG transformation was applied to all the destinations considered (Milan, Pinzolo, Lago d'Iseo) in their entirety after they were split into before and after destination event and investment periods. For a better appreciation of the results, similar to other studies (Baggio and Sainaghi 2016), we used as null models a random series, a random Brownian motion representing correlated stochastic dynamics (generated with the Hurst exponent H=0.5), and a series obtained from the well-known chaotic system described by the Lorenz equations (Lrnz; Parker and Chua 1989). For each of these, a set of values of the same lengths from the three examined destination series was created. The process was repeated ten times, allowing for randomness of generation, and all the results were averaged. Finally, allowing for the confidence levels of all the values calculated, we could reasonably assume that values within ±5% of λc denote systems with prevalent complex or random behaviors.

4 FINDINGS

This section is divided into two parts. First, the three longitudinal time series are investigated, and the turning points are identified for the three cases, thereby testing the first hypothesis. Second, the degree of distribution is analyzed, and the effects generated by the destination events and investments on the level of chaos are reported. In this section, the second hypothesis is tested.

4.1 Destination dynamics (hypothesis 1)

This part tests the first hypothesis. Figure 2 reports the breakthrough in Milan (Panel A), Pinzolo (Panel B), and Lago d'Iseo (Panel C). The three different time series identified at least one turning point for each destination; however, given the focus of this paper on specific destination events and investments, only the turning points related to the analyzed activities were reported. The series shown in the picture are a filtered version of the data. The filter applied was a Hodrick-Prescott filter, and it was used to show the main behavior of the series (Hodrick and Prescott 1997).

In all the cases, a breakthrough was found close to the destination events and investments analyzed. The second part of Figure 2 depicts the network distribution, indicating the ability of the destination events and investments considered to divide the network structure. The dotted line is represented by the realization of i) the Milan Expo (Panel D), ii) the ski connection for Pinzolo (Panel E), and iii) the floating piers for Lago d'Iseo (Panel F).

The Milan case shows a turning point at the beginning of March 2015. The indicator involved was the RevPAR, which is a central metric for hotel managers given its ability to combine rates—ADR, or revenues over rooms sold—and occupancy (rooms sold divided by rooms available). The trend is interesting because the city, strongly positioned in the trade fair and business segment, has suffered a financial and economic downturn since 2007–2008. The RevPAR time series depicts a significant decrease (from 2008–2009). The expo triggered a rise in this indicator, and more important, the trend did not show a dramatic reduction after the event's closure in 2016. These findings are in line with some previous studies focusing on the performance of the Milan Expo (Sainaghi and Mauri 2018;

Sainaghi et al. 2018; Sainaghi, Mauri, and d'Angella 2018). These previous articles explain that the increase in RevPAR was favored by the rise of both ADR and occupancy, but the expo generated a stronger effect on rates than on inventory saturation (occupancy).

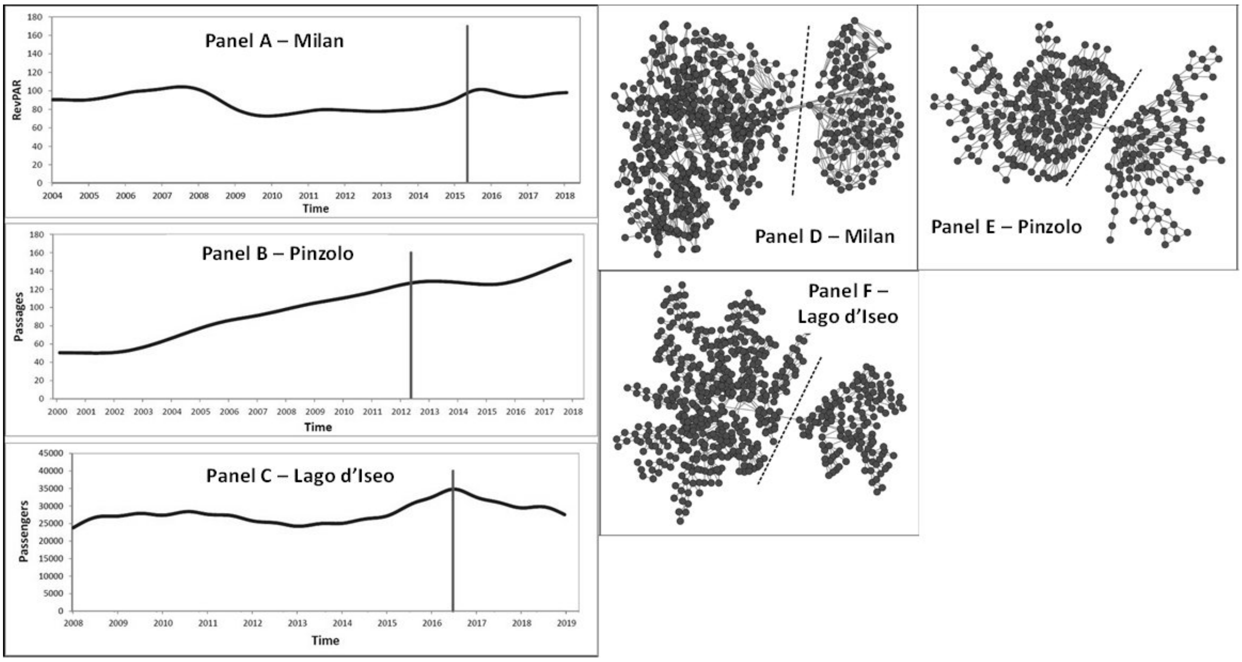

Figure 2. Destination dynamics (turning points)

Moving from Milan to Pinzolo, Panel B indicates a turning point close to the opening of the ski connection with Madonna di Campiglio (the destination investment). The general trend is positive and shows a progressive rise in the number of skiers over a long period of time (2003–2013). After the realization of the new investment, the evolution changes, and from 2013–2015, the curve remains flat but at the top level. However, in 2015, a new positive stage began. The ski connection was able to create a turning point in the destination dynamics, and the new trend was characterized by a greater number of international tourists. This result is in line with that of Baggio and Sainaghi (2016), which focused on Livigno. In that work, some turning points were recorded close to the shift between the prevalence of domestic to international tourists, and vice versa.

Lago d'Iseo also clearly showed a turning point positioned more or less in the middle of 2016, close to the floating piers event. For roughly two weeks, the Christo installation allowed visitors to walk over the lake, creating a magic atmosphere. This small lake, which attracted considerably fewer tourists than the more famous Lake Garda (not far from Lago d'Iseo), reached a peak in its evolutionary structure and, more important, recorded a breakthrough in its time series (Panel C). The postevent was apparently characterized by a strong reduction. However, the overall number of tourists was similar to that recorded before the arrival of the floating piers.

Based on this evidence, the first hypothesis is fully supported. All the analyzed destinations reached a turning point and recorded a breakthrough in their system dynamics. Of course, these results may also have been influenced by other external factors. However, the temporal overlapping between the implementation of destination events and investments and the turning point supports the conclusion reported in this paper. Furthermore, the research team discussed these findings with some local stakeholders (DMOs, leading firms). The stakeholders supported this explanation on the one hand but ruled out the presence of other "relevant" external causes, on the other.

4.2 System stability (hypothesis 2)

The previous section confirmed the system dynamics. Next, the second hypothesis is tested, focusing on the effects generated by the destination events and investments on the tourism structure (topology). The analysis of exponent degree distribution allows the definition of the level of order (chaos) in the system. As explained in the methodology section (see §3.3), there are some benchmarks that can evaluate network stability (fractional Brownian motion: fBm), the edge of chaos (random function: Rnd), and instability (Lorenz function: Lrnz). Figure 3 depicts the analysis, distinguishing between pre- and postevents for Milan (Panel A), Pinzolo (Panel B), and Lago d'Iseo (Panel C). In Panel D, the three previously introduced benchmarks are reported, and the ±5% band around λ_C is also shown (dotted lines).

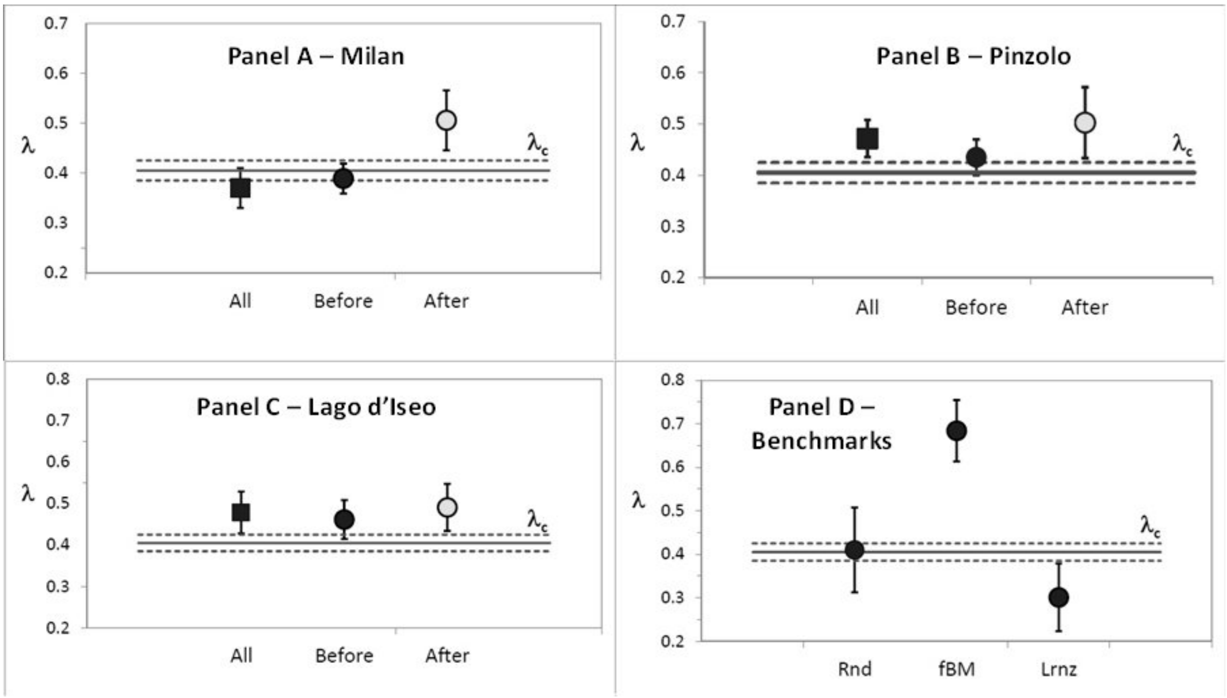

Figure 3. Visibility networks degree distribution exponents

In the case of Milan, the destination stability before the expo was not positive. In fact, the exponent degree was clearly positioned in the chaos threshold and in the lower part of the dotted line (Panel A). This area is critical because it can generate unpredictable evolutionary patterns, typical of the well-known "bifurcation paradigm" of chaos theory. Typically, in this chaos threshold, the linear models considerably lower their ability to forecast future trends. After the expo, Milan showed a significant increase in the exponent degree, and the system was clearly repositioned in the stability area. The exponent coefficient (not reported in Figure 3) registered a significant increase, moving from 0.39 (before) to 0.51 (after).

Pinzolo, as a destination, was positioned very close to the chaos area before the opening of the ski connection. However, although the exponent was in the lower dotted line for Milan, in the case of Pinzolo, the coefficient was in the upper line. This value shows the relevance of this second analysis. As shown in Figure 2 (Panel B), Pinzolo recorded a significant and continuous improvement in the number of passages. However, the degree distribution showed a potential instability in the system; the increase in the number of skiers did not change the internal structure of the tourism flow, meaning that Pinzolo, as a destination, remained fragile as a result. The ski connection with Madonna di Campiglio increased the coefficient both suddenly and consistently. The exponent degree moved from 0.43 (before) to 0.50 (after), positioning Pinzolo within the stability area. This means that the actual volume level can be more easily forecasted and analyzed using linear models.

Lago d'Iseo, as a destination, was the most well-positioned case before the event. In fact, the exponent was the highest of all three destinations (0.46) and was located within the stability area. Nevertheless, it was not far from the chaos threshold. Therefore, this network also showed some problems of stability, even though, in relative terms, it was the best positioned compared to Milan and Pinzolo. The floating piers event was able to increase the coefficient, moving Lago d'Iseo to a more stable condition. The rise was reflected by the degree distribution: the coefficient moved from 0.46 (before) to 0.49 (after). This increase was the lowest of the three cases in terms of the final coefficient value (0.49), and the destination event was able to increase the system's stability. The increase was lower than the other two cases for the type of events hosted. In the case of Milan, the expo spanned six months (from 1 May to the end of October 2015), improving the leisure market segment and reducing the destination's seasonality (Sainaghi and Mauri 2018). For Pinzolo, the ski connection definitively changed the offer, increasing the length of the ski runs and the number of international guests. In the case of Lago d'Iseo, the event duration was considerably shorter (16 days). Despite its international prominence, the effect was relevant (it was able to shift the system to the stability area) but less evident compared to the other two cases.

Based on these findings, the second hypothesis is also fully supported. All the analyzed destinations favored a shift from the chaos threshold to a more stable area (short-term effect), and then the system operated for some years in the ordered area (medium-term effect). This finding is, of course, limited to the period analyzed and may change in the future.

5 CONCLUDING REMARKS

This study investigated the effects generated by some events and investments on three different destinations using network theory. The HVG framework was used to transform the time series in a network. Two hypotheses were tested. The first tested the ability of these events and investments to generate a turning point, whereas the second tested the ability of them (events and investments) to increase network stability. The findings were based on a longitudinal analysis of three tourist destinations in Italy (Milan, Pinzolo, and Lago d'Iseo), and the empirical evidence confirmed both hypotheses. This section discusses the theoretical (§5.1) and practical (§5.2) implications and provides insights for future research (§5.3). Finally, the main study limitations are reported (§5.4).

5.1 Theoretical implications

At the theoretical level, this study shed light on i) the system dynamics, ii) the network structure or topology, and iii) the HVG methodology. Focusing on the system dynamics (first hypothesis), the findings confirmed the ability of events (the Milan Expo and the floating piers) and destination investments (a ski connection) to create a turning point in the system evolution, introducing the destination to a new development stage. This result is in line with the stratified literature on destination evolution (Bhat and Milne 2008; Pavlovich 2003, 2014; Russell and Faulkner 2004). A second important conclusion is related to the "ex-ante" approach adopted by this paper. Whereas previous studies in this field have previously identified turning points and have then explained them (ex-post approach), the current research tested the ability of precise significant destination events and investments to generate a breakthrough, identifying a positive link.

Focusing on the system structure or topology, our findings confirmed the evidence found in some previous studies (e.g., Sainaghi and Baggio 2017). The destination is a complex system (Zahra and Ryan 2007) and tends to operate close to the chaos threshold (Baggio and Sainaghi 2011). When the system is in this area, it can change suddenly from stability to instability, from order to chaos (McKercher 1999). The three case studies analyzed, albeit with some important differences, were all positioned close to the chaos area. The empirical evidence confirmed the ability of destination events and investments to change in the analyzed period the exponent degree and to improve the temporal system stability in all three of the destinations studied. As previously discussed (§2.2), the increase of order raises the ability to predict the system. However, in all the three cases, the stability is not so far toward the chaos threshold, so the destinations maintain the ability to introduce innovations. In other words, the destination events and investments increase the order, but not by much.

Finally, our study allowed us to identify some confirmations and advancements concerning the methodology used. In all cases, the HVG identified a turning point (system dynamics) and revealed the variations in system stability (network topology). Furthermore, this simple tool can be operationalized using different metrics according to the most relevant (and available) data for the specific context under study. The use of daily data improves the HVG's ability to perceive both the destination dynamics and topology.

5.2 Practical implications

In accordance with the structure proposed for the theoretical implications, the empirical advancements are articulated as follows: the distinction between system dynamics, network structure or topology, and methodological improvements.

Focusing on system dynamics, our study confirmed the efficacy of the proposed methodology at identifying destination turning points. These findings can develop the measures used at the destination level for monitoring performance and can identify the diverse effectiveness of different destination strategies or external factors. Given the simplicity of the proposed methodologies, DMOs and destination analysts can use the HVG to analyze the effect generated by some relevant DMM strategies, or external shocks (as economic crises, political instability, natural disasters, etc.) to the system dynamics. This ex-ante approach can consistently enlarge the performance measurement systems of a tourism destination.

Concerning system structure or topology, the findings confirmed the tendency of a destination to operate close to the chaos threshold. This situation can generate sudden instabilities and difficulties in forecasting future scenarios. Therefore, DMOs should monitor the system structure. Furthermore, the findings highlighted some important elements, especially for destination managers. First, a relevant DMM strategy tends to change the tourism flow structure, thereby improving the system's stability. Second, given a specific destination, different realized strategies can be compared to verify their diverse ability to positively change system stability.

Finally, our study provided some insights into applying the proposed methodology. They confirmed the necessity to integrate traditional, linear indicators with some nonlinear tools, such as those presented in this paper, for measuring system dynamics and topology. The proposed methodology can create a new destination *tableau de bord*, enhancing traditional indices and measures.

5.3 Implications for future research

The study raised some new research questions for future studies in this field. The following possible areas of inquiry were identified, distinguishing system dynamics and topology on the one hand and methodology on the other.

The proposed advancements have an impact on both system dynamics and topology; thus, these two levels are analyzed together. To further test the results of this paper, more research that follows three promising avenues is needed. First, new studies can compare the effects generated by different relevant destination events and investments for a specific destination. This type of analysis aids in the understanding, for a specific local context, of the different impacts generated by diverse and significant DMM strategies. This is in line with previous studies on destination life cycles. What is different in this proposed research avenue is that an ex-ante approach should be adopted, and the research should focus on only relevant destination strategies. Second, the effects generated by similar destination events and investments can be compared at different destinations. This would highlight the relevance of local context. Third, different relevant destination events and investments in different local contexts can be explored, and the results can be compared for similarities. This is in line with the research strategy developed by this paper.

Focusing on methodology, one main research question remains open. What are the determinants of turning points and changes in system stability? In other words, this study clearly identified three significant destination events and investments that can positively influence both destination dynamics and the topology. However, the study did not identify the analytical antecedents of this positive impact. Why is turning point registered? Is it because tourism flows change suddenly? What are the determinants of variations in the exponent degree? Is it due to a reduction in seasonality, or the attraction of new market segments? New studies can attempt to answer these fascinating questions. A second methodological feature is related to the definition of "relevant" or "significant" destination events and investments. How can we distinguish between relevant and nonrelevant destination events and investments? Does the same destination event or investment remain relevant in different contexts? New comparative studies are necessary to empirically define relevancy.

5.4 Limitations

There are four main limitations of this study. First, despite the use of a multiple-case approach and a focus on different cases, only three destinations were studied. Therefore, generalization is limited, and more destinations will need to be studied; however, the findings are in line with previous studies. Furthermore, the different destinations analyzed, and the diverse events and investments explored, contributed to enlarging the overlap among the three cases. Second, this paper revealed a positive impact generated by the analyzed events and investments on the destination dynamics and topology. However, the analytical causes of these effects remain unexplored. As previously clarified in the "implications for future research" section, new studies are necessary. Third, as reported in section 3.2 (data structure) the rise in hotel capacity before the Milan Expo could have influenced the increase of system instability in the pre-Expo period. Fourth, the paper analyzed the effects generated by some destination events and investments on system dynamics and topology. The findings confirmed these abilities, as previously discussed. However, over the years some external causes could have influenced the system, reinforcing or reducing the effects generated by the analyzed events and investments.

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