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Posted Date: 22 February 2024

doi: 10.20944/preprints202402.1210.v1

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Article

A Comparison of Technological and Socio-Economic Networks. Case Study: Tourist Destination of Durrës, Albania

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Abstract: Tourism is increasingly becoming one of the most important components of the economy. Coastal tourism is of particular importance in our country, this is because Albania has a very favorable geographical position. The tourist destination chosen for study in this paper is Durrës. It is analyzed as a complex dynamic system that evolves with a series of techniques and methods drawn from the area of network theory. The main objective of this paper is the comparison of technological and socio-economic networks, through different methods and techniques. The methodology of this research includes different data collection methods for both networks and their analysis. 504 nodes were taken into consideration. A significant part of the research is based on network theory, using algorithms and network analysis techniques to reveal their static and dynamic characteristics. Through this paper we show that the internet network and the socio-economic network of Durrës are similar in some aspects and have a great impact on the development of the tourist destination. The analysis of these two networks provides a deeper picture of the relations between the actors of the destination and helps to improve the tourism strategies and the economic development of the area. Thus, the research is an attempt to better understand the impact of technological and socio-economic networks in the development of the tourist destination of Durrës and uses different ways of network analysis to discover the similarities and differences between them.

Keywords: network distribution; socio/economic networks; technological networks

1. Introduction

1.1. A general overview of the technological and socio/economic networks of Durrës

Recent studies have identified that the topology of a network has unpredictable characteristics, which have a significant impact on the overall dynamic behavior of the network. These characteristics can also explain and influence many processes, including the diffusion of ideas, the response to external attacks, and the improvement of relations between parts of the network. This case presents a study conducted on the network of a tourist destination with a focus on Durrës. In essence, the study aims to compare two networks: a technological network, which includes websites and their interconnections, and a socio-economic network, which includes actors and organizations operating in the tourist destination of Durrës [1]. The tourism actors of the two networks, the web and the social-economic network of Durrës, are expressions of the same system: the tourist destination of Durrës. It is interesting to compare the characteristics of the two graphs to investigate possible similarities. Even given the limitations on the validity of this type of interpretation in the case of web pages of commercial companies, it is reasonable to assume, even for the importance given to the practice of hyperlinking, that the extent of the network is a reflection of the structural characteristics of the network social from which it originates [2]. This relationship between cyberspace and the physical world is two-way: on the one hand, online connections represent and complement social relationships in the offline world; on the other hand, offline interactions can influence the way in

which online relationships are established and developed [3]. These analytical techniques used here are also considered a diagnostic method for collecting and analyzing data about patterns of relationships between people in groups, or among organizations. They provide a view into the network of relationships that can give tourism managers a powerful lever to improve information flow and target opportunities where this flow can have the greatest impact on regulatory business activities. In this paper, the most recent results of investigations on network theories are reviewed. Both static and dynamic characteristics of the network and the main processes that may occur are discussed. The models presented have been selected from the best literature on the subject based on their known importance for estimating the structural characteristics of a network. The tourist destination is then discussed as a special form of an industrial area. The industrial economy is presented together with the main issues in the structure and evolution of a group of firms. In this framework, the characteristics of a tourist destination are examined and the current ideas for its possible evolutionary growth are considered. The reasons for choosing the destination of Durrës are part of the discussion in this study [4]. In addition, the issues related to the collection of the necessary data and their evaluation are given. Specific algorithms and measurement techniques for the main static and dynamic characteristics of the destination network are detailed. The results of the study are presented next. They are related to the measurement of the topological features of two networks (real and virtual) and the comparison between them [5]. The characteristics of the interaction at the local level between the actors allow us to show, at a statistical level, some general patterns or behaviors in the evolution of the tourist destination system that can be evaluated by looking at the available data. These, along with other information useful for characterizing the conditions and evolution of the destination (statistical series on tourism and the underlying economy, historical data, etc.) were collected and organized [6]. The characteristics of the interaction at the local level between the actors allow us to show, at a statistical level, some general patterns, or behaviors in the evolution of the tourist destination system that can be evaluated by looking at the available data. These, along with other information useful for characterizing the conditions and evolution of the destination (statistical series on tourism and the underlying economy, historical data, etc.) were collected and organized [7].

1.2. Limitations of the study

A tourism destination system can be seen and analyzed in different ways, as can the network that will represent it. However, the following premises have a global validity in this study:

- network nodes are organizations, companies, associations, and the studied links are considered to connect these elements;
- all connections are intended to be indirect (symmetric) and unmeasured unless explicitly stated in certain parts;
- the general topological characteristics of networks are studied. All elements (nodes) will be considered equivalent. Possible specific functions of network elements are not considered;
- the network and the system are studied at a macro level, and therefore all the resulting characteristics have the same macro scale [1].

In other words, considering only the topological characteristics means abstracting the specific features of actors and connections by examining the structure of the system as a whole and the relationships it has with dynamic processes. These are almost standard assumptions when conducting an initial study of complex networks [8]. In our case, they have been applied to facilitate calculations in order to focus on the interpretation of the results and their implications for the management of a touristic destination. These assumptions, although representing a crude simplification when dealing with a socioeconomic system, are acceptable for the preliminary nature of the study presented here [9].

2. Materials and Methods

The study deals with the structure of a tourist destination network. Structure, in the social science literature, is seen as a consistent pattern in the components of a system. Here structure is

defined (and this term will be used throughout this work in this sense), as a combination of system components (individual elements, the relationships between them), and the way they are connected (the number and distribution of two elements and the relationship between them). A study carried out in a real destination is obviously more interesting and can provide more useful findings in many cases: for example, by relating the results of 'experiments' to real situations or from the constraints presented, arising from actual conditions, in the number and type of simulations that can be run [3]. The first step in this research is the selection of a suitable tourist destination, as this reinforces the quality and validity of the results. It is preferable to deal with the smallest possible destination size to facilitate the data collection process and for 'computational' reasons; some algorithms involved may take a long time if we were to refer to very large networks. On the other hand, the size should be large enough to give statistically significant results. The chosen destination for the study is Durrës (Albania). The city has access to the Adriatic Sea and is also connected to the capital of Albania. This is a typical seaside summer destination. The economy of Durrës is almost exclusively dependent on tourism. Durrës tourism. Durrës is one of the most important Albanian destinations in terms of tourist flows, both local and international. It has an average of 50,000 tourists, with very strong seasonality (peak in July-August). The data collection was carried out by identifying, counting, and surveying the possible types of relationships between the organizations operating in this tourist destination. This data was then augmented with any possible public sources providing similar information. Moreover, the literature allows us to summarize data on comparable social systems (industrial circles, corporate networks, etc.) which can serve as a reference. All data is collected in a database table [10]. The coded elements were: name of interested parties, type of business, geographical location, size of the company or organization (small, medium, large), cultural resources, entertainment. Each record consisted of two entries (fields) containing the codes of interested parties. Another set of data is collected in relation to the technological network. The actors of the destination "and the list of existing pages that make it up are examined. Only the websites with an independent URL are considered [11]. The links between the websites of Durrës are counted using a simple server and filling the data obtained with a visual inspection of the web pages. Also, in this case all the data is coded in a database. Finally, after all these elements have been collected, an assessment is made to assess the completeness of the sample and to extract the possible influences on the main parameters of the network. The web space is, nowadays, an important virtual counterpart of an economic and social system [12]. The age of the Internet has allowed the development of new ways of production and distribution of tourism services. Web access and technologies are helping suppliers and tourism agencies reduce service costs and attract customers. A website seems to be a great tool to conduct business in the field of tourism. As for many other destinations, the Web has become, in recent years, an important tool of promotion and commercialization for the entire tourism community in Durrës and for the operators who access it. The wide spread of these technological tools for both the demand side (tourists) and the supply side (operators) can allow us to use the Internet as a further element to evaluate the characteristics of the destination [13]. The analysis of technological networks began by considering them as the nodes of a complex network, and the necessary data were collected as previously described. The topology of this network was studied to evaluate its agreement with known web models and to compare the derived values with those published in the literature for other similar examples. The results, mainly in terms of connectivity, are compared with those of the 'real' destination network. This allows us to determine the behavioral similarities and differences between 'real' and 'virtual' destination actors. Moreover, these results were used to evaluate the capacity of Durrës tourist operators to use modern technologies in their business development [14].

3. Data collection and analysis

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

Durrës is one of the oldest cities in Albania. As an Illyrian settlement of the Taulant tribe, it has witnessed its life since prehistoric times, based on archaeological findings and the testimonies of

ancient authors. It has survived through the centuries to the present day [15]. The museums, objects and monuments that can be visited, as well as the city itself and the nearby surroundings of Durrës, best reflect historical, archaeological, ethnographic, natural, and urbanistic values (Table 1).

Table 1. Categories of data collected.

Category	NR
Food	204
Transportation	170
Tourism intermediaries	2
Cultural resources	23
Fun	14
Tourism associations	85
Other tourist services	1
Total	5

Durrës is the most important port and tourist center of Albania and the second most important city of the country from the political, economic, administrative, educational, scientific, and cultural point of view of the country [16].

Economic development Durrës Municipality is guided by the fundamental principles of economic development, where it has balanced economic growth with the quality of life, with social and environmental requirements. Strategic planning has been a comprehensive, integrated, and institutionalized process. The improvement of the business environment in general has been targeted by the Municipality, the protection and support of existing businesses has been as important as the attraction of new businesses, because they act as a very good marketing tool for promoting the business climate. Tourism intersects with the environment, economic development, services, trade, transport, order, public peace, constructions, and the preservation of the coastline of 6 km. Even for these next 4 years, Tourism will be one of the priorities of the Municipality [17]. The performance of tourism and the improvement of services supported by the policies followed by the Municipality of Durrës, places it in the first place on the list of contributors to the Albanian tourist product. Durrës has already entered the tourist destinations of Europe, with the promotion of Tourism in the most important International Fairs such as: International Fair "BIT" (Borsa Internazionale del Turizmo) in Milan, Fair "ITB" in Berlin, Fair "World Travel Market" ExCel in London. In order to improve tourism promotion, we will continue to create tourist guides for the archaeological, ethnographic and cultural heritage of the city of Durrës, the possibility of financing for tourism projects will increase. Below we graphically present the main operating sectors (businesses by activity) for the year 2023 (Table 2).

Table 2. Actors of the network of tourist destination of Durrës gathered for the study.

Actors	percent
production unit	6%
service unit	10%
commerce	9%
transport	5%
construction	1%
free professions	5%
bookseller, journalist	2%
institutions	1%
bar-cafe-restaurant	59%
hotel	1%
bank	1%

The tourism actors of the two networks, the web, and the social-economic network of Durrës, are expressions of the same system: the tourist destination of Durrës. It is interesting to compare the

characteristics of the two graphs to investigate possible similarities. In fact, a strand of literature argues that the links between websites (hyperlinks) can be considered not simply as a technological manifestation, but also (and perhaps mainly) as a reflection of social processes [18]. A growing literature shows that these networks reflect offline connections between social actors and the support of particular social or communicative functions. Even considering the limitations on the validity of this type of interpretation, as discussed by [19], in the case of commercial company websites, it is reasonable to assume, even for the importance given to the practice of hyperlinking, that the extent of the network reflects the structural characteristics of the social network from which it originates. This relationship between cyberspace and the physical world is two-way: on the one hand, online connections represent and complement social relationships in the offline world; on the other hand, offline interactions can influence the way in which online relationships are established and developed [20]. Table 3 shows a comparison between the matrix calculated for the Durrës network. As can be seen, apart from the broad factors, most of the values have differences which are lower than the magnitude. [11].

Table 3. The comparison between the two metrics socio-economic (TN) and web network (WN) of the tourist destination of Durrës.

Metric	TN	WN
Number of nodes	504	468
Number of edges	912	495
Density	0.003	0.005
Disconnected nodes	37%	21%
Diameter	8	10
Average path length	3.16	3.70
Clustering coefficient	0.050	0.014
Degree distribution exponent	2.32	2.17
Proximity ratio	34.10	12.21
Average degree	3.19	2.12
Average closeness	0.121	0.155
Average betweenness	0.001	0.003
Global efficiency	0.131	0.170
Local efficiency	0.062	0.015
Associativity coefficient	-0.164	-0.167

Another important indicator is the scale distribution which is usually considered as a key part of the network topology. The distributions of cumulative degrees are shown in Figure 2. Considering the undirected version of the web for true compatibility, the exponents of the scaling law calculated from these data are $\alpha_{tn} = 2.32 \pm 0.269$; $\alpha_{WN} = 2.19 \pm 0.109$ [5]. Thus, they can be considered identical within the statistical uncertainty of their determination. It is known that in most cases, the quantities that characterize the topologies of a complex network can hardly be considered as normal distributions, and their simple comparison (arithmetic means means) may seem insufficient. In these cases, as already proposed by some authors, the Kolmogorov-Smirnov (KS) statistic is quite effective. D - statistic KS gives the maximum distance between the cumulative probabilistic distribution of empirical data $F(x)$ and $G(x)$ during the whole range x , its value is [1]:

$$D = \max(F(x) - G(x))$$

The statistic is non-parametric and is insensitive to the issue of scale. It compares only the shape of empirical distributions.

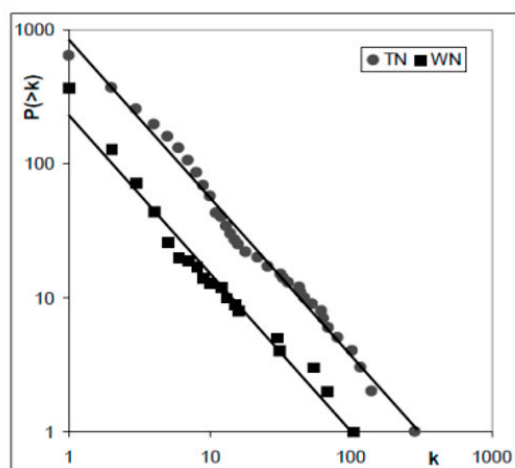


Figure 2. Cumulative distribution rate for (TN) AND (WN).

Table 4 shows the values for the D-statistics calculated when comparing the Web network quantities to those of the real network (WN vs TN). As a reference, the same values are calculated for a random sample of the same size as WN, drawn from the real network (RN vs TN: values are averages over 10 realizations) [21,22]. The consistently lower values of the D-statistic in the case of the Web network can be considered as a good confirmation of the similarities of the two topologies.

Table 4. D-statistic Kolmoorov-Smirinov or different measurements of (WN), (TN), (RN).

Metric	WN vs. TN	RN vs. TN
Degrees	0.119	0.147
Clustering coefficient	0.147	0.178
Closenees	0.044	0.083
Betweenness	0.030	0.077
Local efficiency	0.125	0.184

4. A comparison of technological and socio-economic networks.

Some of the elements of the network (nodes or edges) in different ways can give different results. This is even more important when the network under consideration exhibits a degree of topology as in our case. Two aspects must be considered: completeness in the collection of graph nodes and completeness in listing the connections between them. In the first case, the collected data can be considered almost complete. We can conclude that the considered set contains almost all elements (about 95%). The uncertainty in the official listings mostly concerns a limited number of very small businesses which can reasonably be assumed not to significantly affect the calculation of the main network parameters. The connections between operators are field [5]. In connection with the initial data collection, a very limited number of connections that were not detected at the beginning were discovered. Although these changes are extensive in quantity, they have an impact on the entire network. It seems reasonable to assume that the final plan has about 90% data completeness.

By comparing this estimate with the results reported in the literature on this topic, it is possible to conclude that the calculations of the network parameters are not significantly affected by this figure. The network formed by the websites belonging to the tourist operators of Durrës was studied as described in section 5.5.4. The shape of the webgraph is shown in Figure 3 [6].

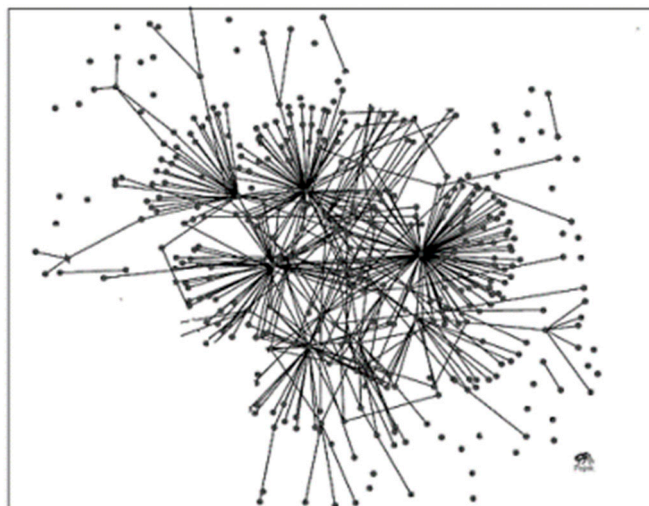


Figure 3. Durrës web network.

The network is considered here as a directed network. The free scale structure is again clear and is further confirmed by inspection of the scale distribution. Both types of distributions are shown in Figure 4. They follow such a law $P(k) \sim k^{-\alpha}$; the calculated exponents are: $\alpha_{in} = 2.96$ and $\alpha_{out} = 1.89$. The main characteristics of this network are listed in Table 5. The values have been compared with the common values published in the literature for the World Wide Web. In general, it is observed that the general links (density, clustering coefficient, percentage of disconnected elements, efficiency) show a high dispersion of webspace for the destination of Durrës.

Table 5. Characteristics of the Durrës network compared to the usual WWW values.

Metric	Durrës	WWW
Number of nodes	358	
Number of links	438	
Degree distribution		
In-degree	2.54	2.1
Out-degree	1.76	2.7
Density	0.001	$O(10^{-1})$
Disconnected nodes	19%	$D_{cc} < 9\%$
Average path length	3.5	16
Diameter	10	28(in scc)
Clustering coefficient	0.003	0.11
Local efficiency	0.014	0.36
Global efficiency	0.16	0.28
Associativity coefficient	-0.101	$O(10^{-1})$

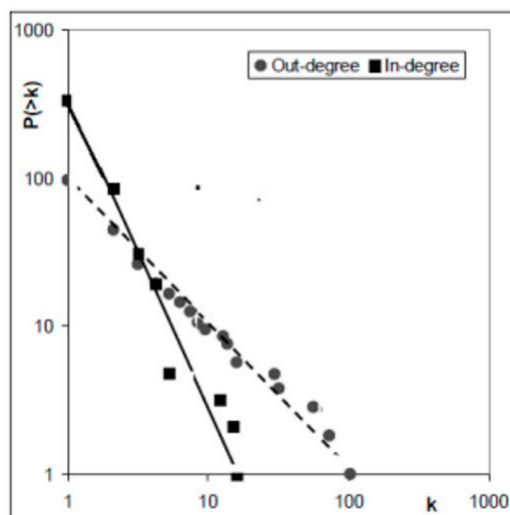


Figure 4. Cumulative IN and OUT rate of web network distribution for Durrës.

The in-degree distribution exponent is higher than that measured for the Web: $a_{in} \sim 2.1$. This means greater concentration. In contrast, the out-degree distribution exponent is much lower (the typical value of the out-degree web is ~ 2.7); that is, the distribution of links is very flexible and more widespread. According to the current understanding, the WWW is thought to display a macro-structure known as an arc-tie. Applying this model of our network we obtained the results shown in Table 6. [23].

Table 6. Bowtie components for Durrës WN and general value for www.

Bowtie components	Durrës WN	WWW
SCC	3%	28%
IN	2%	21%
OUT	52%	14%
TUBE	1%	7%
TENDRIL	16%	9%
DCC	25%	

Comparison with global values reported for the WWW [23,24], again shows that the overall link of tourist destination sites is very low [7].

The process can be summarized as follows:

- A case is selected. Its function, in the present work, will be a field test for the development of the methods used;
- The data has been collected. This implies the definition of the actors of the destination and the connections between them;
- A network graph was built and analyzed;
- The static topological characteristics of graphite are calculated;
- The dynamic aspects of the topology are characterized. The main diffusion processes were simulated; - the network was optimized in relation to the mentioned parameters and the results were compared with those obtained for the non-optimized network;
- Models of network destination evolution are evaluated and compared with 'traditional' measures of tourism destination development.

5. Conclusions

The research contributes significantly to the understanding of how technological and socio-economic networks shape the development of tourist destinations like Durrës. Their work provides a foundation for future investigations and strategic planning in tourism management, emphasizing the importance of network analysis in understanding and enhancing the economic and social fabric of tourist areas.

Here are some concise conclusions drawn from the research:

1. **Significance of Coastal Tourism:** The study underscores the critical role of coastal tourism for Albania, leveraging its geographical advantage. Durrës is highlighted as a key tourist destination whose development is significantly influenced by both technological and socio-economic networks.

2. **Network Analysis Approach:** Employing network theory techniques to analyze 504 nodes, the research offers a comprehensive comparison between Durrës' internet and socio-economic networks. This methodological approach reveals the static and dynamic characteristics of these networks, providing a novel perspective on the interactions and evolution within the tourist destination. [2].

3. **Impact on Tourism Development:** The findings suggest that both the technological and socio-economic networks possess similarities that have a substantial impact on the development of Durrës as a tourist destination. These networks facilitate the understanding of the relationships among various actors in the area, which is crucial for refining tourism strategies and fostering economic growth. [4].

4. **Data Collection and Analysis:** Through meticulous data collection involving organizations, cultural resources, and technological platforms within Durrës, the study paints a detailed picture of the destination's network structure. This includes an analysis of the relationships between entities, offering insights into the efficiency, connectivity, and distribution within the network.

5. **Strategic Implications:** The comparative analysis between the technological and socio-economic networks provides strategic insights for tourism management and economic development in Durrës. Understanding these networks' dynamics can help stakeholders identify opportunities for optimization and improvement, aligning with the destination's growth and sustainability objectives. [24].

6. **Research Limitations and Future Directions:** While the study offers valuable insights, it also acknowledges limitations, such as its macro-level focus and the abstraction from specific actor characteristics. Future research could delve deeper into the micro-level dynamics and explore the specific roles and impacts of individual network elements on tourism development. [25].

7. **Contribution to Tourism Research and Practice:** This study makes a significant contribution to the field of tourism research and practice by applying network theory in a novel context. It enhances our understanding of the complex interplay between technological and socio-economic networks in tourist destinations. For practitioners, the research offers a grounded basis for developing more nuanced and effective tourism management strategies that consider the intricate network relationships that define tourist destinations.

In summary, the comprehensive study not only sheds light on the critical role of networks in the tourism industry but also sets the stage for future research and strategic development in the field. The detailed analysis of Durrës as a case study provides valuable insights that can be applied to other tourist destinations, emphasizing the importance of a network-oriented approach in understanding and enhancing tourism and economic development.

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