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Research paper

Analysis of Social Networks on the Don Vasco tourist route in Michoacán, Mexico, a post-covid-19 analysis

Análisis de Redes Sociales en la ruta turística Don Vasco en Michoacán, México un análisis poscovid-19

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ABSTRACT

Social Network Analysis (SNA) and Smart Tourist Destinations (STDs) are closely interrelated due to the extensive use of goods and services, though the COVID-19 pandemic impacted both STDs and SNA through border closures and a decrease in visitor numbers. Thus, the objective is to calculate the clustering coefficient on the Don Vasco tourist route, which refers to SNA in a context that is taking its first steps towards building an STD. The method used was a Delphi, which involved the application of a semi-structured questionnaire processed with Gephi software. Among the findings, a notable clustering coefficient of 83% among central actors and 90% among tourist operators was observed. It was concluded that the route possesses a solid convex relationship between associations and tourist operators, which remains robust against changes in the tourism industry, thereby contributing to social cohesion.

Keywords: *Interrelationships, community tourism, social actors.*

RESUMEN

El análisis de redes sociales (ARS) y los destinos turísticos inteligentes (DTI) están estrechamente interrelacionados por la cantidad de bienes y servicios utilizados, aunque con la pandemia Covid-19, los DTI y ARS se vieron afectados por el cierre de fronteras y una disminución en el número de visitantes. Así el objetivo es calcular el coeficiente de agrupación en la ruta turística Don Vasco, que hace referencia al ARS en un entorno que está dando sus primeros pasos hacia la construcción de un DTI. El método usado fue un Delphi, el cual implica la aplicación de un cuestionario semiestructurado que fue procesado con el software Gephi. Entre los resultados obtenidos, destaca un coeficiente de agrupación del 83% entre los actores centrales y un 90% entre los operadores turísticos. Se concluyo que la ruta cuenta con una sólida relación convexa entre las asociaciones y los operadores turísticos, la cual se mantiene robusta frente a los cambios en la industria turística, lo que a su vez contribuye a la cohesión social.

Palabras clave: interrelaciones, turismo comunitario, actores sociales.

INTRODUCTION

Tourism activity has experienced steady growth over time (UNWTO, 2020), although it slowed down during the Covid-19 pandemic (UNWTO, 2021). To continue with the analysis, it is emphasized that in this document, tourism is conceived as a social, cultural, and economic phenomenon that involves the movement of people to new environments for personal, professional, or commercial reasons. These individuals can be referred to as travelers or tourists. Currently, new ways of developing this activity have emerged, even in the context of the Covid-19 pandemic. Countries like Mexico, for example, have climbed in the global rankings, moving from sixth to third place in terms of most visited destinations (Government of Mexico, 2020). Among the transformations in the tourism industry, Smart Tourist Destinations (STDs) have gained prominence. Both nationally and internationally, STDs are being promoted, but What exactly is meant by a smart tourist destination?

It is defined as:

"[...] an innovative space, accessible to all, supported by a cutting-edge technological infrastructure, which ensures the sustainable development of the tourist territory, and facilitates the interaction and integration of the visitor with the environment, enhancing the quality of their experience at the destination" (SEGITTUR, 2017:11).

This implies that destinations have multiple interrelations that should be understood as "reciprocal relationship between individuals, objects, or elements" (RAE, 2019) both directly and indirectly in tourism activity. This is how smart tourist destinations have gained significance in the international market. While internationally, countries like China or the United States and even the European Union region are developing programs aimed at transforming their tourist destinations into smart ones, in the case of Latin America, smart destinations have gradually evolved, with Mexico particularly noting the cases of Quintana Roo and Guadalajara.

In Mexico, there is also the Don Vasco tourist route located in Michoacán, which includes a network of institutional, business, and communicative interrelations with an orientation towards the current transformation into a Smart Tourist Destination (STD). The route itself is a journey with a different starting point from the end, where tangible and intangible activities for tourism are presented. Thus, for the present research, a destination will be understood based on the WTO (2021) as: a place visited for recreational purposes; thus, the route will be considered as a potential place. Therefore, it is significant for the Don Vasco route to analyze how the interrelation of the actors in the route has been post-COVID in the area. Thus, this document is comprised of the following sections: impact of COVID on tourist routes, social network analysis on the Don Vasco tourist route, method, results, discussion, and conclusions.
Impact of COVID on Tourist Routes

The COVID-19 pandemic has had a significant impact on the global tourism industry. In 2020, amidst the international pandemic, the World Tourism Organization (UNWTO) identified a 70% drop in international arrivals during the first eight months of 2020. This unprecedented decline has impacted the tourism sector and put millions of jobs and businesses at risk. North America alone saw a 65% drop compared to 2019. In 2021, Mexico experienced a gradual improvement, while in 2022, a sustained rebound was observed (UNWTO, 2020), which remained stable in the early months of 2023. Post-COVID-19 changes in tourism continue in some areas, such as projects aimed at smart destinations, which faced a scenario of uncertainty and developed immediate actions to address the situation. In the case of Mexico, it held a strategic position in Latin America in terms of tourism, ranking third globally despite the global and national tourism downturn (UNWTO, 2021). The ability to maintain a stable level of tourism compared to other countries is attributed to Mexico not closing its borders during COVID, and domestic tourism remained active.

Considering the analysis of the positioning of tourist routes in tourism, the case of the Ribera del Duero Smart Wine Route in Valladolid stands out, which managed to mitigate the effects of COVID through its social interrelations. Regarding the State of the Art of tourist route research, there are four main divisions focused on: 1) proposals for new routes considering the tourism potential with works by Aparicio (2013), Cardoso, et al. (2018), Cabrera (2016), Chávez, et al. (2017), Fernández and Guzmán (2005), Gómez (2017), Gonzales (2011), Litvinova and Voronina (2018). 2) Analysis and proposals aimed at diversifying and enhancing the competitiveness of new routes based on existing ones, with researchers such as Campos (2017),

Chamba, et al. (2017), Hernández (2011), Folgado-Fernández, et al. (2017), Meina and Terressa (2008), and Mira (2017). 3) Evaluation of existing routes in networks, with research presented by Canto (2000), Delgado and Pantoja (2015), Hiriart and Mínguez (2016), García, et al. (2018), and Maak (2009). 4) Analysis of routes in diagnostics, historical or descriptive studies highlighting research by Ascanio (2009), Barón and Gálvez (2016), Barbosa, et al. (2017), CODESPA (2013), García (2017), and Mafé, et al. (2016). Although the importance of the post-COVID tourism rebound is relevant to identify strategies, the following aspects are generally presented:

- Border Closures and Travel Restrictions: Many countries implemented border closures and travel restrictions to contain the spread of the virus (Félix, et al. 2020). In Mexico, there was no border closure, but there were restrictions in tourist areas.

- Cancellations and Refunds: With the spread of the virus and travel restrictions, numerous cancellations of flight bookings, hotels, cruises, and tourist activities occurred (Cerda, 2021). In Mexico, this impact was mitigated by internal mobility and the mobility of foreigners on platforms such as Airbnb, which focused on longer stays than usual in the country.

- Closure of Tourist Attractions and Establishments: Many tourist destinations temporarily closed popular attractions, theme parks, museums, restaurants, and hotels due to social distancing measures and government-imposed restrictions. This led to job losses and negatively affected the local economy (Araya-Pizarro, 2021).

- Change in Tourist Preferences and Behaviors: The pandemic has altered the preferences and behaviors of tourists. Many travelers now avoid crowded destinations and seek less crowded places and outdoor activities (Salazar, et al. 2021).

- Impact on Employment and the Economy: Tourism is a major source of employment in many countries. With the decline in tourism, there were mass layoffs and a significant loss of jobs in the industry. Additionally, the reduction in income from tourism negatively impacted the economy of many destinations dependent on this industry (Madera, 2020).

Overall, COVID-19 has posed significant challenges to the tourism industry in Mexico, but it is expected that, over time, the industry will recover as adequate health measures are implemented and travel restrictions are eased.

Social Network Analysis on the Don Vasco Tourist Route

The theory of Social Network Analysis (SNA) was first proposed by J. Barnes in 1954, defining social networks as structures consisting of nodes connected through various social ties that form networks. Boffil (2017:18) defines the network as follows: "a social network is generally defined as a set of specific relationships (for example, collaboration, support, advice, control, or influence) among a limited number of actors." Social networks are thus a multidirectional chain, comprised of several dimensions that relate people and create a social area (Zequeira, 2009).

Thus, the unit of analysis is not the social actor but the links between those actors (Albicette, et al. 2017). By addressing a society in terms of structures and relationships, Social Network Analysis (SNA) identifies positions within networks of relationships and their functional characteristics in relation to the entire network; this way, it is possible to differentiate positions, strategies, transaction flows, and power distribution (Espejo and Salinas, 2018; Fernández and Díaz, 2018).

During the pandemic, network analysis identified the interrelations along the route, as the environment changed in the way tourist destinations are managed, promoting the adoption of concepts such as "smart destinations." Below are some actions that have been undertaken at the intersection of COVID-19 and smart destinations:

- Digitalization and Technology: Tourist destinations are accelerating the digitalization of their services and adopting innovative technologies (Verduzco, 2020). Solutions such as mobile apps, online booking platforms, QR codes for accessing information, and contactless payment systems are being implemented.

- Technological Infrastructure: Investments are being made in technological infrastructure, such as improving internet connectivity and installing smart sensors in public spaces. This allows for the real-time collection of data to ensure the safety and sustainability of the destination.

- Smart Destination Management: Smart management systems are being used to optimize the planning and operation of tourism services.

- Sustainable Tourism: Sustainable tourism practices are being promoted, such as reducing paper use through digital solutions, implementing renewable energies, and efficiently managing natural resources (Palafox and Rubí, 2020).

- Communication and Citizen Participation: Citizen participation is being encouraged through digital platforms (Korstanje, 2020).

These actions aim to adapt tourist destinations to the new reality imposed by the pandemic, prioritizing health, safety, and sustainability. Additionally, they promote a more personalized and efficient tourism experience through the use of technology and innovation. Thus, taking as a basis the implications generated by COVID-19 in tourism and its interrelations across the sector, the analysis is based on the Don Vasco route, which was launched in 2008 in the State of Michoacán, Mexico, by the initiative of the Michoacán Tourism Secretariat with the goal of promoting the endogenous development of the territory through the launch and implementation of the cultural tourist route in the market.

Figure 1. Territorial Delimitation of the Don Vasco Route

Source: Website of the Government of Michoacán for the Don Vasco Tourist Route (2016).

The development approach of the tourist route encompasses various crucial aspects, such as improving competitiveness, generating value, developing the offer, promoting public-private cooperation, implementing positioning strategies, and establishing an effective coordination framework. Notably, in 2011, the route received prestigious recognition as the "Best Tourist Product" during the XVI edition of the competition for the Best Active Tourism Product, sponsored by the International Tourism Trade Fair (Fitur) and AireLibre magazine (Ceballos, 2019). Additionally, in 2020, representatives from the Government of Michoacán participated in the International Tourism Trade Fair (FITUR) in Spain, with the purpose of promoting the Don Vasco Route and exploring advancements in managing the locality of Madrigal de las Altas Torres, the birthplace of Don Vasco de Quiroga. Madrigal de las Altas Torres is a Spanish municipality located in the province of Ávila, within the autonomous community of Castilla y León.
Currently, the project known as "Kilometer Zero of the Don Vasco Route" is underway, a joint tourism initiative with Spain aimed at strengthening the ties between this place and Michoacán (Quadratín, 2020).

METHOD

Gephi is an open-source network analysis and visualization software that allows the analysis and exploration of networks, complex systems, and dynamic and hierarchical graphs (Kuz, et al. 2016). Among the features it offers for network acquisition is the adjacency matrix, which is represented by the graph G (V, E) where G is the degree, V is the vector, and E is the link. The interactions occur as follows: |V|=n, thus the adjacency matrix takes an entry aij (where a is the entry from row i and column j), which is defined in the following manner:

Equation (1)
$$a_{ij} = \begin{cases} 1 \; si \; e(vi, vj) \epsilon E \\ 0 \; si \; e(vi, vj) \notin E \end{cases}$$

Clustering coefficient, which measures the interconnectedness of the nodes and their neighbors, is represented by the following formula:

Equation (2)
$$\frac{\#\, edges \; of \; the \; complete \; graph \; of \; \; Nv(v)}{\#edges \; of \; G(Nv(v), E)}$$

In social networks, nodes with high betweenness can control the flow of knowledge that occurs within the network (Hanneman, 2001).

Sample of the Don Vasco Tourist Route

The target population consists of members of the Don Vasco route. Therefore, the Social Network Analysis (SNA) focuses on linking experts in the field of analysis, based on the tourist associations of the area which will represent the network's nodes. The considered associations are as follows:

- The Hotel and Motel Association of the State of Michoacán (AHMEMAC)
- The Tourist Guide Association of the State of Michoacán
- The Michoacan Association of Spas and Water Parks, A.C.
- The Craftsmen's Association.
- Michoacán's Secretary of Tourism

Initially, the nodes represent the macro level constituted by the associations. In a second instance, all the tourist operators concentrated on the Don Vasco route are analyzed with a sample of 16 companies.

Semi-structured Questionnaire for the Don Vasco Tourist Route

The questionnaire was administered in May 2021 through both in-person and virtual modalities to the following stakeholders: The Michoacán State Hotels and Motels Association (AHMEMAC), The Michoacán State Tourist Guides Association, The Michoacán Association of Spas and Water Parks, The Artisans Association, and the Michoacán State Tourism Secretariat (three departments linked to the route: 1. Training and modernization, 2. Digital marketing, and 3. Works and projects).

The network of nodes, along with its corresponding mapping, identified the importance of tourist operators on the route. Therefore, a virtual questionnaire was conducted at the end of May 2021, with an 80% response rate.

RESULTS

MICRO-LEVEL INTERRELATIONSHIPS OF THE DON VASCO TOURIST ROUTE

The results obtained on the Don Vasco tourist route in Michoacán show that the major tourist hubs are: Morelia, Pátzcuaro, and Uruapan, due to the concentration of goods and services they offer. This is followed by five magical towns located along the route, which are: Cuitzeo, Pátzcuaro, Santa Clara del Cobre, Tzintzuntzan, and Paracho. These places focalize tourist activity due to the articulation between society, government, and businesses. On the other hand, tourist operators along the route present a perspective ranging from stable to poor due to the slowdown in the tourist market in the state of Michoacán caused by the pandemic, despite multiple institutional supports to mitigate adverse effects. Regarding the perception of the management of the tourist route, operators identify little support despite the government website where services are offered. A positive aspect among the perceived issues is the importance of the government program called "Pueblos Mágicos" which has maintained intra-regional and national tourism.

The interrelationships among the central actors of the route reveal that the Michoacán State Tourism Secretariat and the Tourist Guides Association are the actors that concentrate the most significant interactions in the synergy of the route. They are followed by lesser interactions between the Michoacán Hotels and Motels Association and the Association of Spas and Water Parks. Among the main activities, it is observed that the government is dedicated to the development of projects, programs, and the regulation of the route, although the departments of infrastructure, digital marketing, training, and modernization have also collaborated throughout the tourism sector, both within and outside the route. Other notable interrelationships are related to Chambers of Commerce and the magical towns within the route. Likewise, universities play a relevant role in the training of qualified professionals in the sector.

Table 1. Parameters of tourist operators regarding the nodes of the Don Vasco tourist route, Michoacán, Mexico.

Factors	Indices	Interpretation
Clustering Coefficient	0.78	78% of actors work in a network.
Number of Components	5x5	The network is connected because all actors have interrelations.
Network Centrality	0.40	Implies the centrality of nodes, with Tourist Guides and the Michoacán State Tourism Secretariat being the nodes with the highest centrality within the network.

Distance between Nodes	1.25	Actors are, on average, 1.25 links apart.
Neighbors	2.8	The average direct collaborations of each node are 2.8.
Betweenness Centrality	0.3338	40% of the networks lie between two actors, which are the Tourist Guides Association and the Michoacán State Tourism Secretariat.
Number of Nodes	5	All central actors of the Don Vasco route.

Source: Own elaboration based on field data and the use of Gephi software.

The average clustering coefficient of a network is a measure indicating the tendency of nodes in a network to form interconnected groups or communities. It provides information about the cohesion and local structure of the network. The average clustering coefficient is calculated by taking the average of the individual clustering coefficients of all nodes in the network. In the micro-level analysis of the route network, the average clustering coefficient is 0.783, implying that nodes are interconnected by 78%.

Regarding network centrality, 40% of the nodes are represented by two nodes, namely the Tourism Secretariat and the Certified Guides Association. This results in a connected network, meaning a network with multiple interrelations, averaging 2.8 relationships with other actors within the network. The network that articulates the tourist route needs to develop mechanisms for knowledge management that foster innovation and adaptation both internally and externally. Thus, network actors share knowledge, forge alliances, collaborate, and exchange information formally and informally, contributing to achieving common objectives. The network needs to have dynamic capabilities to absorb innovation within institutions and organizations to achieve successful adaptation of the route towards a smarter approach.

Macro-level Interrelations of the Don Vasco Tourist Route
The interrelations are linked with other associations solely due to the actions taken by the government to generate pre-established packages and make them available to the general public. This implies that tourist operators maintain direct and indirect relationships with more associations, leading to a greater connection in the tourist system of the route.

In the overall analysis of actors, along with businesses within the Don Vasco Tourist Route, there is a consistent linkage between associations and actors of the tourist route. These linkages also include relationships with other businesses, magical towns, the municipality, and communities.

Table 2. Parameters of nodes in the Don Vasco Tourist Route, Michoacán, Mexico

Factors	Indices	Interpretation
Clustering Coefficient	0.83	83% of actors, associations, and businesses work in a network.
Number of Components	15x15	The network is connected because all of them have links.
Network Centrality	0.90	90% implies that associations and tourist operators have centrality in the network, achieving connection among all.
Distance between Nodes	0.268	Actors are, on average, 0.26 links apart.
Neighbors	1.083	The average for each node has two direct collaborators.
Betweenness Centrality	2.85	The linkage of associations and tourist operators includes an average of 2.85 links.
Number of Nodes	5	All central actors of the Don Vasco route.

Source: Own elaboration based on field data and the use of Gephi software.

The clustering coefficient of a specific node measures the proportion of possible links between the neighbors of the node. In other words, it indicates how many of the node's neighbors are connected to each other in relation to the total number of possible connections among them. Thus, the average clustering coefficient of the macro network encompasses associations and tourist operators, with a connectivity value of 83%.

Regarding the macro centrality of the network, 90% of the interrelations are concentrated in two central actors: the Tourism Secretariat and the Certified Guides Association. The network has five nodes represented by associations, but only two of them account for 90% of all formal relationships within the route. This implies that only two actors demonstrate strength in their relationships with the entire

network, while the rest need to strengthen their interactions through the implementation of projects, programs, or regulations that enable them to maintain more active relationships with the rest of the network comprising the route.

On the other hand, the clustering coefficient of 83% reflects a solid linkage as it is above 80%, indicating that institutional actors, associations, and tourist operators maintain an interrelation that facilitates orientation and action execution within the context of the route. However, the coefficient could be improved by further integrating relationships among the actors involved in the route. Therefore, there is a missed collaborative opportunity in this regard.

DISCUSSION OF THE SOCIAL NETWORK ANALYSIS OF THE DON VASCO ROUTE IN A POST-PANDEMIC ENVIRONMENT

One of the strengths of the network is the direction it receives from the Tourism Secretariat, which facilitates the connection between associations and tourist operators. Additionally, it provides public investment in infrastructure and trains tourist operators. The relationships present form a network of formal and informal actions on the route; that is, sometimes these actions are accompanied by contracts, while in others they are based solely on verbal agreements among network actors (North, 1993). Ideally, the relationships should be more formal for the participation of route actors (PE, 2016).

Furthermore, it is important to consider that interrelations provide and strengthen intelligence in tourism, although connectivity, information, and project ties still need to be strengthened to denote solid and constant interrelations that benefit the network. Now, among the aspects that the Don Vasco route addresses and the impact of the Covid-19 pandemic in Mexico, several strategies have been implemented to boost economic and tourist recovery. Here are some highlighted strategies:

Health and safety protocols: Strict health and safety protocols have been established throughout the tourism industry (Sánchez, et al., 2020). This includes measures such as mandatory mask-wearing, social distancing, regular disinfection of spaces, temperature checks, and training in sanitary practices for staff. These protocols aim to ensure the confidence and safety of both domestic and international tourists.

Certification of safe destinations: The "Safe Travels Stamp" has been launched by the World Travel & Tourism Council (WTTC) in collaboration with the Mexican Ministry of Tourism. This stamp certifies destinations that meet international health and hygiene standards, providing a signal of confidence to visitors.

Promotion of domestic tourism: Given that international travel restrictions have limited the arrival of foreign tourists, greater emphasis has been placed on promoting domestic tourism. Campaigns and programs offering discounts and promotions have been launched to encourage Mexicans to travel and discover domestic destinations (Zepeda, et al., 2020).

Financial support for tourism businesses: The government has implemented financial support programs for tourism businesses affected by the pandemic. This includes credit lines, grants, and economic recovery programs to help companies overcome financial difficulties and maintain their operations.

Promotion of sustainable tourism: The adoption of sustainable and responsible tourism practices has been promoted. Awareness is being raised about the importance of preserving natural and cultural heritage, as well as promoting community tourism and the development of tourism products that benefit local communities.

Strengthening of digital tourism: Promotion and sale of destinations and tourism services through digital platforms have been encouraged. Websites, mobile applications, and digital marketing campaigns have been created to reach a wider audience and facilitate travel planning and booking online.

These strategies aim to boost the recovery of the tourism industry in Mexico and adapt to the new normality generated by the pandemic. The goal is to foster tourists' confidence, promote economic reactivation, and ensure a safe and appealing experience for visitors.

CONCLUSIONS

The Don Vasco tourist route and its linkage in social network analysis can be successful in offering tourists a more enriching, convenient, and personalized experience, while benefiting local communities and promoting sustainable practices. The adoption of technology and adaptation to the changing needs of travelers can drive the success of such tourist routes.

Furthermore, the route concentrates its linkage with some Magical Towns that could be linked to strengthen rural and local environments through the services provided. Additionally, the analysis can bring about the following linkages:

• Enhancement of tourist experience: A smart tourist route can provide tourists with real-time information, personalized recommendations, and interactive guides using mobile applications, wearable devices, or augmented reality. This enhances the tourist experience by providing them with relevant and contextualized information, facilitating their navigation, and helping them to better discover and enjoy destinations.

• Efficient management of tourism resources: With technology and data, smart tourist routes can help manage tourism resources more efficiently, such as historical sites, monuments, or popular attractions. Reservation and queue management systems can be implemented to reduce wait times, optimize venue capacity, and ensure equitable distribution of visitors over time.

• Conservation and sustainability: Smart tourist routes can promote the conservation of natural and cultural environments by promoting sustainable practices. They can provide information about the importance of preservation, offer sustainable transportation options, promote waste reduction, and encourage participation in responsible tourism activities.

• Local economic boost: A smart tourist route can help promote tourism in lesser-known or visited local areas, distributing the flow of tourists more evenly. This can benefit local communities by generating economic opportunities, creating jobs, and stimulating the development of tourism services such as restaurants, accommodations, and crafts.

• Data collection for decision-making: By implementing a smart tourist route, data on visitor patterns, preferences, and needs can be collected. This data can be analyzed to better understand tourist behavior, identify areas for improvement, tailor tourism offerings, and make informed decisions for tourism development in the area.

Additionally, the smart tourist route in the post-pandemic context can incorporate health safety measures, facilitate visitor flow and capacity management, offer contactless experiences, provide personalized recommendations, and promote sustainable practices. These adaptations will help restore tourist confidence and drive the recovery of the tourism industry safely and sustainably.

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