Visegrad Fund

EOITN

Empowering Open Innovation Tourism Networks

Report on the tourism stakeholder innovation network development in Vrnjačka Banja

JUNE 2026

University of Kragujevac
Faculty of Hotel Management and Tourism in Vrnjačka Banja

Visegrad Fund

1. Introduction

The report aims to provide a follow-up analysis of the structure of the collaborative innovation network within the tourism destination of Vrnjačka Banja following the implementation of activities conducted under the International Visegrad Fund project. Most notably, these activities included the organisation of an innovation hackathon at the Faculty of Hotel Management and Tourism in Vrnjačka Banja, several meetings with the key stakeholders identified in the previous social network report, and the launch of the EOITN innovation platform, (Connecting Tourism and Innovation).

In line with the previous report, this follow-up study examines the collaborative efforts of identified network actors – managers and owners of public and private tourism enterprises, as well as community representatives – to co-create meaningful and innovative tourism offerings. The report seeks to identify and visualise the structure and dynamics of the destination's collaborative innovation network by analysing its relational characteristics through social network analysis and comparing the results with those obtained in the initial assessment conducted at the beginning of the project, prior to the implementation of the aforementioned activities.

The destination management approach has influenced the formation and operation of networks; however, the engagement of different stakeholder groups within these networks has often been overlooked (Pearce, 2014). Therefore, the focus of this report is to assess changes in the structure of the destination's supply-side collaborative innovation network by examining the roles of different stakeholders and their influence on network structure and dynamics.

Following a network logic, supply-side organisations seek to meet customer needs by establishing interdependent and reciprocal relationships that enable them to provide integrated tourism offerings. In such networks, the pursuit of individual success is closely linked to the achievement of collective success (Barile, 2017). These collaborative networks benefit both individual organisations and the destination as a whole by facilitating value-creating relationships through access to external resources and knowledge. They also enable organisations to expand their offerings through new or improved services and, consequently, better satisfy the needs of tourism stakeholders (Denicolai et al., 2010).

Recent studies have emphasised the importance of collaborative networks in developing innovative solutions to complex challenges through the exchange of knowledge, competencies, and ideas (Torfing, 2019). At the destination level, collaborative innovation networks encompass relationships among tourism firms (e.g., tour operators), providers of complementary services (e.g., hotels), and knowledge providers from both the private sector (e.g., technology providers) and the public sector (e.g., universities and community representatives). Particularly important as mechanisms of knowledge transfer are inter-firm linkages and partnerships between tourism organisations and knowledge-generating institutions, such as universities, government agencies, and NGOs (Espeso-Molinero et al., 2016). The ecosystem approach implies comprehensive and adaptive management, which stems from the complex and dynamic nature of the service ecosystem itself.

For the purposes of this follow-up study, several approaches and methods were employed to obtain current network data and compare it with the baseline network data collected at the beginning of the project:

- Building upon the initial sample while identifying additional actors who have emerged as potential participants in the destination's collaborative innovation network;
- Conducting interviews with all identified actors, including both previously identified stakeholders and newly recognised participants;
- Performing Social Network Analysis (SNA) on the revised sample;
- Assessing changes in the collaborative innovation network by visualising the network structure, comparing key network indicators, and applying the Quadratic Assignment Procedure (QAP) analysis to evaluate similarities and differences between the initial and current network configurations.

The study is based on a mixed-methods approach that combines both quantitative and qualitative research methods. Mariani and Baggio (2020) argue that the separate application of quantitative or qualitative methods may lead to biased and only partially accurate results. Therefore, Decrop (2004) emphasises the importance of methodological triangulation, which enables a more comprehensive and multi-level analysis of the research phenomenon.

As the initial study selected key stakeholders in the Vrnjačka Banja destination, primarily members of the Tourism Industry Cluster of Vrnjačka Banja, as the research sample, all previously identified stakeholders were contacted again for the purposes of the follow-up study. The objective was to expand the initial network by identifying and nominating additional actors who may have become relevant members of the collaborative innovation network. These nominations were based on the stakeholders' most recent collaborative innovation activities. Simultaneously, the second phase of the research was conducted through structured interviews aimed at identifying and mapping the collaborative relationships existing among network members. This process enabled the assessment of both existing and newly established connections within the destination's collaborative innovation network.

Social Network Analysis (SNA) is used to examine the structure of relationships among actors within the collaborative innovation network of Vrnjačka Banja. The analysis focuses on network actors (nodes) and the relationships between them (ties, links, or edges), providing insights into the existence, strength, and quality of their interactions. SNA is a widely applied methodological approach for investigating relationships and connections among individuals, organisations, institutions, and groups, with particular emphasis on the patterns and dynamics of these relationships. For the purposes of this follow-up report, structured telephone interviews were conducted with all previously identified actors of the collaborative innovation network, as well as with newly identified participants. The objective was to assess the current structure of the network and examine the evolution of innovation-oriented collaborative relationships following the implementation of project activities.

According to Cooper et al. (2009), interviews are particularly valuable for uncovering detailed characteristics of stakeholder networks, as such networks are often perceived as complex systems. The in-depth interviews conducted for this study lasted approximately 30 minutes on average. The collected data were processed using the software packages UCINET and NETDRAW, which were employed for network analysis, visualisation of the results (Scott, 2011), and the generation of social network diagrams (Borgatti et al., 2009). Social Network

Analysis (SNA) provides a visual representation of network structures, enabling researchers to identify actors occupying central positions as well as those located on the network periphery (Prell et al., 2016). The basic characteristics of a network examined through SNA include network size, density, centrality, centralisation, clustering coefficient, and other structural indicators (Casanueva et al., 2016).

For the purposes of the follow-up study, the same network indicators used in the initial analysis were examined to ensure the comparability of results. These indicators included network density, which reflects the extent of connections among network actors, and centrality, which measures the relative influence and importance of individual actors within the network (Casanueva et al., 2016). In particular, in-degree centrality was analysed as an indicator of an actor's prominence, visibility, and prestige within the network, as it reflects the number of incoming ties received from other network members (Hanneman & Riddle, 2005). Thus, a high level of in-degree centrality within the innovation partnership network indicates that many organisations engage in innovation-related collaboration with the focal actor. Effective internal network management requires an understanding of existing network relationships and structures, as well as stakeholders' perceptions, attitudes, and positions regarding network goals and objectives. It also involves maintaining effective communication channels among network participants (Lemmetyinen & Go, 2009; Zehrer et al., 2014).

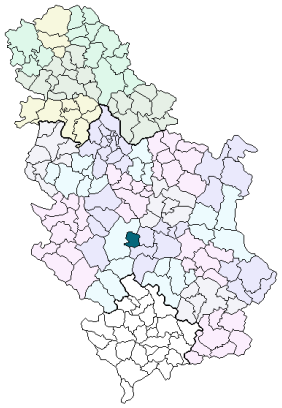
Dense networks are considered as structures that support stability and enable incremental innovation through the exchange of knowledge and information. In contrast, less dense and weaker networks tend to be more dynamic and can facilitate more radical change by enabling innovation through experience co-creation (Håkansson & Ford, 2002). Earlier studies suggest that an actor’s position within a network is associated with innovation outcomes (Burt, 1992; Granovetter, 1973). Actors occupying central positions in a network are able to collect and integrate ideas and resources, thereby enhancing their capacity to generate innovation (Freeman, 1979). McFadyen et al. (2008) conclude that individuals who generate novel knowledge tend to have strong ties and operate within dense networks. Within destinations, well-connected and centrally positioned actors may facilitate innovation processes at the destination level (Baggio & Cooper, 2010). The clustering coefficient reflects the tendency of network actors to form tightly connected subgroups within the network, while the clique approach identifies clusters as distinct subgroups within the network, characterised by dense internal relationships and relatively clearer boundaries between groups, often conceptualised as “networks within networks” (i.e., subnetworks).

2. Analysis of the Development of the Collaborative Innovation Network in the Vrnjačka Banja Tourism Destination

2.1. Subject of the research

The subject of the research is development of the collaborative innovation network in Vrnjačka Banja as tourism destination.

Figure 1. Municipality of Vrnjačka Banja



Vrnjačka Banja is a municipality comprising 14 settlements, covering an area of approximately 240 km² and a population of around 30,000 inhabitants. The main settlement, Vrnjačka Banja, serves as the administrative and functional centre of the municipality and has approximately 16,000 residents. Vrnjačka Banja is located in central Serbia, approximately 200 km south of Belgrade. It is well connected to other major parts of the country via a recently constructed highway and a modernised railway network. Vrnjačka Banja is one of the most renowned spa destinations in South-East Europe, with a tradition dating back to Roman times (2nd–4th century CE), when thermal mineral springs were already in use, including the so-called *Fons Romanus*. Numerous Roman coins have been discovered in the healing springs, serving as material evidence of their use in antiquity. The spa is situated in a valley sheltered by Mount Goč (1,147 m), as well as several other surrounding mountain ranges, including Gledićke, Kopaonik, Željin, Jastrebac, and Stolovi.

The first chemical analysis of the thermal waters of the Vrnjačka springs was conducted in 1835 by Baron Herder, on the orders of Prince Miloš. He described the water as acidic and compared it to the healing waters of Schlossbrunn in Carlsbad, Czech Republic. Baron Herder was commissioned to carry out geological, mining, and balneological research in Serbia, the results of which he published in the report *Bergmännische Reise in Serbien* (Sotirović, 1996). Vrnjačka Banja is a tourism destination with a long therapeutic tradition, as it was recommended by the doctor Josif Pančić for the treatment of Pavle Mutavdžić, the head of the Kruševac District. Following Pančić's recommendation, Mutavdžić utilised the healing properties of the mineral springs for therapeutic purposes, which contributed to his recovery. That moment represents a turning point, as his influence and engagement led to the establishment of the "Founding Foundation Society of Acidic Hot Water in Vrnjci" in 1868. The following year, the first water capture was undertaken, accompanied by the construction of a drinking fountain and a wooden thermal bath with capacity for 35 users, thereby marking the official opening of the first tourist season.

The spa is widely recognised for the treatment of diabetes, digestive disorders, liver diseases, urinary tract conditions, dermatological conditions, ophthalmological disorders, and nervous system diseases. Today, Vrnjačka Banja is one of the most visited tourism destinations in Serbia, attracting visitors with diverse motivations, including urban escape, wellness and spa treatments, business and other events, family weekend stays, and one-day excursions by domestic tourists. According to data from the Statistical Office of the Republic of Serbia, Vrnjačka Banja was the most visited spa destination in Serbia in 2024, with 187,861 visitors.

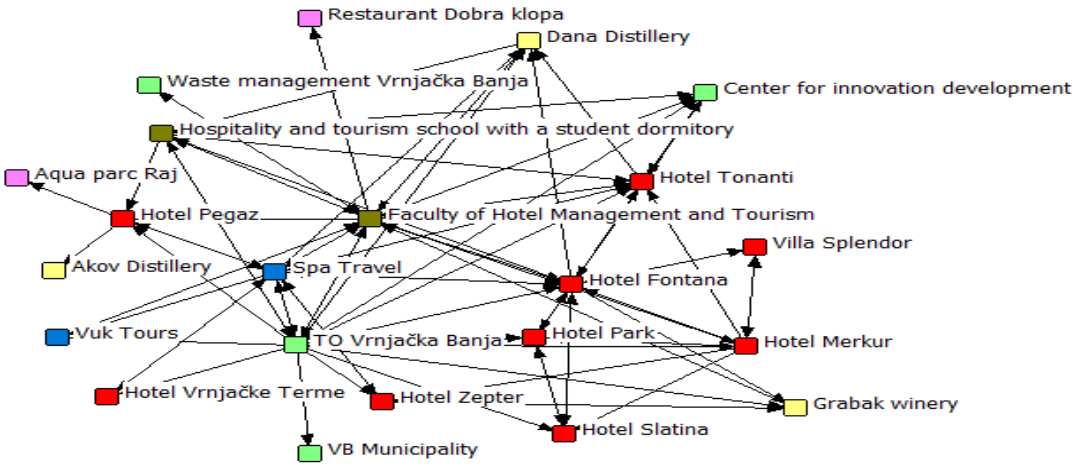
2.2. Stakeholders of Enhanced Collaborative Innovation Network

Freeman (1984, p. 46) defines a stakeholder as "a group or individual who can influence or is affected by the achievement of an organization's goals". Based on this definition, it can be concluded that key stakeholders in a spa destination such as Vrnjačka Banja are entities involved in the tourism experience ecosystem. Cooperation among all relevant actors is essential for the management of the development of the experiential ecosystem. The collaborative innovation network in Vrnjačka Banja consists of different actors that reflect the main premises of the Triple Helix model of innovation, which emphasises interactions among academia, industry, and government. In contrast to the initial network (prior to the implementation of project activities in the destination), which comprised 22 main actors, the follow-up study identified three additional actors: Hotel Kocka, the ZOO, and the Cultural Centre of Vrnjačka Banja. Hotel Kocka was classified as an accommodation facility, while the ZOO was categorised as a hospitality and entertainment facility, and the Cultural Centre of Vrnjačka Banja was classified as a state-owned governmental institution. In accordance with these changes, a revised classification of stakeholders within the initially defined categories was conducted:

1. Accommodation facilities (primarily hotels) (10)
2. Educational institutions (faculty and secondary vocational school) (2)
3. Government and state-owned institutions (tourism organisation, municipality, waste management company, Centre for Innovation Development, and Cultural Centre of Vrnjačka Banja) (5)
4. Travel agencies (2)
5. Hospitality and entertainment facilities (restaurants, aquapark, and ZOO) (2)
6. Wineries and distilleries (3)

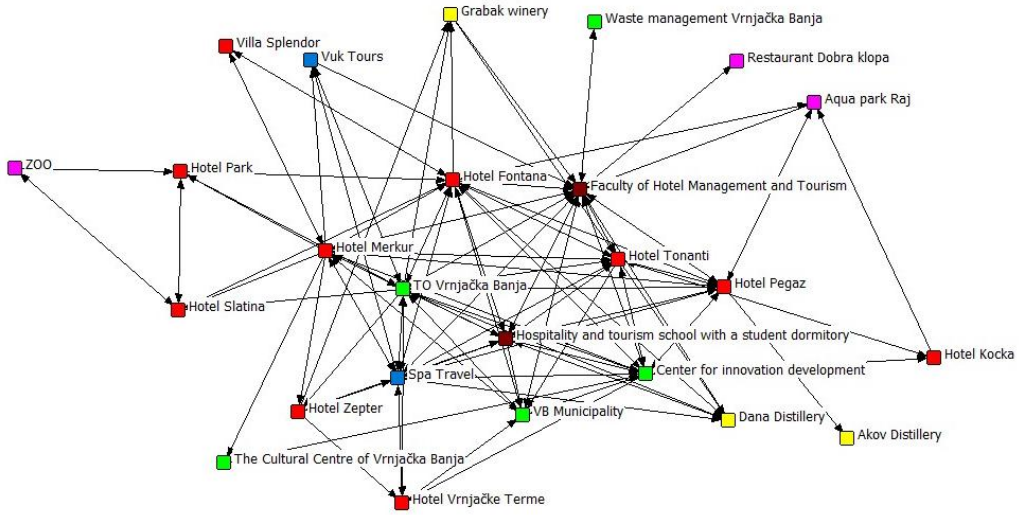
For the purposes of the follow-up study, a Social Network Analysis (SNA) was conducted to examine the ties between previously identified and newly identified stakeholders within the collaborative innovation network of the Vrnjačka Banja tourism destination. A matrix was constructed to systematise all relationships based on innovation-driven collaboration among the actors. Given that 25 actors were identified, a matrix was constructed in which all 25 actors were connected to one another in order to visualise the overall structure of innovation collaboration within the Vrnjačka Banja tourism destination (Figure 3). The network does not contain any isolates, i.e., actors that neither initiate nor participate in innovation-driven collaboration with other stakeholders. To visualise the dynamics of the network, the initial collaborative innovation network (Figure 2) is presented alongside the updated collaborative innovation network (Figure 3).

Figure 2. Structure of the Initial Collaborative Innovation Network in Vrnjačka Banja



	Wineries and distilleries		Education institutions		Government and state-owned institutions
	Accommodation facilities		Travel agencies		Hospitality and entertainment facilities

Figure 3. Structure of the Current Collaborative Innovation Network in Vrnjačka Banja



	Wineries and distilleries		Education institutions		Government and state-owned institutions
	Accommodation facilities		Travel agencies		Hospitality and entertainment facilities

In line with the previous network visualisation, the current network also highlights the structure of innovation-driven collaboration between different stakeholder categories. In particular, when considering Triple Helix innovation actors, collaboration is also relatively evenly distributed across the network. This once again highlights the previously identified potential for transforming the network into a more developed innovation ecosystem through the involvement of a larger number of actors in innovation-driven activities. Considering the time elapsed between the initial and follow-up studies – approximately one year – and the fact that key project activities, such as

the innovation hackathon, stakeholder meetings, and the launch of the innovation platform, were implemented only a few months prior, it is not reasonable to expect substantial changes in the network structure and dynamics. This is supported by the observed changes, which include the inclusion of three new actors and a strengthening of ties among existing stakeholders. Therefore, there remains considerable scope for implementing the European Commission's guidelines for adopting a systemic approach that fosters synergy and cooperation among entities within the ecosystem.

As in the initial study, the analysis was performed using the UCINET and NetDraw software packages, and the following network parameters were considered: density, centralisation, degree centrality, betweenness centrality, core–periphery structure, and cliques. Network density (Density) reflects the overall level of cooperation among all entities in the network. Density values range from 0 to 1 and can be interpreted as "the probability that a connection exists between any pair of randomly selected nodes" (Borgatti et al., 2013). A value of 0 indicates that no connections exist between nodes (actors), whereas a value of 1 indicates that all actors are fully interconnected. In contrast to the initial collaborative innovation network, which had a density value of 0.182 and 84 identified ties, the current collaborative innovation network exhibits a density value of 0.242, with 145 ties identified across the entire network. This represents a clear increase in both network density and the total number of ties, indicating a higher likelihood that a connection exists between any pair of randomly selected nodes. Nevertheless, according to Wang et al. (2016), this updated value indicates that the network cohesion is now moderate (in contrast to low), suggesting that the network has become more cohesive and collaborative. However, it is still in a development phase, with considerable scope for further strengthening collaboration for innovation within the Vrnjačka Banja tourism destination in the future.

Centralisation is an essential network measure, indicating the extent to which a network is dependent on one actor (node). In contrast to the initial collaborative innovation network, which recorded an out-degree centralisation value of 60.8% and an in-degree centralisation value of 30.8%, the current collaborative innovation network shows a lower out-degree centralisation of 44.3% and a slightly higher in-degree centralisation of 35.6%. The comparison of centralisation measures indicates a significant evolution of the collaborative innovation network. While the initial network was characterised by a strong concentration of collaboration initiation among a limited number of actors (out-degree centralisation = 60.8%), the current network exhibits a more distributed pattern of collaboration initiation (44.3%), suggesting broader stakeholder engagement in innovation activities. At the same time, the increase in in-degree centralisation from 30.8% to 35.6% indicates that collaborative ties have become slightly more concentrated around certain actors, which may reflect the emergence of key innovation hubs or coordinators. Overall, the network has evolved from a highly actor-driven structure toward a more participatory system, shifting from competition observed in the initial network toward more cooperative forms of interaction aimed at achieving shared goals (coopetition).

After determining the general characteristics of the network, it was necessary to examine differences between the networks with regard to key actors and their centrality, in order to identify whether there have been noticeable changes in actors exhibiting central positions within the development of the collaborative innovation tourism network and its future dynamics. The aim is to identify key changes in centrality, primarily due to the potential of these actors to assume leadership roles in the further development of the network, including the capacity to connect with other parts of the network that are not yet adequately involved in innovation-related collaboration.

Degree centrality reflects the number of established collaboration links an actor has with other actors, identifying those with the most connections, regardless of whether they initiate cooperation or receive it, within the collaborative innovation tourism network of Vrnjačka Banja. In Figure 4, actors that played a more important role within the initial network are represented as larger nodes in the visualisation. The same approach was applied to the current collaborative innovation tourism network (Figure 5), where node size similarly reflects centrality levels.

Figure 4. Visualization of Central Actors in the Initial Collaborative Innovation Network in Vrnjačka Banja

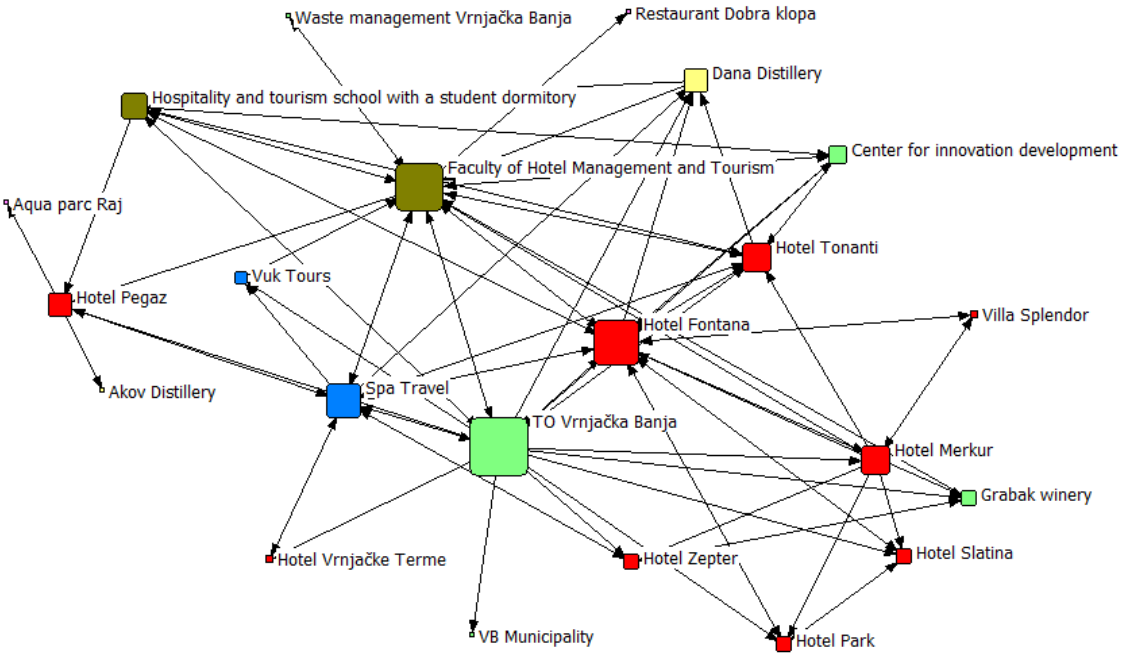
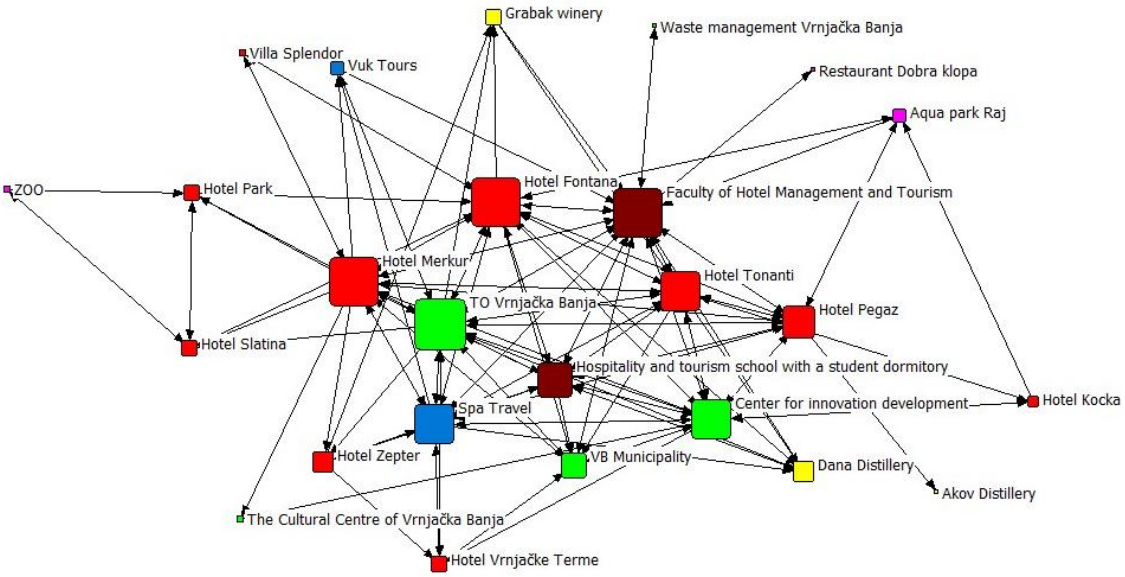


Figure 5. Visualization of Central Actors in the Current Collaborative Innovation Network in Vrnjačka Banja



In order to make changes in centrality between the initial and current networks more transparent, the degree centrality values (in-degree and out-degree) of actors with the highest centrality scores in both the initial and current collaborative innovation networks were systematised in Table 1 and Table 2. Table 1 presents out-degree centrality, reflecting innovation collaboration initiated by the actors across both networks.

Table 1. Out-Degree Centrality Values for the Initial and Current Collaborative Innovation Networks in Vrnjačka Banja

Initial collaborative innovation network		
***Node* (actor, subject, stakeholder)**	**Outdeg**	**nOutdeg**
TO Vrnjačka Banja	16.000	0.762
Hotel Fontana	11.000	0.524
Faculty of Hotel Management and Tourism	10.000	0.476
Spa Travel	9.000	0.429
Hospitality and Tourism School	6.000	0.286
Hotel Merkur	6.000	0.286
Current collaborative innovation network		
***Node* (actor, subject, stakeholder)**	**Outdeg**	**nOutdeg**
TO Vrnjačka Banja	16.000	0.667
Hotel Fontana	15.000	0.625
Hotel Merkur	15.000	0.625
Spa Travel	12.000	0.500
Center for Innovation Development	12.000	0.500
Hotel Tonanti	11.000	0.458
Faculty of Hotel Management and Tourism	11.000	0.458

The out-degree centrality results indicate a redistribution of collaboration initiation roles within the innovation network. In the initial network, the Tourism Organization of Vrnjačka Banja was the dominant actor (nOutDegree = 0.762), followed by Hotel Fontana (0.524) and the Faculty of Hotel Management and Tourism (0.476). In the current network, although the Tourism Organization of Vrnjačka Banja remains the most active initiator of collaboration (0.667), its relative dominance has decreased. At the same time, several actors, including Hotel Fontana and Hotel Merkur, have substantially strengthened their collaborative engagement (both 0.625). The emergence of new highly active actors, such as the Center for Innovation Development (0.500), further suggests that the initiation of innovation-related cooperation is now distributed across a broader range of stakeholders. Overall, these findings indicate a more balanced and participatory collaborative structure. Moreover, Table 1 indicates that all sectors involved in the Triple Helix of innovation occupy central positions within the collaborative innovation network through their respective representatives. From the government sector, the Tourism Organization of Vrnjačka Banja was identified as a key actor stimulating collaboration in innovation initiatives with other entities. This role largely emerges from the requirements of everyday operational activities, which are closely linked to the promotion of Vrnjačka Banja as a tourism destination. From the education sector, the Faculty of Hotel Management and Tourism, as the primary academic institution (in contrast to the broader engagement observed in the initial network, which also included secondary vocational school), was also recognised as an important initiator of collaboration in innovation practices within the Vrnjačka Banja tourism destination, with a more pronounced

position compared to the initial network. Finally, the private sector was also identified as central to the initiation of innovation-related collaboration, both in the case of hotels (Hotel Fontana and Hotel Tonanti) and travel agencies (Spa Travel). Table 2 presents in-degree centrality values for both networks, reflecting collaboration directed towards specific actors.

Table 2. In-Degree Centrality Values for the Initial and Current Collaborative Innovation Networks in Vrnjačka Banja

Initial collaborative innovation network		
***Node* (actor, subject, stakeholder)**	**Outdeg**	**nOutdeg**
Faculty of Hotel Management and Tourism	10.000	0.476
Hotel Fontana	10.000	0.476
Hotel Tonanti	7.000	0.333
Spa Travel	7.000	0.333
TO Vrnjačka Banja	5.000	0.238
Current collaborative innovation network		
***Node* (actor, subject, stakeholder)**	**Outdeg**	**nOutdeg**
Faculty of Hotel Management and Tourism	14.000	0.458
Hotel Fontana	12.000	0.500
TO Vrnjačka Banja	11.000	0.458
Hotel Merkur	10.000	0.417
Hotel Tonanti	10.000	0.417
Spa Travel	10.000	0.417
Center for Innovation development	10.000	0.417
Hospitality and Tourism School	10.000	0.417
Hotel Pegaz	9.000	0.375

In-degree centrality (Table 2) can be interpreted as a measure of the prominence and attractiveness of individual actors, as it reflects the extent to which collaboration is directed towards specific stakeholders within the network. The in-degree centrality results reveal a notable shift in the prominence, attractiveness, and recognition of key stakeholders within the collaborative innovation network. In the initial network, the highest in-degree centrality was shared by the Faculty of Hotel Management and Tourism and Hotel Fontana (both 0.476), indicating that they were the primary recipients of collaborative ties. In the current network, although Hotel Fontana further strengthened its position (0.500), the network became less concentrated around a small number of actors. Several stakeholders, including the Faculty of Hotel Management and Tourism, the Tourism Organization of Vrnjačka Banja, Hotel Merkur, Spa Travel, and the Center for Innovation Development, attracted comparable levels of collaboration. This suggests that recognition and demand for collaboration are now distributed more evenly across the network, reflecting a broader and more inclusive innovation ecosystem compared to the initial network. Moreover, it is noteworthy that representatives of all three sectors of the Triple Helix of innovation – academia, industry, and government – occupy equally important positions within the collaborative innovation network. It is important to emphasise the role of academia, represented by the Faculty of Hotel Management and Tourism, in driving collaborative innovation initiatives. Its central position within the network enables strong connections with key stakeholders involved in the development of tourism in the municipality, thereby facilitating knowledge exchange, cooperation, and innovation. Alongside academia, actors from the private sector were also

identified as important partners in innovation activities for a significant number of surveyed stakeholders. In particular, hotels such as Hotel Fontana and Hotel Tonanti, as well as the travel agency Spa Travel, occupied prominent positions within the collaborative innovation network. Finally, the Tourism Organization of Vrnjačka Banja also plays a pivotal role in fostering collaborative innovation efforts and facilitating cooperation among network participants. Finally, it is important to emphasise another centrality measure, betweenness centrality, which indicates the "presence of nodes that connect different parts or points within the network" (Casanueva et al., 2016, p. 1195). It relates to actors who have the most connections with different parts of the network.

Figure 6. Visualisation of Central Actors (Betweenness Centrality) in the Initial Collaborative Innovation Network in Vrnjačka Banja

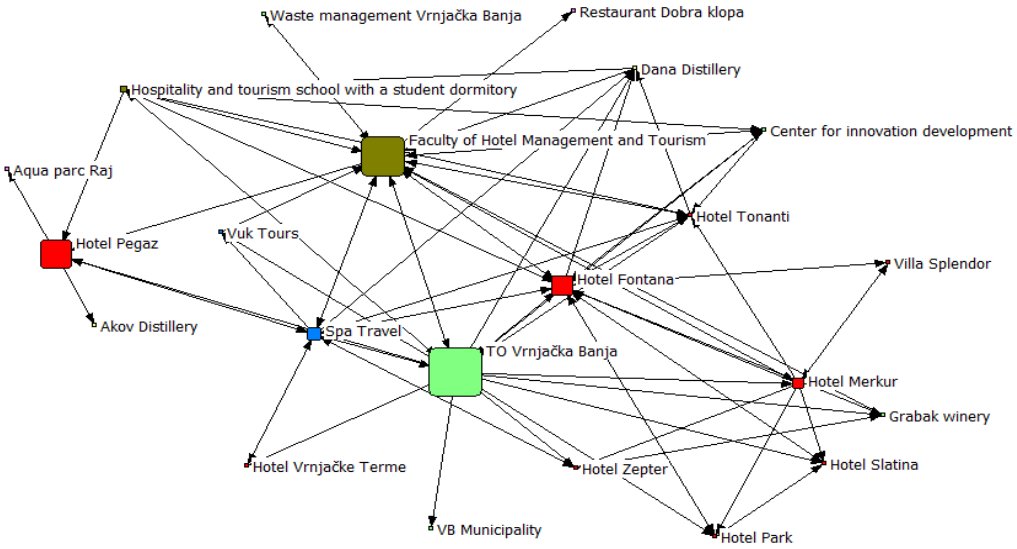
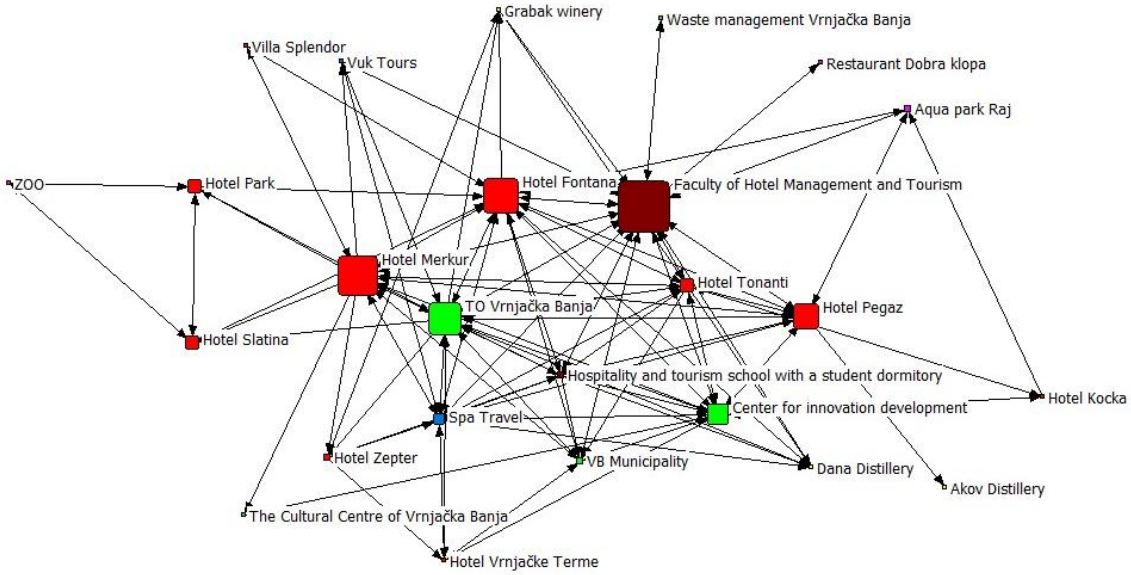


Figure 7. Visualisation of Central Actors (Betweenness Centrality) in the Current Collaborative Innovation Network in Vrnjačka Banja



The values for this centrality measure are presented in Table 3.

Table 3. Betweenness Centrality Values for the Initial and Current Collaborative Innovation Networks in Vrnjačka Banja

Initial collaborative innovation network		
Node (actor, subject, stakeholder)	**Betweenness**	**nBetweenness**
Faculty of Hotel Management and Tourism	114.574	27.279
Hotel Fontana	96.498	22.976
Spa Travel	77.919	18.552
TO Vrnjačka Banja	61.712	14.693
Hotel Pegaz	34.200	8.143
Current collaborative innovation network		
***Node* (actor, subject, stakeholder)**	**Betweenness**	**nBetweenness**
Dana Distillery	174.000	31.522
Faculty of Hotel Management and Tourism	154.66	28.019
Hospitality and Tourism School	69.833	12.651
Center for Innovation Development	68.833	12.470
Hotel Pegaz	24.030	4.353

The findings presented in Table 3 indicate the potential of certain stakeholders to enhance innovation collaboration and contribute to the development of a more cohesive destination network in Vrnjačka Banja. The betweenness centrality results further reveal important changes in the brokerage structure of the innovation network. In the initial network, the Faculty of Hotel Management and Tourism was the most important intermediary actor (nBetweenness = 27.279), followed by Hotel Fontana (22.976) and Spa Travel (18.552), suggesting that these stakeholders played a crucial role in connecting otherwise disconnected actors and facilitating knowledge exchange. In the current network, the brokerage function has shifted, with Dana Distillery emerging as the most influential intermediary (31.522), while the Faculty of Hotel Management and Tourism further strengthened its bridging position (28.019). At the same time, the emergence of new brokers, such as the Hospitality and Tourism School and the Center for Innovation Development, indicates a diversification of intermediary roles within the network. Overall, these findings suggest that the innovation network has become less dependent on a limited number of traditional actors and has developed a broader set of intermediaries that facilitate collaboration and knowledge flows among stakeholders. The SNA results further indicate that the Faculty of Hotel Management and Tourism retains the greatest capacity to enhance innovation collaboration with other parts of the network, extending beyond the usual interactions observed among previously identified central actors in the centrality analysis. Given its strong connections to entities that are themselves well embedded within their respective micro-networks and maintain links to otherwise less accessible actors, it has considerable capacity to expand its sphere of influence.

After analysing centrality values and identifying central actors within the network, it is important to examine how the network evolves over the project period in terms of its division into core and periphery stakeholders. Thus, in addition to the identified actors forming the core of the network – those that are crucial for both existing and potentially future innovation collaboration – and those located at the periphery, who are less actively involved in network-level cooperation (Figure 8), the follow-up analysis also confirms the current division of innovation collaboration into core and periphery (Figure 9).

Figure 8. Core–Periphery Analysis of the Initial Collaborative Innovation Network in Vrnjačka Banja

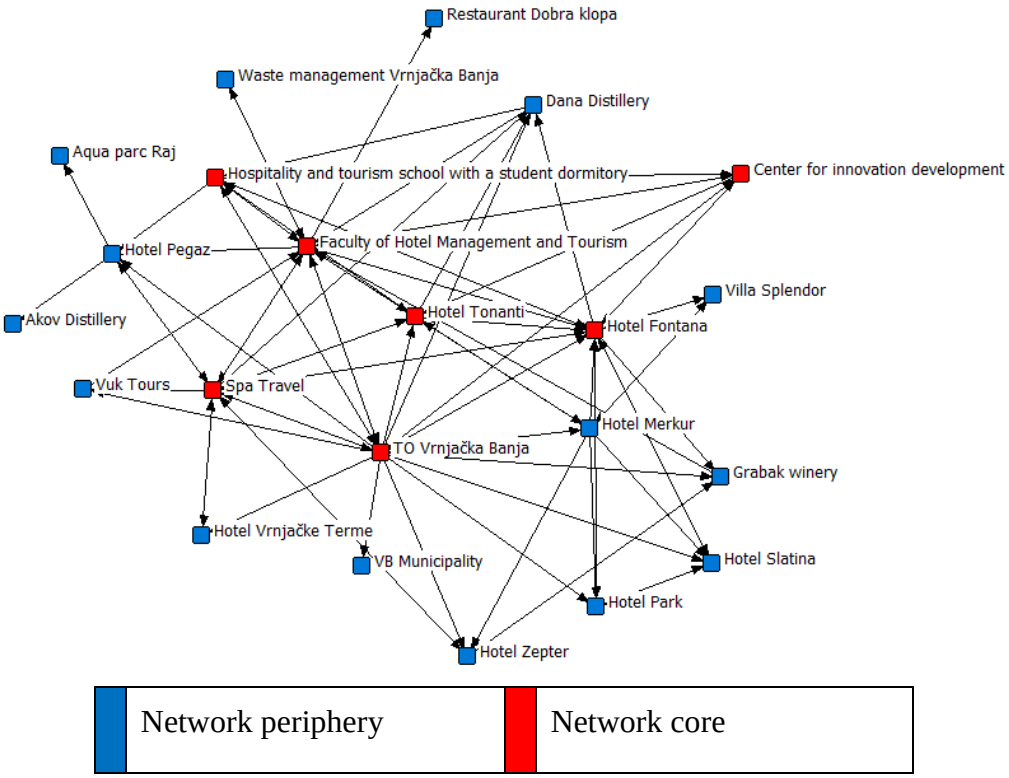
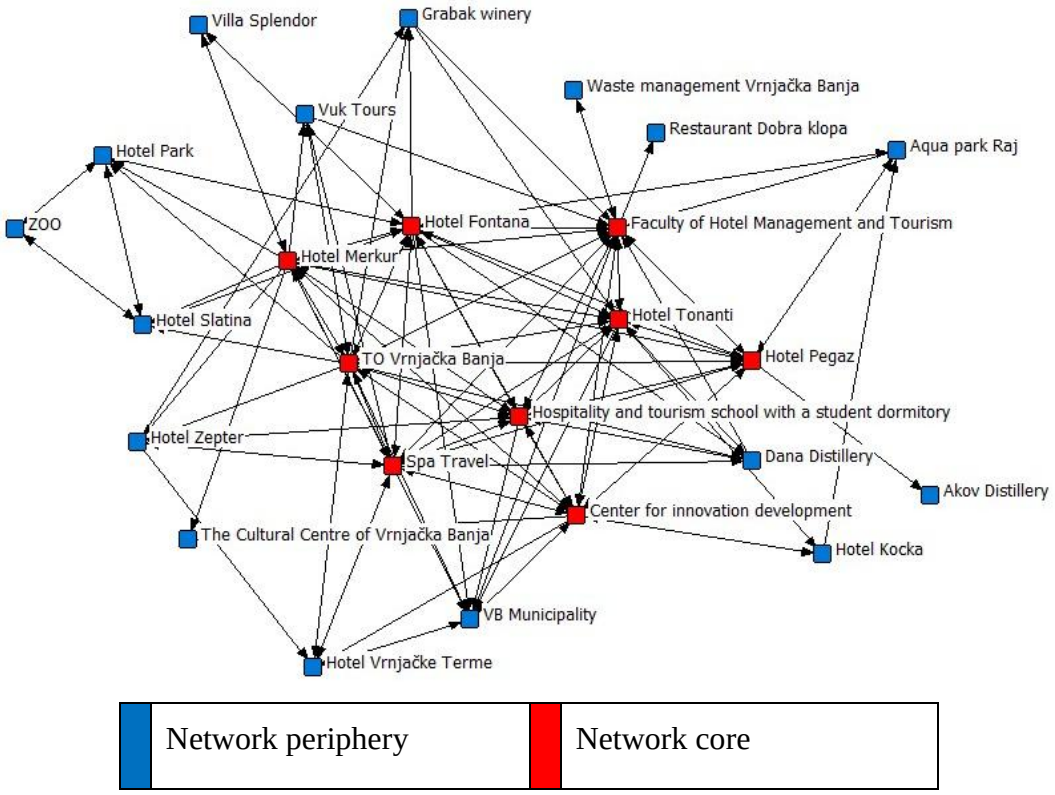


Figure 9. Core–Periphery Analysis of the Current Collaborative Innovation Network in Vrnjačka Banja



The core–periphery analysis of the current collaborative innovation network in the Vrnjačka Banja tourism destination indicates that the network has become both more cohesive and more structurally integrated over time. While the initial network exhibited a pronounced core–periphery structure (fit = 0.7646), the current network demonstrates a substantially stronger configuration (fit = 0.9173), suggesting a clearer differentiation between core and peripheral actors, as well as stronger cohesion among core members. The core expanded from seven to nine actors, with Hotel Merkur and Hotel Pegaz moving from the periphery into the core, reflecting their increased involvement in innovation-related collaboration that has been also evidenced with their continued participation in stakeholder meetings organised at the Faculty of Hotel Management and Tourism. At the same time, the core remains anchored by key tourism, educational, and innovation-support organisations, reflecting the Triple Helix perspective and indicating greater stakeholder integration and a more robust collaborative ecosystem. Overall, these findings suggest that the destination's innovation network has evolved from a relatively concentrated structure towards a more interconnected core capable of supporting knowledge exchange, coordination, and collective innovation activities. It is noteworthy that entities responsible for the organisation of tourism activities in the region, such as the local tourism organisation and key tourism industry actors, hold a significant share within the network. This suggests that the management of the collaborative innovation network is characterised by a top-down approach, with key activities related to destination development largely concentrated within the central actors of the Triple Helix model of innovation.

2.3. Recommendations for the Future Development of the Collaborative Innovation Network in Vrnjačka Banja Based on Initial and Follow-Up SNA Findings

When all previous results of the Social Network Analysis are taken into account, a revised set of guidelines for improving innovation collaboration at the level of the Vrnjačka Banja tourism destination is proposed. The revised guidelines are systematised in Table 4 and contextualised in relation to changes in the network over the project lifespan.

Table 4. Revised Recommendations for the Collaborative Innovation Network in the Vrnjačka Banja Tourism Destination

Recommendations	Guidelines	Involved stakeholders
Enhancement of the Network Structure	The collaborative innovation network should continue to expand its diversity by involving new stakeholder categories. However, unlike the initial network, the current network already demonstrates greater stakeholder integration and stronger collaborative ties, suggesting that future efforts should focus on integrating peripheral actors into the existing innovation ecosystem rather than solely increasing the number of participants.	It is desirable to include additional stakeholder categories, such as NGOs, SMEs, IT companies, creative industries, and cultural organisations. Particular attention should be given to newly emerged stakeholders that have already demonstrated collaborative capacity, such as Dana Distillery and the Cultural Centre of Vrnjačka Banja, as potential contributors to innovation processes.
The network should nurture systemic approach (innovation ecosystem)	An inclusive systemic approach that fosters diversity in innovation generation should be encouraged. The strengthened core–periphery structure and increased network cohesion indicate that the destination already possesses many characteristics of a	The management of the integrated collaborative innovation ecosystem should remain under the coordination of the Tourism Organization of Vrnjačka Banja, supported by the Center for Innovation Development,

	functioning innovation ecosystem. Future efforts should therefore focus on institutionalising collaboration mechanisms and developing joint innovation projects.	educational institutions, and newly active private-sector innovation leaders.
Leverage the potential of actors with high betweenness centrality values	Actors with high betweenness centrality should be utilised to facilitate knowledge exchange across different stakeholder groups. While the Faculty of Hotel Management and Tourism remains a key broker, the emergence of Dana Distillery, the Hospitality and Tourism School, and the Center for Innovation Development indicates that brokerage functions are becoming more distributed and resilient.	All stakeholders identified in Table 3 should be utilised as innovation brokers. Special attention should be given to Dana Distillery and the Center for Innovation Development, whose growing intermediary roles can support cross-sectoral innovation initiatives and strengthen knowledge diffusion across the network.
No cliques were identified within the existing network	The absence of cliques should no longer be interpreted as a sign of immaturity. Instead, it reflects a highly integrated network in which collaboration extends beyond isolated groups. Future efforts should focus on developing thematic innovation communities and project-based partnerships rather than encouraging fragmentation into separate clusters.	Stakeholders with strong in-degree centrality should be encouraged to coordinate temporary innovation working groups focused on specific destination challenges, such as digital transformation, wellness innovation, sustainability, and experience design.
The network is not evenly balanced	Although network participation remains unequal, recent Social Network Analysis (SNA) findings suggest a more balanced structure than previously observed. The expansion of the core and the reduction in out-degree centralisation indicate that collaboration responsibilities are increasingly shared among stakeholders. Future efforts should focus on integrating remaining peripheral actors rather than restructuring the entire network.	Coordination by the Tourism Organization of Vrnjačka Banja should continue through collaborative projects that connect peripheral actors with core organisations. Special emphasis should be placed on mentoring and partnership programmes linking peripheral stakeholders with newly established core actors such as Hotel Merkur and Hotel Pegaz.
Innovation collaboration is centralised	The current network can no longer be characterised as highly centralised. The reduction in out-degree centralisation from 60.8% to 44.3% suggests a significant redistribution of leadership and collaboration initiation roles. Rather than focusing on decentralisation, future governance efforts should focus on maintaining balanced leadership and avoiding excessive dependence on any single actor.	A distributed governance model should be encouraged, in which the Tourism Organization of Vrnjačka Banja retains a coordinating role while strategic responsibilities are shared among key educational, tourism, and innovation-support organisations. The transition towards a Destination Management Organisation (DMO) remains highly desirable.
A balance between top-down and bottom-up approaches should be ensured in the innovation collaboration network	The current network demonstrates a stronger balance between top-down coordination and bottom-up participation. The increased involvement of hotels, innovation-support organisations, and entrepreneurial actors indicates that innovation initiatives are no longer driven exclusively by public and educational institutions. Future efforts should strengthen co-creation mechanisms involving both strategic leaders and operational tourism businesses.	Bottom-up innovation should be encouraged through greater involvement of tourism practitioners and SMEs. At the same time, the growing role of private-sector leaders and innovation intermediaries that have emerged as important initiators and brokers of collaborative innovation within the destination should be capitalised on.

2.4. Future direction: Strengthening the Open Collaborative Innovation Ecosystem

When all previous Social Network Analysis results are taken into account, for both the initial and current collaborative innovation networks, it is possible to propose future directions for improving innovation collaboration at the level of the Vrnjačka Banja tourism destination in the near future. The observed network evolution suggests that Vrnjačka Banja has successfully transitioned from a relatively centralized and institution-driven innovation network toward a more cohesive and participatory innovation ecosystem. Future development efforts should therefore focus on strengthening the quality, adaptability, and innovation outcomes of collaborative relationships rather than merely increasing the number of connections. Particular attention should be given to supporting newly emerged brokerage actors and integrating peripheral stakeholders into innovation projects through cross-sectoral working groups, living labs, and co-creation initiatives. The establishment of formal innovation platforms, coordinated by the Tourism Organization of Vrnjačka Banja and supported by educational institutions (with the Faculty acting as an innovation hub), innovation intermediaries (such as the Center for Innovation Development), and leading tourism businesses, would facilitate continuous knowledge exchange and collective problem-solving. Furthermore, the destination should encourage collaboration among tourism stakeholders, creative industries, cultural organisations, digital technology providers, and local producers in order to stimulate greater diversity and resilience in innovation. Such an approach would enhance the adaptive capacity of the network, reduce dependence on individual actors, and strengthen its ability to respond to future market, technological, and sustainability challenges.

References

Baggio, R., & Cooper, C. (2010). Knowledge transfer in a tourism destination: the effects of a network structure. *The Service Industries Journal*, *30*(10), 1757-1771.

Barile, S., Ciasullo, M. V., Troisi, O., & Sarno, D. (2017). The role of technology and institutions in tourism service ecosystems: Findings from a case study. *Total Quality Management Journal*, *29*(6), 811-833.

Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network analysis in the social sciences. *Science*, *323*(5916), 892-895.

Borgatti, S. P, Everett, M. G., & Johnson, J. C. (2013). *Analyzing Social Networks*. Sage Publication.

Casanueva, C., Gallego, Á., & García-Sánchez, M. R. (2016). Social network analysis in tourism. *Current Issues in Tourism*, *19*(12), 1190-1209.

Cooper, C., Scott, N., & Baggio, R. (2009). Network position and perceptions of destination stakeholder importance. *Anatolia*, *20*(1), 33-45.

Decrop, A. (2004). Trustworthiness in qualitative tourism research. In *Qualitative research in tourism* (pp. 174-176). Routledge.

Denicolai, S., Cioccarelli, G., & Zucchella, A. (2010). Resource-based local development and networked core-competencies for tourism excellence. *Tourism Management*, *31*(2), 260-266.

Espeso-Molinero, P., Carlisle, S., & Pastor-Alfonso, M. J. (2016). Knowledge dialogue through indigenous tourism product design: A collaborative research process with the Lacandon of Chiapas, Mexico. *Journal of Sustainable Tourism*, *24*(8-9), 1331-1349.

Freeman, L. C. (1979). Centrality in social networks: conceptual clarification. *Social Networks*, 1, 215-239
Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology, 78*, 1360-1380.
Hanneman, R. & Riddle, M. (2005). *Introduction to Social Network Methods*. Riverside: University of California
Judge, T. A., Simon, L. S., Hurst, C., & Kelley, K. (2014). What I experienced yesterday is who I am today: Relationship of work motivations and behaviors to within-individual variation in the five-factor model of personality. *Journal of Applied Psychology, 99*, 199–221.
Lemmetyinen, A., & Go, F. M. (2009). The key capabilities required for managing tourism business networks. *Tourism Management, 30*(1), 31-40.
Mariani, M., & Baggio, R. (2020). The relevance of mixed methods for network analysis in tourism and hospitality research. *International Journal of Contemporary Hospitality Management*, 32(4), 1643-1673.
McFadyen, M. A., Semadeni, M., & Cannella, A. A. (2008). Value of strong ties to disconnected others: Examining knowledge creation in biomedicine. *Organization Science, 20*(3), 552-564.
Pearce, D. G. (2014). Toward an integrative conceptual framework of destinations. *Journal of Travel Research*, 53(2), 141–153.
Prell, C., Hubacek, K., & Reed, M. (2016). Stakeholder analysis and social network analysis in natural resource management. In *Handbook of applied system science* (pp. 367-383). Routledge.
Scott, J. (2011). Social network analysis: developments, advances, and prospects. *Social Network Analysis and Mining, 1*, 21-26.
Torfing, J. (2019). Collaborative innovation in the public sector: The argument. *Public Management Review, 21*(1), 1-11.
Wang, N., Liang, H., Jia, Y., Ge, S., Xue, Y., & Wang, Z. (2016). Cloud computing research in the IS discipline: A citation/co-citation analysis. *Decision Support Systems, 86*, 35–47.
Zehrer, A., Raich, F., Siller, H., & Tschiderer, F. (2014). Leadership networks in destinations. *Tourism Review, 69*(1), 59-73.

Acknowledgement

The project is co-financed by the governments of Czechia, Hungary, Poland and Slovakia through Visegrad Grants from the International Visegrad Fund. The fund's mission is to advance ideas for sustainable regional cooperation in Central Europe.

Authors

Darko Dimitrovski
Vladimir Senić
Vesna Milovanović

Vrnjačka Banja, June 2026

Visegrad Fund

ISBN 978-86-89949-99-5