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Empowering Open Innovation
Tourism Networks

Report on the tourism stakeholder innovation network structure in Vrnjačka Banja

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1. Introduction

The report aims to examine the structure of the collaborative innovation network based on the network actors' (managers/owners of public and private tourism companies and community representatives) collaborative efforts to co-create the meaningful and innovative tourism offer. It aims to reveal and visualise the structure and network dynamics of the proposed destination collaborative innovation network by analysing its relational network values through the use of social network analysis. The destination management approach has influenced the formation and operation of networks; however, engagement of different types of stakeholders in the networks was often ignored (Pearce, 2014). Thus, the focus of the report is the analysis of destination supply-side collaborative innovation network structure, by examining the role of different stakeholders in its structure and dynamics. Following a network logic, supply-side companies try to meet customer needs by establishing interdependent and mutual ties with them to provide an integrated offering in which the pursuit of individual success is coupled with the pursuit of a mutual success (Barile, 2017). These collaborative networks are beneficial for the individual organisations as well as the overall destination, and its innovativeness, as they enable to create value-adding relationships by accessing to external resources and knowledge, extending their offerings through new or improved services, and consequently satisfying tourism stakeholders' needs (Denicolai et al., 2010). Recent studies emphasised the role of collaborative networks in finding innovative solutions to complex problems through the exchange of knowledge, competences and ideas (Torfing, 2019). At destination level, collaborative innovation networks depict local relationships among tourism firms (e.g. tour operators), with others firms providing complementary services (e.g. hotels) and finally with knowledge providers, both private (technologies providers) and public (e.g. universities and community representatives). Particularly relevant as vehicles of knowledge transfer are inter-firm linkages and partnerships between tourism organisations and other knowledge-creating bodies, such as universities, government agencies and NGO's (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 the study, different approaches and methods were used in order to obtain results that best reflect the situation on the ground by triangulating data:

- Defining the sample (identifying the actors of the collaborative innovation network through the purposive sampling method and snowball approach to determine the final list of potential actors);
- Interviews with all identified actors in the phase of defining the sample;
- Conducting Social Network Analysis at the level of a defined sample;
- Interviews with selected actors (identified through the SNA approach) that primarily relate to their collaborative innovation efforts perception within the Vrnjačka Banja destination network.

The study is based on a combined methodological approach (quantitative and qualitative), mixed method approach. Mariani and Baggio (2020) argue that applying quantitative or qualitative methods separately could lead to "biased" and partially accurate results, thus Decrop (2004) emphasizes the importance of applying triangulation (methods) as a multi-level analysis.

In the phase of defining the sample, key stakeholders in the Vrnjačka Banja destination were selected, mostly within the existing Tourism industry cluster of Vrnjačka banja (purposive

sampling method). Identified stakeholders are contacted with the idea of nominating a minimum of five new stakeholders who are later contacted in order to obtain new members of the designated collaborative innovation network (snowball sampling method) and this process continues in a couple of "waves" until saturation in nominations is reached, i.e. the newly proposed stakeholders start nominating already proposed members of the potential network. At that moment, the process can be stopped and moved to the second phase of the research itself (that is, structured interviews with the aim of determining the connections that exist between the members of the network itself).

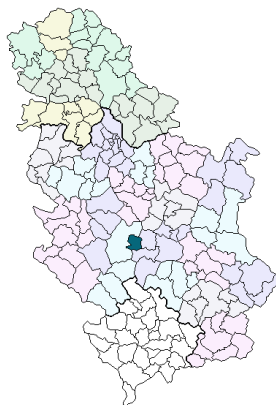
Social Network Analysis explains the structure of relationships between actors (in terms of nodes and ties, edges or links relationships or interactions) within the Vrnjačka Banja collaborative network. This analysis is a very common model for examining relationships and connections between individuals, institutions and groups with a focus on the relationships between them, that is, their existence and quality. For the purposes of compiling the report, telephone interview method with all identified actors of the collaborative innovation network was done with the aim of creating a network depending on their innovation-driven mutual collaboration. Cooper et al. (2009) consider that only through interviews, it is possible to reveal more detailed characteristics of the network, since the stakeholder network is perceived as a complex system. In-depth interviews lasted about half an hour on average. The processing of the collected data was carried out using the software package UCINET and NETDRAW, which were used for analysis and visualization of the results themselves (Scott, 2011) and generating social network diagrams (Borgatti et al. 2009). Before the implementation of the empirical research, a pilot study was conducted on a smaller sample with the aim of determining the level of understanding of the questions that were later used in the interview. Social Network Analysis provides a visual representation of the structure of the network itself, i.e. an insight into which of the subjects in the network has a central role and which has a peripheral role (Prell et al., 2016). Basic network characteristics include: network size, density, centrality, centralization, cluster coefficient, and others (Casanueva et al., 2016). For the purposes of the study, the density of the network, i.e. the number of connections in the network, centrality (the influence of one actor on others in the network) was determined (Casanueva et al., 2016). In-degree centrality is one way to the prominence or prestige within the network (Hanneman & Riddle, 2005). Thus, high in-degree centrality within the network of innovation partner indicates that many firms innovate with the focal firm. Internal network management implies being aware of existing network relations and structures, sentiments and positions of stakeholders towards network goals and objectives, and maintaining communication channels (Lemetyinen & Go, 2009; Zehrer et al., 2014). Dense networks are considered as structures that sustain stability and allows incremental innovation through the exchange of knowledge and information. In contrast, less dense and weaker networks allow for more dynamism, and initiate radical changes, by introducing innovation through experience-co creation (Håkansson & Ford, 2002). Earlier studies suggest that an actor's position in a network is associated with innovation (Burt, 1992; Granovetter, 1973). Actors in the center of a network can collect and integrate ideas and resources and therefore generate innovation (Freeman, 1979). McFadyen et al. (2008) have concluded that individuals that generate recent knowledge are those with strong ties to and dense networks. Within destinations, well-connected, central players may well facilitate innovation within the destination (Baggio & Cooper, 2010). The clustering coefficient represents the tendency to create subgroups within the network, while within the clique approach, clusters are distinguished within the network itself with clearly defined relationships between them, or networks within networks (subnets).

2. Analysis of collaborative innovation destination network of Vrnjačka Banja

2.1. Subject of the research

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

Figure 1. Municipality of Vrnjačka Banja



Vrnjačka Banja is the municipality with 14 settlements stretching over an area of about 240 km² and with roughly 30,000 people, with main settlement Vrnjačka banja as a central with 16,000 inhabitants. Vrnjačka Banja is located in central Serbia, about 200 km south of Belgrade and it is well-connected to other main parts of Serbia through the recently built highway and modernized railway. Vrnjačka Banja is one of the most famous spa destinations in South-East Europe with a tradition tracing to Roman times (2nd to the 4th century) and use of swimming pool with hot mineral spring (Fons Romanus). Many Roman coins were found in the healing spring as a material evidence of its use in this ancient time. The spa is sheltered by closest Goč Mountain (1,147m) and several other mountains such as Gledičke, Kopaonik, Željini, Jastrebac and Stolovi. The first analysis of the hot water from the Vrnjačka springs was carried out by Baron Herder in 1835 on the orders of Prince Miloš, who described it as acidic and compared it to the healing water of Schlossburn in Carlsbad, Czech Republic. Baron Herder was tasked to implement geological, mining and balneological research of Serbia, which he published in the report "Bergmannische reise in Serbien" (Sotirović, 1996). Vrnjačka Banja is tourism destination with a long tradition as it has been recommended by doctor Josif Pančić for a treatment of Pavle Mutavdžić, head of the Kruševac District. Thanks to the recommendation of Josif Pančić, Pavle Mutavdžić, used the healing properties of mineral springs for therapeutic purposes, which leads to his recovery. That moment represents a turning point because thanks to his influence and engagement, the "Founding Foundation Society of Acidic Hot Water in Vrnjci" was formed in 1868. The very next year, the first water capture was carried out, with the construction of a drinking fountain and a wooden hot bath for 35 people, which officially opened the first tourist season. The spa is widely known for treating diabetes, digestive diseases, liver diseases, urinary tract diseases, skin diseases, eye diseases and nervous system diseases. Finally, nowadays Vrnjačka Banja is one of most visited tourism destinations in Serbia, attracting many people with diverse motivations, from desire to escape from the city, indulging in wellness and spa treatments, attending business and other types of events, having weekend

vacations for families with children and other and one-day trips for numerous domestic tourists. According to data from the Republic Statistical Office, the most visited spa in Serbia in 2024 was Vrnjačka Banja with 187,861 guests.

2.2. Stakeholders of collaborative innovation network

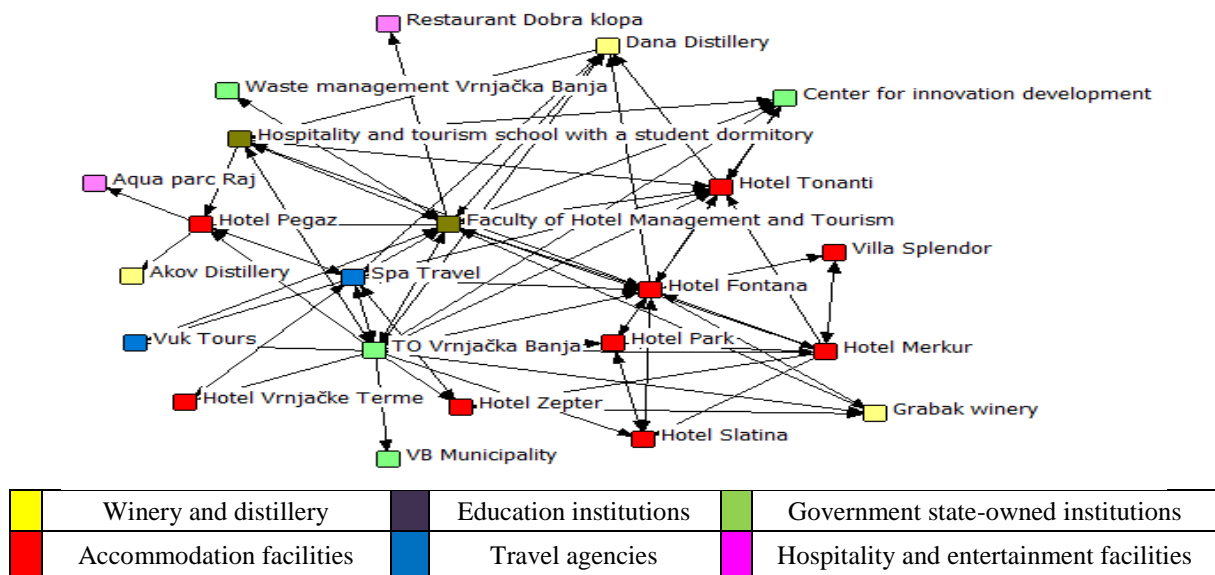
Freeman (1984, p. 46) defines a stakeholder as "a group or individual who can influence or is affected by the achievement of an organization's goals". Based on the above, it is possible to conclude that the key stakeholders in spa destination such as Vrnjačka Banja were entities involved in tourism experience ecosystem. Cooperation between all relevant entities is essential for planning, managing and monitoring the development of the experiential ecosystem. Vrnjačka Banja collaborative innovation network consist of the different actors that reflect the main premises of triple helix model of innovation that consider interactions between academia, industry and government. For the purposes of the creating the report of initial (before set of the project activities take place in the designated destination) collaborative innovation network 22 main actors willing to be involved in the social network analysis were identified. As the starting point members of Tourism industry cluster of Vrnjačka Banja were approached and through the snowball sampling it has been supplemented with all other relevant actors of the interest for identifying destination tourism innovation ecosystem. When dividing the stakeholders into categories the following categories can be distinguished:

1. Accommodation facilities (mostly hotels) (9)
2. Education institutions (faculty and secondary vocational school) (2)
3. Government state-owned institutions (tourist organizations, municipality and center for innovation development) (4)
4. Travel agencies (2)
5. Hospitality and entertainment facilities (restaurants and aqua parc) (2)
6. Winery and distillery (3)

For the purposes of the study, a social network analysis (SNA) was conducted, the aim of which is to analyze the ties between the identified stakeholders involved in collaborative innovation network of Vrnjačka Banja tourism destination. For the purposes of the analysis, a matrix was created that systematizes all relationships based on innovation-driven collaboration between the actors. Given that 22 actors were identified, a matrix was created in which all 22 subjects were connected with other subjects in order to visualize the overall innovation collaboration in Vrnjačka Banja tourism destination (Figure 2). The graph does not recognize any isolates, which do not initiate and are not the subject of innovation-driven collaboration with other stakeholders.

From the proposed network structure, it is possible to determine that at the level of the innovation driven collaboration different stakeholders' categories (in particular taking into account triple helix innovation actors) are to some degree evenly distributed. This indicates the potential of transforming this network into a prosperous innovation ecosystem with the involvement of larger number of actors in the innovation-driven activities. Therefore, there is a noticeable space to implement the guidelines of the European Commission for the implementation of a systemic approach that stimulates synergy and compromises between entities in the system (ecosystem).

Figure 2. Structure of the collaborative innovation network of Vrnjačka Banja



The analysis was performed using the UCINET and NetDraw software packages and the following parameters were considered: density centralisation, degree centrality, betweenness centrality, core and periphery and cliques. Network density (Density) shows the overall level of cooperation between all entities in the network. Density values vary from 0 to 1, that is, they are interpreted as "the probability that a connection exists between any pair of randomly selected nodes" (Borgatti et al., 2013), where in the situation when the value is 0, there are no connections between nodes (subjects), and when the value is 1, all subjects are interconnected. The network density value for the observed network is 0.182, with 84 ties in total were identified within the whole network. According to Wang et al. (2016), this value indicates that the cohesion of the network is low, i.e. that the network is still in the development phase, so it is necessary to make an additional effort to improve collaboration regarding the innovation in the Vrnjačka Banja tourism destination in the future.

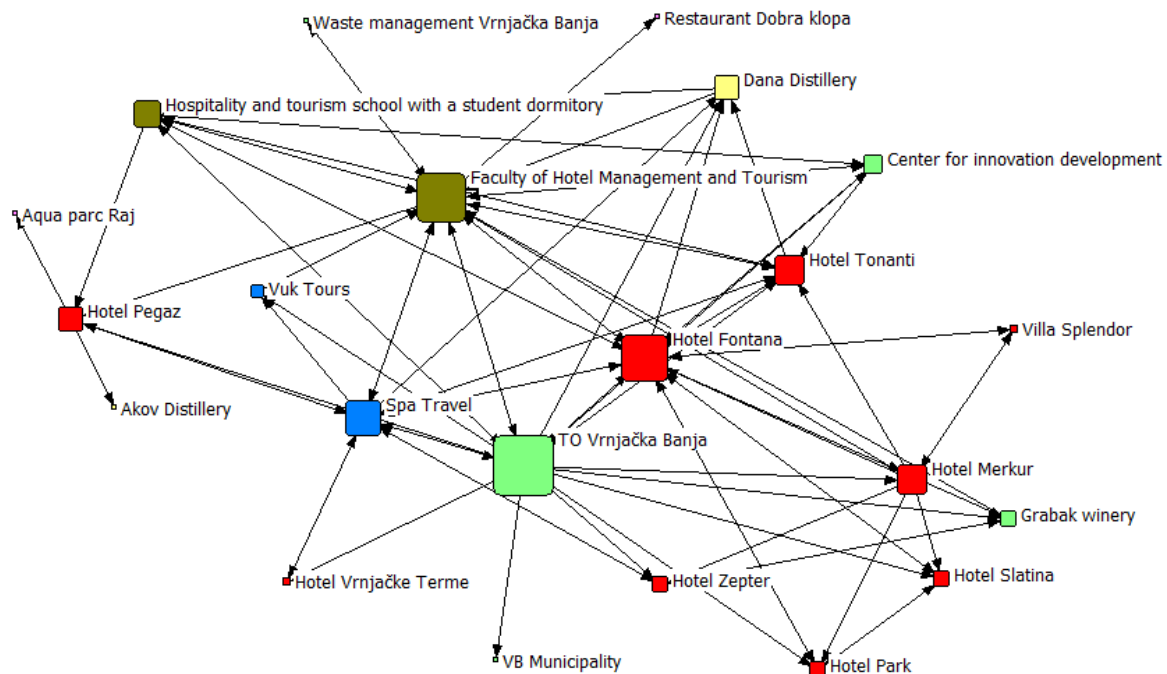
An essential measure of any network is centralization and it indicates the reliance of the network on one subject (node). The value of centralization within the network for actors who initiate cooperation towards other entities (Outdegree) is 60.8%, while the value of centralization when observing entities towards which cooperation is directed (Indegree) is 30.8%. Both values point to the fact that large part of the total network relies on one entity, but it is positive that there is a considerable number of entities initiate collaboration with other entities. The collaboration innovation network of tourism entities indicates that collaboration is established between a small number of entities, while a significant part of entities remains on the margin of the network itself without a visible initiative for collaboration with other entities. The assumption is that this type of behavior is the result of a perception of innovation exchange was perceived by stakeholders as competition, rather than potential for joint future collaboration in achieving a common goal (coopetition).

After determining the general characteristics of the network, it was necessary to look at the key actors, that is, to determine the centrality for individual subjects, primarily in order to determine which of the actors has central characteristics in the development of the innovation collaborative tourism network and its future development and dynamics. The goal is to identify

key subjects that have a central place in the network, primarily because of their potential to take a leadership position in the further development of the network, i.e. to establish a connection with other parts of the network that are not adequately involved in collaboration regarding the innovation.

Degree centrality shows the number of established collaboration links with other actors, which identifies the subjects with the most established ties (regardless of whether they are the ones who initiate cooperation or the cooperation is directed towards them) with other actors in the collaborative innovation tourism network of Vrnjačka Banja. Actors who play a more important role within the network are shown as larger nodes on the graphic itself (Figure 3).

Figure 3. Visualization of central actors in innovation collaboration tourism network of Vrnjačka Banja



In order to make the results more transparent, the values of subjects with the highest values of degree of centrality (indegree and outdegree) will be systematized below in Table 1, both when it comes to innovation collaboration that is initiated by them (outdegree), as well as that which is directed towards them (indegree).

Table 1. Values of centrality (*outdegree*) for innovation collaboration network of Vrnjačka Banja tourism destination

<i>Node (actor, subject, stakeholder)</i>	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 with student dormitory	6.000	0.286
Hotel Merkur	6.000	0.286

From the Table 1, it can be concluded that all the sectors involved in the triple helix of innovation have central position in the collaborative innovation network through its representatives. From the government side, Tourist Organization of Vrnjačka Banja was identified as a central to spur the collaboration regarding the innovation initiatives with other entities. Mostly, it arises as a necessity of everyday business, which is closely related to the promotion of Vrnjačka Banja as a tourism destination. From education side, one academic and secondary school were also recognized as initiators of the collaboration in regard to the innovation practices in Vrnjačka Banja tourism destination. Finally, private sector was also identified as central for the initiation of the collaboration concerning the innovation, both in the case of hotels (Hotel Fontana) and travel agencies (Spa Travel).

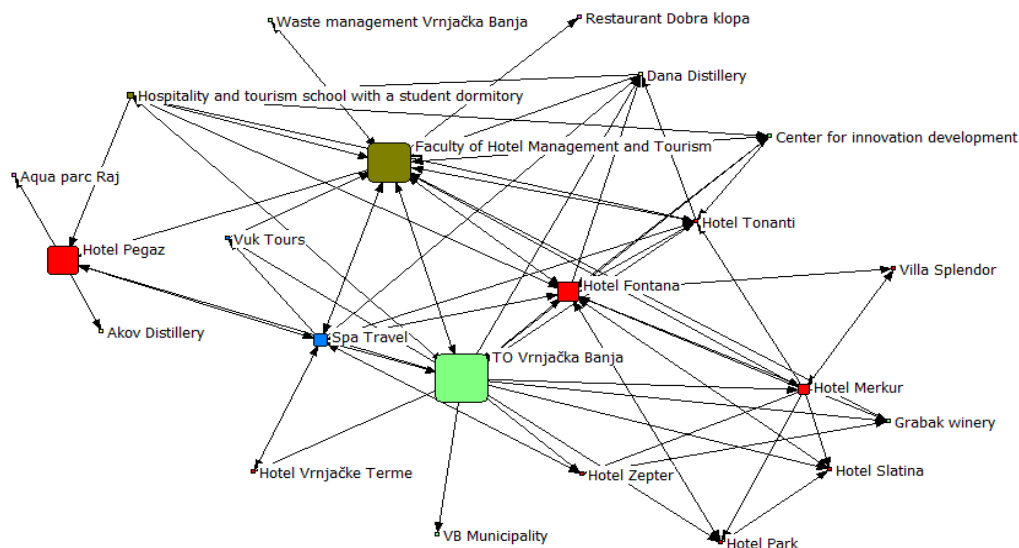
Table 2. Values of centrality (*indegree*) for innovation collaboration network of Vrnjačka Banja tourism destination

<i>Node (actor, subject, stakeholder)</i>	Indeg	nIndeg
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
Hospitality and tourism school with student dormitory	5.000	0.238

The indegree centrality value (Table 2) is often perceived as a measure of the popularity of certain entities, as it indicates cooperation directed towards certain stakeholders in the network. It is interesting that all triple helix of innovation entities have an equal and important place in innovation collaboration. It is important to emphasize the role of academia (Faculty of Hotel Management and Tourism) in driving collaborative innovation initiatives thanks to their central place with all relevant entities of importance for the development of tourism in the municipality. Along the academic, important partner in innovation activities for a significant number of surveyed stakeholders were also actors from profit sector, in particular hotels (Fontana and Tonanti) and travel agencies (Spa Travel). Finally, TO Vrnjačka Banja also plays a pivotal role in encouraging collaboration innovation efforts. It is interesting that most of the actors are presented both in Tables 6 and 7, so it could be concluded that innovation collaboration network of Vrnjačka Banja tourism destination is equally distributed in regard to innovation collaboration both initiated and directed to.

Finally, it is important to emphasize another value of centrality, betweenness centrality, that is, a value that indicates the "presence of nodes that connect different parts or points within the network" (Casanueva et al., 2016, p. 1195), that is, actors who have the most connections with different parts of the network.

Figure 4. Visualization of central actors (betweenness centrality) in innovation collaboration tourism network of Vrnjačka Banja



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

Table 3. Values of centrality (*betweenness centrality*) for innovation collaboration network of Vrnjačka Banja tourism destination

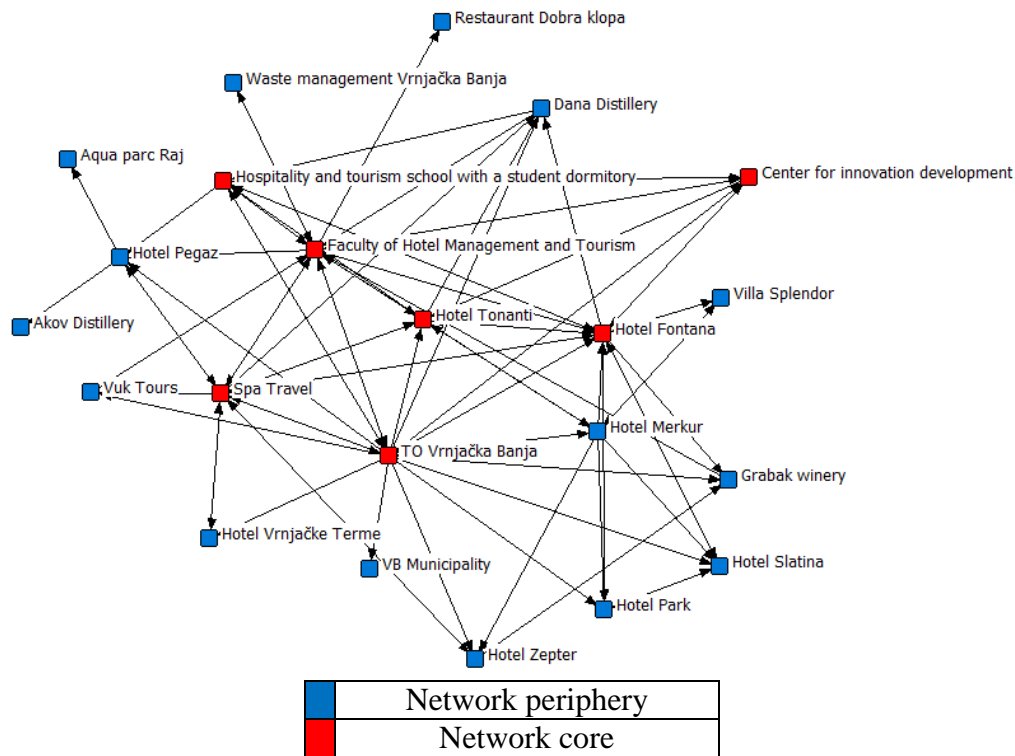
Node (actor, subject, stakeholder)	Betweenness	nBetweenness
Faculty of Hotel Management and Tourism	114.574	27.279
Hotel Fontana	96.498	22.976
Spa Travel	77.919	18.552
TO Vrnjačka Banja	61.712	14.693
Hotel Pegaz	34.200	8.143

The findings presented in table 3 indicate the potential of certain stakeholders for improving innovation collaboration and forming more cohesive destination network of Vrnjačka Banja. The Faculty of Hotel Management and Tourism has the greatest capacity to improve innovation collaboration with other parts of the network, i.e. outside the usual collaboration that exists commonly between central actors previously identified within centrality analysis. Taking into account that it is well connected to entities that within their micro-networks have good connections with entities that would otherwise not be directly accessible to it, it has considerable capacity to expand the sphere of their influence. This also applies to hotels such as Fontana and Pegaz, as well as Spa Travel as travel agency that spur the innovation collaboration along the whole network; nevertheless, it is the case with central and less central stakeholders. Finally, TO Vrnjačka Banja also has institutional capacity to initiate the innovation in the Vrnjačka Banja tourism destination, taking advantage of the institutional collaborative capacity that this governmental body possesses, namely in the coordinated promotion of tourist destination within this municipality.

After the value of centrality and identification of central subjects at the network level, it is important to look at how the network looks when it comes to its division into core and periphery stakeholders. Thus, it is desirable to identify subjects in the network that represent its core,

those that are vital in the context of existing (and prospectively future) innovation collaboration, and subjects that are on the periphery, and therefore are not actively involved in the process of cooperation at the level of the network itself (Figure 5).

Figure 5. Core and periphery analysis of innovation collaborative network of Vrnjačka Banja tourism destination



The Figure 5 shows that the core of the network consists of 7 stakeholders of vital importance for innovation landscape of Vrnjačka Banja tourism destination. The following subjects are classified in this category: Faculty of Hotel Management and Tourism, Center for innovation development, Spa travel, TO Vrnjačka Banja, Hotel Fontana, Hotel Tonanti and Hospitality and tourism school with student dormitory. One of stakeholders that appear in core network and that was not present in the previous graphs and tables is Center for innovation development which role is currently underexploited, however, evidently of vital importance for collaborative innovation network dynamics. The core of the network consists primarily of entities that belong to the all categories within the model of innovation, such as academia, tourism industry and government which essentially make up the tourism destination ecosystem. It is interesting that the entities responsible for the organization of tourist activities in the region, such as local tourist organization and tourism industry players have a significant share, which suggests that the management of the collaborative innovation network was determined by a top-bottom approach, by centralizing all activities important for the development of the destination within the vital actors in triple helix model of innovation.

2.3. Recommendations for collaborative innovation network of Vrnjačka Banja following implemented SNA analysis

When the results of the social network analysis are taken into account, it is possible to propose some guidelines on how to improve innovation collaboration at the level of the Vrnjačka Banja tourism destination in the near future. Some of the proposals are systematized in the following table (Table 4).

Table 4. Recommendations for collaborative innovation network of Vrnjačka Banja tourism destination

Results	Guidelines	Involved stakeholders
The structure of the network is not diverse enough	The collaborative innovation network should prosper of the diversity of its actors, thus, involvement of the novel types of the stakeholders, would provide additional benefits for the innovation ecosystem. The additional effort should be invested to establish better communication between entities that did not show a satisfactory level of collaborative innovation network.	It is desirable to include completely new categories of stakeholders (NGO's, SME's and IT companies), considering that current network is exclusively directed to the hotel companies. As evidenced from the SNA analysis, the role of educational institutions is particularly important due to their importance for the innovation creation and promotion through the wider innovation ecosystem.
The structure of the existing network can support a systemic approach (innovation ecosystem)	Encourage an inclusive systemic approach that favors the diversity of innovation generation. An integrated innovation ecosystem that nurtures the connection of a large number of different stakeholders would improve the collaboration that might lead to innovation creation capacity at the level of the destination itself.	The management of the integrated collaborative innovation network should be left to the local Tourism Organization, supported with the vital local partners, such as the Center for innovation development and education institutions. The idea is to nurture collaborative work on application of innovations that have the capacity to transform the tourism experience in Vrnjačka Banja destination.
Identified actors with significant values of betweenness centrality	Use nodes that have a significant value of betweenness centrality to improve collaborative innovation with remote parts of the network, outside the core of the network. Thus, capacity of the key betweenness players such as the Faculty of Hotel Management and Tourism and The Hotel Fontana should be exploited to improve collaboration with rest of the network.	All stakeholders identified in Table 3, especially the Faculty of Hotel Management and Tourism and the TO Vrnjačka Banja have significant network brokerage capacity that must be exploited to increase the network cohesiveness by connecting different parts or points within the network.
No cliques were identified within the existing network	SNA analysis reveals the cohesiveness of the network, since no cliques were identified within the network, reflecting the network is still far away of the maturity. The intense collaboration related to the innovation might trigger formation of profit-oriented micro-systems that eventually have the capacity to transfer their success stories to other local entities.	Nurture the identified vital in-centrality stakeholders to reach the periphery of the innovation network and initiate formation of the cluster that might act as micro innovation clusters collaboratively working in the innovations that might resolve the everyday business challenges.

<p>The network itself is not evenly balanced</p>	<p>Involve subjects on the margin of the network for some form of cooperation (preferably on the innovative and creative promotion of the destination itself) with other subjects, primarily by setting a common business goal that can benefit all stakeholders involved in this type of collaboration. Stimulate the co-competition approach in contrast to the competitive atmosphere among stakeholders.</p>	<p>Connecting local stakeholders in the design of joint tourism experiences, as well as a combination with experiences offered by entities that are not part of the network, or its periphery, and can be complementary to the ultimate destination experience. Coordination of these activities can be led by local TO. An important goal is to facilitate communication within the system and promote cooperation on the co-competition principle, even between tourism industry competitors.</p>
<p>Innovation collaboration is centralized</p>	<p>The current collaborative innovation network of Vrnjačka Banja destination suggests high level of reliance of the network on one subject (node). The value of degree centralization is 0.557, suggesting the 56% of the network is relied on one actor. This indicates that current collaborative innovation network is centralized network characterized with single point of which is risky if that central node fails. Thus, idea of decentralization of the innovation collaboration network might consider Decentralized Autonomous Organisations (DAOs) that introduce a unique and disruptive governance model where users holding a destination's tokens are granted voting rights to determine critical issues related to the destination.</p>	<p>The implementation of activities driving the cohesiveness of the network should be balanced between triple helix representatives with the central places in the network and monitored by all other entities, mostly from tourism industry that are responsible for the development of the destination. The central place in the process should be given to the TO of Vrnjačka Banja as an umbrella organization responsible for the tourism promotion. The transformation into Destination Management Organization (DMO) should be considered, due to its capacity to manage, rather than to promote tourism destination only.</p>
<p>Characteristics of a top-down (bottom) approach were observed when it comes to innovation collaboration network</p>	<p>The top-down approach is a consequence of the greater involvement of governmental (TO Vrnjačka Banja and municipality) and educational (Faculty of Hotel Management and Tourism and Hospitality and tourism school with student dormitory) in the triple helix model of innovation. Regardless of the positive outcomes of the top-down approach, it is necessary to decentralize activities so that the initiative is supported by smaller local entities who are involved in direct interaction with the tourists and aware of needs of modern tourists.</p>	<p>Encourage a bottom-up approach through greater involvement of tourism practitioners, especially those that have a significant collaborative capacity to offer experiences that match the unique requirements of both tourism demand and supply.</p>

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