

Networks in tourism planning: Stakeholders' perceptions of an astrotourism project

ALBERTO TAPADA * [alberto_tapada@yahoo.com]

CARLA SUSANA MARQUES ** [smarques@utad.pt]

CARLOS COSTA *** [ccosta@ua.pt]

CARLOS PEIXEIRA MARQUES **** [cmarques@utad.pt]

Abstract | The present research aims to listen to a group of stakeholders and the different territorial visions, proposing the creation of a new cooperation model that simultaneously serves the needs of the Tua Valley region and the expectations of its actors and contributes to the success of the Tua Valley Regional Natural Park's Astrotourism Project. Eight representatives of regional organisations were interviewed to ascertain their vision of networks, their involvement in any similar cooperation system, ways these entities operate within them and networks' advantages and disadvantages. The interviewees were also asked about their potential contributions and predictions in relation to the creation of a new collaborative network in the surrounding inland region. The results reveal that most stakeholders are familiar with this organisational concept as they have already integrated similar models into their operations, and the interviewees outlined the associated advantages and difficulties. These stakeholders support the development of a new Tua Valley network, in which must rely on a culture of sharing and mutual trust to meet its members and the region's needs and reflect their specificities. The findings can be used to foster new synergies based on the quintuple helix model, serving as a starting point for further research on networks in tourism and contributing to the enrichment of the relevant existing literature.

Keywords | Astrotourism, networks, development, stakeholders, region, helix

* **Doctoral student** in Development, Societies and Territories at the University of Trás-os-Montes and Alto Douro, **Master in Tourism** at the University of Trás-os-Montes and Alto Douro, **Secretary-General** of AETUR - Association of Tourism Entrepreneurs of the Douro and Trás-os-Montes.

** **PhD in Management** from the University of Trás-os-Montes e Alto Douro, **Assistant Professor** at the University of Trás-os-Montes e Alto Douro, **Researcher** at CETRAD - Centre for Transdisciplinary Development Studies.

*** **Full Professor** at the University of Aveiro. **PhD and MSc** on Tourism Management (University of Surrey, UK). **Leader** of the Tourism Research Unit and the PhD Tourism Programme of the University of Aveiro.

**** **PhD in Management** by the University of Trás-os-Montes e Alto Douro, **Assistant Professor** at the University of Trás-os-Montes e Alto Douro, **Researcher** at CETRAD - Centre for Transdisciplinary Development Studies.

1. Introduction

Cooperation models have historically been linked to the beginnings of human organisation and traditional associative models, eventually contributing to the collective social fabric's structures and becoming part of people's present and future paths to development (Pinho, 1962). Networks are a specific collaborative model whose trajectory has accompanied humanity's evolution over time and which has been taking on a more prominent role in recent years. Networks are especially important to globalisation, alter-globalisation, societal challenges and the development of the predatory approach intrinsic to capitalist and globalisation models. Personal and organisational relationships have occupied a particularly prominent role within alter-globalisation (Breda, 2010; Baggio, 2017).

Networks consist, in their most basic form, of a set of nodes connected by multiple links that represent the social relationships at different levels established between the independent actors involved (Borgatti & Foster, 2009; Echebarria, Barrutia, Aguado, Apaolaza & Hartmann, 2014). Despite networks' quite diverse, complex and segmented components, this concept is a decisive factor in tourism's contributions to countries and regions' development and socioeconomic evolution (Breda, 2010; Breda & Costa, 2013; Brandão, Breda & Costa, 2019). Networks are characterised by relationships and interdependencies between various groups and individuals, including employees, customers, suppliers, governments, or local community members. Together these actors contribute to the implementation of joint strategies, in order to achieve common and personal goals (Freeman, 1984). Cooperation models' complex nature requires deeper insight into and a fuller understanding of the systems and connections involved, making analyses of the existing relationships imperative, given their ability to create opportunities, constraints or values that can affect entire networks of actors (Sotarauta, 2010; Baggio, 2017).

As a result, the literature shows an increase in the number of studies of networks and the social conglomerations on which they are based, especially in the field of tourism (e.g. Breda, 2010; Presenza & Cipollina, 2010; Kimbu & Ngoasong, 2013; Nogueira & Pinho, 2015; Jesus & Franco, 2016; Baggio, 2017; Brandão, Costa & Buhalis, 2018; Brandão et al., 2019; Cehan, Eva, Iaçu & Costa, 2020; Stoddart et al., 2020). The growing attention paid to this topic has contributed to encouraging and promoting existing networks' socio-cultural and economic development, new cooperation models' creation and destinations' increased competitiveness (Jones, 2005; Wilke, Costa, Freire & Ferreira, 2019). Currently, a paradigm shift can be observed due to the mounting pressure on both organisations and governments to adopt new cooperative competition approaches in which networking and network relationships have an essential role (Morgan, Brooksbank & Connolly, 2000).

From a tourism perspective, networks of stakeholders' geographical dispersion and the lack of cohesion and structure among those who plan and manage destinations apparently can be minimised by applying improved models of cooperation and identifying potential partnerships. These strategies foster dialogue and negotiation aimed at developing destinations and generating joint, universal and individual benefits in the medium and long term. However, actors' geographical proximity has been shown to favour knowledge, information and innovation transfer. Sharing is facilitated by network members' regular personal contact, which promotes mutual trust, cooperation among network members and attainment of the desired level of success (Dziadkowiec, Wituk & Franklin, 2015; Brandão et al., 2018; Lohmann, Brandão, Rodrigues, & Zouain, 2021).

Helix innovation models (i.e., triple, quadruple and quintuple) include a set of different actors essential to systems' innovation, success, competitiveness and proper functioning. These actors include educational institutions, which generate kno-

wledge, and organisations that facilitate this knowledge's creation and transfer through their activities. In addition, governments play a regulatory and supporting role, creating the ideal and necessary conditions for innovation's development and promotion. Societies, in turn, aggregate the public's cultures, lifestyles and values, as well as the media, offering distinct views on the creation of knowledge and innovation processes. Finally, the environment inevitably influences the societal challenges faced by network actors regarding socio-ecological aspects (Etzkowitz & Leydesdorff, 2000; Aarsæther, Nyseth & Bjørnå, 2011; Casarmona, Sapia & Soraci, 2015; Lew, Khan & Cozzio, 2016; Carayannis, Grigoroudis, Campbell, Meissner & Stamati, 2017; Galvão, Mascarenhas, Marques, Ferreira & Ratten, 2019; Lohmann et al., 2021).

Based on the existing models, the present study developed an innovative cooperation model by adapting the proposed regional network concept to fit helix innovation models, in general and, in particular, the quintuple helix model as it is the most complete and integrative. The latter model worked well in the research context in question, providing support for the Tua Valley Regional Natural Park's (PNRVT) Astrotourism Project and the cooperative convergence of regional actors and promoting sustainable sociocultural and economic development. This approach allowed the relevant actors to respect the specificities and sources of resistance traditionally present in inland subregions.

The above findings were incorporated from the beginning into the present qualitative research. The study's main objectives included analysing regional stakeholders' perspectives on the concept of network and evaluating these entities' willingness to join a new form of cooperation based on the quintuple helix model. Interviews of regional stakeholders were conducted to generate more information about their views on networks, their participation in similar structures, ways that these actors operate within networks and cooperation's advan-

tages and disadvantages. In addition, the interviewees were asked to provide fresh input and predictions regarding the proposed network model's application in the Tua Valley region.

After this brief introduction, the next section details the results of a literature review focused on network theory, the role these systems play in regional development and tourism and the helix models of innovation (i.e., triple, quadruple and quintuple). The third section describes the methodology adopted, followed by section four with the results and discussion. The final section provides the conclusions, implications, limitations and suggestions for future investigations.

2. Literature review

2.1. Collaborative networks

The literature review detected different opinions and concepts regarding networks, which Echebarria et al. (2014) define simply as a set of actors linked by a series of nodes. Sotarauta (2010), in turn, sees networks as a series of social relationships at different levels established between independent actors. Another perspective is that networks consist of a spontaneous agreement amongst the member actors involving, as a rule, a sharing process capable of producing positive results and increasing competitiveness (Nicolini, 2003; Wilke et al., 2019).

Networks can also be characterised as a set of three, or more, legally autonomous organisations, working together to achieve individual and common goals created by the network actors themselves or by external entities such as the government. Networks thus become complex organisms that require a more comprehensive explanation that goes far beyond what the available theories provide (Provan & Kenis, 2007). From another standpoint, networks can appear as an organisa-

tional resource that allows a limited number of people, organisations or institutions to work together to achieve a common goal that they would not be able to attain individually. This cooperation is characterised by the sharing and transfer of information, knowledge, resources, efforts and opportunity creation – whether business-related or not – thereby becoming an important process that strengthens relationships between individuals and organisations (Jesus & Franco, 2016).

Hadjimichalis and Hudson (2006) further focus their definition on the distinct character of – and spatiality created by – the nodes and links that exist between network actors. More fundamentally, the cited authors concentrate on the inequalities and hierarchical power relationships found within network models, which sometimes carry over from the pre-creation phase. These imbalances generate variations between nodes and links, specific influences and democratic and participative disparities within these networks.

From the start, tourism research has clearly shown that networks are complex and that they involve various actors, activities and connections, with all models revealing an unequal power distribution. Complex structures have been observed to have low-density connections, little agglomeration and negative correlations and a tendency for tourism stakeholders to evade some forms of collaboration and cooperation. Thus, a better understanding is needed of the structural characteristics of destinations, tourism supply chains and their potential for creativity and innovation to be able to identify strategic weaknesses in destinations' level of cohesion. This information could be useful to political and governance organisations seeking to strengthen destinations' networks (Baggio, 2017).

Within global management, networks are considered an important form of multi-organisational governance that, due to their creative and disruptive nature, challenge traditional power structures (Airaksinen & Åström, 2009). Similar to the cooperative movement, even networks operating in

business markets have from the start had a progressive spirit in opposition to the capitalist system. Networks are an effective response to global market challenges as they help companies become more mobile, competitive and suited to entering into the current volatile markets (Nunes, Reto & Carneiro, 2001). In addition, networks generate intrinsic capital because they combine economic effectiveness with primordial democracy and organisational structure – a feature that distinguishes networks from other social models (Defourny, 1987).

Networks rely on different forms of governance, such as a shared approach in which all organisations within the network have a management role. Other patterns concentrate the responsibility for keeping the network functional around one central actor or follow an intermediate governance mode in which each organisation or actor takes turns being responsible for the network's overall management (Provan & Kenis, 2007). The number of actors in networks is one of the most common problems regarding their management because this variable can affect the coordination of members' needs, activities and goals. As the number of network participants increases, the existing connections and relationships also multiply, adding complexity to the entire process.

Given this issue, shared governance between actors could be the best option since control is maintained within the structure, which facilitates direct, active contact when problems arise. This strategy can be more effective in small networks of organisations. When a network grows too large, shared governance can produce communication problems between participants, particularly if they are geographically separated (Provan & Kenis, 2007; Partelow & Nelson, 2020).

Concurrently, the main stakeholders' identification within a specific network contributes to the dynamics and characteristics of the relationships associated with governance, such as local communities' involvement. Identification also

helps key members understand how to increase trust between the different stakeholders (Martini & Buffa, 2015). These actors' confidence in their networks can be enhanced through commitment, shared information and knowledge and a consolidation of relationships, all of which express actors' willingness to be part of the network (Presenza & Cipollina, 2010).

Based on the above findings, an example of a network model (see Figure 1) was developed, that focuses on a broader definition of networks and

the concepts, characteristics and attributes associated with them and their governance. This visualisation can contribute to helping networks to function more appropriately, given that they must be based on mutual trust and cooperation among their actors, as well as on communicating, sharing and exchanging knowledge, information or resources. The network model applied must respect all the principles of democracy and reciprocity to achieve the established goals and objectives.

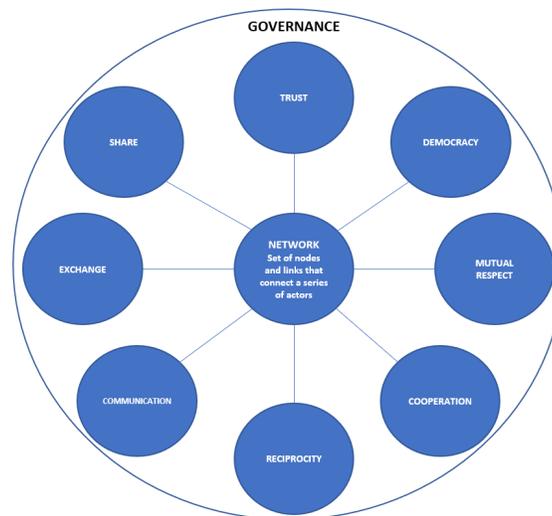


Figure 1 | Example model of network and governance
Source: Adapted from Echebarria et al. (2014), Sotarauta (2010), Nicolini (2013), Provan and Kenis (2007), Martini and Buffa (2015), Presenza and Cipollini (2010) and Defourny (1987)

2.2. Networks, regional development and tourism

In its widest sense, globalisation occurs at different levels and in diverse geographical frameworks, but it must be able to embody appropriate strategies at a regional level. According to Coe, Hess, Yeung, Dicken and Henderson (2004, p. 468), 'one of the many paradoxes of "globalisation" processes is the continuous meaning of "regions" in the sense of subnational spaces as the focus of economic activity.' Echebarria et al. (2014, p. 30) argue that this regional level helps 'explain global competitiveness' since local disputes for power and influence

are a constant (Sotarauta, 2010).

This dynamic has captured academics and politicians' attention (Lundvall, Johnson, Andersen, & Dalum, 2002; Iammarino, 2005; Hadjimichalis & Hudson, 2006), and they see network connections as a tool capable of improving regions' skills and performance. Thus, regions have become the new unit of analysis for those seeking to organise learning systems that can explore all the aspects of the knowledge needed to foster local sociocultural and economic development. These systems enable the construction and continued existence of regional networks that promote the mobilisation of endogenous resources, thereby functioning

as an important factor in generating the economic impulse towards development (Morgan et al., 2000; Hadjimichalis & Hudson, 2006; Brandão et al., 2018).

Local or regional development has been found to occur as a result of complex, interdependent flows of resources, capital and people. Local and regional contexts are also of the utmost importance as they play a key role in shaping development patterns and policy responses (Pike, Rodríguez-Pose & Tomaney, 2017). Sustainable development, in turn, is seen as an important approach at the regional level that is capable of providing solutions, promoting sustainability and fostering an appropriate balance between social, economic and environmental aspects (Burandt, Lang, Schrader & Thiem, 2013).

Encouraging environmentally sustainable tourism requires socially appropriate networks and collective decisions to create balanced relationships between network actors' needs and provide benefits to host communities. This approach also encourages a more conscious use of the available natural, human or capital resources (Martini & Buffa, 2015; Cehan et al., 2020). In addition, the organisational network model's benefits in terms of destinations' operations must be encouraged as these positive results facilitate relationships between stakeholders and bring added value to the relevant systems. Networks thus help position sustainability as an effective tool for tourism innovation (Presenza & Cipollina, 2010; Fernandes, Brandão, & Costa, 2017; Brandão et al., 2018; Brandão et al., 2019).

In tourism, networks can be described as complex, ever-changing entities, in which multiple actors coexist (Presenza & Cipollina, 2010) and which are supported by micro, small and medium-sized enterprises (SMEs) and other simpler organisational structures (Kimbu & Ngoasong, 2013). Networks thus imply the identification and creation of partnerships essential to developing regional competitive advantages (Breda, 2010; Brandão et

al., 2018; Wilke et al., 2019; Cehan et al., 2020). This business strategy operates between the level of SMEs and the larger sphere of company operations and tourism activities and tends to lead to new models and strategies' emergence, facilitating access to resources, knowledge, markets and technologies (Breda, 2010). Networks can even catapult organisations into global competition through cooperation.

However, not all tourism in rural and remote areas is community-based as sometimes the surrounding region is merely used as a backdrop for this sector, leaving the local community without opportunities for active participation. Regional networks thus play a highly important role in boosting communities and regions, given that this cooperation model's social capital encourages interactions between actors, being a vehicle for regional growth (Brandão et al., 2018). Therefore, networks function as a development-boosting source of ideas or resources since members can take advantage of network-based cooperation and communication (Stoddart et al., 2020).

Multiple tourism stakeholders must be considered, whether they are individuals, groups, companies or institutions, as long as they are interested in an activity, project or programme under development. Sustainable regional development, innovation and tourism promotion should, therefore, involve the creation of efficient networks that are centrally coordinated and shared by local institutions and communities – both of whom play a significant role in tourism (Fernandes et al., 2017). These stakeholders depend on each other for success in managing resources, planning tourism activities and generating benefits while developing strategic market positions combined with strong partnerships (Camagni & Capello, 2002; Asheim & Gertler, 2005; Breda, Costa & Costa, 2006; Airaksinen & Åström, 2009; Baggio & Cooper, 2010; Breda, 2010; Niosi, 2010; Kimbu & Ngoasong, 2013; Esparcia, 2014; Nogueira & Pinho, 2015; Jesus & Franco, 2016; Brandão et al., 2018; Bran-

dão et al., 2019; Lohmann et al., 2021; Elvekrok, Veflen, Scholderer, & Sørensen, 2022).

All organisations almost inevitably end up being part of a cooperation structure, but, evidently, few stakeholders actively participate in their networks' activities, when these exist purely to provide insights into how the networks work without focusing on the reason for their existence (Aldrich & Zimmer, 1986; Stoddart et al., 2020). Collaborative networks should function as instruments to achieve members' common and individual objectives through shared resources, knowledge and technology. Networks can also confer great competitive advantages to organisations, especially when a more comprehensive, inclusive, participative and democratic approach is applied. These systems thus have the potential to ensure development and economic growth in the medium and long term, as well as generating respect for cultural and social heritage and economic structures (Granovetter, 1985; Aldrich & Zimmer, 1986; Aldrich et al., 1991; Burt, 1992; Cooper, Folta & Woo, 1995; Hansen, 1995; Andersson & Karlsson, 2007; Weterings & Ponds, 2009).

Authors have examined networks from multiple angles, with some researchers addressing the way different actors relate to each other and others focusing on the levels of legitimacy and access to power and the resources made available within the framework of collaboration. Various scholars report that the circulation of information and knowledge primarily benefits members with a higher status within networks, while other experts approach interactions from a hierarchical perspective in terms of actors' contributions to networks and benefits members derive from their in-network position. Researchers have also advocated constructing network models based on three fundamental pillars: stakeholder representation, community involvement and clarity and transparency in network formation processes (Baggio & Cooper, 2010; Aarsæther et al., 2011; Kimbu & Ngoasong, 2013).

Overall, stakeholders' power and its legitimacy in the eyes of their peers are the characteristics most often used to differentiate between and describe members' roles within cooperation models. The creation of networks of stakeholders thus focuses on the relationships between them, on communication and on the distribution of power and resources (Martini & Buffa, 2015). In addition, this field still has a long way to go given the lack of realistic studies on these organisational networks' operationalisation, requiring deeper examinations of their inequalities, asymmetries and democratic deficits. Findings should include real-life illustrations based on practices, which are shaped by hierarchies and asymmetric power (Hadjimichalis & Hudson, 2006; Aarsæther et al., 2011).

2.3. Helix models of innovation

As mentioned previously, knowledge in the context of networks is a central component of innovation, increasing its chances of success, prestige and competitiveness. Thus, universities and other educational institutions are understood to be the nucleus of knowledge and innovation's generation and transfer, actively supporting and developing research activities. In addition, industries and the relationships between organisations, entities and companies facilitate this knowledge creation and distribution. Know-how and innovation are combined to develop investment activities that allow different network actors to benefit from interactions with educational institutions or other members. The government also occupies a prominent position because of its regulatory and guidance functions, thereby establishing the necessary conditions for innovations' development and promotion. However, local officials' power may vary from region to region (Casaramona et al., 2015; Lew et al., 2016; Galvão et al., 2019).

All the above actors (i.e., academia, organisations and governments) play essential roles within

networks. Higher education institutions (HEIs) generate and make knowledge available to these systems, while other organisations obtain and commercialise this knowledge. Governments establish legal frameworks and support innovation activities in teaching and research institutions, as well as other organisations and companies. These three elements make up the triple helix model (see Figure 2) developed by Etzkowitz and Leydesdorff (2000). This model consists overall of an innovation system and describes the relationships between its actors. The triple helix approach has contributed to regions' socioeconomic development as the model advocates a knowledge-based society – an idea that has played a prominent role in public policies and has been adopted as a strategy in multiple countries (Aarsæther et al., 2011; Casaramona et al., 2015; Lew et al., 2016; Galvão et al., 2019; Lohmann et al., 2021).

Researchers have addressed other aspects rela-

ted to the triple helix models, including growing concerns about society and the environment, which has contributed to the evolution of the triple helix model (i.e., academia, organisations and governments) (see Figure 2). This model has been adapted to suit the most diverse contexts over time, leading to the emergence of new quadruple and quintuple helix models (see Figure 3) that add the component of society and the environment, respectively.

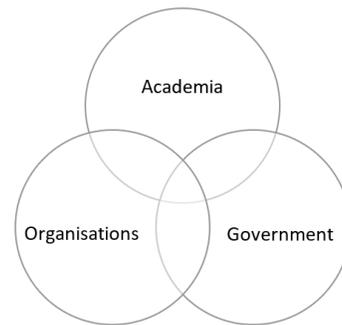


Figure 2 | Triple helix model
Source: Adapted from Etzkowitz and Leydesdorff (2000)

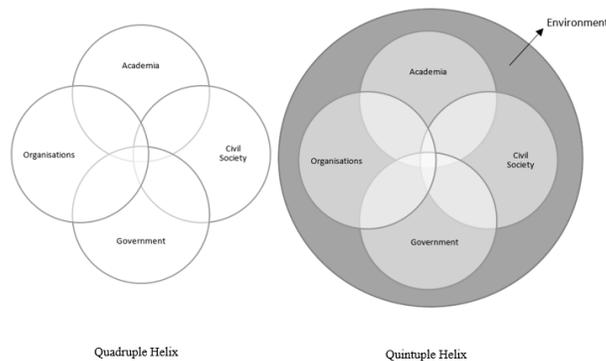


Figure 3 | Quintuple and quadruple helix models
Source: Adapted from Casaramona et al. (2015) and Carayannis et al. (2017)

The quadruple helix model (see Figure 3 above) includes academia, organisations, governments and civil societies, with the latter identified as the public as reflected in the media and cultures. The media is associated with creative industries, values, lifestyles and art, as well as a broader vision of knowledge production, innovation appli-

cation and the public's involvement in the entire process, thereby highlighting society's role (Lohmann et al., 2021). The quintuple helix model (see Figure 3 above) adds environmental issues since the surrounding natural environment influences societal challenges and network actors (i.e., social-ecological aspects) in terms of meeting soci-

eties' needs on an ecological and sustainable level (Casaramona et al., 2015; Carayannis et al., 2017).

While the triple helix model remains the most common and basic innovation model, the quadruple and quintuple helix models are conceptually broader conceptualisations, capable of shedding more light on the complexities of knowledge production and application (Carayannis et al., 2017). The quadruple helix model provides a more in-depth, comprehensive approach. However, the quintuple helix model adds environmental sensitivity to the other four variables, providing a better fit to the greatest challenges faced by contemporary society and thus making this approach the most favourable, complete and inclusive option (Galvão et al., 2019).

Sustainable development at the regional level ideally would be the creation of a common framework and uniform business ecosystem, in which educational and research institutions, organisations, governments, societies and the environment occupy central positions. This inclusive approach guarantees sustainable and responsible social and environmental growth that facilitates the promotion of innovation, cooperation and co-creation based on the helix models and reduces existing inequalities between regions (Galvão et al., 2019). These areas are seen as agglomerations of organi-

sational and institutional stakeholder ecosystems that seek to achieve sociotechnical, economic and political goals. Regional networks also have priorities, expectations and behaviours that converge and diverge and that support the relevant actors' aspirations through entrepreneurial development, exploitation and use of resources (Carayannis et al., 2017).

Given the above findings, the present study focused on implementing a proposed model to create a regional collaborative network, which would contribute to the Tua Valley region's socioeconomic, cultural, tourism and sustainable development. More specifically, this area is currently engaged in an effort to certify the region's park as a Starlight Tourist Destination. This research, therefore, found inspiration in the Cassiopeia constellation because it comprises five stars, making it naturally compatible with the quintuple helix model (see Figure 4) – the most appropriate approach to development of the geographical region under study. The Cassiopeia model comprises a network structure that seeks to improve regional tourism's integrated organisation and resource management, as well as creating new governance patterns to reinforce destinations' competitiveness. This approach is already a recognised research paradigm (see Figure 5).

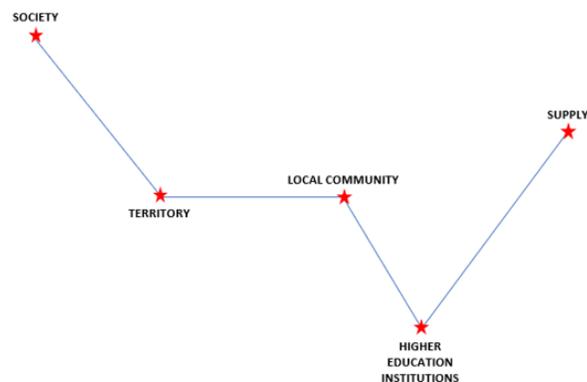


Figure 4 | Cassiopeia model
Source: Authors

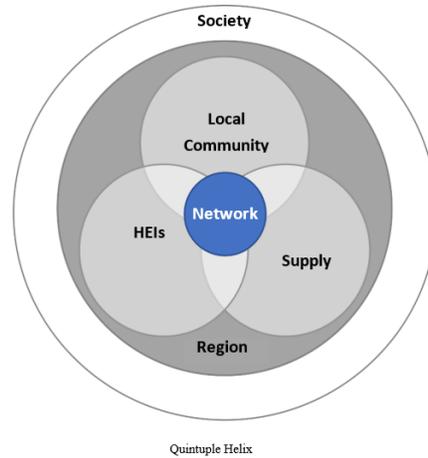


Figure 5 | Conceptual research model adapted from the Cassiopeia and quintuple helix models
Source: Authors

Academia, industries, governments, civil society and the environment have the potential to stimulate regional innovation and strengthen local smart systems (Casaramona et al., 2015). Concurrently, HEIs, supply chains, local communities and the surrounding region form a collaborative network structure that embodies an effective, driving, comprehensive, democratic, inclusive, informed and participatory model (Costa, 1996; Breda & Pato, 2014). This network fosters the emergence of co-creation efforts between the agents that make up the region's quintuple helix ecosystem and cooperation universe (Vieira & Rodrigues, 2016).

3. Method

Qualitative and quantitative methods offer distinct yet complementary images of observed phenomena. Qualitative research seeks appropriate responses by observing various social contexts and the individuals who move within them and assessing the quality of phenomena through words, reports and images. Most quantitative research, in turn, relies on more empirically objective, quantifiable and numerical data and uses technologies,

computers, statistics and formulas to analyse data (Lune & Berg, 2016). Given the innovative nature of the present study's focus on astrotourism, the investigation was based on different views and variables related to the stakeholders selected to participate in this research project. The qualitative methodology applied facilitated more detailed, in-depth data collection and generated innovative and unique contributions, as well as developing new theories and testing existing ones (Richardson, 1999; Bansal, Smith & Vaara, 2018).

To this end, a semi-structured interview guide (see the appendix) was developed for the current research in a suitable format that guaranteed the participants' security and confidentiality. The guide was sent via email to a sample of eight stakeholders considered to be potential actors in the proposed network. This approach meant a smaller database was available for analysis, but the data and results were more comprehensive and information-rich, covering aspects that could not be numerically quantified (Berg, 2007). The present study's objective was to conduct an interpretative analysis of the data collected regarding the importance, operationalisation, advantages and/or disadvantages and development of collaborative networks. The results were then applied and adapted to create a new network proposal that will leve-

rage and support the PNRVT’s Astrotourism Project and to generate new cooperation models in the region.

To achieve the above goals, this research followed the example set by Tapada, Marques, Marques and Costa’s (2020) study of the opinions and perceptions of another set of stakeholders from the same region. A different sample of actors was selected to facilitate the enrichment and diversification of the insights gained and understand the new sample’s visions and expectations regarding collaborative networks’ role in socioeconomic and cultural regional development. With this in mind, a set of representative regional institutions were identified that could, as a whole, reflect the region’s different views and understandings and encompass economic, social, associative and academic areas in order to ensure the opinions detected were representative of the region.

The selected sample of actors was interviewed during October, November and December 2019. The participants were leaders and representatives of local HEIs, business and regional development associations, PNRVT intermunicipal communities and local cooperatives. More specifically, interviewees were recruited from the University of Trás-os-Montes and Alto Douro (UTAD), Polytechnic Institute of Bragança-Mirandela (IPB), Douro and Trás-os-Montes Tourist Entrepreneurs Association (AETUR), PNRVT, Douro Intermunicipal Community (CIM Douro), Terras de Trás-os-Montes Intermunicipal Community (CIM TTM), Favaios Cooperative Winery and Murça Agricultural Cooperative of Olive Growers (CAOM)¹.

Table 1 | Respondents’ characteristics

Interviewee number	Interviewee code	Gender	Age	Occupation	Typology	Organisations	Helix component
1	HEI1	Female	40-49	Researcher	HEIs	UTAD	HEIs
2	HEI2	Male	40-49	Researcher		IPB	HEIs
3	S1	Male	>50	Chairperson	Business and regional development associations	AETUR	Supply
4	S2	Male	>50	Chairperson		PNRVT	Supply
5	T1	Male	>50	Chief executive	Intermunicipal communities	CIM Douro	Region
6	T2	Male	>50	Chief executive		CIM TTM	Region
7	LC1	Male	>50	Chairperson	Cooperatives	Favaios Cooperative	Local community
				Technical assistant		Winery	Local community
8	LC2	Female	30-39	Technical assistant		CAOM	Local community

Table 2 | Interview dimensions

Dimensions	Categories	Authors
Collaborative networks	Network concepts and opinions about networks	Nicolini (2003), Hadjimichalis and Hudson (2006), Provan and Kenis (2007), Sotarauta (2010), Echebarria <i>et al.</i> (2014)
Self-analysis	Organisation’s role and position in networks and those networks’ characteristics and functions	Aldrich and Zimmer (1986), Cooper <i>et al.</i> (1995), Breda (2010), Kimbu and Ngoasong (2013), Martini and Buffa (2015), Jesus and Franco (2016), Stoddart <i>et al.</i> (2020)
Networks, regional development and tourism	Vision and opinion of the creation of a new network in the Tua Valley region	Hadjimichalis and Hudson (2006), Baggio and Cooper (2010), Pregonza and Cipollina (2010), Nogueira and Pinho (2015), Pike <i>et al.</i> (2017)

¹In August 2020, the PNRVT became the first designated protected area to receive certification as a Starlight Tourist Destination, which was awarded by the Starlight Foundation to the five municipalities that make up the Tua Valley: Alijó, Carraceda de Ansiães, Mirandela, Murça and Vila Flor.

After all the eight representatives were interviewed, the qualitative data were analysed based on the literature review's findings presented previously. The responses to the interview questions were divided into three distinct dimensions: 1) collaborative networks, 2) self-analysis and 3) networks, regional development and tourism (see Table 2).

4. Results and discussion

4.1. Collaborative networks

The results regarding the interviewees' vision of and knowledge about networks (i.e., the first dimension) reveal that all the representatives have a solid understanding of these cooperation systems. This finding confirms the results reported by Nicolini (2003), Sotarauta (2010), Echebarria et al. (2014) and Jesus and Franco (2016). The present study's participants defined networks as a group of actors linked by a series of links and nodes based on social relationships, which generates a sharing process capable of producing positive outcomes, increased competitiveness and the achievement of shared and individual goals. The following interview excerpts contain particularly noteworthy answers. Interviewee (hereafter, Int.) 4 (Supply) said, 'a network is a set of partners that work towards a common good, although each one maintains their own identity and autonomy' (personal communication). Another representative stated:

It [a network] can be an association of organisations, companies, entities or individuals who are linked by something, [which] can be information and communication technologies, in order to benefit from – and exploit – the rapid changes that occur at the level of opportunities – [whether] bu-

usiness or implementation – created by a project. (Int.5 – HEI)

A further representative, in turn, asserted that:

[Networks are a] set of people and/or entities of the most varied types and [with divergent] interests that come together to jointly envisage, develop and execute ideas and projects of common interest [while] considering the specificities of each participant and proposed shared goals. (Int.6 – Supply)

In line with Airaksinen and Åström (2009) and Jesus and Franco's (2016) research, the majority of the interviewees thought that collaborative networks are important assets for their members as networks contain extremely useful structures. In particular, Int.4 (Supply) argued that networks are the most appropriate response to current challenges, which relates back to Nunes et al. (2001) and Galvão et al.'s (2019) findings concerning the quintuple helix model. In addition, Int.6 (Supply) and Int.8's (Community) answers can also be highlighted as they consider networks to be a great organisational resource, especially for the most underprivileged regions, because of networks' effect on the relevant economic impulses. Hadjimichalis and Hudson (2006) and Echebarria et al.'s (2014) results also provide support for this finding.

Another representative suggested that, 'in an increasingly complex and interdependent world, they [networks] are the most appropriate response to this complexity because they enable inter- and transdisciplinary work' (Int.4 – Supply). Int. 6 (Supply) also said, 'they are a great asset to the development and pursuit of common goals, projects, and purposes.' A final relevant comment was that 'they [networks] bring added value, especially to "less favoured" regions such as Trás-os-Montes' (Int.8 – Community).

4.2. Self-analysis

The second dimension of the interviews is the representatives' self-analysis. A set of questions were formulated to develop a fuller understanding of whether the selected entities take part in networks, what their role is in those systems, who the other actors are and who plays a central role. Other aspects explored were what the representatives thought about their organisations' networks, what benefits and difficulties they perceived in these systems and, finally, how knowledge is transferred within networks.

According to Aldrich and Zimmer (1986), most organisations now almost inevitably become part of collaborative networks, so, not unexpectedly, all the representatives reported that their organisations are part of one or more networks, with the exception of Int.3 (Community). Notably, Int.2 (Region) stated that the organisation itself is a collaborative network, affirming that 'it is a network of municipalities and it is part of a set of regional collaborative networks' (Int.2 – Region). Int.7 (Region) said something similar, namely, 'I think that it [our organisation] can be considered an institutional collaborative network [of] municipalities and public administration entities, with the main goal of increasing [the number of] projects that promote the social and economic development of the region' (Int.7 – Region). Int.5 (HEI), in turn, acknowledged that their organisation is part of 'several [networks], for example, higher education networks'.

Regarding the role that each actor has in their networks, their position in the system can be defined and identified through the actors' power and legitimacy in the eyes of their peers, as argued by Martini and Buffa (2015). The response offered by Int.5 (HEI) stands out as their organisation constitutes 'a node with well-defined characteristics, similar to those of other nodes but with distinctive functions compared to [other nodes]' endogenous characteristics.'

Int.6 (Supply) referred to the networks' multifunctional features given that 'participation in different networks is carried out at various levels. In some cases, [members] assume a directive role, [while], in others, [their role] is an advisory, participative or cooperative one' (Int.6 – Supply). Int.8 (Community) stressed that 'it is the "thread" that unites each "point" that makes up the network.' Overall, the interviewed entities were aware of their role in their own collaborative networks, emphasising their contributions as coordinators and participants, especially Int.2 and Int.7 (both Region).

Regarding the question about the other actors in the networks, the importance of identifying these systems' main stakeholders has been highlighted in previous research (Martini & Buffa, 2015). In the present study, no representative had difficulty identifying several other members, providing evidence of the distinct, heterogeneous nature of their networks. An interviewee mentioned 'other museums, municipalities, parishes [and] local associations' (Int.1 – HEI). Still another referred to 'other higher education institutions' (Int.5 – HEI). A further representative reported that many actors are 'also integrate[d into] networks – municipalities and administrative bodies, foundations, associations, cooperatives, universities, companies and people – [at] both [the] national and international [level]' (Int.6 – Supply).

Still, with regard to the actors that make up the networks to which the interviewees' organisations belong, one question specifically addressed the issue of relationships between members. Sotarauta (2010) notes that a network can be described as a series of social relationships, which was supported by Int.2 (Region), Int.4 (Supply) and Int.5's (HEI) assertion that they relate in similar ways to all the other network actors. However, the remaining representatives mentioned a particular set of members either because of their central role in the networks or their closer relationship with the interviewees' organisation. For example, Int.6 (Supply) stated that they have 'a strong relationship . . .

with all network partners depending on the project and goal in question’.

According to Baggio (2017), the actors who play a more central role within their networks can be identified by analysing tourism networks using the relevant tools. The most important members are those who are known for making the most significant contributions to their networks or those who benefit from a good position within these systems. The interviewees’ responses tended to be quite specific, with Int.2 (Region), for instance, arguing that the most central roles are played by ‘network coordinators’. Int.4 (Supply), in contrast, did not distinguish between members and suggested that all actors occupy prominent positions, which is in line with Int.8 (Community) and Int.5’s (HEI) opinions. The latter asserted that ‘each node is equally important. The network is homogeneous.’.

Hadjimichalis and Hudson (2006), nonetheless, found that inequality is a common problem within networks due to power abuse and hierarchies, which generate a lack of democracy and an imbalanced participation. Actors’ activities and needs thus need to be coordinated through members’ shared governance to facilitate contact and avoid communication problems. Provan and Kenis (2007) argue that different forms of governance exist: responsibilities shared among all members, responsibility given exclusively to one actor or intermediary forms. The latter cited researchers suggest that all types of governance are valid and constitute management mechanisms capable of responding to networks’ needs, so members must choose the best option to guarantee their network functions properly.

In addition, for organisations competing globally, collaborative network models facilitate access to resources, knowledge, markets and technologies (Breda, 2010). New models and strategies have emerged that help companies overcome possible difficulties and match their products to globalised markets. Networks, however, are also

characterised by positive results generated by the entire system, which would normally not be achievable for each actor individually (Provan & Kenis, 2007; Brandão et al., 2019).

The interviewees’ answers were more heterogeneous regarding the benefits that organisations derive from their networks, particularly tourism destinations and stakeholders (Presenza & Cipollina, 2010; Elvekrok et al., 2022), but all the representatives recognise collaborative networks’ advantages. Int.2 (Region) highlighted ‘solving common problems [and] strengthening the [members]’ “power” to claim [resources].’ Int.6 (Supply) reported that:

There are direct benefits, such as harnessing synergies, harnessing financial assets [and] distributing tasks, ... [as well as] specific contributions and all [the benefits] associated with economies of scale. Other indirect benefits ... [are] exchanges of experience and knowledge sharing. It is an important benefit for everyone to accumulate and leverage the results achieved and the ones [still] to be obtained.

Int.7 (Region) also mentioned ‘the implementation of cross-cutting projects or activities in a region with specific weaknesses’.

The topic of the difficulties or disadvantages that the representatives perceive in their networks brings up the previously mentioned finding that networks must be based on trust and cooperation between its actors. These systems are further dependent on communicating, sharing and exchanging knowledge, information or resources. Above all, the principles of democracy and reciprocity must prevail so that, together, members can achieve established goals and objectives. However, the literature reveals difficulties related to the governance of larger collaborative networks. Communication problems are less severe in smaller networks, especially if their actors are geographically close

(Provan & Kenis, 2007).

Int.3 (Community), Int.4 (Supply) and Int.8 (Community) pointed out that difficulties arise from financial and resource-related complications. These bottlenecks can be overcome by using applications and community funds, according to Int.4 (Supply), yet other interviewees, such as Int.2 (Region), Int.6 (Supply) and Int.7 (Region), mentioned obstacles related to the members. One representative said, 'problems are related to inertia resulting from each participant's "selfishness", mistrust, lack of communication, bureaucracy and administrative difficulties' (Int.6 – Supply). Another interviewee asserted that members experience 'difficulties working as a network, sharing resources and understanding the common [benefits] gain[ed]. There is a strong tendency towards individualism and to "look inwards"' (Int.7 – Region).

The participants also observed that another constraint exists in terms of the relationships between actors within networks. This finding is in line with Stoddart et al.'s (2020) observation that, although networks are clearly important to both the tourism industry and its stakeholders, few actors engage actively in network activities. This problem was reported by Int.1 (HEI), who stated that 'the biggest difficulty is the [members'] willingness to be always present and active'.

Each organisation, however, offers something to their networks since these systems are understood as an agreement between actors who are involved in a collaborative sharing process capable of generating positive results and increasing competitiveness. These same members can benefit from exchanges of information, knowledge, resources and efforts while reinforcing their relationships with their partners (Nicolini, 2003; Provan & Kenis, 2007; Jesus & Franco, 2016; Brandão et al., 2019; Elvekrok et al., 2022).

In the present study, half the responses were similar to the literature review's findings, confirming that each actor can provide their network with specific knowledge and strengthens (i.e., their know-

how). Int.1 (HEI), Int.2 (Region), Int.5 (HEI) and Int.6 (Supply) emphasised that, in addition to knowledge, they can contribute other resources to the system. One interviewee said:

Depending on the network, ... the contributions range from knowledge, techniques [and] administrative [skills] to the most varied financial support for operations and the potential associated with regionwide representativeness rather than only that with which our organisation is associated. (Int.6 – Supply)

In contrast, Int.7 (Region) stated that all their organisation has to offer is 'the ability to think together. [It] helps to know the differences [between members].' Int.8 (Community) asserted that 'the organisations are the basis [of the system] without which the network would not exist'.

In terms of information transfer within these systems, Baggio and Cooper (2010) argue that the knowledge circulating within a network of stakeholders is an important mechanism promoting the system's overall development. The cited authors further observe that this knowledge is disseminated faster in a well-structured network with a good level of cohesion among local stakeholders. According to Presenza and Cipollina (2010), information and knowledge exchange can also increase trust among network actors. In the present research, Int.1 (HEI), Int.2 (Region), Int.4 (Supply) and Int.8 (Community) stated that information is transferred through regular meetings and online communications. Int.6 (Supply) offered a distinct perspective, namely, that knowledge circulates 'through exchanges of experience, distribution of assignments, discussions and shared definition of goals and project development'.

4.3. Networks, regional development and tourism

The last dimension of the interviews relates to the PNRVT Astrotourism Project's development and the related Starlight Tourist Destination certification. The interviewees were asked questions about networks as a tool for regional development. In this context, universities and other educational institutions are extremely important to the generation and transfer of knowledge, information and innovation as reflected in helix models (Casaramona et al., 2015; Lew et al., 2016; Galvão et al., 2019; Lohmann et al., 2021).

Most of the representatives recognise that regional HEIs are well prepared and willing to assist regional actors by addressing local needs, offering appropriate responses or providing alternative solutions upon request. Int.4 (Supply) stressed that 'these... institutions... have collaborated with this network on several levels'. Int.6 (Supply) also stated, 'without doubt, the expertise that the two organisations in question possess – due to their knowledge being grounded in the region's realities – is very important. It [HEIs' knowledge] is relevant to the issues that may emerge.' Int.7 (Region) said, 'as institutions with knowledge about the region and with highly qualified human resources and academic expertise, they [HEIs] can provide effective responses in certain areas. They should not be excluded from networks.' Overall, only Int.8 (Community) did not agree with this point of view, while Int.2 (Region) stated that the adequacy of these educational institutions' response depends on the needs involved.

Questions also sought to clarify the interviewees' perceptions of the creation of a functional network in the Tua Valley focused on regional development. The literature review found that regions are understood as agglomerations of ecosystems made up of organisational and institutional entities with objectives, priorities, expectations and sociotechnical, economic and political

behaviours that converge and diverge. Their stakeholders aspire, through entrepreneurial development, to explore and exploit resources (Carayannis et al., 2017). In addition, various authors (Cagnani & Capello, 2002; Asheim & Gertler, 2005; Niosi, 2010; Esparcia, 2014; Pike et al., 2017) argue that local or regional development can only be achieved through complex, independent flows of people, resources and capital, with all stakeholders being actively involved in decision-making processes.

In this phase of the interviews, Int.1's (HEI) opinions stand out as particularly significant. This representative asserted:

[The proposed cooperation system should be] a multi-actor network based on mutual trust and focused on common goals, including local government, educational and scientific stakeholders and representatives of civil society. [The networks must have a] light structure, shared leadership, a well-defined strategy [and] a well-focused, ... simple action plan. (Int.1 – HEI)

According to Int.4 (Supply):

A functional network in the Tua Valley or elsewhere must guarantee [not only] collaboration between the various partners but also their identity and autonomy. It must also use the new tools of digital society to facilitate communication between its members.

Int.8 (Community) also suggested that, 'for the network to be truly "functional", the different organisations must relate better, foster proximity between themselves, exchange experiences and expectations and work together as much as possible.'

Given the representatives' assertions, the idea

of forming a network in the Tua Valley proved to be a promising proposal that needs to focus on regional development. This finding was specifically confirmed by Int.3 (Community) and Int.6 (Supply), but Int.2 (Region) reacted differently. This interviewee stated, 'the focus on regional development presupposes a critical dimension that the Tua Valley does not have. [However, t]he existence of a network in the region that could respond to concrete problems would be interesting' (Int.2 – Region).

In view of the above results, the conclusion was reached that the representatives' statements are supported by Airaksinen and Åström's (2009) work. The cited researchers argue that networks consist of multi-organisational governance structures with a tendency towards decentralisation and the capacity to strengthen local and regional institutions seeking to foster development. Local community involvement and stakeholder identification are also extremely important ways to increase trust among network actors (Martini & Buffa, 2015), which can be achieved through compromise, sharing of assets and consolidation of relationships (Presenza & Cipollina, 2010).

Interviewees' responses varied to the question about their networks' relationship with the Tua Valley. Int.1 (HEI), Int.2 (Region), Int.4 (Supply), Int.5 (HEI's), Int.6 (Supply) and Int.7 (Region) reported having links with the region, which are shared (Int.5 – HEI), synergistic (Int.6 – Supply) or development-focused (Int. 4 – Supply). In contrast, Int.3 (Community) and Int.8 (Community) had no formal relationships with organisations in the Tua Valley region.

Thus, the views expressed by the representatives indicate that the ideal approach would be to create a common business framework and ecosystem. In this network, teaching and research institutions, organisations, governments, society at large and the environment occupy key positions and ensure sustainable social and environmental growth. The network must be based on the quin-

tuple helix model to reduce the inequalities that exist between regions (Galvão et al., 2019).

The last question asked of the stakeholders was related to the activities or sectors that the network can transform, foster, boost or strengthen. Because networks play an extremely important role in communities and regions' successful development, these systems should be able to mobilise endogenous resources. Network actors function as a source of or resource for development, as a result of cooperation and communication (Hadjimichalis & Hudson, 2006; Burandt et al., 2013).

The interviewees' statements are in line with the cited authors' findings, especially those of the following representatives. Int.1 (HEI) stated that networks can strengthen 'culture, regional dynamics [and] the valorisation of the people, products and services of the Tua Valley'. Int.2 (Region) added that the proposed network can assist in the areas of 'active ageing, social support, tourism [and] rural development'. Int.3 (Community), Int.6 (Supply) and Int.7 (Region) advocated a more targeted vision of the tourism sector, specifically 'tourism – accommodations [and] restaurants – local businesses, agro-industries and services' (Int.6 – Supply). Another interviewee said, 'it [the network] can boost tourism based on natural, heritage, gastronomic and cultural resources' (Int.7 – Region). Int.8 (Community) instead drew attention to the need to boost the agricultural sector since it is currently considered one of the most vulnerable parts of the region's economy.

An analysis of the results confirmed that all the participants are acquainted with the concept of network as defined by Nicolini (2003), Sotarauta (2010), Echebarria et al. (2014) and Jesus and Franco (2016). Concurrently, most interviewees' responses verified that networks are an important asset for their actors, asserting that these cooperation models are the best response to current challenges. Similar to the vast majority of existing organisations, the entities represented are either part of one or more networks or are one

themselves (Aldrich & Zimmer, 1986; Nunes et al., 2001; Hadjimichalis & Hudson, 2006; Airaksinen & Åström, 2009; Echebarria et al., 2014; Jesus & Franco, 2016; Galvão et al., 2019).

The results clarify the roles the interviewees' organisations play in their networks and show that these systems comprise a series of social relationships at different levels (Sotarauta, 2010). All the surveyed representatives were able to identify their organisation's functions in their network quite easily, in particular their roles as coordinators and participants.

When asked to identifying other actors in their networks, no interviewee had difficulty identifying their organisation's peers. Some representatives stated that they engage with all network members in the same way, while other participants mentioned only a particular set of actors with whom they interact due either to their position in the network or to their closer connection. Although all the interviewees identified other actors in their network, few could point out those that have a more central role. Various representatives could identify one such actor, whereas others could not single out any central actors, claiming instead that they all hold prominent positions.

As for the benefits that organisations derive from their networks, nearly the entire sample acknowledged the cooperation model's advantages. The latter include sharing knowledge and information, providing access to new markets, engaging in joint projects or even offering mutual support to overcome obstacles (Provan & Kenis, 2007; Breda, 2010; Presenza & Cipollina, 2010; Elvekrok et al., 2022). Among the difficulties perceived by these representatives, the most frequently mentioned are financial constraints, scarce resources, network organisation, relationships between actors and a lack of active involvement. The latter has already been highlighted by Stoddart et al. (2020) as a com-

mon challenge.

The organisations in question are most often thought to offer their networks knowledge and expertise. The transfer of information and know-how was mentioned by half the sample, reporting that the organisation they represent does this on a regular basis through meetings and online communication. One interviewee indicated that their organisation contributes by delegating tasks and discussing with other actors the goals to achieve and projects to develop, which is consistent with the literature review's findings (Nicolini, 2003; Provan & Kenis, 2007; Baggio & Cooper, 2010; Presenza & Cipollina, 2010; Jesus & Franco, 2016).

Various authors (Casaramona et al., 2015; Lew et al., 2016; Galvão et al., 2019; Lohmann et al., 2021) have noted that knowledge and information transfer has proved to be an essential factor in collaborative networks' proper functioning and success, so HEIs and other educational organisations are extremely important to knowledge and innovation's creation and flow. This result was confirmed by the representatives interviewed, who praised regional universities' role in meeting local needs and advancing the search for the best alternatives.

The present study's findings thus support the proposed innovative and integrated network for the Tua Valley region based on the Cassiopeia and quintuple helix models (Figures 6 and 7). The new network shown in Figure 7 was adapted to fit the region's realities and its actors' distinct nature, and the network was supported and welcomed by the interviewed stakeholders. The proposed model is considered to be quite important to local development and to the dynamic exploration and valorisation of endogenous resources (Camagni & Capello, 2002; Asheim & Gertler, 2005; Hadjimichalis & Hudson, 2006; Niosi, 2010; Burandt et al., 2013; Esparcia, 2014; Pike et al., 2017).

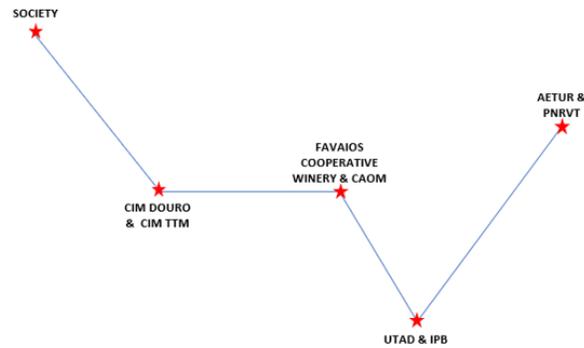


Figure 6 | Cassiopeia model adapted to fit the region
Source: Authors

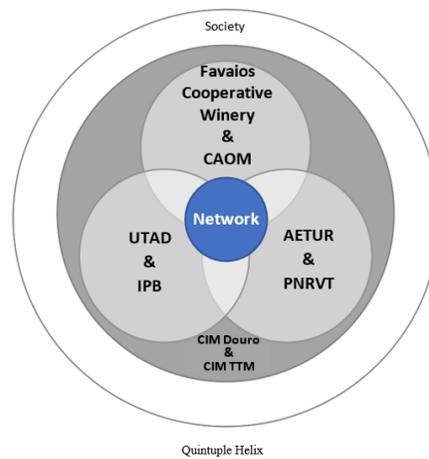


Figure 7 | Proposed network model adapted to fit the region based on the Cassiopeia and quintuple helix models

5. Conclusions, limitations, implications and suggestions for future research

5.1. Conclusions

By collecting data from different regional actors, this research contributed to a fuller understanding of their positions in their existing networks, as well as identifying any difficulties experienced and determining the ways these models function in the real world. The results reveal a series of problems within networks that should be addressed by policymakers, such as poor communication and cooperation between actors, a lack of active participation, excessive bureaucracy and challenges in securing financial and other resources.

Most of the interviewees were already strongly

connected to the region under study, so the interviewees provided a generally homogenous vision of the creation of a new network in the Tua Valley. The representatives felt the proposed network could work as a driving force, offering a structure around which the region’s economic, social, academic and cultural activities could organise and strengthening and boosting the region while valuing local agents and communities.

Therefore, in the scope of astrotourism, it is believed that the creation of a new network can contribute, both in the protection and enhancement of the night sky resource, which constitutes the tourism product, as well as in its sustainable marketing, by creating a collaborative structure that gathers efforts so that this new tourism valence achieves the desired success.

Accordingly, this new regional network, proposed under the scope of astrotourism, fits perfectly into the quintuple helix model, as it comprises the environmental aspect of protecting the night sky and is composed of a multiplicity of local actors, including local authorities, organisations, companies, associations, educational and academic institutions and, of course, communities that, together, will contribute to the success of the PNRVT project.

To sum up, this research allowed, through the testimonies collected, to have a more practical vision of how the governance of these cooperation models is made, contributing to explore new directions of research on the governance of networks, their dynamics, how their actors communicate and what are the difficulties and less positive aspects of these cooperation models and serving to enrich the existing literature on the theme of networks and astrotourism. Since the set of institutions consulted carries relevant aspects of knowledge, perspectives and diversity that can embody the cornerstone for the creation of a new model that serves the regional design, it can be said that this research is the first step towards the creation of a new cooperation network in the Tua Valley, by encouraging the boosting of synergies between the various actors and the model of the quintuple helix, in order to improve, foster and promote sustainable development.

5.2. Limitations

The results are in line with the literature review, but they have some limitations related to the recent advent of astrotourism, especially in Portugal's Northern region, and the sample size. Another limitation is the open-ended interview questions, which allowed the participants to interpret the questions freely and answer based on their subjective analysis. Given the complexity of network systems and their importance to tourism

development as a catalyst for countries and regions' growth, improvement and evolution, future research should seek to increase the sample's size and diversity. In addition, further investigation is needed to provide a more in-depth characterisation of network actors and their relationships. Researchers could also adopt a mixed methodology (i.e., quantitative and qualitative).

5.3. Implications

By confirming collaborative networks' importance and benefits, this study's findings contribute to the alignment and definition of new regional strategies and innovative policies that encourage the creation and development of new networks in order to help local organisations achieve common goals. The proposed model should help individual organisations optimise their existing networks' resources and improve their relationships with other actors. In addition, this research was the first step towards the construction of a new collaborative network in the Tua Valley, fostering synergies between multiple regional actors based on the quintuple helix innovative model to improve, stimulate and actively promote sustainable regional development.

5.4. Suggestions for future research

The present results contribute to the enrichment of the existing literature on networks and astrotourism. This research can also serve as a starting point for further studies of networks. Specific topics to explore include the nature of the relationships and connections between actors, definition of the objectives and goals to be achieved, the best methodologies to apply and governance strategies adopted and the role and importance of networks in tourism, specifically in the development of niche or special interest products such as astrotourism.

The findings could provide a better understanding of the ways networks actually function. The Tua Valley's business fabric is closely related to family businesses and their connection to regional development. Thus, this factor should also be considered in future investigations in order to clarify what relationships exist between actors, which dimensions affect the desired local development and what changes or adjustments are needed.

Acknowledgements

This work was supported by national funds received through the FCT – Portuguese Foundation for Science and Technology [projects UIDB/04011/2020 and UIDB/04728/2020].

References

- Aarsæther, N., Nyseth, T., & Bjørnå, H. (2011). Two networks, one city: Democracy and governance networks in urban transformation. *European Urban and Regional Studies*, 18(3), 306-320. doi:10.1177/0969776411403988
- Airaksinen, J., & Åström, J. (2009). Perceptions of power in regional networks: A Nordic comparative analysis. *Local Government Studies*, 35(5), 595-614. doi:10.1080/03003930903229721
- Aldrich, H. & Zimmer, C. (1986). Entrepreneurship through social networks. In D. Sexton & R. Smiler (Eds.), *The Art and Science of Entrepreneurship* (pp. 3-23). New York: Ballinger.
- Aldrich, H., Birley, S., Dubini, P., Greve, A., Johannisson, B., Reese, P.R., & Sakano, T. (1991). *The generic entrepreneur? Insights from a multinational research project*. Paper presented at the Babson Conference on Entrepreneurship, Pittsburgh.
- Andersson, M., & Karlsson, C. (2007). Knowledge in regional economic growth: The role of knowledge accessibility. *Industry and Innovation*, 14(2), 129-149. doi:10.1080/13662710701252450
- Asheim, B.T., & Gertler, M.S. (2005). The geography of innovation: Regional innovation systems. In J. Fagerberg & D.C. Mowery (Eds), *The Oxford handbook of innovation* (pp. 291-317). United States: Oxford University Press Inc., New York.
- 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. doi:10.1080/02642060903580649
- Baggio, R. (2017). Network science and tourism – The state of the art. *Tourism Review*, 72(1), 120-131. doi:10.1108/TR-01-2017-0008
- Bansal, P., Smith, W.K., & Vaara, E. (2018). New ways of seeing through qualitative research. *Academy of Management Journal*, 61(4), 1189-1195. doi:10.5465/amj.2018.4004
- Basco, R. (2015). Family business and regional development – A theoretical model of regional familiness. *Journal of Family Business Strategy*, 6(4), 259-271. doi:10.1016/j.jfbs.2015.04.004
- Berg, B.L. (2007) *Qualitative Research Methods for the Social Sciences* (6th ed.). Boston, MA: Allyn and Bacon.
- Bischoff, K., Volkmann, C. K., & Audretsch, D.B. (2018). Stakeholder collaboration in entrepreneurship education: An analysis of the entrepreneurial ecosystems of European higher educational institutions. *The Journal of Technology Transfer*, 43(1), 20-46. doi:10.1007/s10961-017-9581-0
- Brass, D.J. (1992). Power in organizations: A social network perspective. In G. Moore & J.A. Whitt (Eds.), *Research in politics and society*, (pp. 295-323) Greenwich, CT: JAI Press.
- Brandão, F., Breda, Z., & Costa, C. (2019). Innovation and internationalization as development strategies for coastal tourism destinations: The role of organizational networks. *Journal of Hospitality and Tourism Management*, 41, 219-230. doi:10.1016/j.jht.2019.10.004
- Brandão, F., Costa, C., & Buhalis, D. (2018). Tourism innovation networks: A regional approach. *European Journal of Tourism Research*, 18, 33-56. doi:10.54055/ejtr.v18i.312
- Breda, Z. (2010). *Network relationships and the internationalisation of the tourism economy: The case of Portuguese overseas investment in the hotel sector* (Doctoral dissertation, Aveiro University). Retrieved from <https://ria.ua.pt/bitstream/10773/1856/1/2010000691.pdf>

- Burandt, A., Lang, F., Schrader, R., & Thiem, A. (2013). Working in regional agro-food networks—strengthening rural development through cooperation. *Eastern European Countryside*, 19, 153-176. doi:10.2478/eec-2013-0008
- Burt, R.S. (1992). *Structural Holes: The Social Structure of Competition*. Cambridge, MA: Harvard University Press.
- Camagni, R., & Capello, R. (2002). *Apprendimento collettivo e competitività territoriale*. Milano: Franco Angeli.
- Carayannis, E.G., Grigoroudis, E., Campbell, D.F., Meisner, D., & Stamati, D. (2017). The ecosystem as helix: an exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. *R&D Management*, 48(1), 148-162. doi:10.1111/radm.12300
- Casaramona, A., Sapia, A., & Soraci, A. (2015). How TOI and the Quadruple and Quintuple Helix Innovation System Can Support the Development of a New Model of International Cooperation. *Journal of the Knowledge Economy*, 6(3), 505-521. doi:10.1007/s13132-015-0253-8
- Cehan, A., Eva, M., Iatu, C., & Costa, C. (2020). Inquiring Structure and Forms of Collaboration in Tourism through Social Network Analysis. *Sustainability*, 12(19), 8161. doi:10.3390/su12198161
- Coe, N.M., Hess, M., Yeung, H. W.C., Dicken, P., & Henderson, J. (2004). 'Globalizing' regional development: A global production networks perspective. *Transactions of the Institute of British Geographers*, 29(4), 468-484. doi:10.1111/j.0020-2754.2004.00142.x
- Cooke, P. (2001). Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change*, 10(4), 945-974. doi:10.1093/icc/10.4.945
- Cooper, A.C., Folta, T.B., & Woo, C. (1995). Entrepreneurial information search. *Journal of Business Venturing*, 10(2), 107-120. doi:10.1016/0883-9026(94)00022-M
- Defournay, J., (1987). Orígenes, contextos y funciones de un tercer gran sector. In J. L. Monzón Campos & J. Defournay (Eds.), *Economía Social: Entre a economía capitalista e a economía pública* (pp. 14-39). Españã: CIRIEC.
- Dziadkowiec, O., Wituk, S., & Franklin, D. (2015). A Social Network Analysis of South Central Kansas Workforce Innovations in Regional Economic Development. *Journal of Place Management and Development*, 8(1), 6-22. doi:10.1108/JPM-08-2014-0012
- Echebarria, C., Barrutia, J.M., Aguado, I., Apaolaza, V., & Hartmann, P. (2014). Capturing the benefits that emerge from regional sustainability networks: The Castile-La Mancha network of sustainable cities and towns. *Papers in Regional Science*, 95(1), 27-49. doi:10.1111/pirs.12110
- Elvekrok, Veflen, Scholderer, Sørensen (2022). Effects of network relations on destination development and business results. *Tourism Management*, 88,104402, doi:10.1016/j.tourman.2021.104402
- Esparcia, J. (2014). Innovation and networks in rural areas. An analysis from European innovative projects. *Journal of Rural Studies*, 34, 1-14. doi:10.1016/j.jrurstud.2013.12.004
- Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and 'Mode 2' to a Triple Helix of university–industry–government relations. *Research Policy*, 29(2), 109-123. doi:10.1016/S0048-7333(99)00055-4
- Fernandes, S., Brandão, F. & Costa, C. (2017). Network-based planning for the sustainable development of tourism destinations: conceptual approach. *Journal of Tourism & Development*, 27/28(1), 1719-1731. <https://doi.org/10.34624/rt.d.v1i27/28.10223>
- Fischer, M.M. (2001). Innovation, knowledge creation and systems of innovation. *The Annals of Regional Science*, 35(2), 199-216. doi:10.1007/s001680000034
- Flecha, Â.C., Silva, A.V.C., Fusco, J.P.A., & Bernardes, A.T. (2012). Redes de empresas e seus efeitos sobre o turismo. *Revista de Administração de Empresas*, 52(4), 386-406. doi:10.1590/S0034-75902012000400003
- Forsberg, G., & Lindgren, G. (2015). Regional policy, social networks and informal structures. *European Urban and Regional Studies*, 22(4), 368-382. doi:10.1177/0969776412474663
- Freeman, E. (1984). *Strategic Management: A Stakeholder Approach*. Boston: Pitman Publishing.
- Freeman, L.C. (1984). Turning a profit from mathematics: The case of social networks. *The Journal of Mathematical Sociology*, 10(3-4), 343-360. doi:10.1080/0022250X.1984.9989975
- Freeman, R.E., Harrison, J.S., Wicks, A.C., Parmar, B.L., & De Colle, S. (2010). *Stakeholder theory: The state of the art*. New York, NY: Cambridge University Press.
- Galvão, A., Mascarenhas, C., Marques, C., Ferreira, J., & Ratten, V. (2019). Triple helix and its evolution: A systematic literature review. *Journal of Science*

- and Technology Policy Management*, 10(3), 812-833. doi:10.1108/JSTPM-10-2018-0103
- Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91(3), 481-510. Retrieved from <https://www.jstor.org/stable/2780199?seq=1>
- Hadjimichalis, C., & Hudson, R. (2006). Networks, regional development and democratic control. *International Journal of Urban and Regional Research*, 30(4), 858-872. doi:10.1111/j.1468-2427.2006.00687.x
- Hansen, E.L. (1995). Entrepreneurial Network and New Organization Growth. *Entrepreneurship: Theory & Practice*, 19(4), 7-19. doi:10.1177/104225879501900402
- Henriksen, P.F., & Halkier, H. (2009). From local promotion towards regional tourism policies: Knowledge processes and actor networks in North Jutland, Denmark. *European Planning Studies*, 17(10), 1445-1462. doi:10.1080/09654310903141631
- Iammarino, S. (2005). An evolutionary integrated view of regional systems of innovation: Concepts, measures and historical perspectives. *European Planning Studies*, 13(4), 497-519. doi:10.1080/09654310500107084
- Jesus, C., & Franco, M. (2016). Cooperation networks in tourism: A study of hotels and rural tourism establishments in an inland region of Portugal. *Journal of Hospitality and Tourism Management*, 29, 165-175. doi:10.1016/j.jhtm.2016.07.005
- Jones, C. (2005). Major events, networks and regional development. *Regional Studies*, 39(2), 185-195. doi:10.1080/003434005200059975
- Kimbu, A.N., & Ngoasong, M.Z. (2013). Centralised decentralisation of tourism development: A network perspective. *Annals of Tourism Research*, 40, 235-259. doi:10.1016/j.annals.2012.09.005
- Laplume, A.O., Sonpar, K., & Litz, R.A. (2008). Stakeholder Theory: Reviewing a Theory That Moves Us. *Journal of Management*, 34(6), 1152-1189. doi:10.1177/0149206308324322
- Lew, Y.K., Khan, Z., & Cozzio, S. (2016). Gravitating toward the quadruple helix: International connections for the enhancement of a regional innovation system in Northeast Italy. *R&D Management*, 48(1), 44-59. doi:10.1111/radm.12227
- Leydesdorff, L. (2012). The triple helix, quadruple helix, . . . , and an N-tuple of helices: Explanatory models for analyzing the knowledge-based economy?. *Journal of the Knowledge Economy*, 3(1), 25-35. doi:10.1007/s13132-011-0049-4
- Lohmann, P., Brandão, F., Rodrigues, C., & Zouain, D. (2021). The quadruple helix as a tool for innovation in tourism: A study in the city of rio de janeiro in the post-olympic period. *Tourism Planning and Development*. doi:10.1080/21568316.2021.1984287
- Lundvall, B.Å., Johnson, B., Andersen, E.S., & Dalum, B. (2002). National systems of production, innovation and competence building. *Research Policy*, 31(2), 213-231. doi:10.1016/S0048-7333(01)00137-8
- Lune, H., & Berg, B.L. (2016). *Qualitative research methods for the social sciences*. Harlow, England: Pearson Higher Ed.
- Martini, U., & Buffa, F. (2015). Local networks, stakeholder dynamics and sustainability in tourism. Opportunities and limits in the light of stakeholder theory and SNA. *Sínergie*, 33(96), 113-130. doi:10.7433/s96.2015.07
- Morgan, B., Brooksbank, D., & Connolly, M. (2000). The role of networking in the new political economy of regional development. *European Planning Studies*, 8(3), 319-336. doi:10.1080/713666409
- Nicolini, R. (2003). Local networks and regional development: Features and perspectives. *Environment and Planning A*, 35(2), 341-360. doi:10.1068/a34226
- Niosi, J. (2010). *Building National and Regional Innovation Systems: Institutions for Economic Development* (No. E14-297). Cheltenham: Edward Elgar.
- Nogueira, S., & Pinho, J.C. (2015). Stakeholder network integrated analysis: The specific case of rural tourism in the Portuguese Peneda-Gerês National Park. *International Journal of Tourism Research*, 17(4), 325-336. doi:10.1002/jtr.1989
- Nunes, F., Reto, L., & Carneiro, M. (2001). *O Terceiro Sector em Portugal: Delimitação, Caracterização e Potencialidades*. Lisboa, Instituto António Sérgio do Sector Cooperativo.
- Partelow, S., & Nelson, K. (2020). Social networks, collective action and the evolution of governance for sustainable tourism on the Gili Islands, Indonesia. *Marine Policy*, 112. doi:10.1016/j.marpol.2018.08.004
- Pike, A., Rodríguez-Pose, A., & Tomaney, J. (2017). Shifting horizons in local and regional development. *Regional Studies*, 51(1), 46-57. doi:10.1080/00343404.2016.1158802
- Pinho, D. B. (1962). *Dicionário de cooperativismo: doutrina, fatos gerais e legislação cooperativa brasileira*. Brasil: Universidade de São Paulo.

- Presenza, A., & Cipollina, M. (2010). Analysing tourism stakeholders networks. *Tourism Review*, 65(4), 17-30. doi:10.1108/16605371011093845
- Provan, K.G., & Kenis, P. (2007). Modes of network governance: Structure, management, and effectiveness. *Journal of Public Administration Research and Theory*, 18(2), 229-252. doi:10.1093/jopart/mum015
- Richardson, M. (1999). *Fundamentos da metodologia científica*. São Paulo.
- Sotarauta, M. (2010). Regional development and regional networks: The role of regional development officers in Finland. *European Urban and Regional Studies*, 17(4), 387-400. doi:10.1177/0969776409352581
- Stoddart, M.C., Catano, G., Ramos, H., Vodden, K., Lowery, B., & Butters, L. (2020). Collaboration gaps and regional tourism networks in rural coastal communities. *Journal of Sustainable Tourism*, 28(4), 625-645. doi:10.1080/09669582.2019.1694526
- Tapada, A., Marques, C. S., Marques, C. P., & Costa, C. (2020). Astroturismo: visões dos stakeholders sobre uma proposta de turismo de interesse especial no Vale do Tua. *Revista Turismo & Desenvolvimento*, 33, 41-59. <https://doi.org/10.34624/rtd.v0i33.20399>
- Timur, S., & Getz, D. (2008). A network perspective on managing stakeholders for sustainable urban tourism. *International Journal of Contemporary Hospitality Management*, 20(4), 445-461. doi:10.1108/09596110810873543
- Weterings, A., & Ponds, R. (2009). Do Regional and Non-regional Knowledge Flows Differ? An Empirical Study on Clustered Firms in the Dutch Life Sciences and Computing Services Industry. *Industry and Innovation*, 16(1), 11-31. doi:10.1080/13662710902728035
- Wheway, C., & Punmanee, T. (2017). Global production networks and regional development: Thai regional development beyond the Bangkok metropolis?. *Regional Studies, Regional Science*, 4(1), 146-153. doi:10.1080/21681376.2017.1333919
- Wilke, E.P., Costa, B.K., Freire, O.B.D., & Ferreira, M.P. (2019). Interorganizational cooperation in tourist destination: Building performance in the hotel industry. *Tourism Management*, 72, 340-351. doi:10.1016/j.tourman.2018.12.015

Appendix: Interview focused on collaborative networks in regional development

Introductory framework

This interview is being conducted as part of a research project conducted as part of the doctoral programme in development, societies and territories at the University of Trás-os-Montes and Alto Douro (UTAD). The data collected will be used to complete a doctoral thesis focused on astrotourism and to support the Tua Valley Regional Natural Park's (PNRVT) certification as a Starlight Tourist Destination.

The PNRVT comprises a protected area of approximately 25,000 hectares located in Baixo Tua, between the districts of Vila Real and Bragança, and includes the municipalities of Alijó and Murça on the right bank of the Tua river and Vila Flor and Carrazeda de Ansiães on the left bank of the same river, as well as Mirandela. The entire protected area and the PNRVT's diversified landscape offer a set of extremely important natural and heritage features that must be maintained and enhanced.

As a thread running through thousands of years of humanity's history, the starry sky needs to be experienced and valued by visitors and tourists in all its diverse forms, namely, historical, social, scientific, contemplative, symbolic and transversal heritage. Starry night skies contribute to the enhancement of tourism destinations, ecological values and cognitive and emotional experiences.

Astrotourism is the increasingly popular practice of engaging in varied tourism activities that are innovative, locally integrated and attractive and that focus on the observation of night skies and celestial phenomena, especially in natural spaces. These activities contribute to local communities' involvement, strengthening and participation and the development of low-density regions, thereby promoting their economy, environment and sustainability.

One of the conditions for observing the stars is a star-filled sky free of the glare emitted by artificial lights, so this type of tourism is typically available in remote regions and low-density areas in which nature provides unique opportunities to contemplate the night skies. The goal is to certify the PNRVT as a Starlight Tourist Destination in order to preserve the night sky, deal with the problem of light pollution, develop astrotourism activities, add value to traditions related to celestial phenomena and contribute to the region's sociocultural and economic development.

Explanation of study

The first phase involved listening to various regional stakeholders. This survey is part of the second phase, which comprises interviewing representatives of a variety of local organisations to examine the dynamics of collaborative networks within regional development. The information obtained will be used as the basis for a qualitative study on how regional networks function in order to understand which actors are involved in each network, what roles they play and what characterises the relationships between them.

Interview

We guarantee that the data collected will be treated as confidential and remain anonymous and will be used in this doctoral research project only.

The interview will last approximately 15 minutes, but the time needed will always depend on each interview's context and circumstance and, of course, the respondent's availability. This study has received no funding, so participation in the interview is voluntary. We would be very grateful for your assistance, but no negative consequences will result from any decision not to participate.

Questions

Instructions: The following questions should be answered based on a geographical framework comprising the five municipalities in the Tua Valley (i.e., Alijó, Carrazeda de Ansiães, Mirandela, Murça and Vila Flor). The questions are to be understood in the context of regional development.

1. What do you understand by the term 'collaborative network'?
2. Do you perceive the organisation you represent as part of a network? If so, which?
3. What role does the organisation you represent play in that network?
4. What other actors are part of that network?
5. With which network actors does your organisation have a more favourable or stronger relationship?
6. In your opinion, which actors play a more central role in the network?
7. In your opinion, what benefits does your organisation draw from the network of which it is a member?
8. What difficulties do you think the network presents, for example, in terms of relationships with other actors, cooperation or the transfer of knowledge, resources and capital?
9. In your opinion, what does your organisation give to the network, in general?
10. How is knowledge and/or information transfer carried out within the network?
11. If that network needs specific know-how to meet the needs of the Tua Valley region's needs, do you think that educational institutions (i.e., UTAD and the Polytechnic Institute of Bragança-Mirandela) can provide the necessary expertise or alternative solutions?
12. What role do you feel a fully functional network in the Tua Valley region would need to play in order to achieve the individual and common goals of its actors (i.e., organisations, associations, local authorities, companies and communities) and maintain a focus on regional development?
13. What relationship do your organisation's networks have with the Tua Valley (i.e., Alijó, Carrazeda de Ansiães, Mirandela, Murça and Vila Flor) within regional development projects?
14. In your opinion, which sectors or activities can the proposed network transform, foster, boost or improve?