# Planning Strategies and Practices for Accessibility in Peripheral Sparsely Populated Areas (SPA). A Spatial Knowledge Interpretation Approach

Tanja Congiu[1], Viola Fonnesu[1], Chiara Garau[2], and Alessandro Plaisant[1](✉)

[1] Department of Architecture, University of Sassari, Design and Urban Planning Piazza Duomo 6, 07041 Alghero, Italy
plaisant@uniss.it

[2] Department of Civil, Environmental Engineering and Architecture, University of Cagliari, Via Marengo, 2 – 09123 Cagliari, Italy

**Abstract.** The authors provide a comprehensive and interconnected approach aimed at strategizing the planning of a sustainable alternative and smart mobility in peripheral sparsely populated areas (SPA) with latent tourism potential. The objective is to represent and optimise the potential for knowledge-driven development of existing resources, distinctive features of contexts, and cooperative networks to support decision makers in defining coordinated interventions at different scales, thereby facilitating the emergence, enhancement, and managed of knowledge. This study demonstrates various strategies for enhancing the accessibility to information and services, for both inhabitants and visitors. A permanent and replicable program comprising a series of integrated, cross-cutting activities at different scales is defined. These activities involve multiple figures who contribute to the daily operations of the area. The proposal suggests the development of an interpretive tool for a SPA with weak connectivity, such as the Sulcis-Iglesiente region in Sardinia, Italy. A spatial organisatiSSon through a network system of accessible nodes is planned. The aim is to promote interconnections and interdependencies among the network nodes, which are linked to the places of greatest strategic potential in terms of services and attractiveness. The focus of this model is particularly on User Generated Content (UGC). The authors conclude that this model aims to improve accessibility to basic services and the use of environmental and cultural resources through alternative and smart sustainable mobility solutions integrated with local services according to the five "S.M.A.R.T." parameters: Specificity, Measurability, Achievability, Resilience, and Time-bound nature.

**Keywords:** Sparsely populated areas (SPA) · peripheral regions · regional development · network system of accessible nodes · User Generated Content (UGC)

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2024
O. Gervasi et al. (Eds.): ICCSA 2024 Workshops, LNCS 14822, pp. 407–420, 2024.
https://doi.org/10.1007/978-3-031-65318-6_27

## 1 Introduction

Peripheral sparsely populated areas (SPA), affected by structural limitations in terms of accessibility, depopulation and rarefaction of services, struggle to implement comprehensive development strategies and projects in line with the new criteria introduced by the EU Commission and the perspectives of the 2021–2027 Programming. The causes seem to be related to the lack of capacity for cooperation among local / regional stakeholders [1–3], as well as the weak endowment and capacity of relevant institutions [4, 5]. OECD has highlighted the need to undertake effective governance agreements and tailor them with business needs [6]. Therefore, the importance of strengthening multi-level governance with a focus on the alignment and coordination of programmes and strategies [7] is acknowledged in the SPA. This serves to establish a cohesive framework of policies that facilitate both local cooperative efforts and cross-cutting projects and proposals, involving the multiple figures that take part in the daily functioning of the region. Indeed, the small size of many towns and hamlets does not allow them to automatically become the nodes of a network to have supra-local comparability. A different spatial model is needed for sparsely populated suburban areas than for urban areas, highlighting the economic basis for their development [8].

Starting from the assumption that plans, programmes, and projects involving the management of resources are crucial for promoting the growth and the enhancement of minor towns as well as the natural and cultural heritage, the results of the TSulki research project – Tourism and Sustainability in Sulcis are here illustrated [1]. The Sulcis-Iglesiente region in southwestern Sardinia, Italy, where a natural environment of considerable public interest coexists alongside abandoned areas severely degraded by mining and industrial activity, is the context of the research project. This decline is evidenced by demographic indicators, with a disappearing population, high average age, and employment below the regional average, concentrated mainly in the service and tourism sectors.

To effectively organise information in sparsely populated areas with inadequate connection, such as the Sulcis-Iglesiente region, it is beneficial to develop an interpretive device that promotes the collaborative development of a territorial organisation model. This model should be built on a network structure of easily accessible nodes. Hence, it fosters interconnections and interdependencies between the nodes of the network linked to the places of greatest strategic potential in terms of services and attractiveness with reference to User Generated Content (UGC) [9]. For the purposes of this study, such a device allows to organise, make accessible, connect, and manage information on tangible and intangible resources (such as historical-cultural, geo-environmental, tourist, etc.) and services. It also allows for the adaptation of accessibility and fruition paths at different connection levels, including economic aspects. By using the existing networks and knowledge-based development potential of rural regions, it is possible to maximise the their knowledge-based representation in an accurate and focused manner. Simultaneously, it is possible to delineate methods to enhance the accessibility of information

[1] Tsulky ("Tourism and Sustainability in Sulcis-Iglesiente area") research project final report – 3rd unit. Project funded by Autonomous Region of Sardinia – fundamental or basic research projects for the implementation of interventions under the research for the "Sulcis Plan", CIPE Resolution n. 31 20.02.2015, and resolution n. 52/36 28.10.2015, "Sulcis Strategic project" – public-private research project.

and services for both inhabitants and visitors. This approach can be implemented in a permanent and replicable way, ensuring lasting and scalable benefits over time [10].

In order to achieve this, the first operational objective is oriented towards the systematisation of expert, local and web knowledge, which brings together basic spatialised information relating to tangible and intangible networks, in order to organise the territory's offer and the rational channelling of the information generated towards the private sector; the second operational objective is geared towards a development strategy through the implementation of a sustainable mobility planning at a *functional* area scale, which efficiently organises physical connections and information, identifying and connecting the areas of greatest strategic potential in terms of the attractiveness of the natural, historical-cultural, residential and productive environment and the potential operators available (Fig. 1).

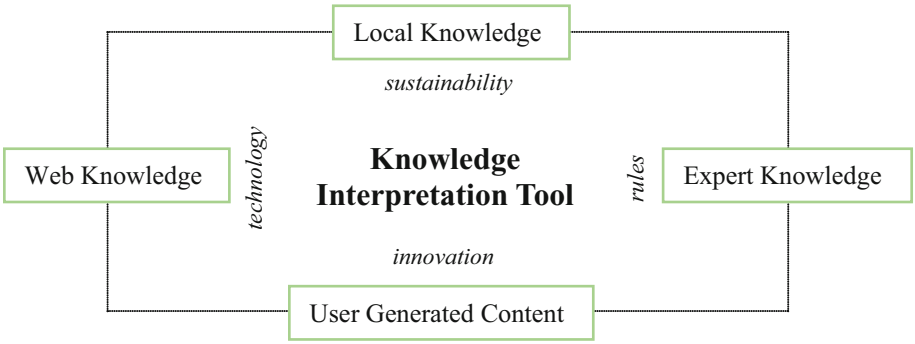



**Fig. 1.** The basic elements of the strategy

## 2 The Methodological Path

The activities of TSulki research project – Tourism and Sustainability in Sulcis (see Acknowledgements), along with the Work Packages, are categorised into the following stages: 1. Context analysis; 2. Definition and implementation of a spatial organisation model based on accessibility, enjoyment and use of tangible and intangible heritage; 3. Classification and organisation of knowledge; 4. Model testing. In order to achieve the objectives of the project, a reference framework is used to analysing the planning, programming, and financing instruments. This enables the authors to understand the coherence among them by comparing goals and actions (Fig. 2). This framework can also support decision makers to define guidelines with the aim to identify and promote integrated interventions and to agree reciprocal commitments and obligations for their implementation in the form of agreements.

The highlighted aspects include the environmental relevance of the region, the lack of a unified strategy and coordination among different planning levels, and the necessity of adopting an integrated approach to address environmental, tourism, and mobility concerns (Figs. 3, 4).

Regarding funding tools, with reference to businesses, two territorial development tools are considered: the Sulcis Plan [2] and the S3 strategy [3] both promoted by the Autonomous Region of Sardinia.

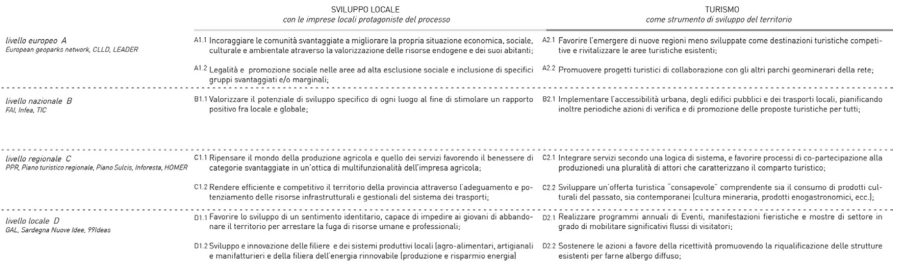



**Fig. 2.** The reference framework (*part*): programs, strategies, goals for local development, tourism, education, research and innovation in the Sulcis – Iglesiente region

It should be noted that the Smart Specialisation Strategy (S3) represents the European Union's place-based regional innovation strategy, which has been recognised as a key means for strengthening regional growth from local vocations [11]. At the regional level, the ICT sector is the one that registered almost half of the co-funded projects and the main achievements in the "Tourism, Culture and Environment" sector are represented by the ability to digitise and organise market processes in a digital key, and by the definition of tools to support strategies for listening, communication and customer and market loyalty. Some of the proposed solutions were addressed to enhance, access, and use the cultural and environmental heritage of the region [12]. In the Sulcis-Iglesiente region, the scarcity of enterprises benefiting from funding and integrated development projects or with an innovation index confirm the lack of capacity for cooperation among local stakeholders. Finally, the authors tested the model for land knowledge management in a specific spatial area identified within the Sulcis-Iglesiente network, selected from the analyses of processes, relationships and practices of land use and operation, with a special focus on the archaeo-mineral, religious, blue, green etc. landscapes.

[2] The Sulcis Extraordinary Plan is a tool for guiding, planning, and coordinating interventions for the development of Sulcis – Iglesiente region, aimed at safeguarding the productive fabric, technological research and development activities, infrastructural interventions, environmental remediation, training and financial commitments.

[3] With the start of the new programming cycle (2021–2027), the Region of Sardinia is updating the S3 considering the results of the previous period (2014–2020) under which the following thematic areas of smart specialisation were identified: ICT; Agribusiness; Tourism, culture, and environment; Smart networks for efficient energy management; Aerospace; Biomedicine.

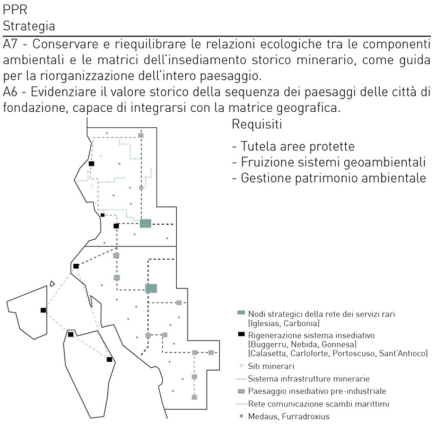



**Fig. 3.** Regional Landscape Plan; Protection and Special Management Tools

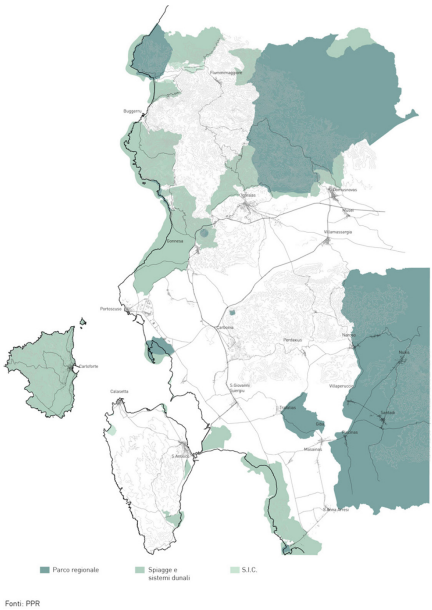



**Fig. 4.** Regional Landscape Plan; Protection and Special Management Tools

## 2.1 Context Analysis

The context analysis is aimed at recognizing the evolutionary dynamics that have passed through the Sulcis – Iglesiente region, producing the current spatial configuration [4] (Fig. 5). The analysis of settlement patterns in terms of appearance, and uses, endowment and distribution of resources and services (Fig. 6), has been of crucial importance in defining "organisational / functional perimeters" with which to describe the present and possible functioning of the spatial network and the interactions between nodes (Fig. 7).

The combination of data from various sources has produced a large, coherent and updatable information base. The Open Data base of Sardegna Geoportale [5] was compared and integrated with cartography and content drawn from official documents and other informal but certified information sources. For example, the framework of physical connections is derived by integrating the existing trail base map taken from OpenStreetMap (OSM) with the trail network from the Regional Hiking Trail Network Plan and IGM tables.

[4] Two types of settlements are identified with respect to mining processes: a) settlements built for the mining needs, which have been transformed or/and evolved (e.g. former agricultural settlements) and b) abandoned settlements. The research delves into only the first type to first recognise and support those settlements that auto poetically reinterpret the evolutionary dynamics following the closure of the mines (1960s and 1970s), in line with a sustainable development model based on human resources.

[5] https://www.sardegnageoportale.it/

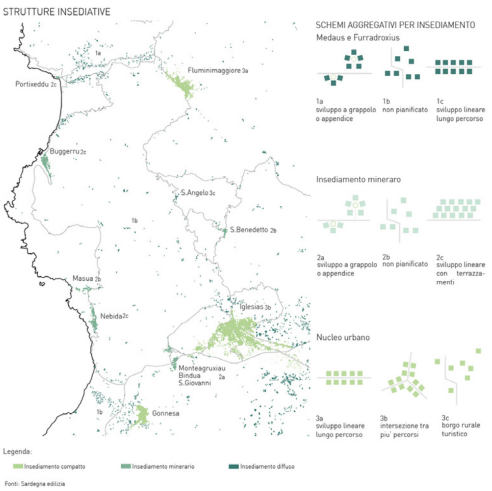



**Fig. 5.** Settlement patterns and service center systems

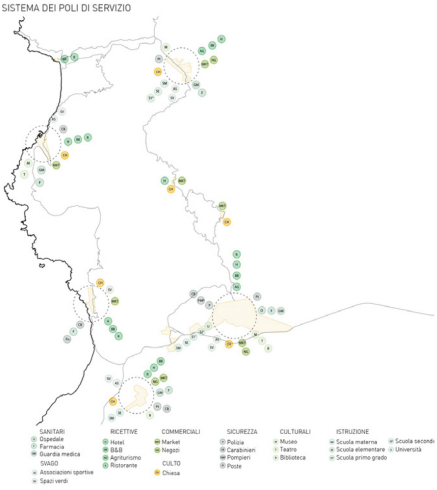



**Fig. 6.** Settlement patterns and service center systems

Other analyses include: a. the existing and potential spatial networks taken from the unstructured information base of the "S. Barbara Mining Trail Foundation", which includes 21 municipalities of the region; b. Web data and User Generated Contents (UGC) taken from specialised platforms and sites with the help of GIS tools, OpenStreetMap [6] and other applications to understand the level of tourist attractiveness of the area (Fig. 8).

It is notable that data collection was done through OSM and social networks including Twitter, and Facebook (Instagram showed difficulties in accessing information). Some other applications include Epicollect, Mapillary [7], Fieldpaper [8], Mapwarper, *etc.* All these tools assume georeferenced mapping of data to support the design and the implementation of the proposed model and its attributes. Additional specific aspects were explored, such as for example, the presence of accommodation facilities (Airbnb [9]), and the representation of the most photographed locations (Flickr [10]). This first phase has revealed the poor recognition of obvious patterns related to mining activities, which have characterised the region since ancient times: most of them are not visible or do not return immediate information of the processes that generated them. The present state of the sites shows frequent abandonment and lack of any kind of spatial organisation, as well as sporadic cases of collaborative forms.

6 OSM allows the identification of some detailed data such as drinking fountains, stairways, cliffs, paths, fences, etc.

7 http://mapillary.com

8 GPS technologies do not always perform well due to antenna reception problems. Fieldpaper is an alternative tool for data collection when there is no connection.

9 https://umap.openstreetmap.fr/it/map/airbnb-tsulki_314332#11/39.3293/8.5187.

10 https://umap.openstreetmap.fr/it/map/airbnb-tsulki_314332#16/39.4093/8.4215.

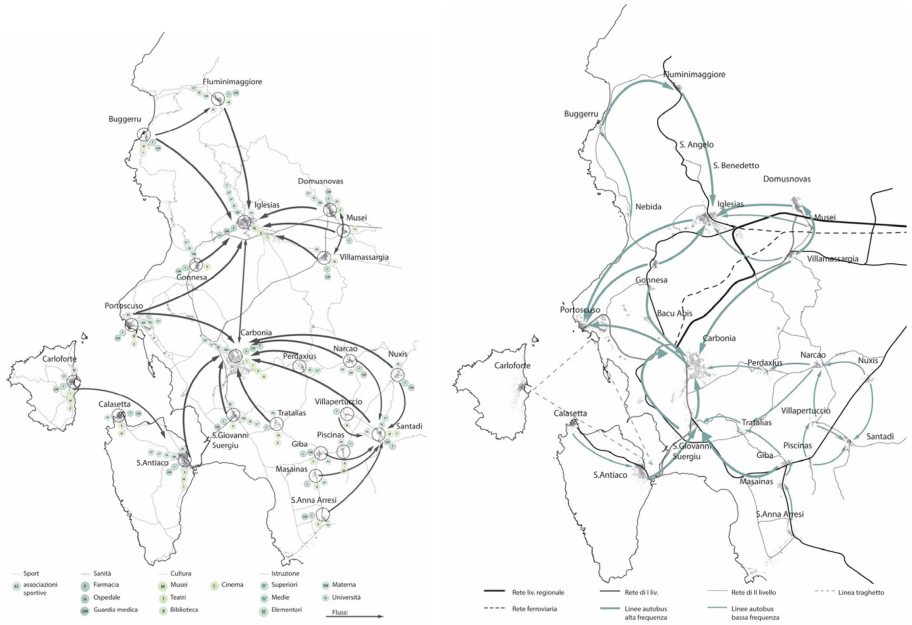



**Fig. 7.** The existing system of connections: the system of services and the system of mobility

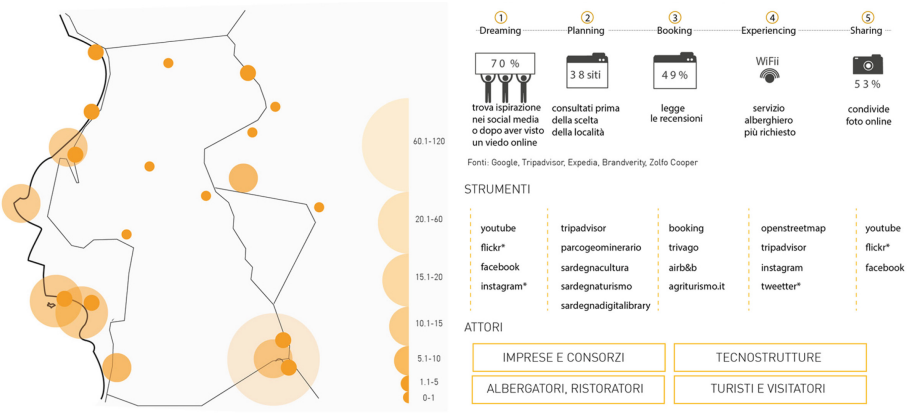



**Fig. 8.** Multi – media knowledge (UGC) in thousands and steps of web use during the trip.

## 2.2 Definition and Implementation of a Spatial Organisation Model

The second phase focuses on the interpretive device of spatial knowledge to co-plan accessibility routes at different levels of knowledge and scales. This model of spatial organisation is based on:

a. a networked system of accessibility nodes with relationships of mutual influence and conditioning. Each node refers to an inhabited location, as surveyed by ISTAT [11], and is characterised by a number of attributes. The following have been identified: *nodes with contextual attributes*, which have played a generative role in the definition and evolution of the mining landscape; *nodes with general attributes*, specified with respect to three typologies: *spatial, functional, and sociocultural accessibility*.
b. The relationships between nodes and guidelines for the recognition, organisation and future management of nodes in terms of spaces and offered services.
c. Identification of key stakeholders (residents, authorities, administrators, managers, businesses, cooperative networks, visitors, *etc.*) to assess the importance of individual nodes in relation to the subjects.

| **SPATIAL ACCESSIBILITY NODES: Attributes \| Indicators** |
|---|
| *Physical infrastructure* \| infrastructural artifacts |
| *Connectivity of the public transportation system* \| connections provided by public transportation |
| *Modes of travel* \| Type and total number of displacement possibilities of the transportation system |
| *Internal connectivity* \| Alternative connections by possible mode of transport |

| **FUNCTIONAL ACCESSIBILITY NODES: Attributes \| Indicators** |
|---|
| *Access to basic services* \| basic services present, e.g., drinking water, electricity, sewage, garbage, telephone network, internet network |
| *Infrastructure/services* \| Cultural (e.g., library, museums, etc.), Education (schools of all levels), Transportation (e.g., car rental, bicycles, nautical vehicles and products, etc.), Health and Social Care (hospitals, doctor's offices, pharmacies, etc.), Sports, Public Administration (city hall, offices, personal services, etc.), Post Offices and Banks, Churches, Tourism (accommodation, info points, etc.), Commerce (food, clothing, handicrafts, etc.); Security garrisons at urban and regional scale |
| *Character of the service* \| Stable or temporary |
| *Correlation with other services* \| multiple services (e.g., a bar kiosk that operates as a ticket office, information point, and food store) |
| *Catchment area of influence* \| Dependence of inhabited locations on service or vice versa. |
| *Internet visibility* \| Official website of the node |

| **SOCIOCULTURAL ACCESSIBILITY NODES: Attributes \| Indicators** |
|---|
| *Inhabitants and employment* \| Number of inhabitants and employment rate |
| *Official "local community networks"* \| Number of formal and informal associations and categorization by themes of the activities they carry out. |
| *Artistic and cultural events* \| Events that express and celebrate artistic or/and cultural values |
| *Identity components* \| Identity places recognised by the local community |

## 2.3 Classification and Organisation of Knowledge

The result of this phase is the survey and selection of already available basic data and sources from which to draw information for each descriptive attribute of the nodes. The

[11] The National Institute of Statistics.

survey sources are of three types: the first group is represented by various regional registers, archives and specialised publications of relevance; the second group is represented by official databases and computer archives of different institutional and non-institutional nature and relevance, and accessible such as, e.g., Sardinia Geoportal, websites of municipalities and the Integrated Water Service; the third group includes a campaign of direct surveys, in the field or through interviews. Next, the different attributes were measured. Note that given the variety of attributes considered, quantitative and qualitative measures were chosen, ranging from coding and use of the binary system (e.g. for the attribute "Connectivity of the public transport system" the value "0" indicates the absence of the service and the value "1" indicates the existence of at least one connection with subsequent specification of the total number of existing connections) to qualitative assessment. An instruction set ensures that the data are collected in a self-contained and replicable manner.

### 2.4 Model Testing. The Case Application

A microstructure of the peripheral SPA is identified [13], between the urban centres of Iglesias and Fluminimaggiore. It was chosen for its landscape-settlement peculiarities and includes the mining village of Buggerru (about 1029 inh.), the rural settlement of Grugua (nr), the rural village of S. Angelo (about 19 inh.) and the mining village of S. Benedetto (about 220 inh.).

In particular, the focus is on a route, central in the connections between the coast and the main road system, obtained by connecting four hiking routes, which refer to the mining and rural agro-pastoral dimension, with the aim of strengthening the relationship between the coast and the inner areas, connecting strategic nodes, and crossing different types of landscapes (Fig. 9).

The following are assumed as design requirements:

*Access to information.*
*strengthening of coast-to-coast relations.*
*establishment of service spaces, intermodal exchange at strategic nodes of the route.*
*integration of territorial and cultural services.*

Three types of interventions support the strategy:

1. multimedia technologies: strengthening of telematics networks for adequate access to services and knowledge; representation and sharing of data and information through crowdsourcing and UGC technologies; *etc.*
2. spatial-programmatic interventions: green road / smart road; trail resurfacing, path construction, safety enhancement; integrated platform for mobility management through demand management; parking areas and modal exchange; monitoring systems with integrated sensor technology for data and information management regarding environmental conditions and safety; *etc.*

Itinerant services: organisation and management of stable and temporary services.

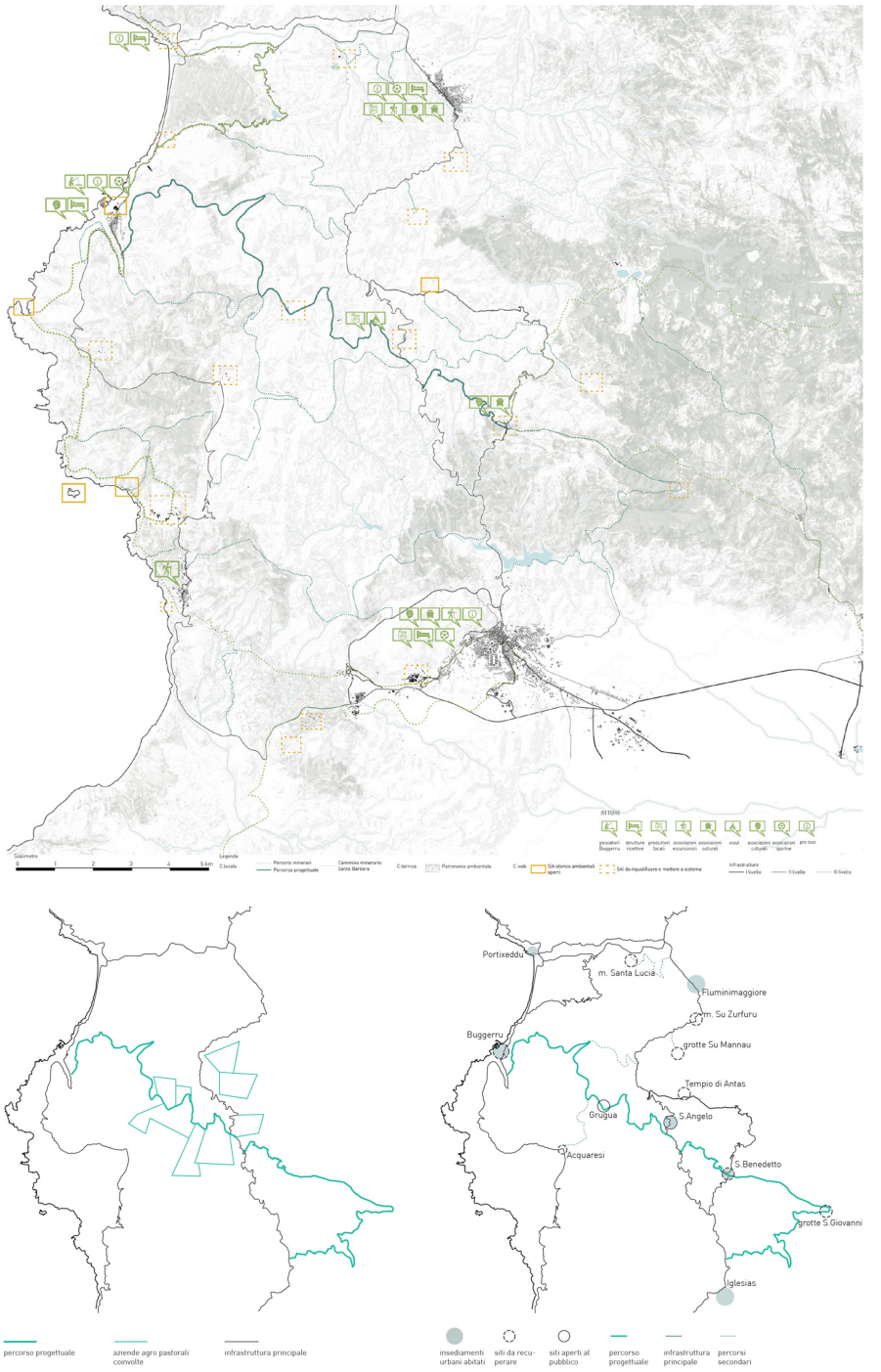



**Fig. 9.** Masterplan. Connections between production system and historical-settlement elements

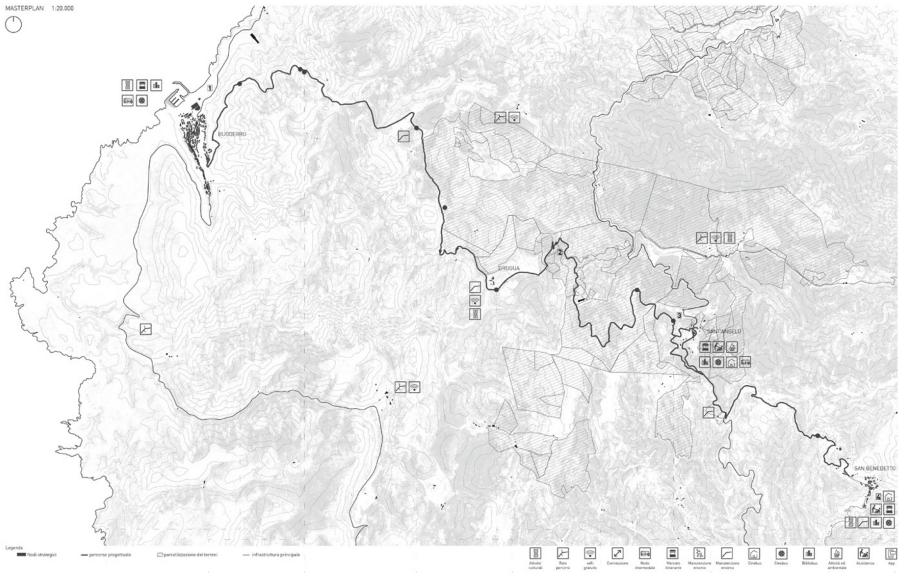



**Fig. 10.** The networked system of strategic nodes for knowledge accessibility (1:20.000)

In other words, the networked system of accessibility nodes with relationships of mutual influence and conditioning is supported by crowdsourcing and UGC technologies, an integrated platform for mobility management through demand management, and itinerant services (Figs. 10 and 11).

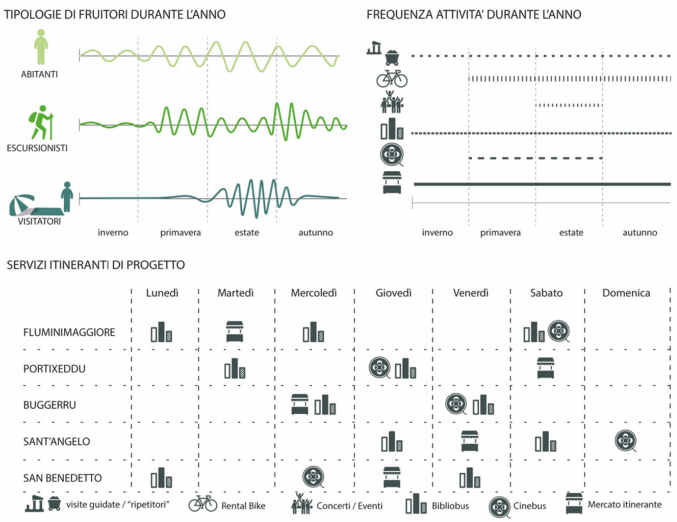



**Fig. 11.** Types of itinerant services

In this way, the proposed organisational model intends to enhance the interconnections and interdependencies among the elements of the system to ensure that inhabitants and visitors can use the essential services at the identified nodes, promote the organisation and management of the nodes, and strengthen the networks of local actors, while at the same time move and enjoy the environmental and cultural resources through sustainable and intelligent alternative mobility systems.

## 3 Conclusions

The use of effective data analysis, communication and sharing tools assists learning and mutual exchange of knowledge and experience, as well as the more informed use of local services, including optimization of economic aspects, fostering growth of SPA. Not the least, the ability to locate information on open editable online maps based on local knowledge and user experiences, offers targeted possibilities for planning sustainable, flexible and responsive transportation infrastructure and services. For example, it is possible to organise in participatory and cost-effective ways the strategic nodes of the territorial network according to different access possibilities, through forms, functions and rhythms that allow everyone, for each place, a complete, free and effective knowledge and enjoyment of the surrounding landscapes. Such an approach characterises many transport system reorganisation models in peripheral sparsely populated and weak demand areas that have been experimented in recent years at the European level. Consider, for example, the projects of the 13 regions participating in the EU-funded "Move on Green" program [14].

In this sense, the prospects of each place will depend on its ability to offer different opportunities and forms of comparative advantage based on accessibility to resources, knowledge and, in general, environmental quality.

To summarise, the paper pursues three practical things:

1. To know and access tangible networks such as services, and intangible ones such as environmental or landscape, through the development of a knowledge approach based on a system of strategic nodes for accessibility that combines quantitative and qualitative, freely editable information.
2. To connect the local productions and businesses through integrated projects to strengthen local economic systems. The focus is on organised networks and territorial cooperation in the context, as a fundamental element on which the principle of subsidiarity at the local level is based, which assumes a crucial role in SPA governance.
3. To represent and maximise the knowledge-based development potential of rural territories and their existing networks, and, on the other hand, to outline possible ways to enhance accessibility to information and services, both for residents and visitors, according to a permanent and replicable program.

This paper faces several limitations, which deserve further work. First, regarding funding tools, the survey of this study has investigated S3 strategy for the region of Sardinia, and the authors have not been able to fully assess the implications for specific peripheral SPA like the Sulcis – Iglesiente region. Second, the difficulties in identifying and verifying all the enterprises in the area due to the lack of up-to-date reference data.

The analysis of this study has identified the capacity for cooperation among local / regional stakeholders and the importance of strengthening multi-level governance with a focus on the alignment and coordination of programmes and strategies, we have been neither able to consider the crucial role of strategic stakeholders like the Geo-mining Park. Third, this research has considered one peripheral SPA only and this requires testing temporary services and its transferability.

**Acknowledgements.** This study was supported by the Tsulky ("Tourism and Sustainability in Sulcis-Iglesiente area") research project. Specifically, the Tsulky ("Tourism and Sustainability in Sulcis-Iglesiente area") research project final report – 3rd unit. Project funded by Autonomous Region of Sardinia - fundamental or basic research projects for the implementation of interventions under the research for the "Sulcis Plan", CIPE Resolution n. 31 20.02.2015, and resolution n. 52/36 28.10.2015, "Sulcis Strategic project" – public-private research project.

This study was also supported by the MUR through 2 projects: SMART3R-FLITS: SMART Transport for Travellers and Freight Logistics Integration Towards Sustainability" (Project protocol: 2022J38SR9; CUP Code: F53D23005630006) and 2) MOVING StEPS: MOVING from Street Experiments to adaptive Planned Solutions (Project protocol: 2022BLK9TS; CUP Code: F53D23005550006), both financed with the PRIN 2022 (Research Projects of National Relevance) program.

This research was granted by PNRR-M4C2- I1.1 – MUR Call for proposals n.104 of 02-02-2022 - PRIN 2022 – ERC sector SH7- - Funded by the European Union – NextGenerationEU.




This manuscript reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them.

**Authors' Contributions.** This paper is the result of the joint work of the authors. 'Abstract', '2', '2.1', '2.4', were written jointly by the authors. CG: '1' and AP: '2.3' '3'; TC: '2.2'. AP and VF: '2.1'. VF: all schemes and figures. AP coordinated and supervised the paper. All authors have read and agreed to the published version of the manuscript.

## References

1. Ghinoi, S., Steiner, B., Makkonen, T., Hassink, R.: Smart specialisation strategies on the periphery: a data-triangulation approach to governance issues and practices. Reg. Stud. **55**(3), 402–413 (2021). https://doi.org/10.1080/00343404.2020.1791321
2. Huggins, R., Prokop, D.: Network structure and regional innovation: a study of university–industry ties. Urban Stud. **54**(4), 931–952 (2017)

3. Rodríguez-Pose, A., Di Cataldo, M., Rainoldi, A.: The role of government institutions for Smart Specialisation and regional development (RIS3 Policy Brief Series, No. 04/2014) (2014)
4. Karo, E., Kattel, R.: Economic development and evolving state capacities in Central and Eastern Europe: can 'smart specialisation' make a difference? J. Econ. Policy Reform **18**(2), 172–187 (2015). https://doi.org/10.1080/17487870.2015.1009068
5. Wang, C., Madsen, J.B., Steiner, B.: Industry diversity, competition and firm relatedness: the impact on employment before and after the 2008 global financial crisis. Reg. Stud. **51**(12), 1801–1814 (2017). https://doi.org/10.1080/00343404.2016.1254766
6. Organisation for Economic Co-operation and Development (OECD): OECD territorial reviews, northern sparsely populated areas, policy highlights (2016). Accessed 17 Oct 2018
7. Sörvik, J., Teräs, J., Dubois, A., Pertoldi, M.: Smart specialisation in sparsely populated areas: challenges, opportunities and new openings. Reg. Stud. **53**(7), 1070–1080 (2019)
8. Rueda-Palenzuela, S.: El urbanismo ecosistémico. Estud. Territ. **51**(202) (2019)
9. Krumm, J., Davies, N., Narayanaswami, C.: User-generated content. IEEE Pervasive Comput. **7**(4), 10–11 (2008)
10. Congiu, T., Napolitano, M., Plaisant, A.: SMART sustainable development planning: un approccio Open-Gov per coordinare politiche e strumenti orientati alla mobilità sostenibile nei territori a bassa densità. *Smartness e healthiness per la transizione,* FrancoAngeli BETHA 86.1.4 2018, p. 131 (2018)
11. Foray, D. Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy, Routledge, London (2015)
12. Autonomous Region of Sardinia: Smart specialisation strategy 2021–2027, Regional Planning Center and Sardegna Ricerche, p. 60 (2022)
13. Fonnesu, V.: Geo_Network. A spatial management model of the Geominerary Park oriented to the fruition of tourist, cultural and geo-environmental itineraries based on the interaction between local, technical and multimedia knowledge, Master's Degree thesis in planning and policy for the City, environment and landscape, University of Sassari, Sassari, Italy (2015)
14. Clotteau M.: Move on the green (MOG) policy guidelines for sustainable mobility in rural areas (2014). http://www.euromontana.org/en/project/move-on-green-2/