Smart Touristic Ports – The Emergence of Sustainable Marinas from Smart Conversion. What Future for Sardinians Ports

Brunella Brundu, Silvia Battino, and Stefano Carboni(✉)

DiSea – University of Sassari, 07100 Sassari, Sardinia, Italy
{brundubr,sbattino,scarboni2}@uniss.it

Abstract. Among the sectors covered by Blue Growth, the Europe 2020 strategy to foster sustainable growth in the marine and maritime sectors, coastal tourism represents an important sector of the tourism industry. The Region of Sardinia recently launched the Regional Plan for the Tourist Port Network as a fundamental tool for strategic planning of the sector, in order to better exploit the islands strategic position in the Mediterranean. However, the potential of ports is not always expressed by the territories in which they are located for various reasons, economic, political, administrative, etc. Competition will therefore take place if all the potential is balanced according to the peculiarities of the territories and the dictates of the most advanced multi-sectoral policies. In this context, the focus will be on the strategy that conceives the future of ports, in particular of the Sardinian Region, considering a smart, green and integrated approach for a better management, accessibility and safety of marinas and surrounding areas.

Keywords: Smart tourism · Marinas · Smart ports · Sardinia

1 Introduction

The 'blue planet' represents a vital resource for all countries of the world. The transition to a sustainable, green and smart world therefore also affects marine and coastal landscapes. The United Nations during the Rio de Janeiro +20 Conference in 2012, introduced for the first time the concept of a 'Blue economy' in which seas and oceans are considered key resources for achieving sustainability goals [1]. The benefits for local communities are undoubted, but at the same time the negative impacts (land use, pollution, water consumption, physical and socio-cultural pressures) are different.

Indeed, for the better management of coastal territories, the European Commission on February 20, 2014, released the 'Strategy for more Growth and Jobs in Coastal and

This study is developed in the Research Project "Tourism, accessibility, and digitalization for sustainable transformation of internal areas", Department of Economics and Business – University of Sassari. This paper is the result of the joint work of the authors. In particular: paragraphs 1, 2 and 3 have been written by Silvia Battino, paragraphs 4 and 6 by Brunella Brundu and paragraph 5 by Stefano Carboni.

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2023
O. Gervasi et al. (Eds.): ICCSA 2023 Workshops, LNCS 14111, pp. 37–50, 2023.
https://doi.org/10.1007/978-3-031-37126-4_3

Maritime Tourism,' which aims, through 14 action steps, to sustainably promote the growth of the sector by helping coastal regions and entrepreneurs achieve the goals of the blue economy [2].

Port areas (industrial, commercial, tourist, etc.) are its pillars, and their operation is fundamental for moving goods and people and connecting even the most peripheral and insular areas. The many and varied activities carried out in the ports are a driving force for the socio-economic development of the coastal regions involved [3]. With specific reference to the activities related to the tourism sector, in particular, coastal and maritime tourism, besides representing one of the oldest forms of tourism, has become one of the main areas of growth in this sector and accounts for 44% of Gross Value Added (GVA) and 63% of employment in the European blue economy [4, 5]. Along with its 70,000 km of coastline, Europe is one of the main destinations for boaters. The more than 4,500 marinas offer around 1.75 million berths for a total of 6.3 million boats [6, 7]. This diversified 'ecosystem' crossed every day by significant flows of people and goods must today survive according to the rules of sustainability. The latter must be followed by an innovative approach in which Information Communication Technologies (ICTs) represent the tools that can improve and optimize the competitiveness and activities of all operators involved.

In this scenario, we will focus on the strategy that conceives the future of ports considering the combination of three elements: smart, green and integrated that will allow better management, accessibility and safety of marinas and surrounding areas. On this line of research, the article consists of three more paragraphs in addition to this first introductory paragraph: 2. Objectives and methods, 3. Related works, 4. Some of the policies dedicated and implemented at local level, 5. Sardinia's smart tourist ports, 6. Conclusions. After a brief literature review on nautical tourism, this research focuses on the case study of the Region of Sardinia (Italy), which aims, by adopting a smart and sustainable approach, to enhance the network of its marinas to improve its position in the Mediterranean tourism context.

2 Objectives and Methods

The purpose of this article is to understand the importance of adopting policies and actions aimed at following the sustainable approach and the use of new technologies capable of helping tourist port realities to design 'new' cohesive and smart spaces. The redevelopment of infrastructural spaces and the creation of new resources and services for tourism is outlined as a strategy capable of satisfying, in the long term, the different users (residents and tourists) and improving the competitiveness and image of the territories involved.

The first part of the work begins with a brief review of the literature on the concept of nautical tourism and the different declinations of this complex tourism typology. The second part is dedicated to the case study of Sardinia, an island at the centre of the Mediterranean, which is working to pursue innovative initiatives and projects to improve the network of its marinas.

3 Related Works

Nautical tourism is a form of tourism generally identified in places where water is the main resource for bringing to fruition a variety of recreational and sporting activities. The multifunctional nature of these recreational activities, which can be achieved by enjoying the landscapes of the sea, lakes, rivers, and other aquatic environments, does not facilitate the definitional framing of the concept of nautical tourism [8]. A recent study (2021) by Martínez Vázquez, Milán García and De Pablo Valenciano [9] reported that, although there are different schools of thought on the definition of the term, the sea, the boat and the marina seem to stand out as peculiar elements of this type of tourism. Therefore, considering the broader meaning of the term, it is necessary to include the concept of nautical yachting, which is expressed through the activities (tourist and non-tourist) carried out with a recreational boat. Luković, acquiring the more general characteristics of the 'tourism' term, seems to summarize these attributes by defining nautical tourism as "a sum of poly-functional activities and relations that are caused by the tourists boaters' stay within or out of the ports of nautical tourism, and by the use of vessels or other objects related to the nautical and tourist activities, for the purpose of recreation, sports, entertainment or other needs" [10, p. 400]. In the following, we will focus on the leading role of port facilities in Italian nautical tourism. Italy, with its 7,500 km of coastline and rooted maritime culture, qualifies as one of the most important nautical tourism destinations internationally. Considering the data extrapolated from the report for the year 2021 by Confindustria Nautica of the approximately 1,622 marinas and multi-purpose ports (ports and small ports, industrial and commercial ports, canal ports and docks) distributed along the Mediterranean coasts, as many as 547 are concentrated on Italian territory, followed by the coastal regions of France (400) and Spain (370). Port structures count 148,634 berths, of which as many as 46,251 are to be subject to marinas which have an average number of berths (526) more than double that of multipurpose ports (223). Among the regional classifications, Sardinia holds first place for the number of berths (21,709), followed by Liguria (21,577) and Sicily (17,875). More specifically on the distribution of berths in marinas, about half are concentrated in four regions (Liguria, Sardinia, Friuli Venezia Giulia, Tuscany) [11]. Each individual infrastructure may be operated in the public, private or mixed form, and represents a simple 'boat park', but also a 'seaside plaza' destined to connect the sea with the mainland by welcoming yachtsmen and tourists seeking tourist-recreational experiences [12, 13]. In addition to yachtsmen and tourists, the actors of this organized space between 'land and sea' are the service providers in the port area and the residents who use or can use the services present. Technical, commercial and tourist services in all types of port must be organized and managed with a view to maximum functionality while also integrating the environmental and socio-economic resources of the surrounding area into the network. The activation of 'new' territorial aggregations for local development is in line with the objectives of the blue economy, which in Italy is implemented in the National Recovery and Resilience Plan (PNRR – Piano Nazionale di Ripresa e Resilienza). The Plan provides for a series of investments and strategic actions oriented towards a green, circular and smart development to increase the competitiveness and qualification of the activities related to the sea. The valorization of the tourist port system must necessarily

pass through the adoption of a smartness approach in which the role of innovative technological tools is essential to create cohesive spaces [3, 14].

4 Some of the Policies Dedicated and Implemented at Local Level

In March 2023, the Ministry of Tourism presented the Strategic Tourism Plan 2023–2027 to Federalberghi and the other organizations dedicated to it, indicating the sea as one of the three pillars on which to support the strategic strengthening of Italian tourism (ferries, island tourism, cruise ships, etc.) and the driving factor of the entire industry. At the moment it seems difficult to calculate the flows that may be generated on Mediterranean passenger routes due to multiple variables, to be identified mainly in the post-Covid flows and the war in Ukraine, although a general increase in the qualitative standards of the offer is considered very likely [15].

The Tenth Report on the Sea Economy (2022) [16] explains Italy's contribution to the European Union's Blue Economy, and in the ranking by incidence of employment and of blue economy enterprises on the regional total, it places Sardinia in second place with 6.6% and 7%, undoubtedly an excellent position but far behind Liguria, which has a value of 11.9% and 10.3% respectively. Of course, there can be many explanations, but it is perplexing that a region located in the centre of the western Mediterranean, with the highest perimeter compared to the other Italian regions bordering the sea (just under 1900 km), is not able to exploit the advantages of blue growth activities to a greater extent. Morphological, structural, political, social, etc., these are the causes presented throughout Sardinian history and which still constitute problems that are far from being resolved.

The multiple activities covered by the nautical industry make it a sector of great importance for the regional economy with which it is strategically connected to the tourist market. Ports are increasingly becoming places of penetration and vehicles for further recreational activities and tourist products and assets located in more inland areas and of which, the tourist who is increasingly well-informed and also eager for new experiences, seizes the opportunities for knowledge and enjoyment.

The island is the second region nationwide, after Sicily, for the number of active ports and berths. In recent years, also due to the pandemic period, more and more tourists, including yachtsmen, have chosen Sardinia's coasts, the preferred areas being in the north, in the Provinces of Olbia and Sassari, on the Costa Smeralda, the Maddalena Archipelago and the Capo Caccia protected area. In particular, in the north-eastern part 'there are 43.48% of the ports in the whole of Sardinia, the highest number of berths on the island and 66% of maxi-yacht and giga-yacht berths' [11, 17, p. 5].

The Region of Sardinia, however, is certainly not unaware of the importance of policies and directives devised at various levels; among the latest documents produced is the Regional Plan for the network of tourist ports (Delib.G.R. no. 47/52 of 24.9.2020), which is of interest for the topic dealt with in this paper.

The Plan's objective is the construction of the island's network of tourist ports and is divided into a Vision and a Mission. The former, considering the island's strategic position at the centre of the Mediterranean and the quality of both services and environmental value of Sardinia as a whole, would like to lead it to be a privileged destination for leisure navigation. The Mission aims to 'implement a capillary system of access points to the hinterland to favor the overall tourist fruition of the regional territory' [18, p. 17].

Achieving these goals requires planning the existing ports, identifying their criticalities and reorganizing their logic for a well-defined offer of a product that is not only nautical but more broadly tourist. In fact, the document states that "port facilities dedicated to nautical pleasure boating do not 'dilute' each other, in the sense that they constitute a whole but not a system" [18, p.19]. The criticalities are innumerable if the real goal is a high target, in line with the dictates of environmental and structural policies indicated by the increasingly dense directives governing the subject.

The Marina Network Plan has used the Strategic Plan for the Development and Marketing of Tourism in Sardinia (STP) – Destination Sardinia 2018 – 2021, and the Regional Landscape Plan as the planning tools of greatest interest [19]. The TSP clearly includes the "Nautical Product" in which it specifies that the Network is dedicated to the promotion of both Sardinian nautical tourism and the inland territory with its specificities. It also highlights the weakness of the shipbuilding industry, which would allow the mooring and maintenance of boats during the winter with an estimated loss, according to the Ports Network, of 60–70% of the potential market that is currently directed to destinations such as Palma or Menorca in the Balearic Islands.

The Regional Landscape Plan (PPR) indicates the planning/design framework of each Plan intervention in terms of constraints and prescriptions to be respected. As is well known, Sardinia's PPR, approved by DGR no. 36/7 of 05/09/2006 and currently being updated, represents the First Homogeneous Territorial Area, and is composed of 27 landscape areas made up of the coastal municipalities hosting all the ports on the island, including marinas [20].

More recently, the Ministry of Sustainable Infrastructures and Mobility, transposed Directive 2014/89/EU through Legislative Decree No. 201/2016 and formulated three Italian Maritime Spatial Plans, traceable to the three sub-regions referred to in the Marine Strategy (Art. 4 of Directive 2008/56/EU):

– the Western Mediterranean Sea;
– the Adriatic Sea;
– the Ionian and Central Mediterranean Sea.

The indications provided by the plans are defined at a strategic and guideline level and each one is based on the characteristics of its own sub-area; Sardinia belongs to the "Ionian and Central Mediterranean Sea" region (2022). The reference time horizon of the Plan is 2032, extendable, according to the needs that may arise, to 2050 [21].

In the "Ionian and Central Mediterranean Sea" region, improved port energy efficiency is desired in order to achieve a conversion to "green ports" and a reduction in pollution in these areas. Finally, the coexistence of various maritime uses and the protection of habitats and species is an obligation. The sub-area in which the island is framed is MO/7 Territorial Waters Sardinia. The Plan states that the general and transversal

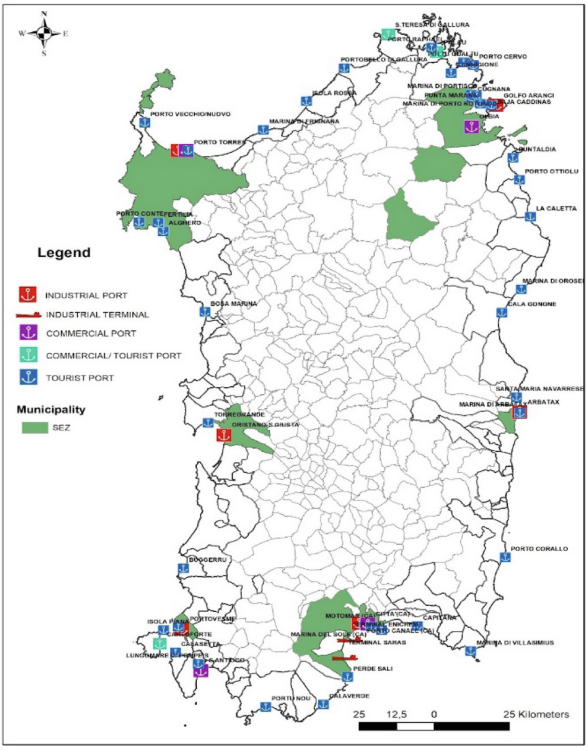

Fig. 1. The main ports in Sardinia and the municipalities over which a SEZ falls. Source: Own elaboration on Sardinia Geoportal data.

objective of the Region of Sardinia is sustainable development, in concert and in compliance with the United Nations 2030 Agenda, the National Strategy for Sustainable Development and the Regional Strategy for Sustainable Development (SRSvS) [21, p. 118]. Among the thirty specific objectives, it identifies Maritime Transport and Ports and Coastal and Maritime Tourism, in addition to the other activities covered by Blue Growth.

While focusing on Sardinia's marinas, this work cannot ignore the island's 'Strategic Development Plan' (2021) [22], which also includes Special Economic Zones (SEZs) in some areas. The Plan proposes a SEZ configured as a 'network' in the coastal area, conceived according to national dictates in which a SEZ is 'also made up of areas that are not territorially adjacent as long as they present an economic-functional nexus, and which include at least one port area…'. These areas are also represented by ports that "present a strategic relevance for the activities of territorial specialization that are intended to strengthen and demonstrate a functional economic link with the port area". The countries in which SEZs are located have clearly demonstrated the importance of the contribution they make to the entire economy. The SEZ that the Plan proposes for the coastal area has, as already stated, a 'network' configuration; it includes the ports of Cagliari, Olbia, Oristano, Porto Torres, Portovesme and Arbatax, to which other ports

or industrial areas may be later connected (Fig. 1[1]). These are port areas that often host further typologies within them, such as, for example, marinas, areas that can convey tourism and tourists towards more inland places or act as a land link between the various seaside areas, places in any case a hinge between sea and land [23].

The PNRR's "Investments and reforms for the port" report (2022) [24], set itself the goal of improving competitiveness through four key points: strengthening the powers of port authorities for strategic planning; improving the processes for planning and awarding port concessions; improving port energy efficiency and cold-ironing; and developing a National Logistics Platform capable of making information content and processes related to port and retro-port activities interoperable. Sardinia, in addition to other projects, is seeing the financing of on-shore power supply plants in many of its most important ports (Olbia – Golfo Aranci – Santa Teresa Gallura – Porto Torres – Portovesme – Cagliari Porto Storico – Cagliari Porto Canale), the objective being to power the ships at berth from dockside installations that allow the engines of the vessels to be switched off with a consequent zero impact on the atmosphere.

5 Sardinia's Smart Tourist Ports

Tourist ports represent one of the main elements of nautical tourism [25] and, by creating demand, they contribute to the development of the local economy [26].

The Region of Sardinia, which aims to strengthen the network of its marinas, is adopting a smart and sustainable approach in order to improve its position in the Mediterranean tourist context [27]. Tourist ports create demand for nautical tourism and are of fundamental importance for the territory of Sardinia, in which the tourist offer is strongly seasonal and of a seaside type. It is essential to protect and apply efficient strategies at the regional level that are capable of offering adequate services and that can satisfy the tourist demand dedicated to this segment.

In a recent report on tourism, drawn up by the Bank of Italy (Banca d'Italia), it is possible to observe that the revenues from international travel in Italy amounted to 21.3 billion euros in 2021, with a tourist presence of around 26 million individuals [28].

These data show that Sardinia is in a context of high tourist levels and the data relating to tourist movements on the island show that the region has contributed decisively to such large numbers of tourists at a national level in 2021 and 2022.

Investigating the specific case of Sardinian ports, the data provided by the Sardinian Sea Port System Authority (Autorità di Sistema Portuale del mare di Sardegna) show that 2.3 million passengers were welcomed by the ports of the region in 2022, of which

[1] Figure 1 identifies the island's major tourist ports and the multifunctional ports located in the most economically dynamic municipalities and benefiting from the projects financed by the PNRR (only the port of Oristano is absent from such funding). The Regional Plan for the Tourist Port Network, however, identifies a further 79 port facilities for nautical pleasure boating under public or mixed management to be developed to complete the Network, some of which already meet the Plan's requirements, while others need upgrading and restructuring. Finally, it recognizes 7 New Port Facilities (NPS) located in territorial areas that, despite offering a qualified tourist offer (landscape, environmental and historical-cultural emergencies), do not enjoy adequate use.

1.9 million from June 1st to September 20th [29]. The most significant period, in terms of tourist flow, is the month of September, in which 275,196 visits were registered. Thus showing an increase of 16.8% compared to the previous year in which 235,613 tourists were registered in the ports of the island [30].

The impact that the large number of tourists, generated by the marinas, creates on the economic development of surrounding urban areas, enhancing its local resources [31] is also of considerable interest. It must therefore be considered that these places must be able to welcome and host all the tourists who go there through a Smart management of the port [32, 33].

By examining the tourist ports of Sardinia, it is possible to observe the data relating to the pleasure craft registered in the Registers of the Peripheral Maritime Offices, the kilometers of coastline, the berths per coast and then comparing them with the data relating to the other Italian provinces (Table 1).

Table 1. Nautical pleasure craft registered in the Registers of the Peripheral Maritime Offices, kilometers of coastline, berths by coastline as of December 31st 2021. Source: Own elaboration on Ministry of Infrastructure and Sustainable Mobility data, 2021.

Region	Units registered with Maritime Offices	Coastline (Km)	Berths per km of coastline
Abruzzo	557	138	12.5
Campania	8,088	522	31.2
Calabria	1,045	796	6.5
Emilia-Romagna	3,434	122	43.4
Friuli-Venezia Giulia	3,569	94	167.9
Lazio	8,378	363	22.9
Liguria	18,141	389	63.9
Marche	2,531	188	24.6
Molise	65	36	16.3
Puglia	2,507	1,015	14.4
Sardinia	4,012	1,851	9.4
Sicily	4,109	1,473	11.0
Tuscany	8,610	561	34.3
Veneto	4,165	140	44.9
Total	**69,211**	**7,688**	**20.4**

Sardinia, with its 1,851 km of coastline, is the region with the largest coastline in Italy. However, it should focus on the availability of berths by exploiting precisely the high extension of its coasts.

Furthermore, it was possible to investigate the data relating to the number of parking places by type of structure, in such a way as to be able to compare the data relating

to tourist ports with two other types, commercial ports and mooring points (Table 2). Comparing the data of Sardinia with those of the other regions of Italy, it can be observed that the number of berths in the tourist ports of Sardinia is the highest compared to the other regions of Italy, thus representing 17.5% of the number of berths throughout Italy.

Table 2. Number of berths by region and type of structure as of September 30th 2021. Source: Own elaboration on Ministry of Infrastructure and Sustainable Mobility data, 2021.

Region	Tourist Port	Commercial Ports	Mooring Points
Abruzzo	140	1,584	–
Campania	5,555	5,220	5,530
Calabria	3,195	1,251	739
Emilia-Romagna	2,483	1,519	1,293
Friuli-Venezia Giulia	10,136	1,177	4,471
Lazio	2,645	2,811	2,845
Liguria	10,623	6,077	8,159
Marche	3,908	200	524
Molise	434	153	–
Puglia	4,558	3,490	6,563
Sardinia	12,584	3,087	1,798
Sicily	4,971	5,548	5,670
Tuscany	6,973	3,235	9,031
Veneto	3,684	1,239	1,362
Total	**71,889**	**36,591**	**47,985**

Since the economy linked to tourist ports is essential for the economy of a country like Italy, it is necessary to plan sustainable development strategies [34] that take into account green policies within tourist ports, and how the care and conservation of the existing greenery is fundamental in the planning process [35]. It is therefore necessary to manage this aspect through an approach aimed at protecting the marine environment by eliminating or reducing the activities that cause pollution [31].

An action that can be done, aimed at mitigating pollution levels and keeping the waters of tourist ports clean, can be achieved by introducing laws that further promote the protection of marine waters [36]. It should also be remembered that sustainable development strategies can be more effective if adopted at the national level [37] thus the success of a sustainable strategy applied in a single tourist port can be replicated in other tourist ports across the country as well, to be able to generate an increase in the quality of port services at a national level.

A constant analysis of the water will then be necessary, especially in the summer period, in which a greater concentration of boats and yachts could worsen their quality compared to the rest of the year.

Tourist ports need dredging of the seabed which can however pollute the waters in which the works take place. Also in this case, sustainable alternatives can be chosen such as the seabed remodeling plant based on the principle of ejectors, which let the removal of sand accumulated in the seabed of the port with zero environmental impact [38].

Within the theme of the sustainability of a tourist port, it must be considered that the boats and port equipment will inevitably pollute the marine waters [39]. The engines of boats and yachts that remain in operation during mooring, in order to power the electronic devices used in tourist boats, generate pollution of both the water and the surrounding air [40].

Solutions that make it possible to satisfy the needs of tourists and at the same time protect the territory from pollution must be adopted, in order to preserve a cleaner sea for future generations [41].

As a response to the issue of environmental sustainability within ports, cold ironing is introduced, which is an innovative energy supply system [42] aimed at reducing water and air pollution near ports [43], caused by the engines of ships and boats during mooring [44, 45].

Through this process it is possible to have electricity in the docks [46] so that parked yachts and boats no longer need to keep their engines running while moored [47], as they will be able to use electricity directly from the pier [48].

It has been ascertained that, thanks to the electrical infrastructure of the port docks, it is possible to obtain a reduction of CO2 equal to 50%, 99% of CO and over 50% of N2O [49].

Obviously, in order to maximize this system, the electricity used for the energy supply of ships should be produced from renewable sources, for example from solar panels, wind or photovoltaic plants [50].

The electricity produced can also be stored in lithium-ion batteries [51] in order to have energy available when it is not possible to receive it from wind and photovoltaic plants.

It has been observed that cold ironing is also convenient in economic terms, taking into account the fuel savings and wear of the engines [52] of boats and yachts.

Cold ironing is spreading in the major ports worldwide, especially in North America, Northern Europe [53] and in Italy as well, such as in Venice, as part of the “green ports” project [54].

The implementation of this system can also be implemented in the tourist ports of Sardinia which, as observed in this work, are of considerable importance at a national level, taking into account that they have the largest number of berths in Italy.

6 Conclusions

It is now well understood that the economy of the sea is of particular importance in Sardinia. The geopolitical context could also favor the shift in global maritime routes and finally grant it the importance that its geographical position should guarantee. The driving sectors (tourism, transport, logistics, etc.), however, must be combined with the often critical nature of the sectors themselves and the dictates of the imperative policies of environmental and landscape sustainability of their development. The island’s strong

vocation for tourism increasingly has indirect effects on other sectors of the economy, such as, for example, agriculture and culture, which place the region in a very low position compared to the regions of the European Union considered on the basis of per capita GDP (177/244).

The greatest criticality, in addition to the now very heavy population deficit, is linked to the port and airport infrastructure, for external connections, which are the gateways to the entire region, but also roads for the penetration of the innermost areas. Sardinia is thus condemned to a perennial, historical and bivalent isolation: difficult accessibility to internal areas and isolation with respect to the peninsula due not only to insularity, but above all to the problems of territorial continuity. The White Paper on Sardinia's infrastructural priorities (2022) [55] reports on all these critical issues and sets two macro objectives: upgrading the main road and rail network and taking care of the secondary road network; connecting Sardinia to the peninsula and to the national and international markets through additional and stronger connections to ports and airports for both freight and passenger transit. However, the commitment to connect the island with itself and to the outside world requires further medium- and long-term projects; there are now many unfinished works that are more than a decade old. Or else an obsolete railway network, for which the White Paper calls for a modern and capillary one that "cancels the gap created by the lack of connections between the island's main ports and airports" [55, p. 30] in order to "interconnect them and link them to the main towns and centres of major tourist attraction" [55, p. 51]. Finally, enhancing the network of marinas is also a strategic regional asset for economic and social development. The policies examined in this paper, although for lack of space they are briefly mentioned, explain what can be achieved at various levels for the needs of our economy but also of our planet. The idea of increasingly exploiting Sardinia's geographic position as the centre of the Mediterranean is not only, though undoubtedly an economic issue, but also the possibility of servicing an ever-growing number of logistical chains by virtue of the various ports dedicated to them, and offering moorings and other types of tourism in and from ports reserved to this segment of the economy.

The future developments of this research envisage the structure of models, not only to bring the ports up to set standards, but which initially involve, organize and revitalize at least the hinterlands and the first belt areas of these systems. These already exist in the hinterlands of Sardinia's major ports, but all the others need a territorial identification, such as a brand, to make them attractive and dynamic for the development of 'new' economic segments.

References

1. United Nations: Blue Economy Concept Paper (2012). https://sustainabledevelopment.un.org/content/documents/2978BEconcept.pdf
2. European Commission: A European Strategy for more Growth and Jobs in Coastal and Maritime Tourism. COM (2014) 86 final, Brussels (2014). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0086
3. Battino, S., Muñoz Leonisio, M.M.: Port Authorities and smartness: the training policies of Spain's smart ports. J. Reading **2**(11), 195–208 (2022)

4. Commission, E.: The EU blue economy report 2022. Publications Office of the European Union, Luxembourg (2022)
5. Orams, M.: Marine Tourism: Development, Impacts and Management. Routledge, Abingdon (2002)
6. European Boating Industry: Nautical tourism in Europe. https://europeanboatingindustry.eu/eu-affairs/eu-issues/tourism
7. Mundula, L., Ladu, M., Balletto, G., Milesi, A.: Smart marinas. The case of metropolitan city of Cagliari. In: Gervasi, O., et al. (eds.) ICCSA 2020, LNCS 12255, pp. 51–66. Springer Nature, Switzerland (2020)
8. Benevolo, C.: Problematiche di sostenibilità nell'ambito del turismo nautico in Italia. Impresa-Progetto Electron. J. Manag. **2**, 1–17 (2011)
9. Martínez Vázquez, R.M., Milán García, J., De Pablo Valenciano, J.: Analysis and trends of global research on nautical, maritime and marine tourism. J. Marine Sci. Eng. **9**(1), 93 (2021)
10. Luković, T.: Nautical tourism and its function in the economic development of Europe. In: Kasimoglu, M. (eds.) Visions for Global Tourism Industry – Creating and Sustaining Competitive Strategies, pp. 399–430. IntechOpen, London (2012)
11. Confindustria Nautica: Boating in figures. Industry statistics for 2021. Fondazione Edison, Milano (2022). https://lanauticaincifre.it/pubblicazioni/. The data do not include the 237 berthing points in Italy with seasonal facilities whose infrastructures are not permanent as they may be removed in winter (quays and wharves, equipped beaches and boat launch ramp).
12. Fortezza, F.: La nautica da diporto: reti produttive, risorse umane e sfide strategiche. Il comparto nella Provincia di Pesaro-Urbino. Franco Angeli, Milano (2009)
13. Spinelli, R., Benevolo, C.: Towards a new body of marine tourism research: a scoping literature review of nautical tourism. J. Outdoor Recreat. Tour. **40**, 100569 (2022)
14. de la Peña Zarzuelo, I.: Cybersecurity in ports and maritime industry: reasons for raising awareness on this issue. Transp. Policy **100**, 1–4 (2021). https://doi.org/10.1016/j.tranpol.2020.10.001
15. Acciaro, M.: Recenti sviluppi dell'economia del mare. In: Il mare che verrà. Analisi strategica sulle opportunità del Mar Mediterraneo. Centro Giuseppe Bono SEACS, pp. 102–122 (2023)
16. INFORMARE (eds.): X Rapporto Economia del Mare 2022. Azienda Speciale della Camera di commercio di Frosinone e Latina, Alatri (2022)
17. Benelli, G., Calatola, R., Ezza, A., Giovanelli, L., Morandi, F., Usai, A.: La Nautica in Sardegna: le prospettive di crescita di un sistema economico territoriale tra industria e turismo. Dipartimento di Scienze Economiche e Aziendali. Università degli Studi di Sassari (2022)
18. Regione Sardegna: Piano Regionale della rete della portualità turistica. Assessorato dei lavori pubblici, Allegato alla Delib. G.R. n. 47/52 del 24.09.2020 (2020). https://portal.sardegnasira.it/-/piano-regionale-della-rete-di-portualita-turistica-prrpt-avviata-la-valutazione-ambientale-strategica
19. Regione Sardegna: Destinazione Sardegna 2018–2021. Piano Strategico di Sviluppo e Marketing Turistico della Sardegna, F-Tourism and Marketing, Torino (2018)
20. Brundu, B., Battino, S.: Riflessioni sul piano paesaggistico regionale della Sardegna: il contributo delle aree interne. Documenti Geografici **2**, 71–89 (2021)
21. MIMS (Ministero delle Infrastrutture e della mobilità sostenibili): I Piani dello Spazio Marittimo italiani Area Marittima "Tirreno-Mediterraneo Occidentale". Sintesi (Agosto 2022)
22. Regione Sardegna: Pianificazione dello spazio marittimo: documento di posizionamento della Regione Autonoma della Sardegna (2021)
23. Zunica, M.: Per un approccio con l'interfaccia terra-mare. Quaderni del Dipartimento di Geografia, pp. 3–15. Padova (1986)
24. MIMS (Ministero delle Infrastrutture e della Mobilità Sostenibili): Investimenti e riforme del PNRR per la portualità (2022)

25. Martín, R., Yepes, V.: Assessing the relationship between landscape and management within marinas: the managers' perception. Land **11**(7), 961 (2022). https://doi.org/10.3390/land11070961
26. Teo, T.W., Choy, B.H.: In: Tan, O.S., Low, E.L., Tay, E.G., Yan, Y.K. (eds.) Singapore Math and Science Education Innovation. ETLPPSIP, vol. 1, pp. 43–59. Springer, Singapore (2021). https://doi.org/10.1007/978-981-16-1357-9_3
27. Balletto G., Milesi A., Ladu, M., Borruso, G.: Networks for reinventing the past. The case of the Santa Barbara Walk (Sardinia, Italy). In: 23rd IPSAPA/ISPALEM International Scientific Conference Napoli (Italy), 4th–5th Jul 2019
28. Banca d'Italia: Indagine sul turismo internazionale. Statistiche - Banca d'Italia (2022)
29. Regione Sardegna: Turismo, estate record per la Sardegna e la stagione continua. Cagliari (2022). https://www.regione.sardegna.it/j/v/2568?s=441458&v=2&c=3692&t=1
30. Regione Sardegna: Turismo, la Sardegna cresce e a giugno supera i livelli pre-Covid. Cagliari (2022). https://www.regione.sardegna.it/j/v/2568?s=437493&v=2&c=3692&t=1
31. Gambino, S.: Nuove forme di turismo per l'Area costiera nebroidea: il ruolo del porto turistico di Capo d'Orlando – New forms of tourism for the Nebrodi coastal area: the role of tourist port of Capo d'Orlando. Bollettino dell'Associazione Italiana di Cartografia **164**, 62–72 (2018)
32. Łapko, A.: Age simulation suits in education and training of staff for the nautical tourism sector. Sustainability **15**(4), 3803 (2023)
33. Radulovic, A.: Smart technology applied in the management of yachting marinas. Int. J. Maritime Eng. **164**(A1), 81–90 (2022)
34. Di Bella, A.: Boutique festival e innovazione turistica: il caso della Sicilia. Rivista Geografica Italiana **1**, 75–94 (2023)
35. Locci, E.: Birth of tourism in southern Sardinia Santa Margherita di Pula. Eur. J. Hospitality Tourism Res. **10**(3), 13–22 (2022)
36. Leonardi, R., Abondio, I., Campolo, F., Fabris, E., Pedersoli, M., Tropea, M.F.: Commentario alle leggi sull'ambiente – Articoli da 53 a 176. Key editore, Milano (2023)
37. Idris, H.: Southeast asian port development: policy and initiatives towards achieving 2030 agenda on sustainable development goals. Akademika **92**(2), 129–142 (2022)
38. Pellegrini, M., Saccani, C.: Tecnologie innovative ad eiettori per la gestione sostenibile di fondali costieri, bocche portuali e porti turistici. In: Gestione sostenibile dei sedimenti e crescita blu in ambito costiero e nei medi e piccoli porti, Tavolo Nazionale Erosione Costiera. Ecomondo Scientific Technical Committee, ISPRA, GNRAC, 2019, pp. 379–385 (2019)
39. Tong, L., Zhang, C., Peng, Z., Wang, L.: Spatial–temporal distribution characteristics and correlation analysis of air pollutants from ships in inland ports. Sustainability **14**(21), 14214 (2022)
40. Barberi, S., Sambito, M., Neduzha, L., Severino, A.: Pollutant emissions in ports: a comprehensive review. Infrastructures **6**(8), 114 (2021)
41. Łapko, A., Hącia, E., Wieczorek, R.: Collection of waste from passenger ships and its impact on the functioning of tourist port city Świnoujście. Sustainability **13**(4), 1–16 (2021)
42. Chica, M., Martínez-López, A., Romero-Filguiera, A.: Specific environmental charges to boost Cold Ironing use in the European Short Sea Shipping, Transport and Environment. Transport. Res. Part **94**, 102775 (2021)
43. Martínez-López, A., Romero, A., Orosa, J.A.: Assessment of cold ironing and LNG as mitigation tools of short sea shipping emissions in port: a Spanish case study. Appl. Sci. **11**(5), 1–16 (2021)
44. D'Agostino, F., Schiapparelli, G.P., Dallas, S., Spathis, D., Georgiou, V., Prousalidis, J.: On estimating the port power demands for cold ironing applications. In: IEEE Electric Ship Technologies Symposium (ESTS), Arlington, VA, USA, pp. 1–5 (2021)
45. Zis, T.: Prospects of cold ironing as an emissions reduction option. Transport. Res. Part A Policy Pract. **119**, 82–95 (2019)

46. Bakar, N.N.A., Bazmohammadi, N., Vasquez, J.C., Guerrero, J.M.: Electrification of onshore power systems in maritime transportation towards decarbonization of ports: a review of the cold ironing technology. Renew. Sustain. Energy Rev. **178**, 113243 (2023)
47. Colarossi, D., Principi, P.: Feasibility study of a cold ironing system and district heating in port area. Firenze University Press **178**, 113243 (2020)
48. Spengler, T., Tovar, B.: Potential of cold-ironing for the reduction of externalities from in-port shipping emissions: the state-owned Spanish port system case. J. Environ. Manage. **279**, 111807 (2021)
49. La Gazzetta Marittima: I porti e l'ambiente (2018). https://www.lagazzettamarittima.it/2017/09/27/remtech-i-porti-e-lambiente/
50. Sifakis, N., Vichos, E., Smaragdakis, A., Zoulias, E., Tsoutsos, T.: Introducing the cold-ironing technique and a hydrogen-based hybrid renewable energy system into ports. Int. J. Energy Res. **46**(14), 20303–20323 (2022)
51. Capraram G., Martirano, L., Kermani, M., de Mesquita Sousa, D., Barilli R., Armas, V.: Cold Ironing and Battery Energy Storage System in the Port of Civitavecchia. In: 2022 IEEE International Conference on Environment and Electrical Engineering and 2022 IEEE Industrial and Commercial Power Systems Europe, pp. 1–6. Prague, Czech Republic (2022)
52. Piccoli, T., Fermeglia, M., Bosich, D., Bevilacqua, P., Sulligoi, G.: Environmental assessment and regulatory aspects of cold ironing planning for a maritime route in the Adriatic Sea. Energies **14**(18), 5836 (2021). https://doi.org/10.3390/en14185836
53. Innes, A., Moison, J.: Identifying the unique challenges of installing cold ironing at small and medium ports – The case of Aberdeen. Transp. Res. Part D: Transp. Environ. **62**, 298–313 (2018)
54. di Venezia, A.P.: Comunicato stampa: Enel consegna all'Autorità Portuale di Venezia il cold ironing per l'area di Marittima, Iniziative "verdi" per il porto, a beneficio della città (2011)
55. CCIAA Sardegna: Libro Bianco sulle priorità infrastrutturali della Sardegna. Uniontrasporti (2022). https://www.caor.camcom.it/notizie/libro-bianco-delle-priorita-infrastrutturali-della-sardegna