Smart Marinas. The Case of Metropolitan City of Cagliari

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Abstract. Nautical tourism market and especially the sector of yachting and marinas is very dynamic. It contributes decisively to the development of local economies of Mediterranean countries and Northern Europe cities. Particularly, marinas (specially designed harbors with moorings for pleasure yachts and small boats) development takes place in coastal areas, which are generally fragile and threatened environments. On one hand marinas are highly desirable for development of recreation and tourism infrastructure, but from the other they are threatened by climate change impacts due to sea level rise. Moreover, marinas are the most complex and highest quality types of port for nautical tourism. They facilitate many nautical tourism activities by providing safe points to access to the water and providing secure locations to store boats. Many marinas also provide additional nautical and ancillary leisure activities and can be visitor attractions in their own right. They also create demand for boating and other tourism products and services and facilitate linkages between nautical and coastal tourism. They have the potential to act as economic hubs for regional development and can catalyze the development of coastal tourism in specific locations. In this perspective, the role of marinas could be reconsidered, transforming them in smart gateway able to push in sustainable way local and regional economy moving the touristic flows from the coastal to the internal areas.

Keywords: Marinas · Nautical tourism · Regional economy · New technologies

1 Introduction

Recent statistical information indicates that tourism is one of the largest and fastest growing industries in the world, and plays an important part in the economic development strategies of many regions. However, the tourism industry can have negative impacts on the environment, such as the loss of natural landscapes, congestion, change or loss of local identity, loss of community employment, and increase of economic

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inequalities. These environmental problems can be exacerbated if planning and management are not sustainable. Sustainable tourism development is tourism that fully considers "*current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities; and maintaining cultural integrity, essential ecological processes, biological diversity and life support systems*" (UNEP and UNWTO 2005).

Marina development takes place in coastal areas, which are generally fragile and threatened environments. On one hand marinas are highly desirable for development of recreation and tourism infrastructure, but from the other they are threatened by climate change impacts due to sea level rise. Moreover, marinas are the most complex and highest quality types of port for nautical tourism. They facilitate many nautical tourism activities by providing safe points to access to the water and providing secure locations to store boats. Many marinas also provide additional nautical and ancillary leisure activities and can be visitor attractions in their own right. They also create demand for boating and other tourism products and services and facilitate linkages between nautical and coastal tourism (Balletto and Casula 2011).

2 Nautical Tourism

Since the addition of tourism to the European Union's competences in 2009 with the Lisbon Treaty, the European Commission has been working to develop a tourism policy, which enhances Europe's broad and competitive tourism industry.

On 20 February 2014, the European Commission adopted the strategy on coastal and marine tourism, where it also recognized the issues signaled by European Boating Industry.

European Boating Industry has been submitting its policy contributions with regards to nautical tourism, given the importance of boating and water based leisure activities (such as water sports) to the wider tourism economy.

Europe boasts close to 70,000 km coastline and 27,000 km of navigable inland waterways. It is a leading destination for boating and water sports enthusiasts from across the world. There are over 4,500 marinas in Europe, which offer 1.75 million berths for a total boat park of 6.3 million vessels. Today, 70% of boat charter takes place in Europe, with a significant part being held in the Mediterranean Sea. These activities represent an important income for coastal and insular economies with boating, water sports and marinas accounting for 180,000 jobs and generating approximately 17 billion euros in revenue per year across Europe.

In its 2012 Communication on Blue Growth the Commission identified coastal and maritime tourism as one of the five sources of new jobs and growth in the Blue Economy[1]. The 2014 Commission Communication "A European strategy for more Growth and jobs in Coastal and Maritime Tourism" (the CMT strategy)[2] proposed

[1] Comprising the economic activity of the marine and maritime sectors.

[2] Specifically, related to CMT Strategy actions 5, 6, 9, 10, 11, 12 and 13.

actions to be undertaken at European level, in cooperation with national, regional and local stakeholders, to tackle the needs and challenges of the sector.

Coastal and maritime tourism is a significant sub-sector of both the wider tourism sector and the Blue Economy. It is estimated to employ approximately 3.2 m people and generate €183bn of gross value added (GVA) (Ecorys 2013).

As highlight by Favro (2008), "*nautical tourism is a subsystem in the economic branch of the maritime economy and tourism within overall national economy, with all the characteristics of system and its partial components which are defined as entities, facilities and elements of nautical tourism*", generating annual revenues of between €20 and €28 billion per year and employing between 200,000 and 234,000 people[3].

The services sector, which includes equipment repair, boat charter, marinas and other services, accounts for around half of this value[4].

There are no official definitions of nautical tourism published by the European Commission or international organizations such as the UN World Tourism Organization (UNWTO). However, the term is not entirely novel. Working definitions have been used in other research. For example: Luković and Gržetić (2007) define nautical tourism as: "*The entirety of multifunctional activities and relations caused by the stay of tourists-boaters in nautical tourism ports or out of them, and by the use of vessels and other objects related to nautical tourism aimed at recreation, sports and entertainment and other needs*".

There is some debate about whether the adoption of the term 'nautical' should mean that nautical tourism refers only to the activities of 'navigation' (e.g. travelling by boat). However, it is more commonly applied to boating-related activities that occur in the sea; where a boat is any waterborne craft, from a cruise liner to a kayak. It commonly excludes beach-based activities and may include or exclude activities such as surfing. For example, Luković (2012) identified a hierarchical set of nautical tourism activities:

- Main activities: (i) harbors (berths, moorings, marinas) (ii) charters (iii) cruising.
- Secondary activities: diving, surfing, rafting, diving-bells, rowing, fishing, etc.
- Supporting: activity providers and related services; manufacturing industries.

Nautical tourism and maritime tourism (as defined by Ecorys 2013) are broadly similar concepts. For the purpose of this study, nautical tourism is taken to be a subset of maritime tourism as it does not cover cruise ship activities. Nautical tourism is here defined as comprising the following activities in coastal and offshore marine waters:

- Harbor and marina-based/facilitated activities;
- Boating activities (including charter and non-charter) i.e. yachting, dinghy sailing, boat based angling and wildlife watching, other watercraft (e.g. kayaking).

[3] There is no comprehensive dataset for nautical tourism activity. The estimated range is from ICF calculations using ICOMIA 2014 data; and Communication from the Commission to the European Parliament calculations using 2011 ICOMIA data (published in COM(2014) 254 final/2 of 13.5.2014).

[4] ICF estimate based on ICOMIA data for 2014.

- Marinas and boating development (including its influence on regional development) and combined nautical and coastal tourism products (henceforth, 'combined products')

Nautical tourism is a phenomenon that in the last three decades has recorded one of the highest development rates known in the European economies. Economic forecasters for tourism development agree that nautical tourism is in its early stages of development and that increasing results are to be expected. From a scientific perspective, nautical tourism development is still not sufficiently represented in the science of tourism even if it contributes to the general development of the economy of any country or any area by fostering growth and development through its regular activities, as well as through horizontally and vertically related activities, such as excursion tourism, diving, photo safaris, servicing, handicrafts and shipbuilding. All these activities contribute to the creation of jobs for residents, in particular, where insular economies are concerned (Jugović et al. 2011).

As far as social aspect of nautical tourism is concerned, its contribution is seen in the transfer of information, knowledge, culture and lifestyle. In this way, nautical tourism has a significant contribution as its foreign boats and yachts and their equipment attract local population, thus promoting the development of ideas, creativity and free thinking. From the viewpoint of the receptive country, nautical tourism represents an important source of foreign exchange yield which is considered a specific form of export (the so-called invisible export). All expenditures of foreign tourism in any country represent a contribution to the balance of payment of the host country.

In this framework, nautical tourism should be considered as a complex system and examined in accordance with the logic of general systems theory (Kovačić 2004) and the principles for the management of integrated complex systems (Favro 2008).

To achieve efficient and maximum results must be guaranteed: manageability of the system; interaction between all the components within the system and between the system and the external components (Favro 2002) - as local services, climate conditions, etc.-; and their joint orientation towards common values and goals.

The above presented characteristics of the system of nautical tourism suggest that nautical tourism is connected with regional economy taking an important place and role.

2.1 The Role of the Marinas in the Nautical Tourism

As highlighted in the previous paragraph, nautical tourism offers enormous development opportunities. In particular, the recreational boating segment is continuously growing. For example looking at the number of megayachts (over 30 m in length) in navigation, the analysis of the data for the last ten years highlights the exponential increase in the world fleet. From 3,906 boats in 2009 it increased to 5,646 in 2019 and the forecast is 5,789 yachts sailing in 2022.

Going into detail, in 2009 there were 2,626 from 30 to 40 m, 1,055 from 40 to 60 m, 183 from 60 to 90 m and 42 over 90 m. In 2019 there are 3,553 by 30–40 m, 1,649 by 40–60 m, 355 by 60–90 m and 89 by more than 90. A growth trend in size that will also be confirmed in 2022, when, according to the forecasts of Redmayne, it will reach 387 boats between 60 and 90 m and even 97 that will exceed 90 m.

Recreational boating is also a sector that has a strong impact on the economy of the area as well as on employment: the multipliers of production and employment are particularly significant and the absolute highest among those of the various sectors of maritime activity.

The Mediterranean is an area extremely affected by recreational boating: in the winter the basin hosts 56% of the yachts, while during the summer the share rises to 70%. Looking at Italy, an ANCE study shows that, considering also the expense of boaters, 1 employed in the sector generates another 6.4 employed; 1 euro spent, activates 4 in the economy. The estimate is that in Italy recreational boating makes a contribution to GDP of 3.35 billion euros: the annual expenditure of boaters is estimated at 5 billion euros, committing overall related activities to more than 120 thousand workers, of whom 27,300 as direct employees.

The main ports for the development of recreational boating are the marinas which, depending on their equipment, determine the development of the sector.

Table 1 illustrates the data on the infrastructural endowments of the Italian regions where recreational boating has a more significant weight. Beyond the figure relating to the numerical consistency of these structures, two indices are presented: the first concerns the ratio between the number of berths and the Km of coastline (density) while the second measures the ratio between the registered recreational boats and the number of berths (crowding) in order to determine the level of infrastructure of the regions in relation to the respective nautical park.

The measurement of these indices is particularly important, since the quantitative (as well as the qualitative) level of recreational infrastructures clearly influences the development of the sector: the scarce or abundant availability of berths can in fact represent an obstacle or an incentive to spread the yachting.

The data in Table 1 show how the docking points for recreational boating are more numerous in Southern Italy, where however the infrastructural facilities for recreational boating highlight significant differences compared to the north of the country. In particular, as of 30/09/2018, the coasts of the Northern Regions offer 73.0 berths per kilometer of coastline to the yachting, compared to the corresponding averages of 28.1 and 13.0 berths calculated respectively for the coasts of the Central Italy and Southern Italy.

The maximum, in the North, is observed in correspondence of Friuli Venezia Giulia (180.8). In the South, however, the minimum of this relationship is found in “Calabria and Basilicata Tirrenica”. Looking at the crowding index (number of registered units per 100 berths), there are high values in Lazio, Veneto and Campania, with a maximum of 122.0 for the Lazio coast. Comparing the number of berths with the number of boats registered, it is to note that, with the exception of Lazio, the Italian coastal regions have a number of berths higher than that of the boats registered at the Peripheral Maritime Offices and how, in particular, Puglia, Calabria, Sicily and Sardinia, whose coasts absorb about two thirds of the overall length of the Italian coasts, offer a significantly higher number of docking points than the pleasure craft actually present in the Region; these data also highlight an infrastructural structure, especially in the South, able to meet the high demand for berths for pleasure craft coming, in the summer months, from abroad or from other regions.

Table 1. Statistics on Italian marinas at regional level

Region	n. berths	Density	Crowding	Registered boats
Piemonte e Valle d'Aosta	–	–	–	3756
Lombardia	–	–	–	6811
Trentino Alto Adige	–	–	–	63
Veneto	6887	49,2	93,3	6427
Friuli Venezia Giulia	17001	180,8	23	3918
Liguria	25157	64,7	72,7	18277
Emilia Romagna	5360	43,9	86	4610
Northern Italy	**54405**	**73**	**80,6**	**43862**
Toscana	17550	31,3	57,6	10104
Umbria	–	–	–	237
Marche	5302	28,2	58	3077
Lazio	8356	23	122	10195
Central Italy	**31208**	**28,1**	**75,7**	**23613**
Abruzzo	2751	19,9	31,2	858
Molise	587	16,3	11,4	67
Campania	16190	31,0	93,5	15132
Puglia e Basilicata ionica	13750	13,3	22,3	3066
Calabria e Basilicata tirrenica	5490	6,9	20,4	1118
Sardegna	19948	10,8	21,3	4244
Sicilia	17344	11,8	27,6	4795
Southern Italy	**76060**	**13,0**	**38,5**	**29280**
Italy	**161673**	**21,0**	**59,8**	**96755**

Source: Ministero delle Infrastrutture e dei trasporti "Il Diporto Nautico in Italia 2018"

Analyzing the function of the tourist ports in a wider way, it is necessary to consider the peculiar geo-morphological character of the coasts as a border element and natural passage area - that is, enter or exit - between the marine and terrestrial ecosystem. From the point of view of socio-economic development, the coasts have been anthropized through the port infrastructures that embody the role of transit places and continuous exchanges of populations, people and different know-how, triggering processes of continuous transformation of natural elements and of the built environment but above all of local and supra-local development. The success of seaside towns, which have been able to build empires with the strength of their military and commercial fleets, is the strongest proof of this.

The strong identity of these places of contact between the urban fabric and the water body derives, on the one hand, from the modification of the reference ecosystem, one enters an ecosystem and exits the other, and on the other from being intermodal hub, it passes from the boat (of whatever type it is) to other forms of mobility.

As when a traveler arrives in a city he does not know, he needs to find all the information that can allow him to move easily within it, enjoy its beauty and fuel its economy; so those who arrive in a port should be able to find not only a safe mooring but also all the information, infrastructures and services to visit the territory connected to it.

This function of ports, in particular tourist ones, is not yet fully understood today, with the consequence that these often remain relegated to their role as "shelter places" and "service stations" of boats rather than access doors (gateway) to the territory.

The major problem is the poor communication between the local context (city, village or what else) and the marina. The two entities have to coexist in a restricted area and, from the outset, would appear to have opposing interest and objectives.

- The marina as a business is focused on the economy, productivity, competitiveness, as well as on the market and on business development.
- The city/town/Municipality, together with residents, is more focused on what impact the marina will have on the quality of life, as well as on visual and ecological concerns.

This divergence contributes to a vision of conflict over the physical and functional compatibility of the two opposing sides. Marinas and cities often have conflicting strategies about getting control over the area. The marina industry, looking to build new premises for their activities, can often be to the detriment of the city or local waters. Urban areas generally oppose this expansion due to environmental reasons and insist on the rational use of existing capacity (Robinson 2009). Urban areas are interested in regaining access to the coast by taking abandoned or underutilized areas which can be used for building houses, cultural activities, recreation, swimming and more.

To overcome difficulties arising from the lack of space or from a desire to use space in a different way, it is therefore necessary to implement a concept that will incorporate the marina into the city, making it an integral part of the city and part of a system that works in synergy.

City harbors always contribute to the development of a city and of a territory. This development is in accordance with the pathway determined by the local and broader community. A particular case is that of communal ports because the commercial character of the boatbuilding increasingly being replaced by tourism.

Coastal cities are developing new activities to attract more trade and visitors. These new developments often replace old established businesses, such as boatbuilding and commercial wharfs, that are relocated to a less attractive area. These changes directly give rise to new questions, such as the value of the coastal zone (Bizzarri and La Foresta 2011). This means that the old city ports, harbors and marinas need to find a balance with the expansive demands of nautical tourism that is looking for integrated offer systems. In this view, the established forms of management should be replaced by a way of thinking which should ensure interaction with all the components of the territorial system.

Aiming to ensure sustainable development and achieve optimal regional socio-economic development, the existing classification and categorization of ports of nautical tourism needs to be adapted to established goals and planned results.

Marina should become a meeting point for exchange of experiences, communication with other guests, but also with employees (currently not optimal). Education, i.e. workshops and seminars should provide training of personnel. Nautical tourism should organized into a community. The interest group of people providing professional services in marinas still cannot meet all the needs of leisure mariners. An example of what needs to be provided for leisure mariners is an efficient and prompt mail delivery, because marina is just their temporary address. Marina should have a social and service orientation, not only serve as a physical storage place for vessels.

3 Marinas as Territorial Gateway: A Proposal for an Evaluation Methodology

To calculate the propensity of a marina to be a territorial gateway, two aspects were combined: its introversion, intended as the set of its intrinsic characteristics, and its extroversion, intended as its projection towards the outside.

To calculate introversion, the following indices were considered: physical accessibility and internal services. To calculate the extroversion, the following were taken into consideration: the distance from complementary services outside the marina, virtual accessibility and the quality of virtual accessibility.

Each of the above indices, in turn, is composed of a series of indicators as shown in Table 2.

Table 2. Indicators used to define the "Introvert" and "Extrovert" indices

Introvert (Vi)		Extrovert (Ve)		
Physical **A**ccessibility (PHA)	Internal services (IS)	Distance from complementary services (CS)	Virtual accessibility (VA)	Quality of the virtual accessibility (QVA)
n. of berth (B); Draft (D); Max length (MaxL)	Water; Electricity; WiFi; Fuel; Bath and shower; Laundry; Shipyard; Travel lift; Crane; Boat slide; Swing Lift; Weather service; Parking; Bar/Restaurant/Pizzeria; Sailing school; Diving; Playground; Car rent; Scooter rent; Inflatable boat rent; Bike rent; Surveillance; Mooring assistance; On-board technical and electronic assistance (GPS, depth sounders, air conditioners, etc.).	Supermarket (S); Pharmacy (P); Post office (PO); Bus (B)	Bilingual (Italian - English) (BL); More than 2 languages (ML); Website (WS); Touristic information (TI); Accessibility from different devices (DA); Link to municipality website (LWS)	Touristic information (QTI); User friendly (UF); Quality of accessibility from different devices (QDA); Presence on specialized portal (PSP)

The calculation of the indices was made according to the following criteria.

As regards physical accessibility (PhA), a scale from 0 to 1 has been defined according to the values assumed by the various indicators, as shown in the following Table 3.

Table 3. Score values for the indices of physical accessibility

Berth	Draft	Vessels max length
0–50 = 0,1	0–1 mt = 0,1	0–10 mt = 0,1
51–100 = 0,2	1, 1–2 mt = 0,2	10, 1–20 mt = 0,2
101–150 = 0,3	2, 1–3 mt = 0,3	20, 1–30 mt = 0,3
151–200 = 0,4	3, 1–4 mt = 0,4	30, 1–40 mt = 0,4
210–250 = 0,5	4, 1–5 mt = 0,5	40, 1–50 mt = 0,5
251–300 = 0,6	5, 1–6 mt = 0,6	50, 1–60 mt = 0,6
301–350 = 0,7	6, 1–7 mt = 0,7	60, 1–70 mt = 0,7
351–400 = 0,8	7, 1–8 mt = 0,8	70, 1–80 mt = 0,8
401–450 = 0,9	8, 1–9 mt = 0,9	80, 1–90 mt = 0,9
451–500 = 1	9, 1–10 mt = 1	90, 1–100 mt = 1

The physical accessibility value (PHA) is therefore defined as the average of the values reported in each variable.

$$PhAcc = \frac{B + D + MaxL}{3}$$

The value of internal services (IS) is instead calculated as a percentage, that is, as the number of existing services compared to the total of services identified as relevant.

$$IS = \frac{n.of\ existing\ services}{n.of\ prelevant\ services}$$

As for Distance from complementary services (CS) index, a scale from 0 to 1 has been defined according to the distance of services from the tourist port as shown in the following Table 4.

The value of the Distance from complementary services is therefore defined as the average of the values reported in each variable.

$$LS = \frac{S + P + PO + B}{4}$$

The value of the intangible accessibility (VA) is instead calculated as a percentage, that is, as the number of characteristics present on the websites compared to the total of the characteristics identified as relevant.

Table 4. Score values for the distance from complementary services (CS)

Distance from Complementary services
0–500 mt = 1
501–1000 mt = 0, 9
1001–1500 mt = 0, 8
1501–2000 mt = 0, 7
2001–2500 mt = 0, 6
2501–3000 mt = 0, 5
3001–3500 mt = 0, 4
3501–4000mt = 0, 3
4001–4500mt = 0, 2
4501–5000 mt = 0, 1

$$VA = \frac{n.of\ existing\ characters}{relevant\ characters}$$

As regards the quality of intangible accessibility (QVA), the scores on a scale from 0 to 1 are attributed based on a subjective judgment, except for the presence on the sector portals which is instead calculated as a percentage value (number of portals in which the port appears compared to the total number of reference portals).

The value of the quality of the intangible accessibility is therefore defined as the average of the values reported in each variable.

$$QVA = \frac{QTI + UF + QDA + PSP}{4}$$

The calculation of the introversion (Vi) and extroversion (Ve) values is finally carried out by calculating the average of the values of the various indicators that compose them.

$$Vi = \frac{PHA + S}{2}$$

$$Ve = \frac{BLS + VA + QVA}{3}$$

Finally, the result obtained is normalized through the following formula:

$$x_i norm = \frac{x_i - min}{max - min}$$

The last step is the clustering of marinas according to the indices values (Table 5).

Table 5. Clusters of the marinas

	Extrovert	Introvert	Description
Old way	0–0, 5	0–0, 5	Marinas that have characteristics such as to serve small boats, which have few services and which have a low if not any projection towards the outside in a virtual or physical sense
Potential	0–0, 5	0, 51–1	Marinas that have characteristics such as to serve even large boats, with a good level of services but which have not yet developed an outward projection in a virtual or physical sense
Supporter	0, 51–1	0–0, 5	Marinas that have characteristics such as to serve small boats, which have few services but which have understood that their success passes from a good projection towards the outside both in a virtual and physical sense. Although they cannot, in all likelihood, expand their structural endowments, they constitute an excellent complement to the "gateway" tourist ports
Gateway	0, 5–1	0, 5–1	Tourist ports that have characteristics such as to serve even large boats, with a good level of services and that have developed an outward projection both in a virtual and physical sense

4 The Marinas of the Metropolitan City of Cagliari

With its almost 2000 km of coastline, fine beaches and cliffs, the Sardinia Region remains one of the most beautiful scenarios in the world for those who want to do nautical tourism. Also strong in the presence of several smaller islands, parks, marine reserves and protected areas, this land has no equal in the tourist offer of the Mediterranean.

As shown in Table 1, Sardinia today boasts 31 marinas with 19948 berths offering on the one hand a density significantly lower than the national average with 10.8 berths/km of coastline (Italy figures out for 21), and a number of berths significantly higher than the number of recreational boats registered (that is a crowding index of 21.3, versus an Italian average of 59.8).The latter data reveals the presence of an infrastructure intended to meet the high demand for berths for tourist boats coming in the summer months from abroad or from other regions. A further aspect to highlight concerns the 334 berths over 24 m offered by Sardinia, 10% of Italy. This segment is very important because the expenditure of these units, in Italian waters, was valued at € 209 million (estimate based on a sample of 1,200 units in transit, for an average stay of 3.8 days and with an expense daily average of € 8,900).

In this framework, the case study of the Metropolitan City of Cagliari (CMC) is particularly interesting. In Italy the metropolitan cities are a recent institution, established by the Law 56/2014 (Delrio Law), that represent a new governance level between regions and municipalities replacing, de facto, the Province level. By the way not all the

Province has been replaced by metropolitan cities but only 14[5], and 13 of them (with the exception of Cagliari) are constituted by the same municipalities of the old Province. In the area of the metropolitan city of Cagliari there are eight marinas (Fig. 1).



Fig. 1. The marinas of the metropolitan city of cagliari (*elaboration by Luigi Mundula)*

It's to note that three of them (Marina del Sole, Marina di Bonaria, Marina di Sant' Elmo), are very close (just few meter of distance), four of them (Marina del Sole, Marina di Bonaria, Marina di Sant'Elmo and Portus Karalis) are inside the same port (Cagliari port) and five of them (Portus Karalis, Marina del Sole, Marina di Sant'Elmo, Marina di Bonaria, Marina Piccola) are in the same municipality (Cagliari). Nevertheless, these marinas present different characteristics in terms of equipment and services.

[5] The Italian Metropolitan Cities are: Bari, Bologna, Catania, Cagliari, Firenze, Genova, Messina, Milano, Napoli, Palermo, Reggio di Calabria, Roma, Torino, Venezia.

Applying the methodology depicted in the previous paragraph to the 8 marinas of the CMC, the final results (Fig. 2) show a polarized situation with three marinas entering in the "gateway" group and five in the "old way" group.

Among the three marinas entering in the "gateway" group (Portus Karalis, Marina di Sant'Elmo and Marina di Capitana), Portus Karalis reach the highest normalized value of the introversion and extroversion indices (Vi, e = 1), followed by Marina di Capitana (Vi = 0.83; Ve = 0.86) and Marina di Sant'Elmo (Vi = 0.55; Ve = 0.95).

The Portus Kalaris thus establishes itself as the most important gateway of the metropolitan area. In fact, although it guarantees a much lower number of berths than those of Marina di Sant'Elmo and Marina di Capitana, Portus Karalis is the only one with characteristics that can accommodate boats of 90 m in length, guaranteeing them a significant offer of services. Moreover, the direct proximity of the infrastructure to the historic urban core of the city of Cagliari and to its main cultural, institutional, administrative, managerial and logistic centers, means that it is possible to reach important external services from this port, located within a buffer less than km. This represents an element of uniqueness compared to all the other ports analyzed. Finally, Portus Karalis presents a good degree of virtual accessibility and quality of the latter. Its presence is confirmed in the main sector portals.

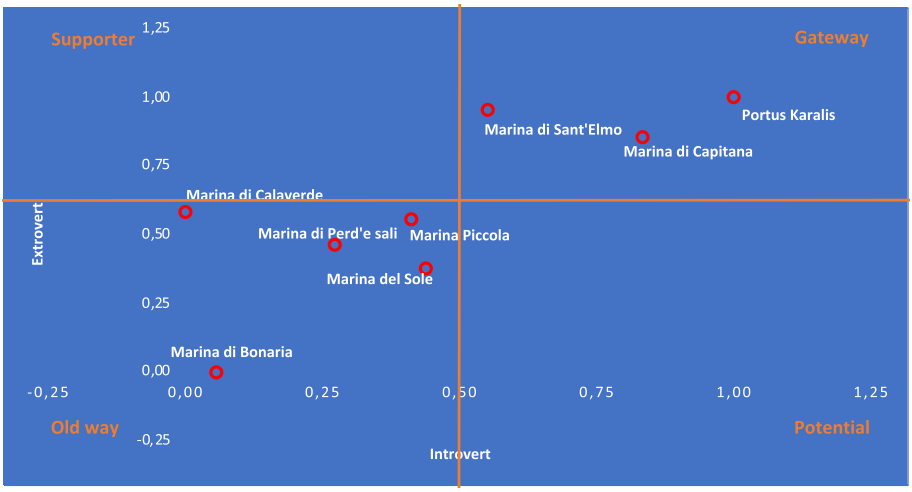

Fig. 2. Cluster analysis of the CMC marinas (*elaboration by Luigi Mundula)*

Among the five Marinas entering the "old way" group (Marina di Bonaria; Marina del Sole; Marina di Perd'e sali; Marina di Calaverde; Marina Piccola) Marina di Bonaria is the one with the lowest values (Vi = 0, 6; Ve = 0). To influence overwhelmingly this result is the absence of internal services (the port offers only water, electricity and fuel), but also the distance greater than 1 km from the main external services and the absence of virtual accessibility. The port is present only on two portals.

Higher values are reached by Marina del Sole (Vi = 0.44; Ve = 38) and Marina di Perd'e sali (Vi = 0.27; Ve = 0.46).

It's to note that two of the "old way" group (Marina di Calaverde and Marina Piccola) are very close to the threshold with the "supporter" group. In fact, the analysis shows that Marina di Calaverde (Vi = 0.00; Ve = 0.58) has a good physical accessibility and a good offer of internal services, although some important external services such as the pharmacy and the post offices are distant about 10 km from the infrastructure. In general, the Port has a good virtual accessibility as well as a good quality of the same. On the other hand, Marina Piccola (Vi = 0.41; Ve = 0.56) guarantees a greater offer of internal services and is about 1 km away from the main external services. It has good virtual accessibility and good quality of the same. Furthermore, it is present in most sector portals.

5 Results and Final Remarks

The results produced by the application of the assessment methodology to the 8 marinas in the Metropolitan City of Cagliari (CMC) form the basis for planning future development policies for smart and sustainable marines, based on innovation and investment in marina infrastructure and boating products, but also on the integration of marinas into regional development planning. It means encourage planning, innovation and investment that supports the sector adjust to, and exploit, changes in consumer demand and broader its role as a hub and catalyst for economic activity. This is expected to benefit the competitiveness and the performance of coastal regions more broadly.

The analysis carried out in the context of this research has highlighted the uneven nature (albeit then polarized into two groups), especially with regard to the quantity and quality of services offered by the CMC tourist ports. Unfortunately, this characteristic unites the whole of Sardinia and more generally the regions that have a potential for development in nautical tourism.

The output, in terms of policy, generated by the results produced, should not necessarily lead to programming a set of measures aimed at transforming each port into a gateway. In a metropolitan context such as the one in question, it could be useful to plan the system of tourist ports by thinking in terms of clusters and networks.

Establish a virtual platform for combined coastal and nautical tourism products to support networking, engagement and information exchange, as well as the provision of a micro-funding facility for SMEs developing combined products can be considered future goals.

The virtual platform will help to address problems created by the fragmented nature of the sector, providing a forum for information sharing, collaboration and partnering. At the same time, support the diversification of tourism products allow to meet a growing area of consumer demand, improving the competitive position of the sector.

Within a network (no longer a node) approach, groups of ports similar in location/context, and function, such as Marina di Bonaria, Marina del sole and Marina di S. Elmo, could constitute a single system based on integrated programming and management, also with reference to the offer of internal and external services. On the

other hand, this approach would facilitate the transition of some of the existing infrastructures to the "supporter" level of the main gateways.

As regards the importance of strengthening the link between the tourist ports and the urban and territorial context of reference, one of the main challenges concerns the development of connection and logistics hubs and the promotion of a series of measures to strengthen the public transport service. And alternative and sustainable mobility. In this sense, a virtuous example is provided by the tourist ports of Villasimius and Teulada (which are located just outside the border of the metropolitan city, which since summer 2019 offer some smart services for those arriving by boat. The keywords are three: welcome, technology/innovation and environment/green. The novelties include a smartphone to allow tourists to move more easily and a greater offer of electric vehicles on the quay to improve connections with the coast and the town.

The possibility of using rent electric vehicles allows to think about a welcome that goes beyond the summer. Helping the tourist to get to the heart of the area is a benefit for everyone. The assets to focus on are environmental sustainability and knowledge of the territory, which need an operational tool such as the mobile phone, already equipped with all the information to facilitate the approach with the territory: historical places, places to visit, food and wine excellences, etc.

In this context, the need to establish an association between the managers of the tourist port facilities, which has taken on the consortium form and the name of Sardinia Ports Network, has matured. Established in 2001, among four public entities, today the Sardinia ports network consortium, associates 19 of the main port facilities along the coast of Sardinia and pursues the objective of associating all the tourist ports by raising the standard of services, limiting internal competition, establishing common management platforms and trying to conquer new slices of the yachting market.

In addition, the community project "Odyssea" was presented, which aims to transform marinas from simple parking lots of boats to places of access to the territory. Those who arrive on the island, for example, can immediately immerse themselves in the local culture by tasting the Gallurese soup or the Campidanese malloreddus and discovering the true, sometimes hidden, specificities of the place.

The transformation of the marina into a Marina resort is a cultural leap as well as a technical and technological one. The increase in the number of charters, the presence of foreign boats and crews, the demand for new services as well as climate change are new realities that need to be promptly answered.

An opportunity to be taken in this direction will be the CMC Strategic Plan, currently being defined, which represents an extraordinary opportunity to give a new impulse to the development of smart and sustainable marinas, intended as the main access gates to the metropolitan and island territory.

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