

## Article

# An Integrated Methodology Model for Smart Mobility System Applied to Sustainable Tourism

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**Abstract:** This work aims to analyze the impact of technological eco-innovation on the modernization and development of a local area. The role of eco-innovation would be to stimulate an innovative environment and spur a development of the territory and economic districts, and the diffusion of said particularities among wider geographic contexts, hence allowing a globalization model more observant of local specificities, and thus an open system able to develop economic and cultural exchange respecting local particularities. In recent years, smart city has asserted itself as a general model for the city of tomorrow, and sustainability has become a focal point in urban development policies. In this paper, we investigate how an integrated and intermodal methodology for the development of smart mobility systems—the European project “Life for Silver Coast”—is impacting the modernization and development of an Italian coastal area in Tuscany. The main focus of our paper is to understand how an integrated mobility network allows a transition toward a sustainable form of social relationship and a new economic pattern and could represent the starting point for a spatial, relational and institutional reorganization process that would lead to a change in the production and management dynamics of the local ecosystem concerning cultural, social and economic issues.

**Keywords:** smart city; sustainable tourism; smart mobility

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## 1. Introduction

Cities have always been privileged places of experimentation and economic, social and technological innovation. Moreover, in recent years, urban systems have acquired an increasingly more important role in global challenges, such as the struggle against climate change. In this situation, the smart city paradigm is an opportunity to activate an integrated system that will allow the city to respond to internal and external stimuli, will encourage a new, more sustainable lifestyle and will enable a growth and production process (Zawieska and Pieriegud 2018; Nijkamp and Kourtit 2013; Logan and Molotch 2007). As a result, a city can be defined as “smart” when investments in human and social capital, as well as traditional (transport) and modern (ICT) infrastructure, contribute to the development of a green economy and a high quality of life, through wise resource management and participatory governance that aims to integrate technology development with various functions/components, such as mobility, energy management and environmental protection (Debnath et al. 2014; Yigitcanlar 2015).

Transport and mobility systems in general, specifically in urban areas, entail an increasing amount of environmental, social, economic and cultural issues (Mihyeon Jeon and Amekudzi-Kennedy 2005; Roda et al. 2017). It is estimated that transport itself produces 23% of greenhouse gas emissions related to the generation of power, and vehicles with internal combustion are responsible for three-quarters of this rate. Such contribution to the emission of greenhouse gases related to transport is the highest in OECD countries and

the lowest in non-OECD countries. As for the urban areas, the majority of the polluting emissions come from mobile sources (cars, buses, trucks), and the information about the air quality shows that many cities have problems with very low air quality levels.

To mitigate the negative effects of urban vehicle transport, many industrialized economies have attempted to construct public transportation networks that could provide appropriate mobility options while also contributing to a significant reduction in environmental impact. Unfortunately, even in places with very efficient public transportation systems, the issue of automobile emissions from internal combustion engines remains a major concern. This is because public transportation is often unable to provide the same capillarity, quick trip time and comfort that people can attain through personal transportation (Anas and Lindsey 2011; Santos et al. 2010). As a result, presently, it is almost mandatory to “possess” a particular mode of transportation to reach specific areas or fulfill certain duties. Such challenges are especially important in tiny tourist towns, such as Italian towns, where public transportation is currently insufficient to meet people’s requirements and where, during the holiday season, an influx of visitors causes significant environmental and traffic problems.

Various authors have emphasized the importance of a well-functioning sustainable mobility scheme in the alternative tourism industry, and a large body of literature has identified it as a function responding to market demand and competitive constraints (Waligo et al. 2013; Lee et al. 2011). At both the global and micro levels, a well-functioning mobility system outperforms factors such as infrastructure and facility availability in determining travel destinations (Hallegatte et al. 2019). This technique can be used not only in a single city but also in a larger area with a shared socio-economic and environmental identity, giving rise to the notion of a smart land (Ritchie and Crouch 2003).

In this paper, we propose an integrated methodology for urban mobility, particularly touristic mobility, based on innovative approaches to urban public transportation, to develop a sustainable mobility network and implement integrated and comprehensive policies for environmentally sustainable urban planning. It would be achievable through the research and development of coordinated and integrated solutions that can rejuvenate local systems while balancing economic, social and environmental concerns to transform the city’s complexity into an efficient urban system (Girard 2014; Mattoni et al. 2015). The approach model, in more detail, envisions the implementation of a sustainable intermodal mobility system based on electric vehicles and boats, modern ICT and energy infrastructures, and a GIS platform.

The following is a breakdown of the paper’s structure. An innovative integrated approach model for the development of smart transportation systems is detailed in Section 2. Section 3 describes a case study of a sustainable tourist mobility initiative in the Silver Coast. Section 4 presents the results of a field survey aimed at assessing the degree of satisfaction of the users who participated in the experimental phase of the project in the Silver Coast area. Section 4 contains the final comments and future projects.

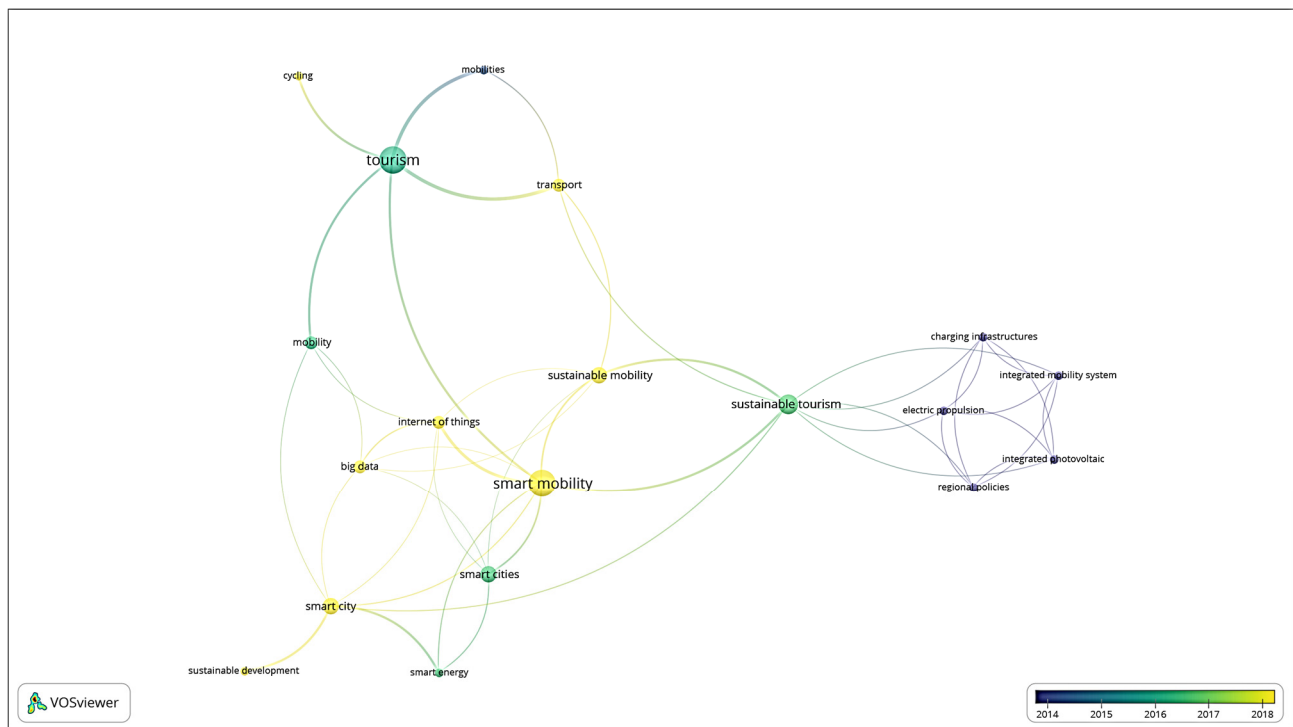
## 2. Literature Review

Given the huge amount of scientific literature available on the topic of sustainable tourism, with more than five thousand references indexed only on Scopus, we decided to apply a bibliometric approach to our analysis, given its ability to process large amounts of data in order to highlight statistics and trends in the domain to be reviewed, enabling us to understand the development of the field and its emerging areas. Following the guidelines of established protocols (Donthu et al. 2021; Paul et al. 2021), we have defined the search mechanism to be used to source the articles responding to our research question:

What is the impact of Smart Mobility Systems in terms of sustainable tourism?

The scientific contributions on the topics of smart mobility and/or mobility systems in relation to tourism available in the existing literature are few; those relating to sustainable tourism in particular are even fewer in numbers and very recent, as shown by the bibliometric map presented in Figure 1. The research in Scopus through the query

(TITLE – ABS – KEY (tourism) AND TITLE – ABS – KEY (smart mobility OR mobility system\*)) returns, in fact, only 50 contributions (up to December 2021).



**Figure 1.** Co-occurrence of author keywords (overlay visualization).

The map presented in Figure 1 was constructed in the following way: after exporting the references data from Scopus in RIS format, we have conducted a preliminary bibliometric analysis through VOSviewer, developed by [van Eck and Waltman \(2010\)](#), a software capable of providing bibliometric maps based on distance, i.e., graphical representations in which the importance of a unit of analysis (in terms of citations received or connections with other publications) is represented by its size, while the distance between two units analysis reflects the strength of the relationship between them; the smaller the distance, the more intense the relationship that binds them. The choice of the software was dictated by the authoritativeness of the source, by its computing power, by the expressive-ness of the maps themselves and by their zooming and scrolling functions for exploration. To study the development of the field of sustainable tourism, we have evaluated the co-occurrence of author keywords in our database, presented in Figure 1 in chronological visualization, ranging from blue (older keywords in the field) to yellow (more recent fields).

Among the ancestries in the field, [Høyer \(2000\)](#), in his anticipatory work, emphasizes the strong connection between sustainable tourism and the concept of sustainable mobility, intended as a vision of mobility, which is in accordance with the demands for sustainable development ([Høyer 1997](#)), stressing the relation between the volume of tourism-related mobility and harmful emissions. While literature on the topic of sustainable mobility grew larger, with much of the debate centered on the outcomes and the barriers to implementation, the sustainable mobility paradigm is later resumed by [Banister \(2008\)](#), outlining seven key elements in promoting public acceptance and awareness of sustainable mobility and four basic types of actions to achieve it, including making the best use of the available technology, planning and regulations, and targeted promotion ([Dickinson and Dickinson 2006](#); [Hannam et al. 2014](#)). [Niñerola et al. \(2019\)](#), in their bibliometric analysis, identify two different streams in the existing literature concerning tourism research and sustainability issues: the first stream on ecotourism and environmental management-related aspects (ecology, environmental protection, environmental management, ecosystems and so on),

and the second stream on more sustainability-related aspects (sustainable tourism, sustainability, sustainable tourism development), thus encompassing all its dimensions and not only the environmental one. The existing gap between sustainability and smartness in the management of tourist destinations is also addressed by [Perles and Baidal \(2018\)](#), pointing out common elements between the concepts.

The connection between smart mobility and the performance of sustainable mobility is also extensively reported in the existing literature; sustainable solutions are required as key elements for current transportation systems ([Jiménez Herrero 2011](#); [Pinna et al. 2017](#)) to mitigate the increasing demands for mobility and the potentially negative environmental, economic and social impacts ([Olaverri-Monreal 2016](#); [Seuwou et al. 2019](#)). [Francini et al. \(2021\)](#), in their recent systematic literature review on smart mobility, define the main elements influential in the implementation of smart transition processes to planning mobility, namely the characteristics of the infrastructure system, technological innovation, environmental sustainability and user satisfaction.

Among the contributions considered, those specifically aimed at sustainable tourism, which therefore best contribute to answering our research question, are shown in Table 1.

**Table 1.** Contributions combining sustainable tourism and smart mobility systems.

Title	Authors	Year	Source	Source Type
Sustainable mobility at the interface of transport and tourism: Introduction to the special issue on 'Innovative approaches to the study and practice of sustainable transport, mobility and tourism'	Hopkins, D.	2020	<i>Journal of Sustainable Tourism</i>	Journal
Urban bicycle tourism: path dependencies and innovation in Greater Copenhagen	Nilsson, J.H.	2019	<i>Journal of Sustainable Tourism</i>	Journal
Mobility as a service: a new model for sustainable mobility in tourism	Signorile, P., Larosa, V., Spiru, A.	2018	<i>Worldwide Hospitality and Tourism Themes</i>	Journal
Smart city strategies for sustainable tourism: Definitions and taxonomy	Dameri, R., Benevolo, C., Garelli, R.	2020	Proceedings of the International Conference on Tourism Research	Conference Proceedings
An integrated methodology model for smart mobility system applied to sustainable tourism	Roda, M., Giorgi, D., Joime, G.P., (...), Paschero, M., Mascioli, F.M.F.	2017	RTSI 2017-IEEE 3rd International Forum on Research and Technologies for Society and Industry, Conference Proceedings	Conference Proceedings
An integrated sustainable mobility territorial system	Fabbri, G., Mascioli, F.M.F.	2014	ICIST 2014-Proceedings of 2014 4th IEEE International Conference on Information Science and Technology	Conference Proceedings
Bonifica 2.0: An integrated territorial system of sustainable mobility and micro smart grids	Fabbri, G., Dessi, M., Frattale Mascioli, F.M.F., (...), Anniballi, L., Nardecchia, S.	2014	IEEE International Symposium on Industrial Electronics	Conference Proceedings

The interdependence between smart innovations and improved sustainability of tourist flows is recognized in all contributions. Among the articles focused on smart cities, [Roda et al. \(2017\)](#) specifically focus on the development of a smart mobility system that combines technological innovation in electric transportations and mobility services in urban and surrounding areas for a transition toward sustainable forms of tourism based on strategies of public transportation capable of producing benefits for the community. [Dameri et al. \(2020\)](#) do not limit their analysis to the theme of mobility but broaden the perspective to the smart city policies and conditions that support the transition toward sustainable tourism with reference to the quality of the journey for city visitors. Three

contributions refer to case studies: (Fabbri et al. 2014; Fabbri and Mascioli 2014) present the results of a tourist exploitation project of the Pontine territory through the design of a system of mixed routes (waterways, channels and bicycle/pedestrian paths) based on new technologies and environmentally sustainable means of transportation and managed through a telematic fleet management system using the GIS platform; Nilsson (2019) studies the dynamics behind the development of urban bicycle tourism through the case study of the Greater Copenhagen region, framing the phenomenon as driven by the incremental change in local socio-technological mobility systems consisting of innovative services and procedures supporting bicycle tourism. Signorile et al. (2018) illustrate the characteristics of the Mobility as a Service (MaaS) model, consisting of creating the conditions for personalized use of a bundle of public and private transport means aimed at reducing the use of private cars and evaluating their applicability to the Alpine contexts of the Aosta Valley and the Autonomous Province of Trento. In his introduction to the Special Issue of the *Journal of Sustainable Tourism* dedicated to sustainable mobility at the interface of transport and tourism, Hopkins (2020) provides an interpretative scheme of mutual interdependence between tourism, transport systems and mobility systems, given the accelerated technological and organizational innovations underway in such sectors.

Our work frames, in the field of research identified by the referenced contributions, through a new case study (the European project “Life for Silver Coast” concerning the modernization and development of an Italian coastal area in Tuscany), the experience in place of a smart mobility system, integrating the (scarce) existing literature with the highlighting of the aspects, previously only touched upon, related to the communication of the initiative, to the marketing policies with particular reference to the pricing and the perception of the usefulness and benefits brought from the system not only to tourists but also to residents.

### 3. Proposed Method

The following considerations analyze the case study from a systemic point of view, which allows for enclosing the multiple aspects of public transport and urban mobility in a holistic perspective. In particular, reference is made to the principles and tools of the Viable System Model (Beer 1979, 1981) and the Viable Systems Approach (Golinelli 2010; Barile et al. 2014). The methodology used aims to develop a smart mobility system for sustainable tourism. The model is based on a complex methodology that aims to model the development of a local mobility system in the future, implementing integrated and comprehensive policies for sustainable urban planning and design through innovative approaches regarding urban public transport and mobility that allows integrating the benefits of public transport with those of individual transport. The innovative strategy is to create sustainable cyclical patterns, improving unusual mobility services, which constitute an important link in the creation and stabilization of a virtuous system.

The methodological vision goes in the sense of the considered approach as a paradigm of participation, social and economic integration, and legitimacy of governance. This type of approach aims to improve the sustainability of the system by reducing the environmental impact toward new lifestyles and sustainable tourism. This model, in the planning phase of the program, was adapted to the specificity of the territory, using a local approach to address its weakness and release its potential through monitoring and revising sectoral integration, as well as sustainable development strategy (Dematteis and Governa 2005). The concept underlying this approach is to shift the paradigm from the possession of a means of transport to access to integrated mobility services (Banister 2008).

The model will combine innovative solutions, such as zero-emission vehicle prototypes, mini smart grids of renewable energy sources and monitoring of the territory using remote sensing, together with sustainable management of the territory with a bottom-up approach to release the potential of the territory. From a technological point of view, the model foresees the realization of an integrated and sustainable mobility system, integrating public transport and private sharing services, which will develop three types of infrastructures:



- An intermodal sustainable mobility system: small fleets of electric propulsion vehicles and boats;
- An energy infrastructure designed according to the structure of the micro smart grids that can draw energy from small production systems by renewable sources and meet the energy demands—primarily those from the vehicle fleets—through innovative “double-front” quick charging systems (for both water and land vehicles) and contactless charging system (Qiu et al. 2013) for wireless pedelecs battery charging;
- An advanced ICT infrastructure (inspired by the paradigm of Open Data and the Internet of Things) aimed at control of the fleets; application management; security; collecting environmental data through a sensor network (fixed sensors to be installed in the infrastructure, mobile sensors to be placed in the vehicles, considering also the use of drones) (Di Dio et al. 2018; Li et al. 2020).

The system is implemented via a GIS that allows combining a variety of data and spatial information for a physical-mathematical representation of the territory able to accommodate the data flow from the sensor network and to feed proper models of evaluation, planning and monitoring, not only of the area but also of the experimentation itself. To develop this kind of methodology mobility system, we consider both active (planning) and passive (monitoring) roles of GIS (Boothby and Dummer 2003) as an interactive technology that can use geographical information to help provide solutions to a range of issues, facilitating territorial development process. The GIS platform aims to analyze the territorial ecosystem and support planning action to define important issues, such as the spatial distribution of the potential demand for trips, the location of the auxiliary infrastructures using location-allocation models or to determinate the main characteristics and the accessibility of each station (D’Amico et al. 2013).

Mobility network planning plays a crucial role in the proper functioning of the system, which must be directly related to each territory’s critical analysis of the potential development performed by an ex-ante evaluation of the potential for implementing the development system and ex-post evaluation of the territorial added value they produce. Moving from the results of the preliminary analysis, GIS platform, through a set of indicators linking to each topic of the project, allows evaluating the performance of the plan during its realization to verify whether the goals are achievable and whether corrective actions should be taken into account when monitoring the effect of the action and supporting the planning process for the local area. It will perform the design, integration and experimentation on a set of devices and wireless communication interfaces for the monitoring of ambient and environmental parameters.

#### 4. Case Study: The Silver Coast

The Silver Coast is a site of particular interest located in the southern portion of the Tuscany coast, precisely in Grosseto Province. The geographic area comprises the country of Monte Argentario, Orbetello, Magliano in Tuscany, Giglio Island and Capalbio, together located in the Maremma Grossetana territory. In this area, tourism is one of the most important economic sectors, especially in the main towns, such as Monte Argentario, Orbetello and Giglio Island, which together have around 29,000 inhabitants. This area, according to local authorities’ statics, hosts up to 330,000 tourists per year. Although many employment opportunities benefit the local population by the great environmental context of this area, there are many critical issues for local development, such as:

- Non-coordinate promotion of the territory by local authorities;
- Reduced accessibility to many natural areas and themed routes;
- Lower sectoral program integration;
- Lower appeal to foreign tourists;
- High management cost of the system.

In small tourist towns, such as those on the Silver Coast, such issues are even more critical (Cicin-Sain 1993). Such a huge number of end users generates considerable environmental and management problems, and the whole transport system is often overloaded.

The existing public transport services (a train line that stops in Orbetello and a few bus lines) are unable to compensate the people's need to use cars, including those tourists who take their cars on ferryboats to visit Giglio Island. To address these issues and develop a sustainable tourist mobility system in this stretch of the Italian coast, the project aims at integrating the benefits of public transport with those of individual transport, encouraging people to shift from the concept of owning a means of transport to that of accessing integrated mobility services, where inhabitants and tourists can access individual or public transport services depending on their personal needs and on the destination they need to reach.

The project will produce a sustainable mobility intermodal system focused on the use of electric vehicles, supported by a complex system of production and storage of energy from renewable sources, a charging station and a control and data collection system inside the municipalities of Orbetello, Monte Argentario and Isola del Giglio.

A preliminary approach of this kind of methodology was already proposed by Pole for Sustainable Mobility (POMOS) of the University of Rome "Sapienza", in the Agro Pontino area located in the south of Rome (Mascioli et al. 2015).

The project will therefore include:

- A sharing system working with different types of electric vehicles: e-bikes, small electric cars e-scooters;
- A connection through the lagoon with electric boats;
- Electric boats adapted to sea operations for tourist connections on the coastal area of Argentario and Giglio;
- Implementing an electric shuttle bus service between the Orbetello train station and the city center;
- Fast-charging stations with continuous current, with a storage system and control unit (Paschero et al. 2013).

The project will also provide an integrated mobility platform that allows end users to access all public transport services, including ferryboats and sharing services. A pricing integration will be set up, as well as a website and an App providing end users with information about bus schedules, availability of sharing vehicles at stations and the different sustainable mobility options. The platform will also include a community management feature that will help involve local stakeholders, citizens and tourists, as well as raise general awareness.

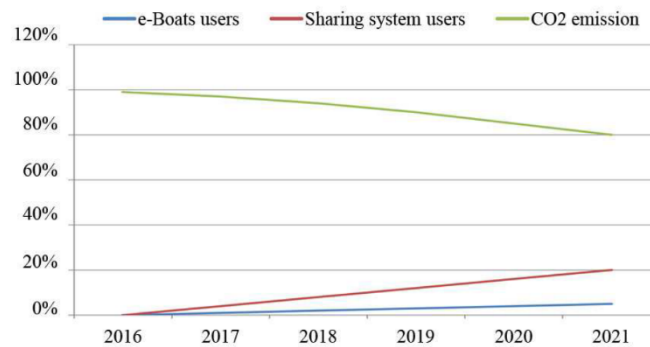
The platform will be connected and integrated with the GIS platform, providing information to end users and insiders on the status of the system, the location of the network nodes, such as e-hub and station, or information about the environmental status by a related indicators system.

The activities proposed aim at solving various environmental problems related to transport and mobility, with a focus on reducing the emission of pollutants through the development of innovative technologies, systems and business models to start a green and competitive low-carbon economy.

Indeed, one of the three towns (Orbetello) is located on a peninsula in the middle of the lagoon, which is closed on the northeast side by the Giannella beach, on the southwest side by the Feniglia beach (a protected area) and on the southeast side by Monte Argentario (a mountain in the middle of the peninsula that is 630 meters high). The lagoon is a very delicate environment; water has a maximum depth of two meters, and many of the protected wet areas are visited every year by migrant bird species. In this specific situation, the project will be implemented with a solution and approach connected with the mobility system but focused on other results. In particular, the second experimentation of a novel water sanitation method based on a combination of the classical bioremediation approach with the use of e-boat will take place in Orbetello lagoons.

Therefore, designing a more sustainable plan for mobility and tourism is crucial to protect and preserve such a delicate environment, while assuring local economic growth. Such introduction of the smart mobility system in the Silver Coast is expected to signif-

icantly change the modal share inside the towns. The availability of sharing services, connecting all the points of interest of the area, will allow the end users to leave their private cars in favor of electric shared vehicles. Based on the findings of different studies and the characteristics of the Silver Coast, a decrease of at least 10% of private means use is expected due to the car and bike sharing systems. This should entail reductions in CO<sub>2</sub> emissions of about 15%. The new services of sharing, provided also by the introduction of the e-Boats, coupled with an adequate business model, are expected to reduce long trips by at least 20%, corresponding to 20% less CO<sub>2</sub> emissions (Figure 2).



**Figure 2.** Expected results in terms of CO<sub>2</sub> reductions.

Additionally, important benefits for the environment will be provided by the other solutions integrated with previous ones, such as the mobility platform, cycling and pedestrian paths, recharging columns for electric vehicles and e-buses. These integrated services are expected to support a reduction in private car use indicated above and thus contribute to the reduction of CO<sub>2</sub> emissions. Moreover, photovoltaic roofs will be implemented in different areas (e.g., parking lot in Argentario) and used for recharging e-bikes and other services (excluding cars), thus further reducing CO<sub>2</sub> emissions. In addition to the positive impacts on pollutant emissions, the first impact is related to the increase in accessibility to those areas that are difficult to reach by public transport, which would allow further development of the enormous natural, environmental and gastronomic heritage, especially from the point of view of tourism. In the long run, the increase in sharing and mobility services could contribute to a reduction in motorization rate of between 10% and 60% and could lead to a complete re-planning of public transport with significant reduction in costs. This would allow end users to have significant cost savings, while the community will benefit from a reduction of space occupied by parked vehicles.

## 5. Field Study

Taking advantage of the fact that the “Life for Silver Coast” project is currently (from May 2021) operational in the testing phase, with e-bikes, e-scooters and e-cars available for sharing, a field survey was conducted in July through a structured questionnaire administered in person to two samples of users, the first consisting of residents in the area considered, the second consisting of tourists gravitating to it.

The objective of the survey, divided into the sub-objectives referred to in the research questions explained below, was the assessment of the degree of user satisfaction based on the rates applied, comfort and the territorial detail covered (capillarity). Once the status of the user of the services offered by the project was ascertained, 87 correctly completed questionnaires were obtained from residents in the area considered, and 55 questionnaires from were obtained from tourists. The profile of the two samples is shown in Table 2.



**Table 2.** Profile of the interviewees.

	Tourists			Residents		
	Male	Female		Male	Female	
Gender	23	32		40	47	
Age range	18–55	over 55		18/55	over 55	
	37	18		59	28	
Qualification	University	High School	Middle School	University	High School	Middle School
	20	30	5	31	45	11
Frequency of use of sharing vehicles	Always	Occasionally		Always	Occasionally	
	12	43		19	68	
Electric vehicle most useful for sharing	Auto	Scooter	Bike	Auto	Scooter	Bike
	12	25	18	28	39	20

Among the items of the questionnaire, whose answers were collated using the classic Likert scale (fully satisfied, satisfied, average, not satisfied, fully dissatisfied), the following aspects were considered:

- The degree of satisfaction in relation to the service used (fully satisfied, satisfied, average, not satisfied, fully dissatisfied);
- The degree of satisfaction in relation to the rates applied;
- The degree of comfort;
- The degree of satisfaction in relation to the territorial level covered.

The set of answers obtained allowed us to answer the following research questions:

RQ1: Do tourists have a greater propensity than residents to use the facilities made available by the Silver Coast project?

RQ2: Which factors, including “rates applied”, “comfort”, “capillarity of services”, have the greatest influence on the degree of user satisfaction?

### 5.1. Residents

From a methodological point of view, the elaboration of the questionnaires was carried out for each of the two samples examined to identify a significant number of clusters of homogeneous respondents in terms of the overall degree of satisfaction with the services used in relation to the price, comfort and covered territorial level. The results, accompanied by comments, are shown below in Tables 3 and 4 for the two types of users interviewed.

**Table 3.** Value of cluster centroids (residents).

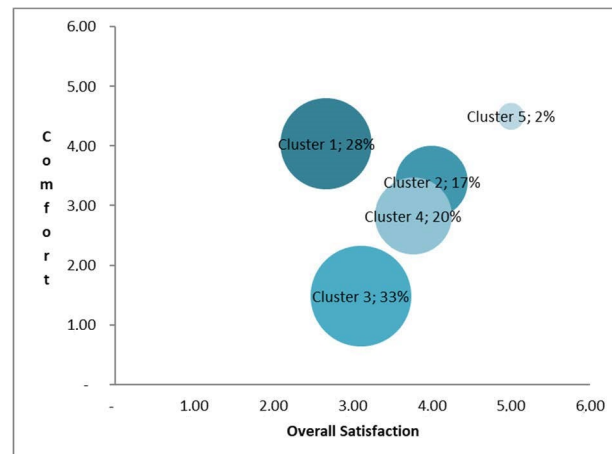
Centroid	Overall Satisfaction	Price Satisfaction	Comfort	Capillarity
Cluster 1	2.88	2.73	4.00	2.55
Cluster 2	5.00	4.75	4.25	3.50
Cluster 3	3.25	2.50	1.53	2.47
Cluster 4	3.83	3.78	2.78	3.89
Cluster 5	3.31	2.95	2.85	2.84

**Table 4.** Value of cluster centroids (tourists).

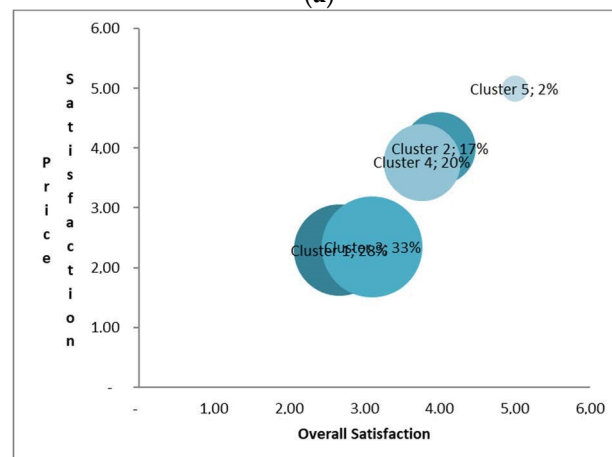
Centroid	Overall Satisfaction	Price Satisfaction	Comfort	Capillarity
Cluster 1	2.38	3.00	3.75	2.50
Cluster 2	3.92	4.23	4.15	2.46
Cluster 3	2.20	4.30	3.10	4.50
Cluster 4	2.60	2.00	4.40	3.00
Cluster 5	4.63	2.74	3.32	3.95

### 5.2. Tourists

The comparison of Figures 3 and 4 shows how the degree of satisfaction in the use of services is of the same order of magnitude for the two sets of respondents analyzed (about 59% of tourists (clusters 3 and 5) and about 50% in the case of residents (clusters 2, 5 and 4, and a significant fraction of cluster 3)). The detailed examination shows that cluster 5 of Figure 4, which represents the cluster in which the highest degree of satisfaction is expressed, accounts for 35% in the case of tourists and only 2% in the case of residents.

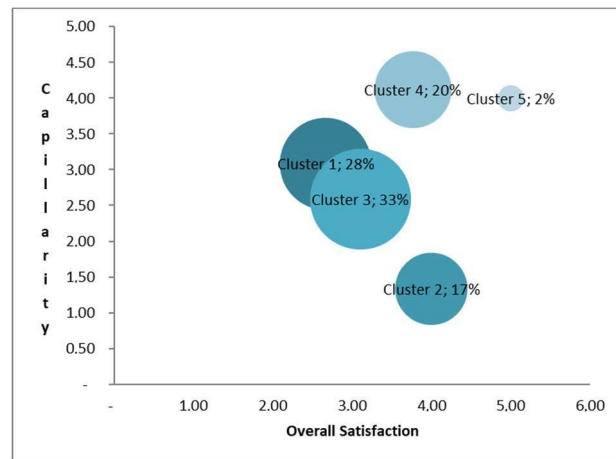


(a)



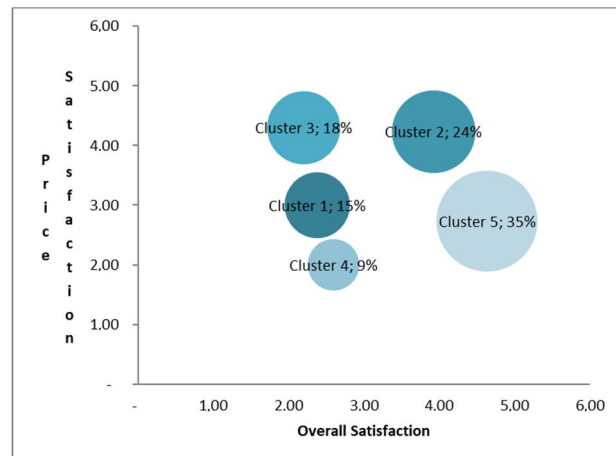
(b)

Figure 3. Cont.

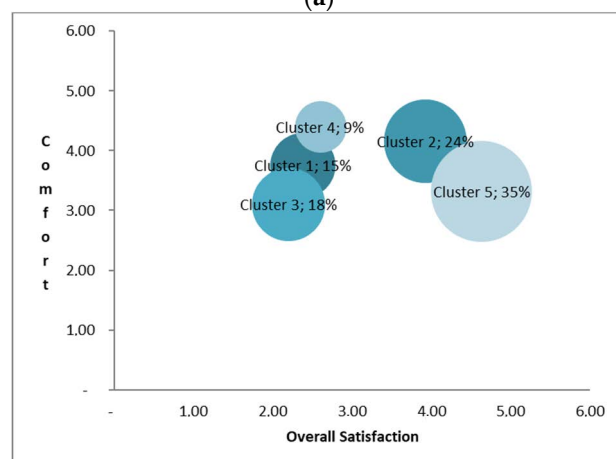


(c)

**Figure 3.** (a) Sensitivity of residents to comfort. (b) Sensitivity of residents to price. (c) Sensitivity of residents to capillarity.

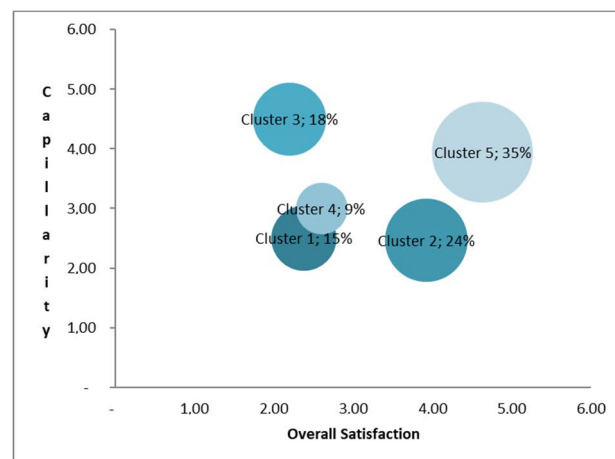


(a)



(b)

**Figure 4.** Cont.



(c)

**Figure 4.** (a) Sensitivity of tourists to price. (b) Sensitivity of residents to comfort. (c) Sensitivity of residents to capillarity.

## 6. Conclusions

The adoption of an innovative and environmentally friendly methodology for the design and implementation of a smart mobility system was recommended in this research. With the advancement of technology in integrated and intermodal mobility and transportation services, a few vehicles and micro-grid prototypes have been developed in our case study. The system is currently operational (since May 2021) concerning the rental of e-bikes, e-scooters and e-cars, electric recharging columns, and the introduction of e-boats with solar propulsion is nearing. Completion of the project will ensure the new form of mobility also through a mobility platform, allowing for complete integration of the new multi-service system with the current public transport services. Once fully operational, the system will improve the use and efficiency of the tourism mobility system with no increases in emissions. The implementation of the system will lead to the creation of new jobs in the industry. The experimental phase of the Silver Coast project, which began in May 2021, has allowed the carrying out of a field survey using a structured questionnaire that highlights the degree of satisfaction of the users of the project's services and their sensitivity to price, comfort and coverage of level of the territorial area considered (capillarity).

### *Applicability and Significance of the Findings*

The approach model appears to be simple to replicate and transfer to other contexts in other countries with similar characteristics. In particular, our country, with its 8000 km coast, presents areas of such tourist congestion so as to compromise their potential for economic development in the sector. Our work aims to arise as a reference project in particular, as similar contexts are present throughout Europe and beyond, shedding light on the different levels on which innovative solutions can be developed for a sustainable mobility system in a coastal area: on the level of the network of subjects who determine the realization of the project; on the level of customer satisfaction identifying the main factors that influence it both for residents and tourists; on the level of acceptance by the host community; and on the degree of attraction of tourist flows. As such, in addition to the technological and technical aspects of the proposed innovative solutions, this work also takes into account cultural and social issues, public acceptance and awareness in particular, together with the economic ones, a topic barely explored in recent literature.

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## References

- Anas, Alex, and Robin Lindsey. 2011. Reducing urban road transportation externalities: Road pricing in theory and in practice. *Review of Environmental Economics and Policy* 5: 66–88. [\[CrossRef\]](#)
- Banister, David. 2008. The sustainable mobility paradigm. *Transport Policy* 15: 73–80. [\[CrossRef\]](#)
- Barile, Sergio, Marialuisa Saviano, Francesca Iandolo, and Mario Calabrese. 2014. The viable systems approach and its contribution to the analysis of sustainable business behaviors. *Systems Research and Behavioral Science* 31: 683–95. [\[CrossRef\]](#)
- Beer, Stafford. 1979. *The Heart of Enterprise*. Chichester: Wiley.
- Beer, Stafford. 1981. *Brain of the Firm*, 2nd ed. Chichester: Wiley.
- Boothby, John, and Trevor J. Dummer. 2003. Facilitating mobility? The role of GIS. *Geography* 88: 300–11.
- Cicin-Sain, Biliana. 1993. Sustainable development and integrated coastal management. *Ocean & Coastal Management* 21: 11–43.
- Dameri, Renata, Clara Benevolo, and Roberto Garelli. 2020. Smart city strategies for sustainable tourism: Definitions and taxonomy. Paper presented at the 3rd International Conference on Tourism Research, ICTR 2020, Valencia, Spain, March 27–28.
- D’Amico, Pietro, Ferdinando Di Martino, and Salvatore Sessa. 2013. *A GIS as a Decision Support System for Planning Sustainable Mobility in a Case-Study Multicriteria and Multiagent Decision Making with Applications to Economics and Social Sciences*. New York: Springer, pp. 115–28.
- Debnath, Ashim Kumar, Hoong Chor Chin, Md. Mazharul Haque, and Belinda Yuen. 2014. A methodological framework for benchmarking smart transport cities. *Cities* 37: 47–56. [\[CrossRef\]](#)
- Dematteis, Giuseppe, and Francesca Governa. 2005. *Territorialità, sviluppo locale, sostenibilità: Il modello SLoT*. Milano: Franco Angeli.
- Dickinson, Janet E., and Julie A. Dickinson. 2006. Local Transport and Social Representations: Challenging the Assumptions for Sustainable Tourism. *Journal of Sustainable Tourism* 14: 192–208. [\[CrossRef\]](#)
- Di Dio, Salvatore, Maria La Gennusa, Giorgia Peri, Gianfranco Rizzo, and Ignazio Vinci. 2018. Involving people in the building up of smart and sustainable cities: How to influence commuters’ behaviors through a mobile app game. *Sustainable Cities and Society* 42: 325–36. [\[CrossRef\]](#)
- Donthu, Naveen, Satish Kumar, Debmalya Mukherjee, Nitesh Pandey, and Weng Marc Lim. 2021. How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research* 133: 285–96. [\[CrossRef\]](#)
- Fabbri, Gianluca, Marco Dessì, Fabio Massimo Frattale Mascioli, Maurizio Paschero, Simone Sgreccia, Luigi Anniballi, and S. Nardecchia. 2014. Bonifica 2.0: An integrated territorial system of sustainable mobility and micro smart grids. Paper presented at the 2014 IEEE 23rd International Symposium on Industrial Electronics, ISIE 2014, Istanbul, Turkey, June 1–4.
- Fabbri, Gianluca, and Fabio Massimo Frattale Mascioli. 2014. An integrated sustainable mobility territorial system. Paper presented at the 2014 4th IEEE International Conference on Information Science and Technology, ICIST 2014, Shenzhen, China, April 26–28.
- Francini, Mauro, Lucia Chieffallo, Annunziata Palermo, and Maria Francesca Viapiana. 2021. Systematic Literature Review on Smart Mobility: A Framework for Future “Quantitative” Developments. *Journal of Planning Literature* 36: 283–96. [\[CrossRef\]](#)
- Girard, Luigi Fusco. 2014. Creative initiatives in small cities management: The landscape as an engine for local development. *Built Environment* 40: 475–96. [\[CrossRef\]](#)
- Golinelli, Gaetano Maria. 2010. *Viable Systems Approach (VSA): Governing Business Dynamics*. Padova: Cedam.
- Hallegatte, Stephane, Jun Rentschler, and Julie Rozenberg. 2019. *Lifelines: The Resilient Infrastructure Opportunity*. Washington: World Bank Publications.
- Hannam, Kevin, Gareth Butler, and Cody Morris Paris. 2014. Developments and key issues in tourism mobilities. *Annals of Tourism Research* 44: 171–85. [\[CrossRef\]](#)
- Hopkins, Debbie. 2020. Sustainable mobility at the interface of transport and tourism: Introduction to the special issue on ‘Innovative approaches to the study and practice of sustainable transport, mobility and tourism’. *Journal of Sustainable Tourism* 28: 225–39. [\[CrossRef\]](#)
- Høyer, Karl G. 1997. Sustainable development. In *The Global Environment. Science, Technology and Management*. Edited by Dag Brune, Deborah V. Chapman, Michael Gwynne and Jozef M. Pacyn. Weinheim: VCH.
- Høyer, Karl G. 2000. Sustainable Tourism or Sustainable Mobility? The Norwegian Case. *Journal of Sustainable Tourism* 8: 147–60. [\[CrossRef\]](#)
- Jiménez Herrero, Luis M. 2011. Transport and Mobility: The Keys to Sustainability. *Fundacio ‘n General CSIC Lychnos* 4: 40–45.



- Lee, Jungwoo, Songhoon Baik, and Choonwa Choonwa Lee. 2011. Building an integrated service management platform for ubiquitous cities. *Computer* 44: 56–63. [\[CrossRef\]](#)
- Li, Wenwen, Michael Batty, and Michael F. Goodchild. 2020. Real-time GIS for smart cities. *International Journal of Geographical Information Science* 34: 311–24. [\[CrossRef\]](#)
- Logan, John R., and Harvey L. Molotch. 2007. *Urban fortunes: The political Economy of Place*. Berkeley: University of California Press.
- Mascioli, Fabio Massimo Frattale, Federico Spano, Marco Dessi, and Maurizio Paschero. 2015. Bonifica 2.0—A Sustainable Mobility Network Based on the Agro Pontino Land Reclamation Waterways. *Procedia Environmental Science, Engineering and Management* 2: 63–72.
- Mattoni, Benedetta, Franco Gugliermetti, and Fabio Biseegna. 2015. A multilevel method to assess and design the renovation and integration of Smart Cities. *Sustainable Cities and Society* 15: 105–19. [\[CrossRef\]](#)
- Mihyeon Jeon, Christy, and Adjo A. Amekudzi-Kennedy. 2005. Addressing sustainability in transportation systems: Definitions, indicators, and metrics. *Journal of Infrastructure Systems* 11: 31–50. [\[CrossRef\]](#)
- Nijkamp, Peter, and Karima Kourtiti. 2013. The “New Urban Europe”: Global challenges and local responses in the urban century. *European Planning Studies* 21: 291–315. [\[CrossRef\]](#)
- Nilsson, Jan Henrik. 2019. Urban bicycle tourism: Path dependencies and innovation in Greater Copenhagen. *Journal of Sustainable Tourism* 27: 1648–62. [\[CrossRef\]](#)
- Niñerola, Angels, Maria-Victoria Sánchez-Rebull, and Ana-Beatriz Hernández-Lara. 2019. Tourism Research on Sustainability: A Bibliometric Analysis. *Sustainability* 11: 1377. [\[CrossRef\]](#)
- Olaverri-Monreal, Cristina. 2016. Autonomous Vehicles and Smart Mobility Related Technologies. *Infocommunications Journal* 8: 17–24.
- Paschero, Maurizio, Luigi Anniballi, Guido Del Vescovo, Gianluca Fabbri, and Fabio Massimo Frattale Mascioli. 2013. Design and implementation of a fast recharge station for electric vehicles. Paper presented at the 2013 IEEE International Symposium on Industrial Electronics, Taipei, Taiwan, May 28–31.
- Paul, Justin, Weng Marc Lim, Aron O’Cass, Andy Wei Hao, and Stefano Bresciani. 2021. Scientific procedures and rationales for systematic literature reviews (SPAR-4-SLR). *International Journal of Consumer Studies* 45: O1–O16. [\[CrossRef\]](#)
- Perles, Ribes José Francisco, and Josep Ivars Baidal. 2018. Smart sustainability: A new perspective in the sustainable tourism debate. *Investigaciones Regionales* 42: 151–70.
- Pinna, Francesco, Francesca Masala, and Chiara Garau. 2017. Urban Policies and Mobility Trends in Italian Smart Cities. *Sustainability* 9: 494. [\[CrossRef\]](#)
- Qiu, Chun, K. T. Chau, Chunhua Liu, and Ching Chuen Chan. 2013. Overview of wireless power transfer for electric vehicle charging. Paper presented at the 2013 World Electric Vehicle Symposium and Exhibition (EVS27), Barcelona, Spain, November 17–20.
- Ritchie, J. R. Brent, and Geoffrey I. Crouch. 2003. *The Competitive Destination: A Sustainable Tourism Perspective*. Wallingford: CABI Publishing.
- Roda, Massimiliano, Davide Giorgi, Gian Piero Joime, Luigi Anniballi, Marco London, Maurizio Paschero, and Fabio Massimo Frattale Mascioli. 2017. An integrated methodology model for smart mobility system applied to sustainable tourism. Paper presented at the 2017 IEEE 3rd International Forum on Research and Technologies for Society and Industry (RTSI), Modena, Italy, September 11–13.
- Santos, Georgina, Hannah Behrendt, and Alexander Teytelboym. 2010. Part II: Policy instruments for sustainable road transport. *Research in Transportation Economics* 28: 46–91. [\[CrossRef\]](#)
- Seuwou, Patrice, Ebad Banissi, and George Ubakanma. 2019. The Future of Mobility with Connected and Autonomous Vehicles in Smart Cities. *Digital Twin Technologies and Smart Cities* 37–52. [\[CrossRef\]](#)
- Signorile, Pierdomenico, Vincenzo Larosa, and Ada Spuru. 2018. Mobility as a service: A new model for sustainable mobility in tourism. *Worldwide Hospitality and Tourism Themes* 10: 185–200. [\[CrossRef\]](#)
- van Eck, Nees Jan, and Ludo Waltman. 2010. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* 84: 523–38. [\[CrossRef\]](#) [\[PubMed\]](#)
- Waligo, Victoria M., Jackie Clarke, and Rebecca Hawkins. 2013. Implementing sustainable tourism: A multi-stakeholder involvement management framework. *Tourism Management* 36: 342–53. [\[CrossRef\]](#)
- Yigitcanlar, Tan. 2015. Smart cities: An effective urban development and management model? *Australian Planner* 52: 27–34. [\[CrossRef\]](#)
- Zawieska, Jakub, and Jana Pieriegud. 2018. Smart city as a tool for sustainable mobility and transport decarbonisation. *Transport Policy* 63: 39–50. [\[CrossRef\]](#)