TeMA

Journal of
Land Use, Mobility and Environment

print ISSN 1970-9889 e-ISSN 1970-9870
FedOA press - University of Naples Federico II

DOAJ anvur Rivista scientifica di classe A - 08/F1 Scopus WEB OF SCIENCE

Special Issue 1.2026

Living and Walking in Cities

Mobility, Public Space and Spatial Justice

The Special Issue of TeMA results from the XXVII International Conference "Living and Walking in Cities", held in Brescia (Italy) on the 11-12 September 2025. Over more than thirty years, the LWC conferences promoted an interdisciplinary platform for discussing among researchers, practitioners and decision-makers engaged in the fields of transport and urban planning. The Special Issue contains ten articles that deal with an integrated mobility perspective as a spatial, social, and environmental planning issue, with a focus on spatial justice, health, and urban regeneration processes.

TeMA is the Journal of Land Use, Mobility and Environment. The Journal publishes papers which adopt unified approach to planning, mobility and environmental sustainability. With the ANVUR resolution of April 2020, TeMA Journal and the articles published from 2016 have been included in the A category of scientific journals. The articles published on TeMA are part of the Core Collection of Web of Science, since 2015, and of Scopus database, since 2023. The journal is in the Sparc Europe Seal of Open Access Journals and the Directory of Open Access Journals.

TeMA Journal of
Land Use, Mobility and Environment

Special Issue 1.2026

Living and walking in cities: Mobility, Public Space and Spatial Justice

Published by
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

TeMA is realized by CAB - Center for Libraries at “Federico II” University of Naples using Open Journal System

Editor-in-chief: Rocco Papa
print ISSN 1970-9889 | online ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

Editorial correspondence
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Building and Environmental Engineering
University of Naples "Federico II"
Piazzale Tecchio, 80
80125 Naples

web: www.serena.unina.it/index.php/tema
e-mail: redazione.tema@unina.it

The cover image was created using an AI tool, taking into account the thematic content of the articles included in this issue.

TeMA - Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include: engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science and complex systems.
With ANVUR resolution of April 2020, TeMA Journal and the articles published from 2016 are included in A category of scientific journals. The articles published on TeMA are included in main international scientific database as Scopus (from 2023), Web of Science (from 2015) and the *Directory of Open Access Journals* (DOAJ). TeMA Journal has also received the *Sparc Europe Seal* for Open Access Journals released by *Scholarly Publishing and Academic Resources Coalition* (SPARC Europe). TeMA is published under a Creative Commons Attribution 4.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

TeMA Journal of
Land Use, Mobility and Environment

Special Issue 1.2026

Living and Walking in Cities: Mobility, Public Space and Spatial Justice

Contents

TeMA Journal of Land Use, Mobility and Environment

TeMA Special Issue 1 (2026) 21-36
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6093/1970-9870/13323
Double-blind review under the responsibility of the "Living and Walking in Cities 2025" Conference Committee.

https://serena.sharepress.it/index.php/tema

Assessing socio-spatial equity in access to coastal areas of Italian island cities

Mana Dastoum[a,b]*, Tazyeen Alam[a], Reza Askarizad[a], Tiziana Campisi[c], Chiara Garau[a]*

[a] DICAAR, University of Cagliari, Italy
e-mail: seyedehmana.dastoum@unica.it; tazyeen.alam@unica.it; reza.askarizad@unica.it; c.garau@unica.it
ORCID: https://orcid.org/0009-0008-4166-1290
ORCID: https://orcid.org/0000-0002-6076-0947
ORCID: https://orcid.org/0000-0003-2751-9024
ORCID: https://orcid.org/0000-0002-6239-5402
* Corresponding authors

[b] ETSAM, Universidad Politécnica de Madrid (UPM), Spain
e-mail: mana.dastoum@alumnos.upm.es
ORCID: https://orcid.org/0009-0008-4166-1290

[c] Faculty of Engineering and Architecture
Kore University of Enna, Enna, Italy
e-mail: tiziana.campisi@unikore.it
ORCID: https://orcid.org/0000-0003-4251-4838

Abstract
Coastal environments are integral to metropolitan regions, operating as strategic civic and socio-economic interfaces that underpin tourism, everyday wellbeing, and local economies. Despite their significance, ensuring equitable inclusion in coastal cities remains a persistent challenge. Research on socio-spatial equity has predominantly addressed access to essential urban infrastructures, (such as green spaces, healthcare, and transport networks) while the distributional and procedural fairness of access to coastal spaces has been comparatively under-examined. Italian island cities offer major coastal opportunities, but without intentional equity-oriented planning, existing disparities may deepen and comparative assessments across municipalities are also rare. This study develops a new comparative methodology to evaluate ingress efficiency to coastal enclaves in Cagliari and Catania. Using space syntax (DepthmapX 10), it analyses spatial configuration and the extent to which the built environment controls connections to preferred coastal areas, identifying barriers to socio-spatial parity and quantifying how accessibility can mitigate or amplify inequities. This high level of attention to detail, in its turn, yields quantitative results on how urban infrastructure accessibility is mediated, thereby relieving or enhancing disparities. The paper concludes with practical suggestions and strategic policy-oriented recommendations to foster fairer access to coastal spaces and strengthen social equity in coastal territories.

Keywords
Accessibility; Italian island cities; Socio-spatial equity; Space syntax; Coastal area; Social justice

How to cite item in APA format
Dastoum, M., Alam, T., Askarizad, R., Campisi, T. & Garau, C. (2026). Assessing socio-spatial equity in access to coastal areas of Italian island cities. *TeMA - Journal of Land Use, Mobility and Environment*, (1), 21-36. https://dx.doi.org/10.6093/1970-9870/13323

1. Introduction

Socio-spatial parity refers to equitable and fair distribution of space resources, communal facilities, and opportunities in the city fabric and as such ensures that all people, regardless of their socioeconomic status, corporeal abilities, or social identity can access ingress to, and enjoy felicity of shared civic spaces (Manaugh et al., 2015; Behbahani et al., 2019). Such a notion touches upon both physical and social aspects of accessibility (Grengs, 2015; Faedda et al., 2024; Congiu et al., 2024), which is effective to manage unequal mobility differences (MacLeod et al., 2022), infrastructure delivery (LeClair et al., 2023), and the inclusion of space (Ashik et al., 2020). Enhancing inclusivity, escalating social cohesion, and improving the felicity of the aggregate, in general, depend on the most crucial accomplishment of the socio-spatial parity in urban centres (Akcali & Cahantimur, 2023; Cassiers & Kesteloot, 2012; Garau & Annunziata, 2022). However, certain inequalities in the built environment often give rise to unequal access to essential urban facilities (Gelormino et al., 2015), thus reinforcing pre-existing tendencies of segregation and exclusion (Seyedrezaei et al., 2023). These disparities can be further increased due to such factors as insufficient public conveyance (Jahangir et al., 2024), physical barriers in infrastructure (Campisi et al., 2021), and uneven space formation, which disproportionately affect disadvantaged groups (Power, 2012). Since the movement of urbanisation is accelerating, and the need to focus on socio-spatial equity is on the increase, the mandate accomplishment of the socio-spatial equality is an urgent issue among modern urbanists and policymakers (Madanipour et al., 2022).

Coastal enclaves aren't just nice views—they're vital parts of city life, full of environmental and cultural significance. In island municipalities (Nunkoo & Ramkissoon, 2010), these zones help shape how people see themselves and their communities (Cetin, 2016). They attract tourists (Kim et al., 2021), serve as gathering places (Liu et al., 2024), and give locals somewhere to relax (Bell et al., 2015). Still, not everyone gets equal access. Older adults, people with disabilities, and those facing financial hardship often get left out (Berke et al., 2023). Spotty public transit, poor infrastructure, and confusing directions keep these spaces out of reach for many (Askarizad et al., 2024a).

Conversely, coastal enclaves are inwardly necessary communal spaces, which offer an extensive array of stewardly and cultural felicity, which is crucial to the health of urban communities. These areas are not just dominant to the civic identity (Cetin, 2016) but also major tourism destination nodes (Kim et al., 2021), nodes of socialization (Liu et al., 2024), and daily leisure venues (Bell et al., 2015), which are found within island municipalities (Nunkoo & Ramkissoon, 2010). Regardless of these advantages, the challenge of gaining fair ingress to littoral enclaves will be difficult, especially among the vulnerable groups such as the elderly, disabled, and those who belong to the economically disadvantaged groups (Berke et al., 2023). Poor public conveyance connections, insufficiently designed or inaccessible infrastructure, and the lack of comprehensive wayfinding systems are some obstacles that make these populations unable to access and engage with seaside settings (Askarizad et al., 2024a). Even though the concept of equitable ingress was scrutinized carefully as far as verdant zones (He et al., 2024), healthcare (Chen et al., 2022), and pedagogical facilities (Pizzol et al., 2021) are concerned, the littoral dimension is given much less consideration, especially in terms of urban form and spatial arrangement. It is imperative to address this omission as being out of the coastal areas is not only restrictive of physical intrusion, but also contributes to larger socio-spatial disparities in urban areas.

In turn, this question examines the socio-spatial fairness of the access to maritime places of Italian insular urban centres through an interpretative comparison of the space of Cagliari and Catania. It attempts to estimate the effect of the structure of these cities on the accessibility to coastal areas by the use of space syntax methods. Thus, the study will compare the morphological obstacles that excessively limit access to large littoral regions. The evaluation of the degree of integration and segregation in the thoroughfares leading to the littoral highlights the differences in spatial extent that can serve to enhance social marginalisation. Through such critiques as a result, the enquiry presents visible facts in order to move forward exclusive urban

planning paradigms that foster impartial and thorough access to waterfront common areas. Lastly, the literature deepens the gap in the current literature on the topic of socio-spatial equivalence by enhancing an obvious gap within the existing literature dealing with the subject of coastal reach within the context of insular policies.

Since social equity represents a set of indicators, including access to built-in services (Jian et al., 2020), the extent of connectivity within and between communities (Kaplan et al., 2014; Eizenberg & Jabareen, 2017), inclusion of heterogeneous social groups (Mrak et al., 2019; Venezia, 2024), the safety and security of the individuals and communities (Abed & Jokhadar, 2022), and equitable distribution of public facilities (Manaugh et al., 2015). Further consideration on the rest of equity markers is off the current scope. The work attempts to respond to the following questions: 1) How is the spatial structure of Italian coastal cities related to access to the coastal areas? 2) Which physical, infrastructural, and spatial obstacles limit fair use of coastal areas? 3) What is the socio-spatial parity of accessing coastal areas between Cagliari and Catania cities?

The paper is divided into a few parts that are considered to be integrated. After this introduction, the second part will provide an inclusive literature overview where the past research on spatial equity and maritime urban development will be critiqued. In the third part, we describe the materials and methods applied particularly in the calculation of the values of the axial analysis and integration to plot the cities. This is then followed by the revelation of the results in the fourth section, which illustrates a proliferation of spatial patterns (between integration and segregation) in the two urban centres. These results are then discussed in the Discussion where they are assessed in the light of socio-spatial parity. Finally, the Conclusion addresses the same research questions it started with, provides policy-oriented maneuvers, and the pertinent gaps that the future research should focus on.

2. Literature review

In the past few decades, the academic literature on the topics of spatial and social equality in urban milieus has grown to abundance of disciplines, which include transport planning to the meticulous examination of the organisation of the built up environment. The key connection between accessibility and equity is the center of this scholarly discussion; researchers continuously emphasize that physical organization of a city determines the social inclusion and movement (Manaugh et al., 2015; Behbahani et al., 2019; Grengs, 2015). Consequently, such an idea as socio-spatial equity (which can be defined as a fair and impartial distribution of spatial resources) has become one of the analytical prism elements. It enables a more holistic approach to assess the state of urban life, correcting the materialistic barriers on the one hand and the social imbalance on the other, which determines the way access to opportunities is distributed (Cassiers & Kesteloot, 2012; Madanipour et al., 2022).

Present research is making greater and greater arguments in favor of combining quantitative spatial measurements with equity ratings. In particular, the use of GIS-based tools and space syntax techniques has enabled researchers to quantify the role of the urban morphology in movement, connectedness, and social homogeneity (Karimi, 2023). A good example of this could be observed in the article by Sharma & Patil (2022) who evaluated the gaps in access to education in Greater Mumbai. They could synthesise Lorenz curves and Gini index using GIS-driven accessibility ratios in order to reveal disparities that are aggravated by different modes of transport. Moreover, the latest framework created by Garau et al. (2025) makes use of space syntax to evaluate the social equity at a regional level. This study highlights how configurational paradigms are becoming dominant in determining the structural obstacles that cause social marginalisation.

The key contribution of the accessibility of the public services especially healthcare and education has remained a milestone of the spatial equity research. As an illustration, the differences in the access to tertiary hospitals between the elderly were evaluated by the gravity-based model of Chen et al. (2022) and later enhanced by Gu et al. (2023) by a more detailed Balanced Floating Catchment Area framework. This research abundance

spills over to the green space too; researchers such as Iraegui et al. (2020) and Wang et al. (2022) have discovered evident inequity in the distribution of green spaces within divergent demographic settings. To the same correct assessment, Zhao & Gong (2024) have proposed optimisation-based models, which combine social and spatial views. Their contribution enhances the methodological accuracy that is required to redress the eminent disparities in the way the parks in cities are distributed.

And yet, stepping outside the conventional spheres, maritime areas are becoming widely regarded as important elements of city access and overall wellbeing. These coastline areas serve both as a means of the environment quality and economic sustainability, but the objective access to those places in the present research is an overt gap (Cetin, 2016; Nunkoo & Ramkissoon, 2010; Bell et al., 2015). Recent research points out that poor planning and infrastructural constraints can enhance social marginalisation in littoral areas. An example is that Berke et al. (2023) examined the overlap of equity and susceptibility within the city urban framework, showing that the physical restrictions limit access to disadvantaged societies. Moreover, Liu et al. (2024) used the social network analysis to reveal the spatial connections between the settlements of the coastal areas, highlighting the critical need to consider the impactful planning process of the local and regional level in a comprehensive and inclusive manner.

Recent interdisciplinary models are starting to combine attributes of spatial configuration with social justice theory in order to evaluate equity in a more comprehensive approach. To illustrate, the article by Askarizad et al. (2024a) embodies the physical structure of organic street networks as a complementary feature when it comes to determining both wayfinding and vehicle access. This is also indicated by Askarizad & Garau (2025) who tested simulation-based space syntax methodologies against empirical human movement data and hence emphasized the essence of configurational analysis in quantifying inclusiveness. These technical implications are consistent with the compelling reasoning of policy-oriented scholars, including Meerow et al. (2021) and Wan et al. (2025). It is argued by these authors that an equitable urban growth can no longer be considered through the acts of mere measurements, but must respond to the comprehensive procedural, distributive, and contextual aspects of justice in order to achieve a sustainable result.

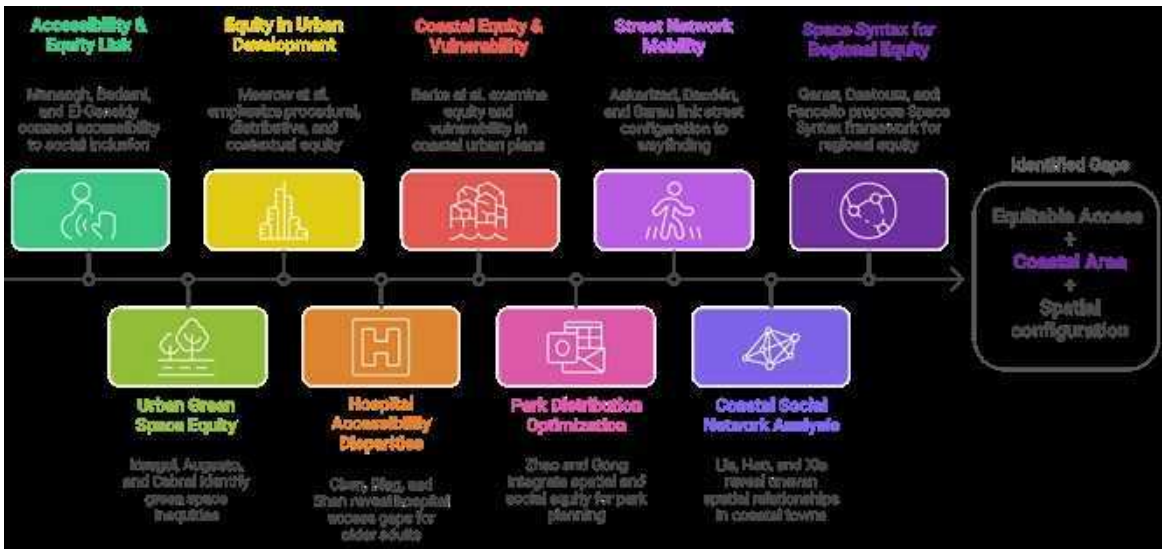


Fig.1 Conceptual synthesis of the literature on socio-spatial equity and accessibility in urban areas

Collectively, this literature emphasizes the reality that the issue of spatial imbalance continues to dominate many different kinds of urban infrastructure. Despite the evident advancements in computational and spatial modelling, a striking gap still remains in terms of combining multidimensional equity appraisals that bridge the difference between physical accessibility and social inclusiveness. Particularly, the maritime aspect, which gathers the shape of the city, the pressures of tourism and environmental restrictions have been at the

receiving end of a lack of academic interest. As indicated in Fig.1, the line of research linking accessibility with equity cuts across a number of divergent fields including green public spaces as well as healthcare up to coastal areas. Here visual overview identifies applied methodological and thematic milestones, including GIS-based analytics, optimisation models, and space syntax paradigms. Lastly, this synthesis reveals the research gaps that have existed to date, which are at the point of equitable access, coastal places, and spatial organization.

3. Material and methods

In order to unravel the complexity of the socio-spatial equity, this query provides a comparative examination of two Italian insular urbanities Cagliari Sardinia and Catania Sicily. The reasons why these particular municipalities are chosen have to do with the reason of sharing a maritime environment, similarity of city formations and a similar socio-economic heterogeneity, as well as the fact they all rely on the coast in civic life and tourism. The critical analysis prism focuses on the spatial structure of both cities and assesses the influence of the built form on the movement of pedestrians and cars towards the most important littoral areas. The study offers a concrete way of quantifying connectivity by applying the space syntax methodology (an ancient methodology of calculating the influence of urban form on movement). This method reveals those particular places that are either smoothly assimilated or highly delineated, thus bringing out the apparent disparities in both nautical capacities.

The query generated a segment based analysis using Depthmap 10 software, with the analysis being based on significant syntactic values like integration, and connectivity values. These measures are used to measure the conformity of the urban streets, which makes it possible to make a trenchant evaluation of how possible the movement towards the maritime areas is. On any city, a careful segment map was cut on the latest OpenStreetMap data, which was carefully corrected and cleared of errors to reflect the existing street network with an impeccable fidelity. Littoral ingress points were identified using direct site analysis with special emphasis to be placed on the domain of the population and that is the most glorious beaches.

As it has been defined in the available literature, the ingress ability is an essential manifestation of social parity. The metrics of connectivity are adequate to define the coverage of local scale (Askarizad et al., 2025a), but global integration is much more powerful to measure the accessibility of macro-scale or region-wide (Garau et al., 2025). In order to assess the objective access to the maritime territories of Cagliari and Catania, we provoked a multi-step workflow when the littoral access points were identified. At first, a piece-meal examination of the Cagliari metropolitan surroundings was carried out to identify whether the thoroughfares that headed towards the coast were organically melded or discontinuously combined. The resulting syntactic values of both the coastal locations were then tabulated in comparative tables. The process was repeated on the Catania milieu and its buffer zone, which meant that the information about its glorious beaches was also vetted. In conclusion, the results of the two urbanities were combined to enable the complete consideration of the accessibility of the coastal lands. The main steps of this research are explained in Fig.2.

3.1 Study area

Two outstanding Italian city-states of the insular type are picked out by this question, Cagliari the capital of Sardinia and Catania, a metropolitan centre of the eastern littoral of Sicily. Both cities hold a daunting niche in the Mediterranean, with a significant urban coastline that is part of the city life, tourism, and the general interactions. Regardless of the similarity of their geographic setting and historical prominence, urban structure and socio-economic path development are distinct in each city, making them suitable objects of a comparative analysis.

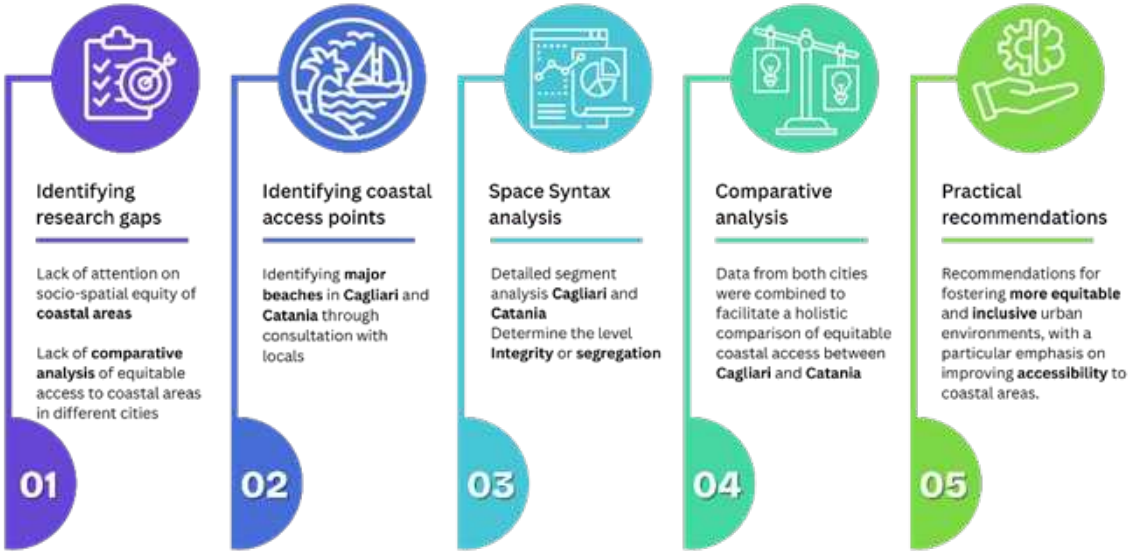


Fig.2 The adopted research methodology process

Cagliari is characterized by the precipitous topography and a compact structure of the city of history which fades slowly moving toward the coast. It has a variety of marine surroundings, with the most important being Poetto Beach, Calamosca, Sant Elia, and Giorgino, which are invaluable resources to the local people and the tourists. However, the physical engagement between the interior city structure and these littoral areas are always tortuous; they are often cut off by infrastructural barriers, height differences and broken walkways. Catania, by contrast, has developed over a more planar topography, and has a rectilinear urban form that is parallel to the shore. Its most maritime locations (e.g. Catania beach, Le Capannine, and La Piramide) are located next to some of the old core. Even though the municipality draws utility through a fairly accessible shoreline, some of the industrial and port-oriented developments have triggered discontinuities in littoral reach. Moreover, the highly developed socio-economic heterogeneity of different quarters raises relevant questions about the impartial distribution of these common resources.

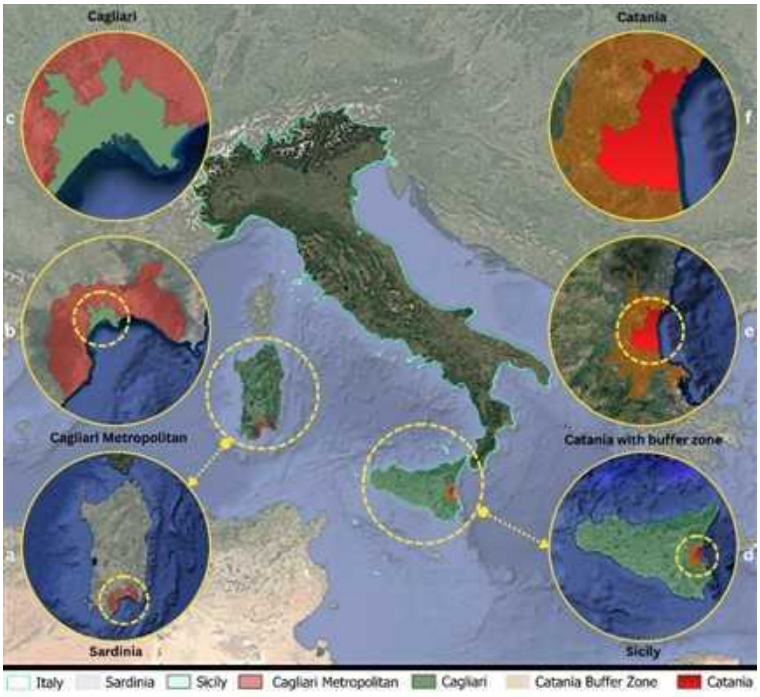


Fig.3 Study areas: (a) Sardinia. (b) Cagliari metropolitan area (c) Cagliari (d) Sicily (e) Catania with buffer zone (f) Catania

The contrast of these two urbanities enables the investigation of the effect that different urban morphologies and spatial structures have on the coastal permeability. Their shared regional prominence and their exposure to the sea, together with the structural features in comparison, offer a powerful conceptualization of identifying patterns of socio-spatial equality through space syntax methodology. The geographic environment of these urban areas, which are located in their own islands, is illustrated in Fig.3.

4. Findings and results

4.1 Urban morphology of Cagliari and Catania through Space Syntax Analysis

Space syntax can be defined as an excellent paradigm to actualise how spatial arrangements determine movement, social and behavioural phenomena (Karimi, 2023). These dynamics are outlined through a chromatic scale, according to which bright, hot colours are used to denote the areas of spatial integration of the highest order, and muted and cool colours are used to show the areas where it is segregated (Askarizad et al., 2024b). A segment-based analysis of the case as a whole was conducted on Cagliari (Fig.4). The data thus formed are that Via Roma (coloured in the most vivid shade in the southern parts of the city) is the most integrated street, and the numerical values are between 4,510 and 4,489. The five streets with highest integration are, respectively, the Via XX Settembre, Via Sydney Sonnino, Viale Armando Diaz, Via Ottone Bacaredda and Via Francesco Ciusa with values of 4,450 to 4,230. It is also interesting to note that Via Roma borders the Cagliari port, as it serves as a crucial intersection point on which all these secondary streets meet.

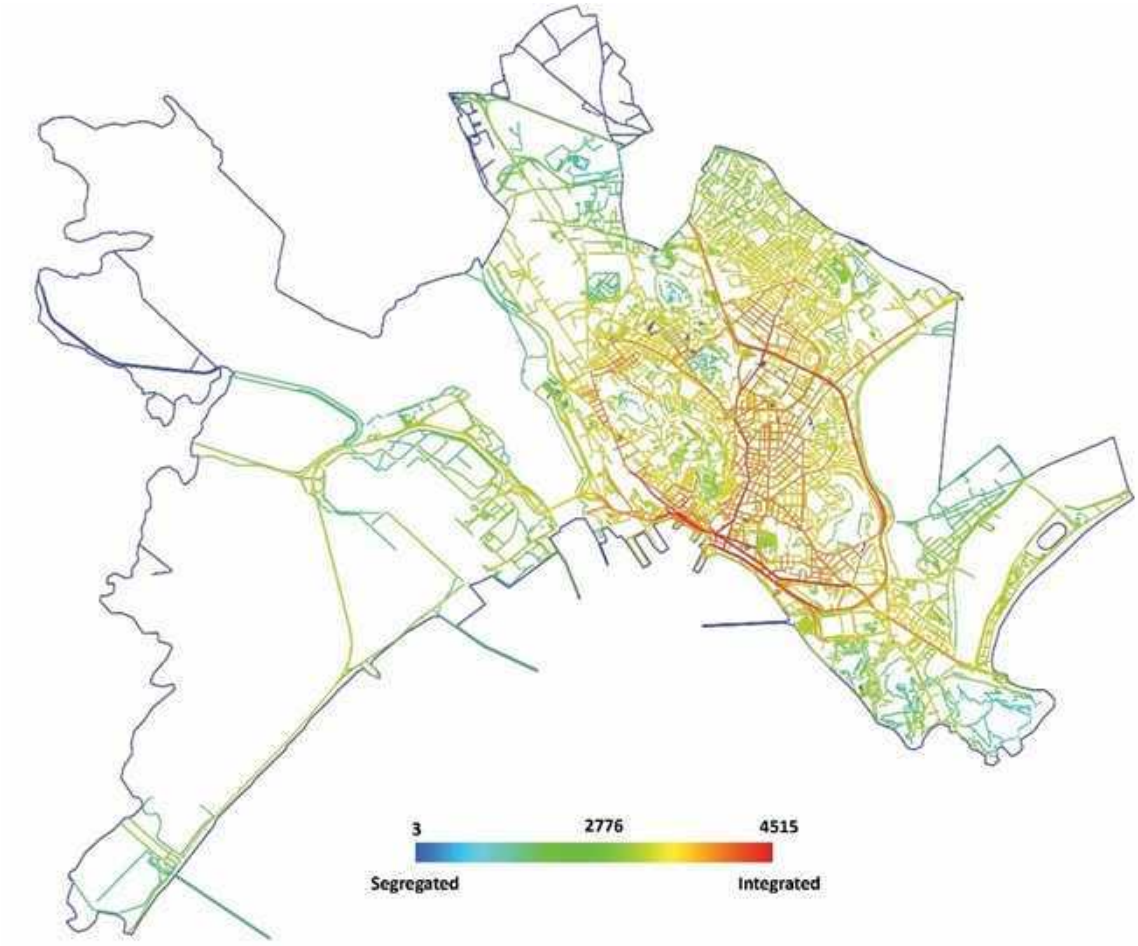


Fig.4 The analytical integration (HH) graph of Cagliari using space syntax methodology

On the other hand, the integration diagram of Catania shows that there is a disaggregated arrangement of the integrated and segregated thoroughfares (Fig.5). Through Etnea, in which a number of 7,309 is registered, reaches the important position of being the most integrated street, whereby closely follows Via Caronda whose value is 7,291. These two pathways pass across south to north through the city centre creating a basic structural formation. Through Vittorio Emanuele, one more avenue of great integration (7,105) cuts the urban grid in an east-west direction and meets with Via Etnea, which further enhances the central connectivity. There is a multitude of parallel streets, integration values ranging between 7,055 to 6,708, which also interact with this central axis in order to create a rigorously integrated network of streets. This space syntax analysis indicates results, as revealed in Fig.5, highlighting the predominant position of these streets in the spatial arrangement of the cities of interest.

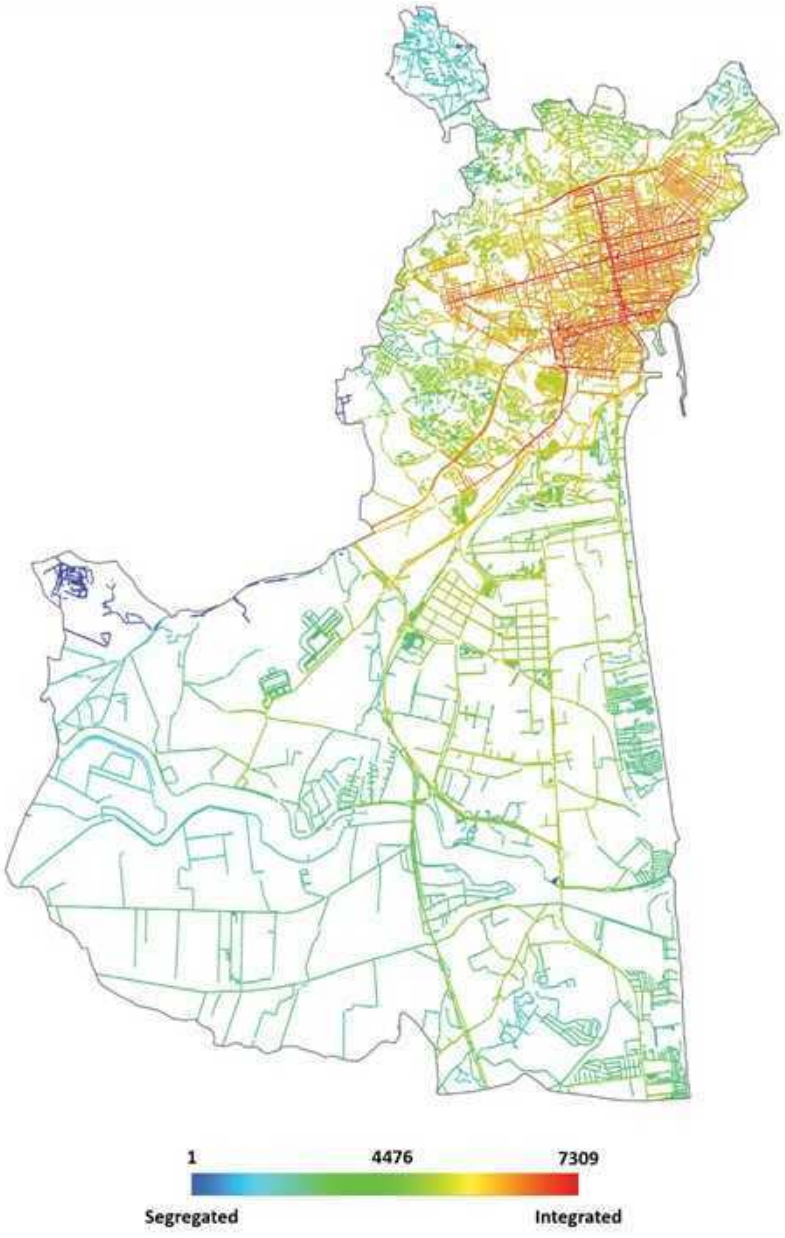
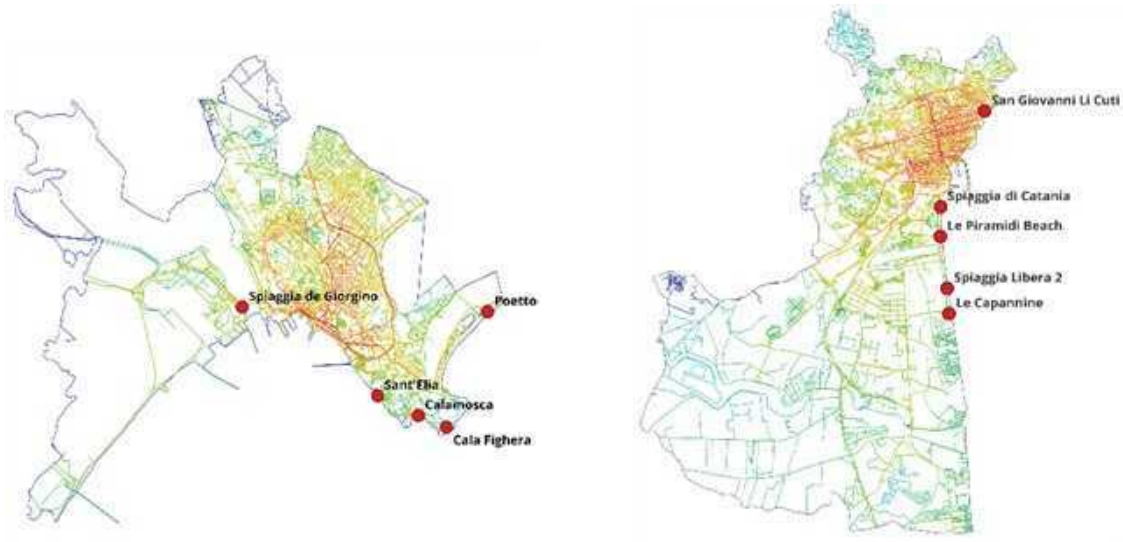


Fig.5 The analytical integration graph of Catania using space syntax methodology

4.2 Identifying the most important beaches of Cagliari and Catania

The study was then further refined and the researcher came up with the identified and distinguishable coastal enclaves of Cagliari (e.g. Poetto, Calamosca, Cala Fighera, Giorgino, and Sant'Elia) were brought out by the local consultation process and overlaid onto the space syntax integration matrix (Fig.6a). The access paths to

these coastal destinations were then calculated in order to get the particular integration metrics. The resulting data reflect that the approach to the Poetto Beach reaches the highest degree of spatial integration (3,637), and Giorgino Beach (3,502) and Calamosca (2,812) come next. The connectivity of Sant'Elia (2,449) and Cala Fighera (1,894) has an apparent significant reduced value with the latter registering the lowest value. This keen critical series was applied to the territory of Catania. The integration graph (Fig.6b) was plotted with five important seaside locales (e. g. Catania Beach, San Giovanni Li Cuti, Le Capannine, La Piramide, and Spiaggia Libera 2) on it. The analysis shows that San Giovanni Li Cuti is the most benefited in terms of the deepest integration (6,688), especially compared to the Catania Beach (5,907) and La Piramide (4,667). In the meantime, Spiaggia Libera 2 (4,591) and Le Capannine (4,237) are more peripheral to the urban conformation, and the latter has the lowest values of connectivity measures in the cohort.



(a) (b)

Fig.6 (a) The five most important beaches of Cagliari (b) The five most important beaches of Catania

4.3 Comparative analysis

Fig.7, based upon the space syntax appraisal, is a comparative analysis of the paramount littoral zones in Cagliari and Catania.

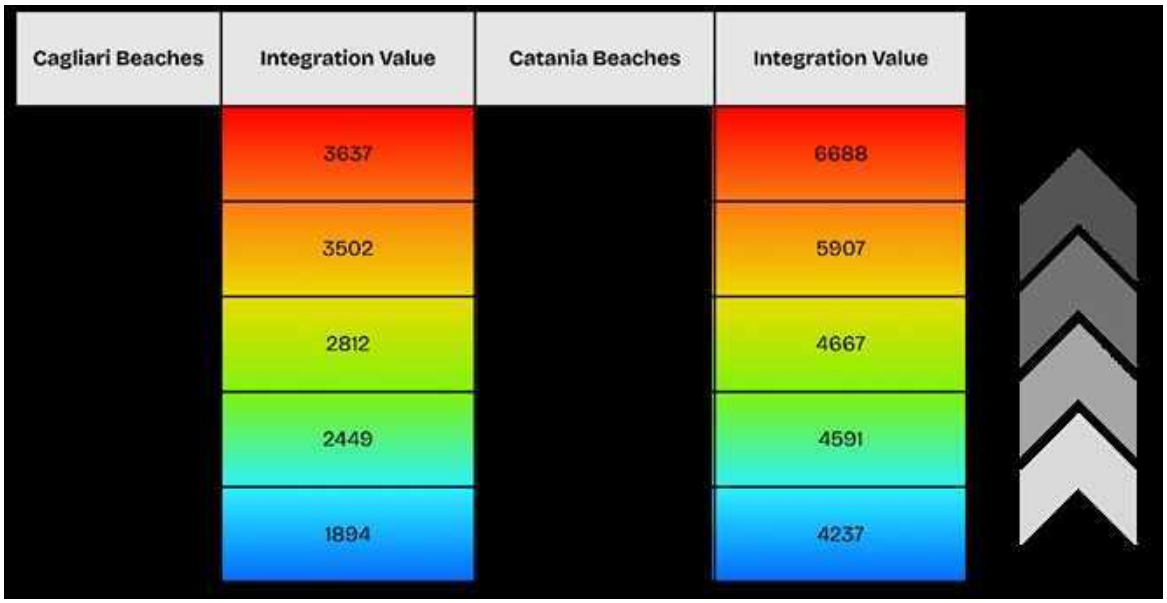


Fig.7 Comparative analysis of the integration values of the main beaches in Cagliari and Catania

The five chosen beaches of Cagliari are shown on the left hand side and their respective numerical integration value as opposed to the right hand side that includes homogeneous maritime locations of Catania and their respective quantitative measures of the same. This contrast is expressed in a gradation of chroma, running between the most integrated conduits in lurid red, to the least integrated ones in a muted azure, a conspicuousness that is immediately determined as a measure of accessibility in space.
The corresponding indicators display a conspicuous pattern: the littoral enclaves of Catania are always ahead of the ones of Cagliari on the measures of spatial integration (Fig.8). Whereas the city of Catania has San Giovanni Li Cuti with a value of 6,688, the Poetto Beach (the most integrated destination in Cagliari) has a much lower value of 3,637. Indeed, the width of the coast line of Catania, between 6,688 and 4,237, is far deeper than the paltry distance that is visible in Cagliari, which goes between 3,637 and 1,894. This contrast indicates that maritime destinations in Catania are more well-integrated into the urban form, and the coastal accessibility in Cagliari is relative and stands in contrast to the urban centers.

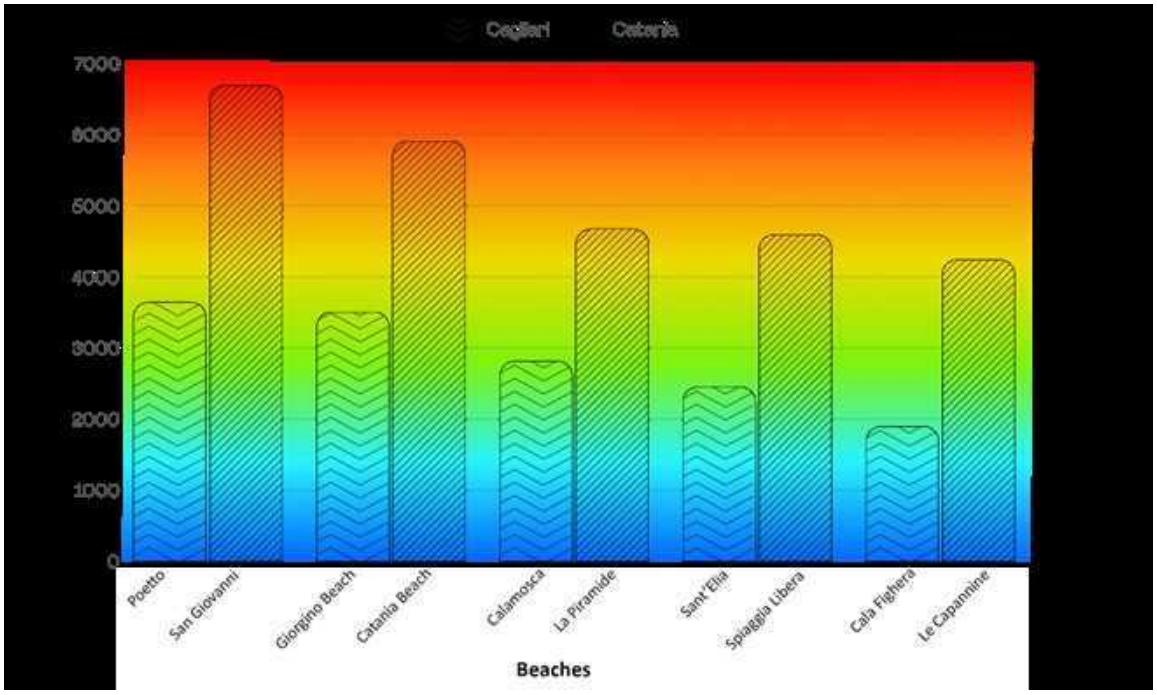


Fig.8 Comparative chart analysis between Cagliari and Catania beaches

A much more integrated ease of access is apparent through this comparative study in Catania, so the patterns of easier and more equitable usage may be more frequent and consistent in Catania than in Cagliari. The graphic gradient and the arrow attached to it highlight the course of the rising integration, supporting the comparative advantage of accessibility that is inherent in the Catania, coastal structure (Fig.7 and Fig.8). On a bigger scale, the results indicate huge differences in maritime coverage in the two urbanities: a phenomenon that is inextricably connected to the distinct urban structure. The more strictly welded to the main frame of the city those beaches, suggest the better accessibility, and the fruitful consequences in terms of leisure habit, tourism wellbeing, and the unprejudiced access to the entire resident population.
Lastly, the low values of integration that have been registered in the beaches of Cagliari can be attributed to the ancient history development of the city and the natural stubbornness of the street system. Cagliari, in a sudden contrast with Catania, with its more rectified and rectilinear urbanism, which was in great part due to its rebuilding following the disastrous earthquake of 1693, had an urban structure which had evolved over a number of centuries with an informalised planning spirit. This has created a more discontinuous and meandering street pattern especially in the older areas that is used to limit spatial connectivity between the urban core and the littoral areas.

4.4 Practical recommendations for enhancing socio-spatial equity

Based on the results, there are a number of practical measures that are vital to enhance the socio-spatial equity with respect to the coastal access, which, in this case, is in the Cagliari urban situation. A key measure is to address the lack of movement within the population; it means optimal trajectories and times in transit to balance the distance between underprivileged subsidiary areas and the coastline with seasonal shuttles that would make frequent stops in areas that are underserved. Increased inclusiveness can be significantly improved by enhancing active mobility by the means of providing secure, continuous, and shaded pedestrian and cycling routes, designed to be universally accessible and with wayfinding that is clear and unambiguous.
The morphological solutions, i.e. the renovation of major axial avenues, the enhancement of permeable connections by means of the construction of dense urban blocks would help to cement the merging of the inland areas with the coast. In addition, the stimulation of undertook maritime edges by instigating micro-scale open access, equipped with simple facilities and reliable transport networks, would help with the more equal allocation of accessibility through the urban grid. Such physical corrections should be coupled with participatory paradigms of planning, where the local communities are involved to identify the particular hindrances and jointly develop solution options. Lastly, by integrating the land-use and transport planning to encourage mixed use developments along the main conduits, the city will experience more walkable streets, reduce car addiction, and strengthen the social structure.

5. Conclusion

The research discusses how the spatial form of Italian insular metropolitan areas influences equitable access to maritime space through a comparative space syntax-based paradigm of Cagliari and Catania. These data show that the morphology of the city is the most important parameter to identify the parity of accessibility: the high level of integration in Catania presents more integrated and inclusive urban structure whereas in Cagliari, a higher level of spatial segregation is manifested through fragmented morphology, which would limit access to a larger number of marginalised inhabitants. With the help of those findings, the debate on spatial justice can be expanded to the coastal environment, a field that has always been haunted by deficiency of scholarly concern.
The results are substantially connected with the article by Di Ruocco (2024), which advocates for the integration of transport policy, land-use planning, and digital innovation to alleviate mobility disparity among vulnerable groups. The two articles lead to a similar conclusion with one common assumption that spatial and institutional structures are co-determinants of the results of accessibility. However, where Di Ruocco is so concerned about the governance and technology landscape of the mobility systems, the existing question shifts the responsibility of the spatial justice to the urban morphology. The research is providing a spatial-analytic perspective through which the mediating effects of the spatial configuration on coastal permeability are measured and which adds to the policy-based approaches and offers the structural foundations of inequality that lie behind the urban configuration.
Meanwhile, by interrogating the concept of spatial fairness through the distribution of community services in Tabriz et al. (2016) suggest that formal equity in service delivery does not necessarily translate into actual accessibility of the population. Their work and the ongoing investigation have a coherent interest in identifying the incongruency between spatial structure and experience. However, even though Zali et al. (2016) work in a land-use and service-allocation context, the study expands to maritime open spaces, spaces that are often lacking in the mainstream urban planning. This research fills an informative void in the current methodological and thematic gap by applying space syntax to these littoral boundary points and offering a learned quantitative methodology of coastal approach using a socio-spatial parity approach.
The behavioural and socio-demographic knowledge of Arif et al. (2025) and Alam (2026) also overlaps with this study. They demonstrate the interaction of urban structure with demographic and economic variable so

as to alter mode-choice behaviour in transitional mobility systems. Their model emphasizes the idea of accessibility to be mediated not only by infrastructure, but also by social norms, gender, and household. The present investigation has the same preoccupation as the structural determinants of equity, only it surpasses mobility options to assess territorial incursion on the coastal enclaves. Although Arif et al. (2025) reveal the manner in which people make decisions about using urban systems, the question for which the answer is given is how the city itself supports or restricts transit. As a result, individual behaviour is not the critical explanatory variable as is the spatial configuration.

A further layer of complexity that is included into the paradigm suggested by Akhavan & Vecchio (2018) relates mobility and ingress to the well-being of the aged based on the Capabilities Approach. The subjectivity and heterogeneity of transit among them are emphasized by their scholarship, which suggests a comprehensive evaluation of the profiles of ageing mobilities. Although their structure is fundamentally qualitative and individual oriented, the focus of this question is spatial and quantitative. Despite these conflicting directions, both studies are guided to the same valid conclusion that the lack of accessibility is a key requirement of social inclusion. The novelty in this case is to make a combination of these anthropocentric issues and to make spatial evidence real, to make morphological conformation a quantifiable factor of experiential parity.

All these comparisons represent an apparent gap in the sphere: whereas current scholarship explores socio-spatial fairness by focusing on governance or behavioural dynamics, there are little studies that explicitly connect urban form and maritime accessibility. This is the fundamental input of the current study; it brings together spatial configuration research and the concepts of socio-spatial equity, which is empirically proved that the morphology of the coastal urbanities can either perpetuate or alleviate the social imbalance and injustices. Focusing on the public spaces of the coastlines, a field historically overlooked by equity research, the study creates a new area where city justice may be quantified, visualised, and improved.

To sum up, this study contributes to the discussion of socio-spatial equity by extending it to the urban-maritime interface, indicating that the spatial arrangement is not a passive context, but a proactive force of developing equitable access. Progressive research ought to attempt to blend configurational analysis with the participatory and well-being models to have the structural and phenomenological sides of justice. By detecting salient spatial mismatches in the permeability of the coasts and establishing them in relation to more comprehensive governance dilemmas, the current research proposes new empirical and methodological insights to the transforming framework of urban justice and accessibility planning.

Declaration of interest

The authors declare that they have no conflicts of interest.

Writing assistance disclosure

During the preparation of this work, the authors used AI tools to improve language and readability. After using these tools, the authors reviewed and edited the content as needed and took full responsibility for the final content of the publication.

Data availability statement

The data could be available on request.

Authors contribution

This paper is the result of joint work by all authors. The Abstract, "Introduction", and "Comparative Analysis" were written collaboratively. MD wrote the "Materials and Methods" and "Practical Recommendations for Enhancing Socio-Spatial Equity". TA wrote the "Literature Review". RA wrote "Morphological Analysis of Cagliari

and Catania using Space Syntax". TC wrote the "Study Area" section and "Identifying the most important beaches of Cagliari and Catania". CG wrote "Urban morphology analysis of Cagliari and Catania using Space Syntax", the "Conclusion", and supervised and coordinated the research.

Acknowledgments

This study was partially supported by the MUR through two projects, (1) SMART3R-FLITS: SMART Transport for Travelers and Freight Logistics Integration Towards Sustainability" (Project protocol: 2022J38SR9; CUP Code: F53D23005630006) and (2) MOVING StEPS: MOVING from Street Experiments to adaptive Planned Solutions (Project protocol: 2022BLK9TS; CUP Code: F53D23005550006), both financed by the PRIN 2022 (Research Projects of National Relevance) program, funded by the European Union (NextGenerationEU). This study was also partially supported by the Ecosystem of Innovation for Next Generation Sardinia (e.INS) and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.5 – ECS00000038). In particular, the "Material and methods" and Conclusion" was funded by eINS. This study reflects only the authors' views and opinions, and neither the European Union nor the European Commission nor MUR can be considered responsible for them.

References

Abed, A. & Al-Jokhadar, A. (2022). Common space as a tool for social sustainability. *Journal of Housing and the Built Environment, 37* (1), 399-421. https://doi.org/10.1007/s10901-021-09843-y

Akcali, S. & Ispalar Cahantimur, A. (2023). How socio-spatial aspects of urban space influence social sustainability: A case study. *Journal of Housing and the Built Environment, 38* (4), 2525–2557. https://doi.org/10.1007/s10901-023-10052-y

Akhavan, M. & Vecchio, G. (2018). Mobility and accessibility of the ageing society: Defining profiles of the elderly population and neighbourhoods. *TeMA - Journal of Land Use, Mobility and Environment, 2*, 9-22. https://doi.org/10.6092/1970-9870/5757

Arif, M. M., Adeel, A. & Sheikh, N. B. (2025). Mode choice patterns and socio-spatial equity in contrasting transitional urban mobility systems. *TeMA – Journal of Land Use, Mobility and Environment, 18* (2), 271-292. https://doi.org/10.6093/1970-9870/11740

Alam, T. (2026). Integrating Space Syntax and Bathtub Flood Modelling to Assess Accessibility Impacts of Sea-Level Rise in Copenhagen's Historic Core. *Journal of Environmental Management*. 397 (128314). https://doi.org/10.1016/j.jenvman.2025.128314

Ashik, F. R., Mim, S. A. & Neema, M. N. (2020). Towards vertical spatial equity of urban facilities: An integration of spatial and aspatial accessibility. *Journal of Urban Management, 9* (1), 77-92. https://doi.org/10.1016/j.jum.2019.11.004

Askarizad, R. & Garau, C. (2025). Visibility Graph Analysis vs. Human Mobility Patterns: An Empirical Validation of Simulation-Based Analysis Using Space Syntax in Public Squares. In *International Conference on Computational Science and Its Applications*, 51-68, Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-97654-4_4

Askarizad, R., Lamíquiz-Daudén, P. J., Dastoum, M. & others. (2025a). A cross-cultural study to identify social behaviours of pedestrians in urban public spaces: Evidence from Iran, Spain, Italy, and Australia. *Scientific Reports, 15*, Article 31338. https://doi.org/10.1038/s41598-025-16421-7

Askarizad, R., Daudén, P. J. L. & Garau, C. (2024a). Exploring the role of configurational accessibility of alleyways on facilitating wayfinding transportation within the organic street network systems. *Transport Policy, 157*, 179-194. https://doi.org/10.1016/j.tranpol.2024.09.001

Askarizad, R., Dastoum, M. & Garau, C. (2024b). Street puppet theatre shows on the façades of commercial buildings as a novel stimulator for social gatherings in smart cities. *Buildings, 14* (9), Article 2950. https://doi.org/10.3390/buildings14092950

Behbahani, H., Nazari, S., Kang, M. J. & Litman, T. (2019). A conceptual framework to formulate transportation network design problem considering social equity criteria. *Transportation Research Part A: Policy and Practice, 125*, 171-183. https://doi.org/10.1016/j.tra.2018.04.005

Bell, S. L., Phoenix, C., Lovell, R. & Wheeler, B. W. (2015). Seeking everyday wellbeing: The coast as a therapeutic landscape. *Social Science & Medicine, 142*, 56-67. https://doi.org/10.1016/j.socscimed.2015.08.011

Berke, P., Yu, S., Malecha, M. & Cooper, J. (2023). Plans that disrupt development: Equity policies and social vulnerability in six coastal cities. *Journal of Planning Education and Research, 43* (1), 150-165. https://doi.org/10.1177/0739456X19861144

Campisi, T., Mrak, I., Errigo, M. F. & Tesoriere, G. (2021, March). Participatory planning for better inclusive urbanism: Some consideration about infrastructural obstacles for people with different motor abilities. In *AIP Conference Proceedings* (Vol. 2343, No. 1). AIP Publishing.

Cassiers, T. & Kesteloot, C. (2012). Socio-spatial inequalities and social cohesion in European cities. *Urban Studies, 49* (9), 1909-1924. https://doi.org/10.1177/0042098012444888

Cetin, M. (2016). Sustainability of urban coastal area management: A case study on Cide. *Journal of Sustainable Forestry, 35* (7), 527–541. https://doi.org/10.1080/10549811.2016.1228072

Chen, Y., Ding, Q. & Shen, Y. (2022). Assessing accessibility and social equity of tertiary hospitals for older adults: A city-wide study of Tianjin, China. *Buildings, 12* (12), Article 12107. https://doi.org/10.3390/buildings12122107

Congiu, T., et al. (2024). Planning strategies and practices for accessibility in peripheral sparsely populated areas (SPA): A spatial knowledge interpretation approach. In O. Gervasi et al. (Eds.), *Computational Science and Its Applications – ICCSA 2024 Workshops (Lecture Notes in Computer Science, Vol. 14822)*. Cham: Springer. https://doi.org/10.1007/978-3-031-65318-6_27

Di Ruocco, I. (2024). Eco-mobility justice in the ecological transition: An analysis for possible directions in mobility and transport equity. *TeMA - Journal of Land Use, Mobility and Environment*, 97-111. https://doi.org/10.6093/1970-9870/10162

Eizenberg, E. & Jabareen, Y. (2017). Social sustainability: A new conceptual framework. *Sustainability, 9* (1), 68. https://doi.org/10.3390/su9010068

Faedda, S. et al. (2024). A scoping review of the barriers and prerequisites for MaaS implementation in low-demand contexts. In O. Gervasi et al. (Eds.), *Computational Science and Its Applications – ICCSA 2024 Workshops (Lecture Notes in Computer Science, Vol. 14821)*. Cham: Springer. https://doi.org/10.1007/978-3-031-65308-7_19

Garau, C. & Annunziata, A. (2022). A method for assessing the vitality potential of urban areas: The case study of the Metropolitan City of Cagliari, Italy. *City, Territory and Architecture, 9*, 7. https://doi.org/10.1186/s40410-022-00153-6

Garau, C., Dastoum, M. & Fancello, G. (2025). Developing a methodological framework to assess social equity in regional spaces through the lens of space syntax. In *International Conference on Computational Science and Its Applications (ICCSA) – ICCSA 2025 Workshops. ICCSA 2025. Lecture Notes in Computer Science, vol 15897.* Cham: Springer. https://doi.org/10.1007/978-3-031-97660-5_16

Gelormino, E., Melis, G., Marietta, C. & Costa, G. (2015). From built environment to health inequalities: An explanatory framework based on evidence. *Preventive Medicine Reports, 2*, 737-745. https://doi.org/10.1016/j.pmedr.2015.08.019

Grengs, J. (2015). Nonwork accessibility as a social equity indicator. *International Journal of Sustainable Transportation, 9* (1), 1-14. https://doi.org/10.1080/15568318.2012.719582

Gu, Z., Luo, X., Tang, M. & Liu, X. (2023). Does the edge effect impact the healthcare equity? An examination of the equity in hospitals accessibility in the edge city in multi-scale. *Journal of Transport Geography, 106*, 103513. https://doi.org/10.1016/j.jtrangeo.2022.103513

He, J., Ren, F., Dong, J., Zhang, H., Yan, W. & Liu, J. (2024). Social inequity of park accessibility in Taiyuan: Highlighting the unfair layout of parks in second-tier cities of China and the relative role of contributors. *Geo-Spatial Information Science, 27* (4), 1118-1140. https://doi.org/10.1080/10095020.2022.2125835

Iraegui, E., Augusto, G. & Cabral, P. (2020). Assessing equity in the accessibility to urban green spaces according to different functional levels. *ISPRS International Journal of Geo-Information, 9* (5), 308. https://doi.org/10.3390/ijgi9050308

Jahangir, S., Bailey, A., Hasan, M. M. U. & Hossain, S. (2024). Inequalities in accessing public transportation and social exclusion among older adults and people with disabilities in Bangladesh: A scoping review. *Transportation Research Interdisciplinary Perspectives, 26*, 101138.

Jian, I. Y., Luo, J. & Chan, E. H. (2020). Spatial justice in public open space planning: Accessibility and inclusivity. *Habitat International, 97*, 102122. https://doi.org/10.1016/j.habitatint.2020.102122

Kaplan, S., Popoks, D., Prato, C. G. & Ceder, A. A. (2014). Using connectivity for measuring equity in transit provision. *Journal of Transport Geography, 37*, 82-92. https://doi.org/10.1016/j.jtrangeo.2014.04.016

Karimi, K. (2023). The configurational structures of social spaces: Space syntax and urban morphology in the context of analytical, evidence-based design. *Land, 12*, 2084. https://doi.org/10.3390/land12092084

Kim, G. S., Chun, J., Kim, Y. & Kim, C. K. (2021). Coastal tourism spatial planning at the regional unit: Identifying coastal tourism hotspots based on social media data. *ISPRS International Journal of Geo-Information, 10* (3), 167. https://doi.org/10.3390/ijgi10030167

LeClair, K., Tiznado-Aitken, I., Klumpenhouwer, W. & Farber, S. (2023). A web-based tool to incorporate social equity in infrastructure planning and delivery. *Case Studies on Transport Policy, 13*, 101068. https://doi.org/10.1016/j.cstp.2023.101068

Liu, Q., Hao, W. & Xia, M. (2024). Spatial association of coastal towns and villages in Funing District, Qinhuangdao: A study using social network analysis. *Journal of Rural Studies, 107*, 103261. https://doi.org/10.1016/j.jrurstud.2024.103261

MacLeod, K. E., Kamruzzaman, L. & Musselwhite, C. (2022). Transport and health equity, social inclusion and exclusion. *Journal of Transport & Health, 27*, 101543. https://doi.org/10.1016/j.jth.2022.101543

Madanipour, A., Shucksmith, M. & Brooks, E. (2022). The concept of spatial justice and the European Union's territorial cohesion. *European Planning Studies, 30* (5), 807-824. https://doi.org/10.1080/09654313.2021.1928040

Manaugh, K., Badami, M. G. & El-Geneidy, A. M. (2015). Integrating social equity into urban transportation planning: A critical evaluation of equity objectives and measures in transportation plans in North America. *Transport Policy, 37*, 167-176. https://doi.org/10.1016/j.tranpol.2014.09.013

Meerow, S., Natarajan, M. & Krantz, D. (2021). Green infrastructure performance in arid and semi-arid urban environments. *Urban Water Journal, 18*, 275–285. https://doi.org/10.1080/1573062X.2021.1877741

Mrak, I., Campisi, T., Tesoriere, G., Canale, A. & Cindrić, M. (2019). The role of urban and social factors in the accessibility of urban areas for people with motor and visual disabilities. *AIP Conference Proceedings, 2186* (1), 1-8. https://doi.org/10.1063/1.5138007

Nunkoo, R. & Ramkissoon, H. (2010). Small island urban tourism: A residents' perspective. *Current Issues in Tourism, 13* (1), 37-60. https://doi.org/10.1080/13683500802499414

Pizzol, B., Giannotti, M. & Tomasiello, D. B. (2021). Qualifying accessibility to education to investigate spatial equity. *Journal of Transport Geography, 96*, 103199. https://doi.org/10.1016/j.jtrangeo.2021.103199

Power, A. (2012). Social inequality, disadvantaged neighbourhoods and transport deprivation: An assessment of the historical influence of housing policies. *Journal of Transport Geography, 21*, 39-48. https://doi.org/10.1016/j.jtrangeo.2012.01.016

Seyedrezaei, M., Becerik-Gerber, B., Awada, M., Contreras, S. & Boeing, G. (2023). Equity in the built environment: A systematic review. *Building and Environment, 245*, 110827. https://doi.org/10.1016/j.buildenv.2023.110827

Sharma, G. & Patil, G. R. (2022). Spatial and social inequities for educational services accessibility: A case study for schools in Greater Mumbai. *Cities, 122*, 103543. https://doi.org/10.1016/j.cities.2021.103543

Venezia, E. (2024). Gender issues, social equity, and the sustainable management of urban transport networks: An Italian case study. *European Scientific Journal, 20* (23), 1-10.

Wan, Y. K. P., Sou, P. U. J. & Kong, W. H. (2025). Spatial justice and street accessibility for wheelchair users in Macao. *Tourism Geographies, 27*, 1424-1444. https://doi.org/10.1080/14616688.2024.2443888

Wang, S., Yung, E. H. K. & Sun, Y. (2022). Effects of open space accessibility and quality on older adults' visits: Planning towards equal right to the city. *Cities, 125*, 103611. https://doi.org/10.1016/j.cities.2022.103611

Zali, N., Rahimpoor, M., Benab, S. S., Molavi, M. & Mohammadpour, S. (2016). The distribution of public services from the perspective of sustainable spatial equality in the Tabriz Metropolitan in Iran. *TeMA - Journal of Land Use, Mobility and Environment, 9* (3), 287-304. https://doi.org/10.6092/1970-9870/3976

Zhao, Y. & Gong, P. (2024). Optimal site selection strategies for urban parks' green spaces under the joint perspective of spatial equity and social equity. *Frontiers in Public Health, 12*, 1310340. https://doi.org/10.3389/fpubh.2024.1310340

Image Sources

Fig.1: Elaborated by the authors;

Fig.2: Elaborated by the authors;

Fig.3: Elaborated by the authors;

Fig.4: Elaborated by the authors;

Fig.5: Elaborated by the authors;

Fig.6: Elaborated by the authors;

Fig.7: Elaborated by the authors;

Fig.8: Elaborated by the authors;

Author's profile

Mana Dastoum

She is an architect and she has a background in the field of urban planning and architecture. She is a research fellow at the University of Cagliari, Italy, supported by the project by the Ecosystem of Innovation for Next Generation Sardinia (e.INS). She is a PhD candidate in Construction and Architectural Technology at the Polytechnic University of Madrid in Spain. Her research interests focus on urban analytics, spatial configuration, socio-spatial equity, sustainable development, and energy efficiency. Her research efforts have led to publications in different journals and international conference presentations. She has also earned awards both as an architectural designer and as a young researcher.

Tazyeen Alam

She is a Postdoctoral Fellow at the University of Cagliari, Italy. She has a PhD in Urban and Regional Planning. She is actively engaged in the project SMART3R-FLITS: SMART Transport for Travelers and Freight Logistics Integration Towards Sustainability, financed by the PRIN 2022 (Research Projects of National Relevance) program. She has achieved various reputed publications and international participation in her research tenure and is recognized globally. Her area of research includes Urban Planning, Urban Morphology, Sustainable Cities and Communities, Statistical modelling and Mixed methods for urban assessments.

Reza Askarizad

He has a background in the fields of urban planning and architecture. Currently, he is a research fellow at the University of Cagliari, Italy, where he is actively engaged in a research project funded by the European Union. He is passionate about exploring the horizons of urban spaces through space syntax and social behavioural studies to understand the role of urban morphology on accessibility, walkability, and social encounters. His research achievements have been published in more than 35 journal papers. Additionally, he has served as a technical reviewer and editorial member for more than 40 prestigious international journals.

Tiziana Campisi

She is an associate professor at the Department of Engineering and Architecture, University of Enna Kore, Italy. She holds a PhD in Civil Protection Engineering from the same university. Her research focuses on transport supply and demand, sustainable and shared mobility, road safety, and traffic microsimulation. She has authored over 130 publications in international journals and conferences. Tiziana Campisi leads the local unit of the PRIN2017 project WEAKI TRANSIT and serves as Editor-in-Chief of The Open Transportation Journal.

Chiara Garau

She is an associate professor in Urban and Regional Planning at the DICAAR of the University of Cagliari, Italy. She was a scientific and technical adviser to Observatory Smart Cities of Rome and she held several postdoctoral fellowships, before being a researcher and then a professor at the University of Cagliari. She currently coordinates, is responsible for a local unit and is a member of various national and international projects including: SMART3R-FLITS: SMART Transport for Travelers and Freight Logistics Integration Towards Sustainability, financed by the PRIN 2022 (Research Projects of National Relevance) program. According to the ranking Stanford Research Excellence, she is in the top 2% list of world's most cited scientists on Scopus for the last 5 years (from 2021 to 2025). Her main research interests are focused on issues of the Scientific Disciplinary Sector of Urban and Regional Planning, particularly on smart cities; participatory processes; cultural heritage; urban governance and urban policies. A referee of several international scientific journals, she is author of over one hundred and sixty publications, including monographs, conference proceedings, articles in books, national and international journals.