Developing a Methodological Framework to Assess Social Equity in Regional Spaces Through the Lens of Space Syntax

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Abstract. Social equity is a fundamental principle of sustainable urban development, emphasising the fair distribution of resources, services, and opportunities to all individuals, regardless of socioeconomic or demographic characteristics. Although many studies utilising social science methods have investigated different aspects of equity in society, the use of Space Syntax analytical method in urban planning has not been well covered in current literature. Space Syntax is a well-established method for analysing spatial configurations and provides particular consistencies to the main indicators of social equity, such as accessibility, connectivity, inclusivity, security, and the equitable distribution of public and green spaces. This study seeks to provide an original methodology linking Space Syntax analysis with the socio-spatial dimensions of social equity in regional contexts. To achieve this, relevant indicators of social equity from a socio-spatial perspective are identified and analysed. The research's originality is combining spatial analysis with the multidimensional concept of social equity. These results show that the socio-spatial equity indicators and Space Syntax used together provide a useful diagnostic tool for identifying spatial inequality and guiding a fair urban development.

Keywords: Social Equity · Social Justice · Space Syntax · Urban Accessibility · Public Space · Sustainable Urban Development

1 Introduction

Social equity is a multidimensional concept within urban and regional planning, reflecting a commitment to justice by recognising the ways in which resources, services, and opportunities are allocated among different people [1–4]. This encompasses multiple

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attributes like accessibility to basic services [5, 6], connectivity within and between communities [7, 8], inclusion of different social groups [9], personal and security for every individual [10], and the equitable allocation of public amenities or utilities [11] and green spaces [12]. These interact to affect the socio-spatial structure of urban environments and, for that reason, influencing the quality of life as well as more broadly the dynamics of social cohesion and economic opportunity. Conversely, Space Syntax offers quantitative insights of how urban layouts influence accessibility, connectivity, and inclusivity, due to its ability to model and quantify spatial relationships [13–15]. Accessibility, which is a central component of social equity, can be analysed through Space Syntax metrics [16], because they show how the spatial configuration of the built environment (or urban morphologies) enables and constrains movement [17]. Connectivity, a key indicator, can be explored using network centrality measures to understand how well different areas are interconnected [18, 19], shedding light on spatial disparities that may contribute to social exclusion [20]. Moreover, visibility graph analysis (VGA) allows one to assess the inclusiveness and equitable distribution of public and green spaces, consequently emphasising areas where spatial design could either promote or hinder social contact and involvement [21, 22].

Despite the evident alignment between the indicators of social equity and the analytical tools provided by Space Syntax, the integration of these two domains remains largely unexplored in urban research and practice. While Space Syntax has been extensively applied to study spatial accessibility [23–25], connectivity [26, 27], and the inclusivity of urban spaces [28–30] its potential to address the broader and multidimensional concept of social equity has yet to be fully realised. Existing studies often focus on specific spatial metrics without adequately linking these findings to the socio-economic and demographic inequalities that shape access to urban opportunities [17]. This disparity underlines the need of a theoretical framework connecting Space Syntax analysis to the different aspects of social equality. Consequently, the objective of this research is to establish a methodological framework that combines the two (a Space Syntax and socio-spatial approaches to social equity), in an attempt to fill this gap. It is crucial to take such measures because they play a key role in detecting and examining spatial patterns that affect equitable access, connectivity, and inclusivity, particularly at the regional level.

Based on these assumptions, the following research questions are proposed to seek suitable solutions: From a socio-spatial viewpoint, what are the key indicators of social equity and how can they be operationalised within the context of Space Syntax analysis? In what ways it affects fairness in access, connectivity, and inclusivity? How may the combination of Space Syntax metrics with social equity factors reveal new insights into spatial patterns? What methodological framework may be developed to methodically connect Space Syntax analysis with the different aspects of social equity?

This research has a significant insight from both the theoretical and practical point of view. It contributes theoretically by linking space syntax with social equity studies, advancing knowledge on how spatial analysis techniques (Space Syntax analysis) is related to social equity. This paper derives a new theoretical framework for researchers to systematically analyse the relationship between space organisation and the extent to which spaces serve different groups equitably. It extends beyond the typical access metrics to cover a broader range of social accessibility parameters. In practice, this

study gives useful insights for urban planners and policymakers. The findings might inform the design of fairer cities, ensuring that all people have equitable access to basic services, green spaces, and public services. The proposed framework can serve as a tool to assess current urban challenges, identify aspects that require improvement, and rank interventions that can help in addressing spatial inequalities. Through mitigating spatial segregation and fostering inclusion, this research is linked to the fulfillment of three Sustainable Development Goals (SDGs): Goal 5: Gender Equality, Goal 10: Reduced Inequalities, and Goal 11: Sustainable Cities and Communities.

The structure of this document is organised in 5 sections. After this introductive section, the section of materials and methods describes the conceptual and analytical approach used by reviewing the most relevant academic literature, consequently specifying the process of defining social equity indicators and relating them to Space Syntax metrics. The Sect. 3 shows the results, namely the methodological framework, by combining Space Syntax analysis with socio-spatial equity indicators. The Sect. 4 critically evaluates the discussion, by considering under the existing urban planning research and practice field, the strengths, limitations, and broader implications of the framework. Finally, Sect. 5 summarises the key findings, highlights the contributions of this research to the field of urban planning, and identifies potential directions for future research.

2 Material and Methods

The research methodology in this study is a qualitative approach that outlines the conceptual and analytical framework adopted to integrate Space Syntax analysis with the socio-spatial dimensions of social equity. The methodology involves four key phases that can be summarised as follow: (1) Overview of the Relevant Literature, (2) Identifying relevant indicators of social equity in regional spaces, (3) Reviewing the space syntax metrics, (4) Linking social equity indicators to Space Syntax metrics, and (5) Constructing and validating the proposed methodological framework through a review of academic literature. Figure 1 presents a brief overview of the research methodology.

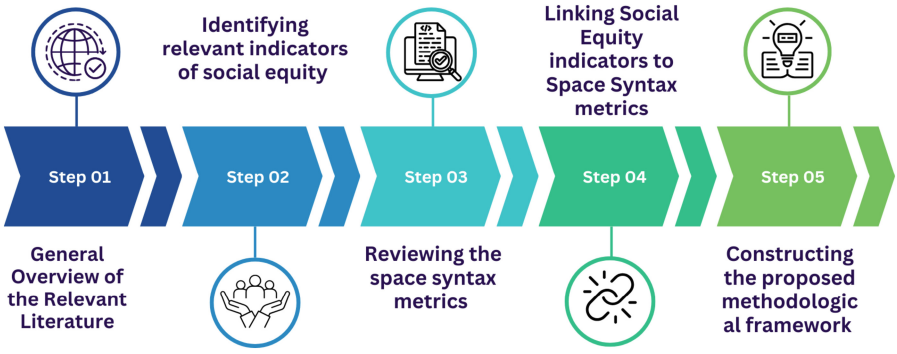


Fig. 1. Visual representation of the research methodology applied in this study.

First, it is essential to develop a clear understanding of social equity. Therefore, the initial stage involves defining social equity and its closely related concepts. Following this, the literature review examines existing research on social equity in urban and regional contexts, identifying gaps and establishing a foundation for integrating these concepts. To build a comprehensive methodological framework, relevant indicators that capture the socio-spatial dimensions of social equity must be identified. Drawing from existing literature, key measures and indicators of social equity are selected, forming the basis for operationalising social equity within the context of Space Syntax analysis. Namely, Space Syntax allows not only to assess quantitatively spatial configurations but also to evaluate their impact on human movement, interaction, and accessibility. In this phase, syntactic measures of Space Syntax are reviewed and analysed to establish a framework that links these measures with social equity indicators. The next phase systematically associates social equity indicators with quantifiable Space Syntax measures to create a robust analytical framework. Finally, based on the findings from the first four phases, a methodological framework is developed to integrate Space Syntax analysis with social equity indicators systematically.

2.1 Search Strategy

Important studies on social equity in urban and regional contexts are analysed using a keyword search strategy in the Scopus database. A carefully chosen set of keywords—including Social Equity, Accessibility, Urban and Regional Spaces, and Space Syntax—was employed for this objective. The initial search yielded only four articles, three of which were not fully relevant to the subject and were excluded. A second search was then conducted, this time removing Space Syntax from the keywords. This process initially identified 448 articles, underscoring the limited exploration of space syntax analysis in relation to social equity. Following the application of selection criteria, including language, subject area, and document type 78 articles were excluded.

The remaining 370 records were extracted and organised in an MS Excel spreadsheet, including their titles, abstracts, keywords, authors' names, affiliations, journal names, and publication years. Duplicate and irrelevant articles were removed, after which the authors manually screened the remaining studies by reviewing their titles, keywords, and abstracts. A total of 56 papers then underwent a detailed eligibility assessment through full-text examination. Ultimately, 19 studies were deemed highly relevant to the research objectives, as they specifically explored the relationship between social equity and accessibility in urban and regional spaces. The process of identification relevant articles, screening and excluding records, eligibility criteria and final inclusion has been depicted briefly in the systematic review flow diagram (Fig. 2).

3 Finding and Results

3.1 General Overview of the Relevant Literature

In recent decades, the concept of social equity has become a central concern in urban planning [31, 32], reflecting the growing need to create more inclusive and just cities [33]. Rapid urbanisation, socio-economic disparities, and uneven access to essential services

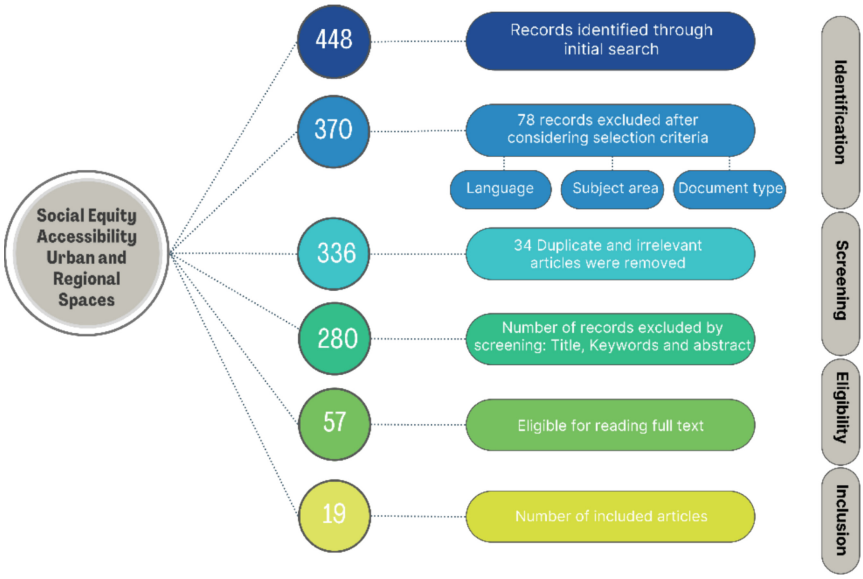


Fig. 2. Systematic review flow diagram

have intensified the urgency to design urban environments that promote fairness and equal opportunities for all [34]. Other closely related concepts to social equity include spatial justice, inclusivity, equitable access, and social fairness, which have been defined in Table 1.

Table 1 . Other closely related concepts to social equity and their definitions

Terms	Definition
Social equity	Fair distribution of resources and opportunities, ensuring all individuals can participate in society regardless of background [35].
Spatial justice	Equitable allocation of spatial resources and infrastructure to provide fair access to services and public space [6].
Inclusivity	Designing environments and policies that accommodate diverse populations, ensuring participation for all [36].
Equitable access	Fair opportunities for all individuals to reach and use public services, removing barriers for disadvantaged groups [37].
Social fairness	Equal treatment and opportunities for all, addressing systemic inequalities in society [38].

The word cloud visualisation (Fig. 1) represents a rapid qualitative overview of the prominent themes emerging from the literature. Word size within the cloud corresponds to the frequency of each term. Prominent terms such as “Social Equity,” “Spatial Justice,”

"Equitable Access," and "Accessibility" highlight the fundamental concerns of ensuring fairness in spatial distribution and urban design. Other significant terms, including "Transportation," "Public Transport," "Healthcare," "Educational Services," and "Green Space Equity," emphasise the urban areas which social equity has been investigated predominantly. Additionally, concepts such as "Segregation," "Disparity," "Vulnerability," and "Inequity" reflect the socio-spatial challenges that hinder inclusivity in urban and regional planning. The presence of "Connectivity," "Spatial Pattern," and "Sustainable Development" further underscores the role of spatial analysis in assessing accessibility and mobility dynamics. However, the notable absence of the term "Space Syntax" in this word cloud suggests that the integration of social equity assessment with the space syntax techniques has not been adequately investigated in the existing literature. This gap reinforces the originality and necessity of this research in developing a novel methodological framework that bridges spatial analytics with the multidimensional concept of social equity (Fig. 3).



Fig. 3. Word cloud visualisation of the frequently occurring keywords

3.2 Previous Studies in the Field

This paper explores the relationship between equity, accessibility, and cohesion in urban public spaces, and the possibility of measuring social equity by using space syntax analysis. The connection between equity and transportation, urban green spaces and parks, has been extensively studied by scholars. There are also several studies about social equity of public infrastructures, healthcare and educational services. Since the

focus of this study is to develop a new methodological framework only the employed research methods of the existing literature have been represented in this section.

The study of spatial and social equity in urban environments has been extensively explored across various domains, including transportation accessibility, public services distribution, and the built environment. A key theme in this body of literature is the intersection between accessibility measures and equity assessments, highlighting disparities in urban resource allocation. This review synthesises various perspectives, drawing connections among methodologies, findings, and implications, while identifying existing research gaps.

Cavallaro et al. [39] examined the spatial and social equity impacts of High-Speed Railways in north-western Italy, employing Spatial and Social Equity Railway Indexes to assess variations in travel times, connections, and socioeconomic impacts. Similarly, Sharma and Patil [40] investigated spatial and social inequities in access to educational services in Greater Mumbai, using the Lorenz curve and Gini index for spatial equity and a public-private transport accessibility ratio for social equity. Their research underscores how different transport modes contribute to inequities, echoing concerns raised by Wilberg et al. [41] regarding variations in walking accessibility across different population groups in Helsinki, particularly older adults. They integrated seasonal walking speed data with service accessibility, revealing temporal inequities, a dimension that is often overlooked in traditional accessibility studies.

A related concern is how transport infrastructure influences social equity. Cuthill et al. [42] combined quantitative and qualitative approaches using geographically weighted regression to assess local variations in accessibility, reinforcing the notion that equity concerns require localised, context-specific evaluations. This aligns with Sharma and Patil's [43] broader framework analysing accessibility equity in Greater Mumbai, encompassing multiple urban services such as jobs, education, healthcare, and parks. Their spatial autocorrelation analysis further confirms inequities observed in earlier studies, bridging gaps between micro-scale and macro-scale assessments.

Beyond transport, urban infrastructure plays a critical role in spatial equity. Zhao et al. [44] utilised a quantitative approach to examine cycling infrastructure distribution in Canada, correlating infrastructure levels with sociodemographic characteristics using Pearson correlation and multilevel regression. This approach parallels Chang et al. [45], who analysed spatial and social justice dimensions of public service facilities through service area analysis and the Gaussian two-step floating catchment area (G2SFCA) method. These methodologies demonstrate how multi-dimensional accessibility frameworks may be applied to different urban environments, such as in the case of Cai et al. 's [46] study on public charging stations in Shanghai with the use of both a supply-demand gap analysis with equity metrics.

Another important aspect of social equity is healthcare accessibility. Chen et al. [47] assessed accessibility to tertiary hospital services for older adults using a simple gravity model, revealing substantial regional variation. In a similar way, Iraegui et al. [48], who evaluated urban green space (UGS) accessibility in Barcelona, using spatial clustering methods. Such methodological parallels imply that differences in accessibility are neither confined to transport mode choices nor are limited to the distribution of essential services and thus demand more cohesive and holistic policy approaches.

Gu et al. [49] further investigated healthcare accessibility in Kunshan, China with the Balanced Floating Catchment Area (BFCA) method, identifying inequities among hospital types and travel modes. Wang et al. [50] explored similar themes in relation to open spaces, ascertaining how the accessibility of those places affects older adults' visitation in high-density urban settings. This use of GIS and Space Syntax Theory exemplifies the spatial nature at the heart of urban equity.

Using public space accessibility research as an example, Xu and Wang [51] studied public space accessibility in Nanjing Old City beyond the traditional ones, which included socially vulnerable groups. On the other hand, the gravity potential addresses accessibility variability differences, as also highlighted by Rashid [52], based on Space Syntax research that analyses social equity through street networks and urban compactness in 25 cities in England. Unlike Zhao and Gong [53], who used optimisation models to examine urban park accessibility inequalities in Nanchang. This approach shows different methods used in equity studies while demostrating their adaptability.

Recent advancements in accessibility evaluation are evident in Sun et al. [54], who introduced an enhanced three-step floating catchment area (3SFCA) method, integrating Space Syntax metrics with multi-modal transportation analysis. This refinement, in fact, provides better estimation of demand across populations, a problem also noted and addressed by He et al. [55], that applied machine learning along with geostatistical analysis to evaluate accessibility to urban parks in Taiyuan, China. These studies illustrate the ongoing shift in the accessibility assessment paradigm towards the use of cutting-edge computational methods to achieve more accurate measurements.

Beyond spatial metrics, policy frameworks play a significant role in shaping urban equity. Meerow et al. [56] analysed social equity in urban resilience planning, using a qualitative content analysis of resilience plans from North American cities. Their consideration of procedural equity fits with Wan and Titheridge [57], who proposed in a conceptual framework for transport equity in China the need for tripartite equity. They note that equity assessments need to recognise the socio-political context reminding the importance of policy-sensitive analysis, as their findings suggest.

Together, these studies demonstrate how diverse urban equity research can be. While methodologies range from GIS-based accessibility models to regression analyses and machine learning approaches, a common theme emerges: spatial inequities persist across different urban services and infrastructures. Despite significant advancements, gaps remain in integrating multi-dimensional equity assessments that account for temporal variations, socio-political contexts, and evolving urban structures. Future research should prioritise interdisciplinary frameworks that combine spatial, social, and policy-driven analyses to address these persistent inequities comprehensively.

Figure 4 illustrates the frequency of methodological approaches employed in the reviewed studies, using a heatmap with a colour gradient ranging from dark blue (indicating lower frequency) to bright green (indicating higher frequency). The most frequently applied method is GIS-based spatial analysis, followed by equity measurement techniques, such as the Gini index, Lorenz curve, and Moran's I. The floating catchment area methods (e.g., 2SFCA, 3SFCA, G2SFCA) and multi-modal transport and travel time analysis also appear prominently. Regression models and network-based accessibility

assessments are moderately frequent, reflecting their role in capturing spatial and socio-economic dynamics. Gravity-based accessibility models and social equity frameworks, such as qualitative content analysis, are applied less frequently. Space syntax analysis, though valuable in urban studies, is among the least used methodologies in the selected literature. The visualisation effectively highlights methodological trends, revealing a preference for quantitative spatial techniques in accessibility and equity research.

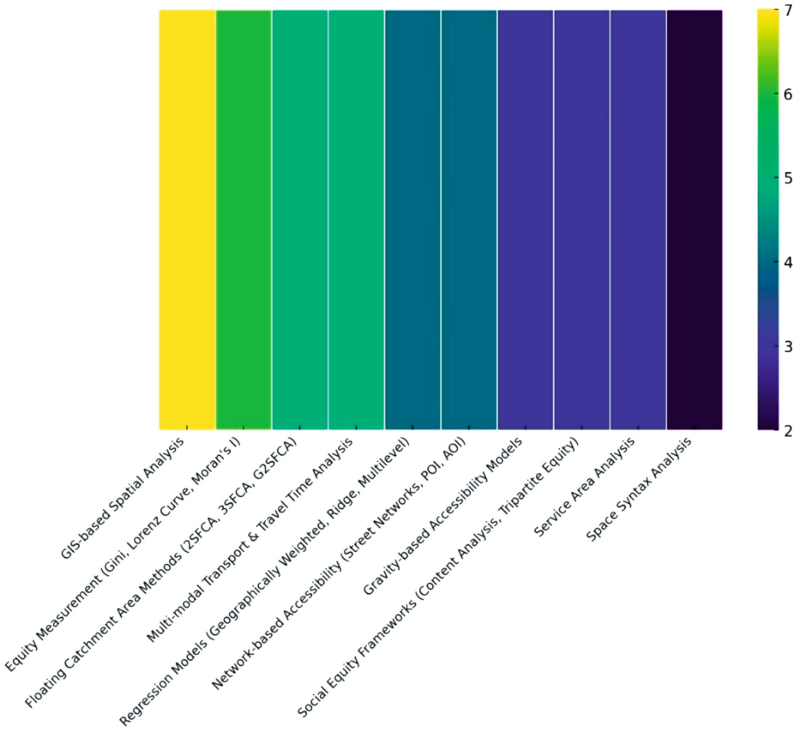


Fig. 4. Frequency of applied methods in previous studies

3.3 Measures and Components of Social Equity

Social equity in urban planning is a multidimensional concept that seeks to reduce disparities and improve the quality of life for marginalised or vulnerable populations [58]. It encompasses various measures that ensure fair access to urban resources, social services, and opportunities for all individuals, regardless of socio-economic status, age, gender, or physical ability. A socio-spatial perspective on social equity considers how urban spaces and infrastructure contribute to or mitigate inequalities, focusing on key dimensions such as accessibility, inclusivity, fair distribution of amenities, and security.

Accessibility is one of the most fundamental indicators of social equity, as it determines the extent to which individuals can reach essential services, work-places, educational institutions, and recreational spaces. Equitable urban accessibility

requires a well-connected and affordable public transport system that accommodates diverse demographic groups, including individuals with disabilities, elderly citizens, and lower-income populations who may lack private transport options [11]. Furthermore, pedestrian-friendly environments, cycling infrastructure, and barrier-free urban design enhance mobility and independence, fostering greater participation in social and economic activities.

Inclusivity in urban spaces refers to the design and governance of public areas that welcome and serve diverse communities. Parks, plazas, and streets should be planned with a variety of users in mind, incorporating amenities that support different cultural, recreational, and social needs [59]. Universal design principles play a crucial role in ensuring that individuals with disabilities, parents with young children, and elderly residents can fully engage with urban environments. Additionally, inclusive governance structures that involve local communities in decision-making processes contribute to more socially just urban development by reflecting the voices of historically underrepresented groups [60].

Fair distribution of amenities is another critical aspect of socio-spatial equity, ensuring that essential services such as healthcare facilities, schools, supermarkets, and green spaces are equitably dispersed across urban areas. The most vulnerable and socio-economically disadvantaged communities have limited access to a high-quality public service [61]. Urban policies, such as mixed-income housing and equitable zoning, emphasised investment in disadvantaged neighbourhoods and can help bridge these gaps, by promoting and creating a more equitable urban fabric.

Security is a critical axis of social equity, as this dictates how freely people use and access public spaces. Safety perception, and actual safety, directly influences outdoor participation, especially for women, children and older generations. Crime prevention through environmental design (CPTED) strategies such as better street lighting, active surveillance, and well-maintained public spaces can improve urban security and promote feelings of belonging and trust within communities [62]. Moreover, equitable law enforcement practices and halting discriminatory policing are essential for socially just and safe cities [63].

3.4 Space Syntax Metrics

In the 1980s, Bill Hiller and his collaborators at University College London developed space syntax theory and analytical methods and discovered that space has its own social logic that influence the behaviour of humans, including pedestrian mobility [64]. This theory claims that the configuration of the urban grid itself is the primary generator of movement and social encounters [65]. The Space Syntax approach employs an axial map, which is used to quantify the spatial networks of this map, using the longest and minimally set of straight lines that can pass through all the undivided spaces in the built environment (in this case for the agglomeration of urban areas). These axial lines provide a basis for analysing the configurations of spacetime and function as lines of sight in the space [66]. In contrast, segment-based analysis relies on a segment map, which is derived from the axial map by dividing axial lines into smaller segments at their intersections [67].

Space syntax offers a set of theories, methods, techniques and metrics for analysing urban environments that identify the underlying spatial structures that determine perception, use and experience [68]. It offers a lens through which to understand how different spatial configurations affect human social behaviour and movement [69]. The term "spatial configuration" is used in space syntax when referring to the relationships between individual spatial units and the overall structure of a spatial system [27]. In urban studies, these units typically include axial lines (uninterrupted lines of movement, visibility) and segments (portions of axial lines divided at intersections with other lines). Space syntax has its own rigorous methods for modelling street networks in the form of configurations, via the use of axial lines creating an axial map and via segments producing a segment map [70]. Furthermore, it provides analytical tools to examine the intersection patterns of these lines or segments through various topological and topo-metric measures. Additionally, space syntax enables users to visualise data by applying colour gradients to the map based on the values of specific measures for individual units [71].

Several Space Syntax measures have been applied in previous studies, demonstrating varying degrees of correlation with movement patterns. These include integration, connectivity, choice, control, intelligibility, angular step depth, intensity, and synergy. However, an initial review indicates that four classic Space Syntax metrics integration, connectivity, choice, and control are the most commonly utilised for examining social behaviours [72]. A concise explanation of these key measures is presented below.

Integration is one of the fundamental measures in Space Syntax used to analyse pedestrian and vehicular movement patterns [73] It evaluates to what extent the spatial configuration possesses the capability to absorb human mobility patterns. From a topological perspective, integration calculates distance based on the number of turns and directional shifts required to navigate through the system. A network with fewer axial lines and directional changes tends to be more integrated [13]. Angular integration measures the closeness of each segment to all others by summing angular changes, whereas metric integration considers the straight-line distance between the midpoints of two adjacent segments [74].

Choice refers to the extent to which a particular street is part of the shortest path between any two other streets in a network [75]. Areas with high choice values are positioned along the shortest paths between multiple origins and destinations, making this measure particularly effective in predicting pedestrian and vehicular movement patterns [76]. This metric enables researcher to identify the trajectories which are most likely to be used by citizens who are aware of shortcuts within the spatial network of cities. Connectivity, another key measure, captures the number of direct connections a street or space has with its immediate surroundings [77]. Since this measure evaluates spatial relationships based only on immediate neighbouring areas without considering the broader network, it is classified as a local measure [78]. Thus, it could be considered a critical metric for the measurement of urban accessibility on a local scale.

Lastly, control quantifies how much influence a space has over access to its immediate neighbours, factoring in the number of alternative connections available to each of them [79]. It measures to what degree a space restricts access to neighbouring spaces, considering what alternative links are available for each neighbour space [80]. Higher control

values mean significant opportunities for appropriate surveillance of urban areas. Collectively, these measures create a powerful framework for linking spatial configurations to social behaviour.

Other measures include intelligibility, which evaluates the correlation between integration and connectivity of spaces [81]; Angular step depth assesses movement efficiency calculating the distance travelled on a network, and intensity defines the relationship between the rate of entropy change and the total depth [82]. Likewise, the factor of synergy, which captures the relationship between local and global integration, has been addressed to a lesser extent [83].

4 Discussion

4.1 Linking Social Equity Indicators to Space Syntax Metrics

The methodological framework used to evaluate social equity through Space Syntax analysis is analysed in this section. The framework is organised by considering four main indicators: accessibility, inclusivity, equitable distribution of public facilities, and security. All of them are mapped to specific Space Syntax metrics. This approach helps to find spatial patterns in urban environments that either promote or reduce social inequalities.

Based on the literature on both variables, this research identifies customised Space Syntax metrics for each social equity indicator. By considering accessibility, the appropriate metric depends on the scale of analysis. On local or neighbourhood scales studies, the connectivity measure is particularly useful in assessing the accessibility of urban spaces. At a regional or city-wide scale, global integration is a more coherent indicator for understanding the overall accessibility of spaces across a spatial context.

Within the main context of social equity, the inclusivity indicator should be examined via a mix of syntactical criteria (such as integration, connectivity, and choice) and empirical observations. This guarantees a broader understanding of inclusiveness across all demographic groups, including for instance gender and age. Furthermore, universal design principles should be integrated into this assessment to facilitate adaptive solutions that enhance accessibility for individuals with disabilities [84, 85].

For the equitable distribution of public amenities (green spaces, public squares and so on), Space Syntax analysis should be combined with GIS-based land-use distribution evaluations. In this way, it is possible evaluate spatial disparities in service supply.

Finally, security can be assessed through various syntactical measures, by considering its theoretical foundations. Gehl [86] claims that crime rates usually drop in cities with considerable pedestrian movement and social interaction. In the same way, urban contexts with increased visibility and clear sightlines benefit from improved natural surveillance, hence promoting safer environments. In this sense, apart from integration and connectivity, Space Syntax metrics such as choice and control are useful for assessing security. At a local or neighbourhood scale, visibility graph analysis can further contribute to the design of secure built environments. Moreover, to address the subjective dimension of security, a combined methodological approach incorporating CPTED surveys can offer deeper insights into perceived safety levels, thereby strengthening the overall social equity framework. In summary, the methodological approach outlined above allows for a multi-dimensional assessment of social equity through Space Syntax

analysis. Depending on the research focus and scale, these methodological strategies can be adapted to ensure a functional and comprehensive evaluation of urban spatial equity.

Figure 5 visualises the framework for linking social equity indicators to space syntax metrics and its methodological procedures.

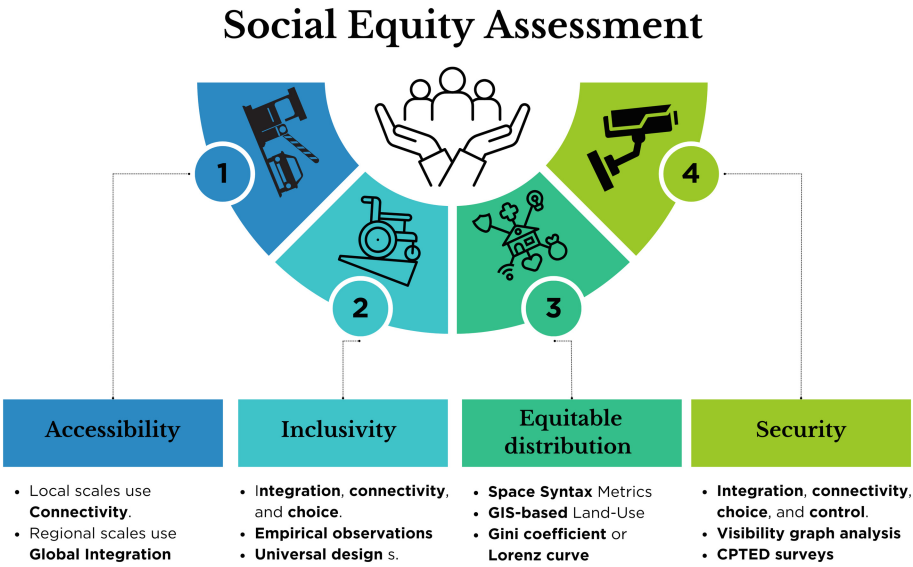


Fig. 5. Framework for linking social equity indicators to space syntax metrics

4.2 Implications, Limitations, and Future Research Directions

One of the main strengths of this research is its interdisciplinary approach, integrating spatial analytics with socio-spatial equity concepts. The framework provides a replicable methodology that urban planners and policymakers can employ to assess and address spatial inequalities. However, certain limitations must be acknowledged. First, Space Syntax analysis primarily focuses on spatial configurations and does not inherently account for socio-economic variables such as income levels, cultural dynamics, or governance structures. To overcome this limitation, the integration of socio-economic data with Space Syntax metrics is recommended for a more comprehensive equity assessment. Additionally, while this research establishes a foundational framework, further empirical validation through multiple case studies is necessary to refine and generalise its applicability.

5 Conclusions

This study responded to a notable research gap in the fields of urban studies by developing a methodological framework that integrates Space Syntax cost-benefit analysis to bear on the socio-spatial aspects of social equity.

In response to the first research question (from a socio-spatial viewpoint, what are the key indicators of social equity and how can they be operationalised within the context of Space Syntax analysis?), accordingly four key indicators of social equity were identified: accessibility, inclusivity, equitable distribution of public facilities, and security.

In that manner, these indicators were operationalised within Space Syntax analysis through specific metrics: accessibility was measured using connectivity and global integration, depending on the scale of analysis; inclusivity was assessed by combining integration, connectivity, and choice values with empirical observations and universal design principles; equitable distribution of public facilities was examined using GIS-based land use distribution coupled with Space Syntax analysis; and security was analysed through visibility graph analysis, choice, and control metrics, with additional insights from CPTED surveys (this sentence replied the second research question: in what ways it affects fairness in access, connectivity, and inclusivity?). By focusing on the third research question (how may the combination of Space Syntax metrics with social equity factors reveal new insights into spatial patterns?), this paper demonstrated that integrating Space Syntax metrics with social equity indicators could uncover spatial disparities that impact urban fairness. Finally, in response to the fourth question (What methodological framework may be developed to methodically connect Space Syntax analysis with the different aspects of social equity?), a structured methodological framework was developed, demonstrating how quantitative spatial analysis can be combined with qualitative empirical observations and socio-economic measures to comprehensively assess urban equity. These findings imply that Space Syntax may have the potential to be an effective diagnostic tool for finding areas of spatial injustice and guiding equitable urban solutions when used with socio-spatial equity indicators.

The originality of this research lies in the convergence of Space Syntax analysis with the various forms of social equity discussed in this study, which goes beyond the traditional accessibility studies to include broader socio-spatial issues.

This research clearly links spatial analysis to social justice, while informing not only the critical debate on the equitable development of cities but also guiding meaningful progress in key Sustainable Development Goals (SDGs).

Future work may strengthen this framework through real-world case studies and more broadly test for applicability across different urban contexts to refine its adoption and replication in policy and practice.

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