TeMA

Journal of Land Use, Mobility and Environment

NEW CHALLENGES FOR XXI CENTURY CITIES

Global warming, ageing of population, reduction of energy consumption, immigration flows, optimization of land use, technological innovation

Vol.17 n.2
August 2024

TeMA Journal was established with the primary objective of fostering and strengthening the integration between urban transformation studies and those focused on mobility governance, in all their aspects, with a view to environmental sustainability. The three issues of the 2024 volume of TeMA Journal propose articles that deal the effects of global warming, the ageing of population, the reduction of energy consumption from fossil fuels, the immigration flows from disadvantaged regions, the technological innovation and the optimization of land use.

TeMA is the Journal of Land Use, Mobility and Environment and offers papers with a unified approach to planning, mobility and environmental sustainability. With ANVUR resolution of April 2020, TeMA journal and the articles published from 2016 are included in the A category of scientific journals. The articles are included in main scientific database as Scopus (from 2023), Web of Science (from 2015) and the Directory of Open Access Journals (DOAJ). It is included in Sparc Europe Seal of Open Access Journals, and the Directory of Open Access Journals.

TeMA

NEW CHALLENGES FOR XXI CENTURY CITIES:
Global warming, ageing of population, reduction of energy consumption, immigration flows, optimization of land use, technological innovation

2 (2024)

The cover image shows railway street in Hanoi, Vietnam (Source: TeMA Journal Editorial Staff).

TeMA

NEW CHALLENGES FOR XXI CENTURY CITIES:
Global warming, ageing of population, reduction of energy consumption, immigration flows, optimization of land use, technological innovation

2 (2024)

Contents

REVIEW NOTES

TeMA Journal of Land Use Mobility and Environment

NEW CHALLENGES FOR XXI CENTURY CITIES:
Global warming, ageing of population, reduction of energy consumption, immigration flows, optimization of land use, technological innovation 2

ROCCO PAPA

DICEA - Department of Civil, Building and Environmental Engineering

University of Naples Federico II, Italy

ORCID: https://orcid.org/0000-0003-3355-1418

e-mail: rpapa@unina.it

TeMA Journal was established with the primary objective of fostering and strengthening the integration between urban transformation studies and those focused on mobility governance in all their aspects, with a view to environmental sustainability. In other words, its mission is to contribute to developing a novel theoretical and methodological framework that transcends the boundaries separating these research domains and develops innovative solutions for issues now being tackled with methods and techniques rooted in the scientific culture of the last century.

The three issues of the 2024 volume of TeMA Journal propose articles that deal the effects of global warming, the ageing of the population, the reduction of energy consumption from fossil fuels, the immigration flows from disadvantaged regions, the technological innovation and the optimization of land use.

In this issue, the section "Focus" contains one research. The paper titled "Towards participatory urban planning: insights from citizens. Results of a survey on the local effects of climate change in Parma" by Ilaria De Noia, Barbara Caselli, Astrid Kemperman, Silvia Rossetti, Peter van der Waerden (University of Parma in Italy and Eindhoven University of Technology in Netherlands), presents and discuss the outcomes of a survey that investigated the perception of the citizens of Parma regarding climate change and its local effects. The analysis of collected data from 1,352 participants was subject to univariate and bivariate analyses, revealing the potential of surveys and citizens' involvement in shaping urban planning scenarios, acknowledging the citizens' role as bearers of knowledge and active stakeholders.

The section "LUME" (Land Use, Mobility and Environment) contains seven articles. The first, "The 15-minute cities concept applied to a Brazilian neighbourhood: case study of the cidade universitária Pedra Branca neighbourhood in Palhoça-SC", by Marcela Juliana Cargnin, Cintia de Castro Marino, Thaísa Leal da Silva (ATITUS Educação and UNINOVE in Brazil), carries out a bibliographic analysis to understand the theoretical and conceptual reflections on the 15-minute city concept. In the second part, the bibliographical research is correlated with the case study of the 'Cidade Universitária Pedra Branca' neighbourhood in Palhoça-SC, Brazil, enabling the understanding of the historical context of the place.

The second contribution is "Highlighting circular cities trends in urban planning. A review in support of future research tendencies" by Giulia Marzani, Simona Tondelli (Alma Mater Studiorum - University of Bologna in Italy). The article focuses on the interrelations between circular economy and urban planning. Through a scoping review and a bibliometric analysis, the study allowed to systematize and analyse the knowledge about the existing trends in planning circular cities and identify gaps for future research. What emerged is that a methodology to integrate circular economy principles into urban planning tools and procedures still does not exist in the literature, even though some recurrent decision-making frameworks are frequently used, and the topic is currently under debate.

The third article, "Right-based approach to urban accessibility: analysis of user perspective" by Cihan Ercetin (Spatial Applications Division Leuven in Belgium), aims to reveal the deficiencies of the perception that accessibility is a human right. The primary finding from both the theoretical review and these discussions is that accessibility must be perceived as an integrated concept with the inclusiveness of urban spaces, emphasizing the social and spatial dimensions of the issue.

The fourth article of the section, "Managing local knowledge about NBS in spatial planning. A group model building approach" by Stefania Santoro, Giulia Mastrodonato, Domenico Camarda (Italian Research Council and Polytechnic University of Bari in Italy), contributes to a current debate about methodological approaches to knowledge assessment to adopt in urban planning processes. Specifically, this paper proposes a Group Model Building approach for one of the activities carried out within the planning process for the Master Plan draft of the city of Brindisi, to support Natural Based Solutions (NBS) implementation.

The fifth article of the section, "The relationship between walkability and landscape values in transportation. Examination of landscape values in urban area transportation axes", by Zeynep Pirselimoğlu Batman, Elvan Ender Altay, Sena Şengül (Bursa Uludağ University in Turkey), aimed to determine the relationship of walkability in transportation-based areas with the landscape values and to determine the potential of the area. In this context, the landscape values of Atatürk Street, which is located in the city core of Bursa and has both touristic, social, and commercial functions in pedestrian transportation, were evaluated based on walkability on the sidewalks, and a partially sufficient result was reached. Exceptionally, TeMA Journal published this article in its complete version despite exceeding the text limits set for regular articles.

The sixth article, "A scoping review of urban design and planning studies on the Covid-19 pandemic and elements of the built environment" by Pouria Boujari, Sarah Ghamar, Mahdi Nasirian, Fateme Ghapanchian, Mahtab Khajavi, Atieh Ghasemi, Mohsen Bahari, Yasin Delavar, Hamideh Garrousi (Karadeniz Technical University in Turkey and University of Florida in United State of America), aims to assess the role of the influential components of the built environment in the outbreak of Covid-19 by conducting a systematic literature review. The studies were searched through the Scopus database and screened and reviewed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. In total, 145 studies among 13,002 met the predetermined criteria.

The last article of the LUME, "The identification of rurality at Nuts-3 level in Turkey", by Seda Özlü, Sinem Dedeoğlu Özkan, Dilek Beyazli (Karadeniz Technical University in Turkey), faces with the issue of rural-urban interactions. Rural and urban areas have a complex social, economic and natural structure that cannot be handled from a single perspective. This situation necessitates a multidimensional approach to rural areas and rurality. The study aims to address the socio-demographic and economic structure of Turkey's provinces with a multidimensional approach and to analyze them comparatively.

The Review Notes section proposes four insights on the themes of the TeMA Journal. The Urban planning practice section of Review Notes, "Energy transition and renewable energy policies in Italy", by Valerio Martinelli, examines the role of cities in the energy transition, focusing on Italian and European policies and regulations, with particular attention to Renewable Energy Communities (RECs). It analyzes the Renewable Energy Directive II and its transposition in Italy, highlighting challenges and the need for urban and energy planning coordination. The second section, "Strategies and instruments for active mobility: a European overview", by Annunziata D'Amico, offers an overview of the instruments and strategies implemented in Europe to encourage active mobility. Furthermore, some measures implemented in various European cities have been reported that promote the necessary, indispensable, and continuous process of improving urban mobility in the direction of environmental sustainability. The third contribution, "Global warming or global warning? A review of urban practices for adaptation to extreme heat", by Stella Pennino, provides an overview of the challenges posed by extreme heat in the context of climate change. Existing risks and adaptation threads are outlined, and international case studies of extreme heat adaptation are reviewed. Finally, three emblematic case studies of extreme heat adaptation are presented and discussed with the aim of fostering integration and sharing of know-how on the topic. Finally, the fourth section, "Exploring approaches and solutions for urban safety: a focus on childhood", by Tonia Stiuso, provides an in-depth

analysis of emerging issues in urban planning, mobility and the environment. This issue focuses on child-friendly, safe cities, presenting a comprehensive overview of the challenges and solutions related to urban safety for children. The section includes insights from different scientific sources and practical resources, highlighting effective approaches and innovative strategies. By examining recent books, journals and reports, the aim is to shed light on critical aspects of urban safety and child well-being, addressing issues such as community violence, road safety and the conditions of urban parks.

References

Boujari, P., Ghamar, S., Nasirian, M., Ghapanchian, F., Khajavi, M., Qasemi, A., Bahari, M., Delavar ,Y. & Garrousi, H. (2024). A scoping review of urban design and planning studies on the Covid-19 pandemic and elements of the built environment. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 309-337. http://dx.doi.org/10.6093/1970-9870/10427

Cargnin, M. J., Marino, C. C. & Silva, T. L. (2024). The 15-minute cities concept applied to a Brazilian neighborhood: case study of the cidade universitária Pedra Branca neighborhood in Palhoça-SC. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 213-229. http://dx.doi.org/10.6093/1970-9870/10314

D'Amico, A. (2024). Strategies and instruments for active mobility: European overview. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 363-371. http://dx.doi.org/10.6093/1970-9870/10940

De Noia, I., Caselli, B., Kemperman, A., Rossetti, S. & van der Waerden, P. (2024). Towards participatory urban planning: insights from citizens. Results of a survey on the local effects of climate change in Parma. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 193-212. http://dx.doi.org/10.6093/1970-9870/10836

Ercetin, C. (2024). Right-based Approach to urban accessibility: analysis of user perspective. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 249-264. http://dx.doi.org/10.6093/1970-9870/10510

Martinelli, V. (2024). Energy transition and renewable energy policies in Italy. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 357-362. http://dx.doi.org/10.6093/1970-9870/10941

Marzani, G. & Tondelli, S. (2024). Highlighting circular cities trends in urban planning. A review in support of future research tendencies. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 231-247. http://dx.doi.org/10.6093/1970-9870/10757

Özlü, S., Dedeoğlu Özkan, S. & Beyazli, D. (2024). The identification of rurality at Nuts-3 level in Turkey. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 339-356. http://dx.doi.org/10.6093/1970-9870/10632

Papa, R. (2024). NEW CHALLENGES FOR XXI CENTURY CITIES Global warming, ageing of population, reduction of energy consumption, immigration flows, optimization of land use, technological innovation 1. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (1), 3-6. https://doi.org/10.6093/1970-9870/10880

Pennino, S. (2024). Global warming or global warning? A review of urban practices for climate adaptation to extreme heat. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 373-381. http://dx.doi.org/10.6093/1970-9870/10949

Pirselimoğlu Batman, Z., Ender Altay, E. & Şengül, S. (2024). The relationship between walkability and landscape values in transportation. Examination of landscape values in urban area transportation axes. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 285-308. http://dx.doi.org/10.6093/1970-9870/10462

Santoro, S., Mastrodonato, G. & Camarda, D. (2024). Managing local knowledge about NBS in planning. A Group Model Building approach. *TeMA - Journal of Land Use, Mobility and Environment, 17* (2), 265-283. http://dx.doi.org/10.6093/1970-9870/10810

Stiuso, T. (2024). Exploring approaches and solutions for urban safety: a focus on childhood. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 383-389. http://dx.doi.org/10.6093/1970-9870/10939

TeMA
Journal of
Land Use, Mobility and Environment

Towards participatory urban planning: insights from citizens. Results of a survey on the local effects of climate change in Parma

Ilaria De Noia [a*], Barbara Caselli [a], Astrid Kemperman [b], Silvia Rossetti [a]
Peter van der Waerden [b]

[a] Department of Engineering and Architecture, University
of Parma, Parma, Italy
e-mail: ilaria.denoia@unipr.it; barbara.caselli@unipr.it;
silvia.rossetti@unipr.it
ORCID: https://orcid.org/0000-0002-4496-0877;
https://orcid.org/0000-0002-3236-8681;
https://orcid.org/0000-0002-3358-2129
* Corresponding author

[b] Department of the Built Environment
Eindhoven University of Technology, Eindhoven,
Netherlands
e-mail: a.d.a.m.kemperman@tue.nl;
p.j.h.j.v.d.Waerden@tue.nl
ORCID: https://orcid.org/0000-0002-1312-4913

Abstract

Citizens' involvement in urban transition processes has been gaining recognition within the scientific literature and urban transformation initiatives. Co-design and co-planning, in both top-down and bottom-up urban transformation processes, allow stakeholders to collaborate in defining the future of cities in a climate change adaptation framework that encompasses interventions such as soil desealing. In this framework, surveys have emerged as valuable instruments to solicit citizens' insights into participatory processes, as an aid to orient urban planning and transformation scenarios towards their needs and vulnerabilities. After tracing the outline of a local bottom-up project (named "Green in Parma"), this contribution will present and discuss the outcomes of a survey that investigated the perception of the citizens of Parma regarding climate change and its local effects. Univariate and bivariate analyses, including Chi-square tests and factor analyses, were conducted on data collected from a sample of 1,352 participants. The findings provided insights linked to the city and to the neighbourhoods, allowing to localise the quantitative data and to qualitatively associate them with the neighbourhoods socio-environmental characteristics, fostering the envisioning of climate change adaptation strategies. The analyses reveal the potential of surveys and citizens' involvement in shaping urban planning scenarios, acknowledging the citizens' role as bearers of knowledge and active stakeholders.

How to cite item in APA format
De Noia, I., Caselli, B., Kemperman, A., Rossetti, S. & van der Waerden, P. (2024). Towards participatory urban planning: insights from citizens. Results of a survey on the local effects of climate change in Parma. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 193-212. http://dx.doi.org/10.6093/1970-9870/10836

1. Introduction

Within the context of cities adaptation to climate change, the role of desealing (i.e., the removal of the impervious soil layers) and greening interventions, under the wider umbrella of Nature-based solutions (NBSs), has been increasingly promoted by researchers and urban stakeholders as an effective mean to mitigate the effects of the increasing soil consumption (Frantzeskaki et al., 2019; Salata & Yiannakou, 2016; De Noia et al., 2022; Ceci et al., 2023).

In this framework, the role of public participation and the knowledge borne by citizens and communities have been studied and recognized by researchers since the last century (Paez, 2003; Few et al., 2007). Smith (1983) defined public participation as the inclusive process that grants those affected by a decision the opportunity to provide input into that decision. Public participation acquires relevance in urban transformation processes as it helps to understand the aspirations of the stakeholders and is considered one of the main aspects to guarantee the effectiveness and quality of urban planning (Semeraro et al., 2020). However, there are issues and/or challenges which need to be assessed. *Who and in what measure is participating? What processes can be defined as participatory processes?* Both in research and practice, it appears relevant to consider the purpose and meaning of participation, avoiding its instrumentalization and valuing the emotions of those involved, avoiding, for instance, illusions of power in the decision-making process that imply feelings of dissatisfaction (Arnstein, 1969). This appears especially significant in a highly uncertain framework such as climate change (Few et al., 2007).

In this context, the effectiveness of bottom-up initiatives in highlighting the needs of the citizens is emerging (Pissourios, 2014), as well as the value borne by their integration with top-down practices (Girard et al., 2015). After tracing an overview of bottom-up participatory processes, as well as presenting the relevance of surveys in this framework (Section 2), Section 3 will briefly trace the outline of a bottom-up project, "Green in Parma", which is being carried out in Parma, an Italian city located in the western Emilia-Romagna Region. Section 3 will then focus on presenting a survey that, within "Green in Parma", aimed at investigating the citizens' perception of climate change and its local effects to understand the reasons behind a "failed" attempt of a participatory co-design desealing intervention. This section will also present the methodology that was employed[1], describing the analyses (e.g., Chi-square tests and factor analyses) that were conducted on data from a 1,352 participants sample. The research findings provided insights linked to the city and the neighbourhoods, allowing for the localisation of the quantitative data, which were then linked to socio-environmental characteristics. Sections 4, 5, and the Conclusions will include the results of these analyses and a discussion about their implication in urban planning practices, while investigating at the same time the role of surveys in urban planning and bottom-up processes, underlining their strengths and weaknesses in the context of urban adaptation to climate change: the analyses reveal the potential of surveys and citizens' involvement in understanding the needs of the communities, acknowledging the citizens' role as bearers of knowledge and active stakeholders.

2. Literature review

The relevance of bottom-up participatory processes in urban planning has been addressed in the scientific literature from a variety of perspectives, aiming to tackle several socio-economic and environmental issues related to climate change. Some authors investigated these processes through applicative case studies (i.a., Geropanta et al., 2022; Nicolini & Pinto, 2013; Vogt, 2002), while others provided taxonomies and reviews of the existing approaches (i.a., Seve, Redondo, et al., 2023; Meroni & Selloni, 2022).

---

[1] The results of the survey were analysed by the Research Group of Urban and Regional Planning of the University of Parma (Italy) in collaboration with Eindhoven University of Technology (the Netherlands).

On a general level, bottom-up participatory processes have been broadly recognised as efficient tools/strategies for increasing urban resilience to climate change (i.a., Strange et al., 2022; Vaňo et al., 2021), while other authors underlined their significance in the framework of urban development or regeneration (i.a., Canesi et al., 2022; Mayrhofer, 2018), highlighting their political and socio-economic role (i.a., García de Jalón et al., 2020; Kuokkanen & Palonen, 2018; Eizenberg, 2019).

Other researchers focused on investigating the tools that can serve as an aid to promote and foster bottom-up participatory processes, such as art (Seve et al., 2023). Among the available tools, the role of digital technologies emerged (Sharifi et al., 2017; Stelzle et al., 2017) to overcome the spatial and temporal limits. Overall, the contribution of the knowledge, expertise, and perception of citizens and stakeholders in the improvement of the urban transformation processes appears crucial.

2.1 Bottom-up participatory processes for urban planning to face the effects of climate change

Two points of view have been identified in the research that deals with fostering the participation, empowerment, and bottom-up contribution of the citizens and stakeholders to face the effects of climate change. The first group of authors recognises a bottom-up need for urban space transformation and investigates ways to respond to those needs. Among others, Santoro et al. (2020) acknowledged a bottom-up demand for the enhancement of the environment. Zagare (2018) focused on self-organising processes, linking climate adaptation and urban development, and investigating local participatory methodologies. In this framework, co-design and co-planning emerge as physical and/or digital participation strategies/tools (Sharifi et al., 2017; Stelzle et al., 2017), that allow stakeholders to collaborate in defining the future of cities, both in the top-down and bottom-up urban transformation processes. The second group of researchers investigates strategies to foster the emergence of bottom-up processes themselves. For instance, Charli-Joseph et al. (2018) proposed a methodological approach for promoting "transformation laboratories", aiming to create a safe space that can stimulate dialogue and interaction among the participants. Focusing on the tools, Ranjbar Nooshery et al. (2017) studied public participation Geographical Information Systems (PPGIS) as a mean to address urban environmental problems, as well as data mining tools to gather insight from the citizens. Vaňo et al. (2021) proposed a model that, through the involvement of mediatory agencies, creates links between lower and higher planning levels in response to procedural barriers. According to their model, bottom-up actions might stimulate the planning of green infrastructure in their case, at a higher level.

In the framework of promoting soil desealing in urban areas, "Depave" (United States), "Depave Paradise" (Canada), and "Steenbreek" (Netherlands) emerge as bottom-up initiatives that aim to create a collaborative network of stakeholders to put in action desealing interventions in urban areas, involving communities and institutions (Garda, 2019; Puerari et al., 2013; Stobbelaar et al., 2021).

2.2 The role played by surveys

Among the various involvement tools and strategies that are available to foster the dialogue between the citizens and the stakeholders, digital instruments have emerged as valuable instruments to solicit citizens' insights into participatory processes (Schröter et al., 2023). Balram & Dragićević (2005) have underlined that there is a dominant use of surveys to characterize people's environmental attitude, and are recognised as valuable instruments to act locally and gather fine social and attitude data. Boglietti & Tiboni (2022) employed surveys to enrich the technical analysis of neighbourhood mobility with citizens' perception of critical issues, planning regeneration proposals accordingly. Tiellemans et al. (2022), in the framework of discrete choice modelling, presented a stated choice experiment to study residents' preferences for sustainable energy measures on dwellings. Specifically, residents were asked to choose between hypothetical choice situations (alternatives), which are defined in terms of attributes that are then used to determine the preferences.

Similarly, Verboven (2021) presented a stated choice experiment to investigate the preferences of urban residents regarding Green-Based Solutions for heat adaptation. Cervera et al. (2021) employed surveys about the community's perception before and after implementing bottom-up urban acupuncture interventions that were combined with a top-down intervention. Franco & Cappa (2021) mentioned surveys as a valuable quantitative instrument for the application of citizen science in urban areas, emphasising their ability to highlight urban peculiarities.

3. Materials and methodology

Soil consumption rates of the city of Parma have been increasing, while the urban area has to deal more and more with climate change-related alterations such as heat waves and floodings. The growing awareness of the citizens about these issues fostered initiatives such as the bottom-up project "Green in Parma", which, promoted and led by the Centro Etica Ambientale (CEA) of Parma[2], is among the first community projects in Parma that advocates for urban resilience supporting soil desealing and the enhancement of green areas. One of the project initiatives consists of the survey "Parma si interroga sugli effetti locali del cambiamento climatico" (Parma wonders about the local effects of climate change)[3], which will be presented in this contribution. The survey is part of the bottom-up process that aims to put into action a desealing intervention in Parma through the project partners and local communities' involvement and was intended as a tool that - in a participatory perspective - allows to give a voice and gather (localised) information from the citizens and stakeholders, such as their perception and opinions.

3.1 The "Green in Parma" project

The first series of dissemination and divulgation initiatives of the "Green in Parma" project took place in 2021 and fostered the establishment of the project partners and a stakeholders' network. On this basis, a bottom-up desealing project was proposed in 2022 in the San Leonardo neighbourhood. As a first step, informative and co-design meetings were organised to involve the local community (Centro Etica Ambientale, 2021; Caselli et al., 2023). However, the issues that were encountered during the process, i.e., the difficulties in involving the citizens' community in a fruitful dialogue, as well as the uncertainties about the availability of the project area, led to taking a step backward and investigating the reasons why the project was unsuccessful. This was particularly motivated by the fact that, despite the hardships faced in setting up the desealing intervention, a noticeable willingness to collaborate was observed among the citizens and the stakeholders, thus serving as a prompt for the following phase of the project (Ceci et al., 2023). An online survey was setup during the last months of 2022, with the main aim of gathering insight about the citizens' perception about climate change and its related local effects in the urban area. The communities' perception is intended as one of the mosaic pieces of the urban context knowledge framework, thus helping to orient the urban planning and transformation scenarios towards the socio-environmental needs and vulnerabilities (Ceci et al., 2023).
Furthermore, another purpose of the survey is to foster the citizens' knowledge and empowerment about their role and the role of greening in the local climate change adaptation strategies.

3.2 Questionnaire design and data collection

The online questionnaire was designed during various meetings, throughout which the structure and the contents of the questionnaire were carefully and iteratively defined by the project partners, in a reciprocal exchange of ideas.

---

[2] The CEA is a third-sector local organisation that is part of the Italian Network of Centres for Environmental Ethics (CepEA).
[3] The survey was promoted by the project partners, e.g., the CEA of Parma, the Emilia-Romagna Agenzia Regionale Prevenzione Ambiente Energia (ARPAE), and the Research Group in Urban and Regional Planning of the University of Parma.

The questionnaire was designed to be easily understandable by all the population classes and encompassed 13 questions (Fig.1), divided into three main sections: i) demographic questions about the participants; ii) climate change risk and effects at the regional, urban and local (neighbourhood) level; iii) citizens' preferences concerning climate change adaptation intervention.

	Question	Choice answers	Variable denomination and characteristics	
Q1	Age	<15; 15-20; 21-30; 31-50; 51-70; >70	Age	DEMOGRAPHIC/STRING/INDEPENDENT
Q2	Sex	Single choice: F; M; Other	Sex	
Q3	Neighbourhood where you live/that you most frequently visit	Parma Centro; Oltretorrente; Molinetto; Pablo; Golese ; San Pancrazio; San Leonardo; Cortile San Martino; Lubiana; San Lazzaro; Cittadella; Montanara; Vigatto	Neighbourhood	
Q4	Activities	Unpaid domestic worker; Student; Freelancer; Employee in the public sector; Employee in the private sector; Entrepreneur (industry-agriculture); Entrepreneur (services-trade); Retired; Other	Activities	
Q5	Social activities [...]	Regular; Saltuary/occasional; None	Social activities	
Q6	With reference to western Emilia, from the Apennines to the Po River, how relevant do you consider the role of climate change on the increasing trend of dry spring-winter and large summer droughts, heavy rains, hailstorms and tornadoes?	Very relevant; Somewhat relevant; Irrelevant	Relevance of climate change	CLIMATE CHANGE RISK AND EFFECTS/STRING/DEPENDENT
Q7	With reference to western Emilia, from the Apennines to the Po, how relevant do you consider the role of climate change on the trend of increasing temperatures and frequency of heat waves?	Very relevant; Somewhat relevant; Irrelevant		
Q8	With reference to the city of Parma, what do you think could be the main effects (impacts) of dry springs and winters and major summer droughts, heat waves, heavy rains, hailstorms and tornadoes?	Degradation of green areas and street greenery; Reduced usability/liveability of the outdoor environment for people and animals; Negative effects on the safety and well-being of workers in the outdoor environment; Adverse effects on health and well-being within homes and workplaces; Adverse health effects from poor air quality [...]; Increased deaths among the elderly and frail people; Damage to public/private outdoor properties; Restrictions on drinking water supply; Flooding; Non-significant impacts; I do not know	Effects of climate change_City of Parma_1 A/A_2 ... A/A_11	
Q9	In the neighbourhood that you have selected in question D3, as a result of the heat waves and prolonged summer droughts of the past two decades, have there been any cases of people becoming/feeling seriously ill?	Several; Some; None; I do not know	Observed effects of climate change_Neighbourhood	
Q10	In the neighbourhood that you have selected in question Q3, as a result of the heat waves and prolonged summer drought periods of the past two decades, have there been any instances of major green losses?	Several; Some; None; I do not know		
Q11	In the neighbourhood that you have selected in question D3, as a result of heavy rainfall/hail/high winds/thunderstorms in the past two decades, have there been any instances of flooding or damage to public/private properties?	Several; Some; None; I do not know		
Q12	Considering the neighbourhood and the parts of the city of Parma that you frequent, and referring to the state of the built-up areas (cemented/paved/asphalted), what interventions do you think are most urgent in order to reduce climate risk?	Replacement of dark flooring/asphalts with light-coloured flooring/asphalts [...]*; Implementation of greenery on buildings [...]; Removal of excess concrete/asphalt [...]; Refurbishing manholes and street drains [...]; Wastewater network refurbishment [...] ; Aqueduct network refurbishment [...]; Build rainwater storage tanks [...]; I am not sufficiently informed to answer. *each answer included the purpose of the intervention	Perceived urgency of interventions_Built-up areas_1 A/A_2 ... A/A_8	ADAPTATION INTERVENTIONS/STRING/DEPENDENT
Q13	Considering the neighbourhood and the parts of the city of Parma that you frequent, and referring to the state of the unbuilt and green areas (but also of the strips, often built up, on the side of roads/sidewalks/sidewalks), what interventions do you think are most urgent in order to reduce climate risk?	Implementation of trees/shrubs on green areas to be redeveloped and on unbuilt areas, including partly cemented areas [...]*; Implementation of new greenery connected to existing greenery [...]; Redevelopment/rehabilitation of aquatic ecosystems [...]; Construction of [infiltration] trenches/pits [...]; Implementation of trees/hedges in roadside/sidewalk strips [...]; I am not sufficiently informed to answer. *each answer included the purpose of the intervention	Perceived urgency of interventions_1 A/A_2 ... A/A_6	

Fig.1 The questions and the choice answers of the questionnaire. A/A stands for as above

Fig.2 shows the conceptual model of the questionnaire, which first purpose was to investigate the hypothesis of a relationship between population classes and their answers. While questions (variables) were chosen in concert with the stakeholders and were therefore mainly connected with their expertise on climate change, bivariate analyses were conducted based on the existing literature, which suggests a relationship between the demographic variables and people's perception of climate change (Poortinga et al., 2019; Weber, 2016).
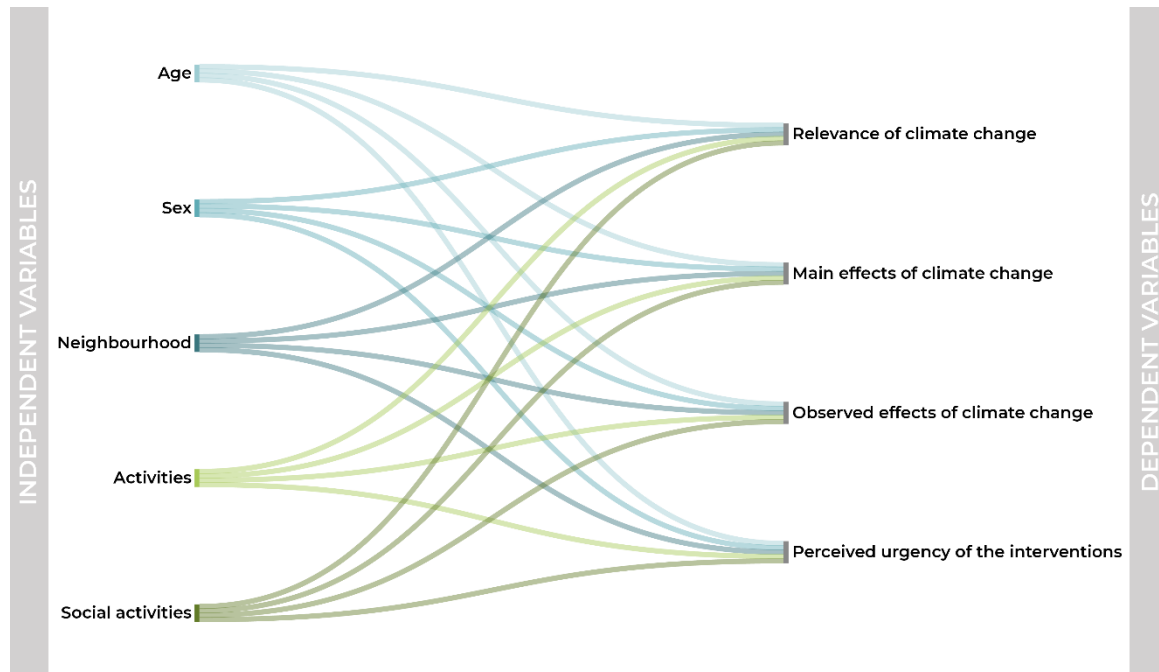
Fig.2 Conceptual model behind the questionnaire setup

Among the different options available to setup a questionnaire, the online questionnaire was chosen for its ability to reach a broad audience and for its technical and economic accessibility, as well as its potential to collect opinions and information also from the citizens that are generally less involved in the community or public life.

The questionnaire was setup through the EUSurvey platform (www.ec.europa.eu/eusurvey) and was published online, in Italian, during December 2022.

The questionnaire was promoted through the mailing lists of the University of Parma and of the CEA, and through local newspapers. 1,352 responses were collected between 27 December 2022 and 28 February 2023. The first descriptive analyses were carried out and shared with the citizens at a press conference on 4 March 2023, and later publicly presented at conferences and in publications.

In-depth statistical analyses of the responses were carried out employing Chi-square tests to test the statistical significance of the results, and factor analyses were employed to find patterns in the answers. The software used e are Microsoft Excel and IBM SPSS, while the opensource QGis software (www.qgis.org) was used to uncover the relationship of the questionnaire data with the urban socio-environmental characteristics.

3.3 Methodology for the analysis of the questionnaire data

This section presents the methodology employed to carry out univariate descriptive and bivariate analyses of the questionnaire results.

The first step consisted of the variable definition for the univariate descriptive analysis, i.e. the exploration of each variable in the dataset, separately. In the case of multiple-choice questions, a variable was created for each. A category was attributed to each variable, chosen among i) demographic, ii) climate change risk and effects, and iii) adaptation interventions, which correspond to the three main sections of the questionnaire. Fig.1 encloses the variables and their characteristics, namely their category, their value type ("string" for all

cases), and variable type (independent/dependent). Simple histograms were then plotted, with the variables choice answers on the x-axis and the count of respondents on the y-axis. Some choice answers needed to be grouped to be suitable for further analyses, i.e. they were merged to obtain groups with similar and significative number of respondents.

A crucial step in the univariate analyses consisted in assessing the sample representativeness of the urban population (Gobo, 2004). The urban population of Parma characteristics (in percentage) were compared with those of the sample, using the available open data.

To understand the relationship between the citizens' classes (demographic variables) and their perception of climate change and its local effects (bivariate analyses), Chi-square tests (Voinov et al., 2013) and factor analyses (Adelman, 1990) were run. Performing a Chi-square test means investigating two variables of nominal or ordinal measurement level, testing a null (H$_0$ - there is no difference between the groups) and an alternative hypothesis (H$_1$ – there is a difference between the groups) through, for instance, a cross table that shows the observed frequencies in a sample. Chi-square (χ^2) measures the difference of these values (frequencies) with the expected values, as explained by the following formula:

$$\chi^2 = \sum_{i=1}^{k} \frac{(o_i - e_i)^2}{e_i}$$

where o_i is the observed frequency in cell i; e_i is the expected frequency in cell i.

In other words, it was tested whether a difference found in the sample could be generalised to the population, with a significance of 5%. If a significance level lower than 5% was found, the null hypothesis (H$_0$) could be rejected, finding, therefore, a statistically significant difference between the groups.

Factor analyses were also carried out, defining and interpreting the rotated component matrix which was obtained, thus identifying patterns in the answers of the respondents.

To proceed with the bivariate analyses, the first step, similarly to the univariate analyses, was the definition of the variables. The same variables of the univariate analyses were kept, except for what concerned questions Q8, Q12, and Q13, for which new variables were defined, corresponding to one or more choices of the multiple-choice question (Tab.1).

Question code	Corresponding variable(s)	Variable group
Q8	Physical_Effects of climate change_City of Parma Drinking water_*A/A* Flooding_*A/A* Health_*A/A* None_*A/A*	Climate change risk and effects
Q12	NBSs_Perceived urgency of interventions_Built-up areas Grey measures__*A/A* Desealing__*A/A* None__*A/A*	Adaptation interventions
Q13	Perceived urgency of interventions_Green areas	

Tab.1 Overview of the questions and corresponding variables and categories. A/A stands for as above

The bivariate analyses were conducted between all the independent and dependent variables, but for the purpose of this contribution, the Results and Discussion sections will focus only on the Chi-square tests and factor analyses between the Neighbourhood and the dependent variables.

The statistically significant Chi-square tests were qualitatively compared to the socio-environmental characteristics of the neighbourhoods[4], aiming to discuss the influence of properties such as the neighbourhoods soil consumption rates on the respondents' answers.

4. Results

This section will present the analyses results, namely: the demographic characteristics of the sample (Subsection 4.1); the univariate analyses concerning the climate change risk and effects variables (Subsection 4.2) and the adaptation interventions variables (Subsection 4.3); the results of the Chi-square tests (Subsection 4.4); and the results of the factor analyses (Subsection 4.5).

4.1 Sample characteristics

The univariate analyses of the dataset showed that the age groups consist of 215 people aged 0-20; 298 people aged 21-30; 350 people falling into the 31-50 group; and 489 people in the 51-70 or >70 one. For what concerns the participants' sex, 819 individuals identified as females, while 533 identified as male or other. As shown in Figure 3, most participants selected "Parma Centro" (344), "Cittadella" (181), and "Oltretorrente" (166) as their neighbourhood. The least represented neighbourhood is Cortile San Martino.
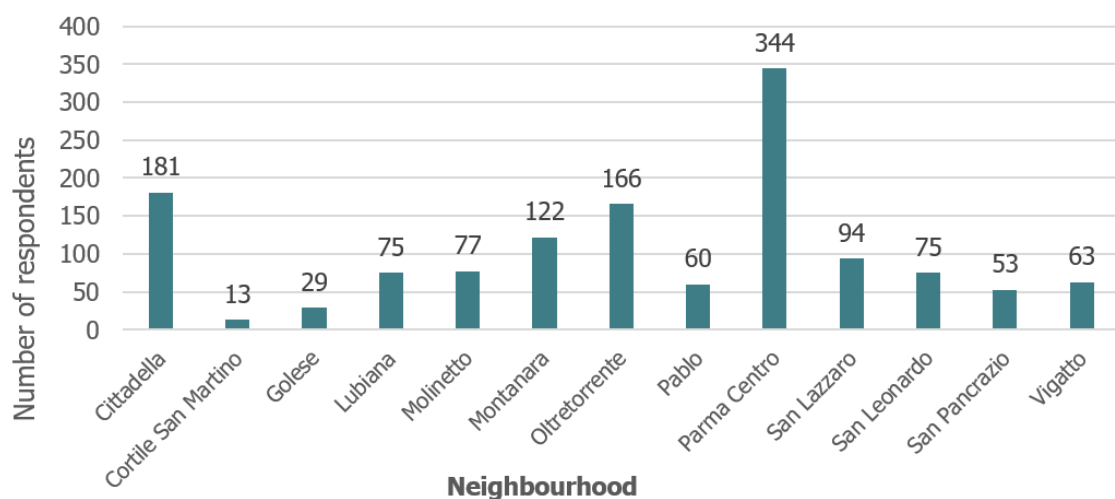
Fig.3 Distribution of the sample among the neighbourhoods

For what concerns the activities of the participants, most respondents were students (481) and employees in the public sector (391), followed by employees in the private sector (192), and by freelancers or entrepreneurs (120).

Finally, most people (631) selected that they are not active in social or volunteering activities, 302 are regularly involved in such regard, while 419 only occasionally.

The available open data allowed for the comparison of the demographic (independent) variables with the population of Parma, even though no open data concerning the activities or the social engagement of the citizens of Parma was found online. The results of this analysis (Fig.4) show that, in general terms, the urban population is well represented.

---

[4] The social and environmental data consisted of: the neighbourhood green areas retrieved from the four-level urban land use (Regione Emilia-Romagna, 2018); the demographic density (Comune di Parma, 2021), the mean age of the population (Comune di Parma, 2021); the soil consumption rates obtained with an elaboration based on the 2021 land consumption map of the Italian Institute for Environmental Protection and Research (Istituto Superiore per la Protezione e la Ricerca Ambientale, 2021); the Urban Heat Island (UHI) analysis (Rota, 2017) and the hydraulic hazard of the city (Comune di Parma, 2016).
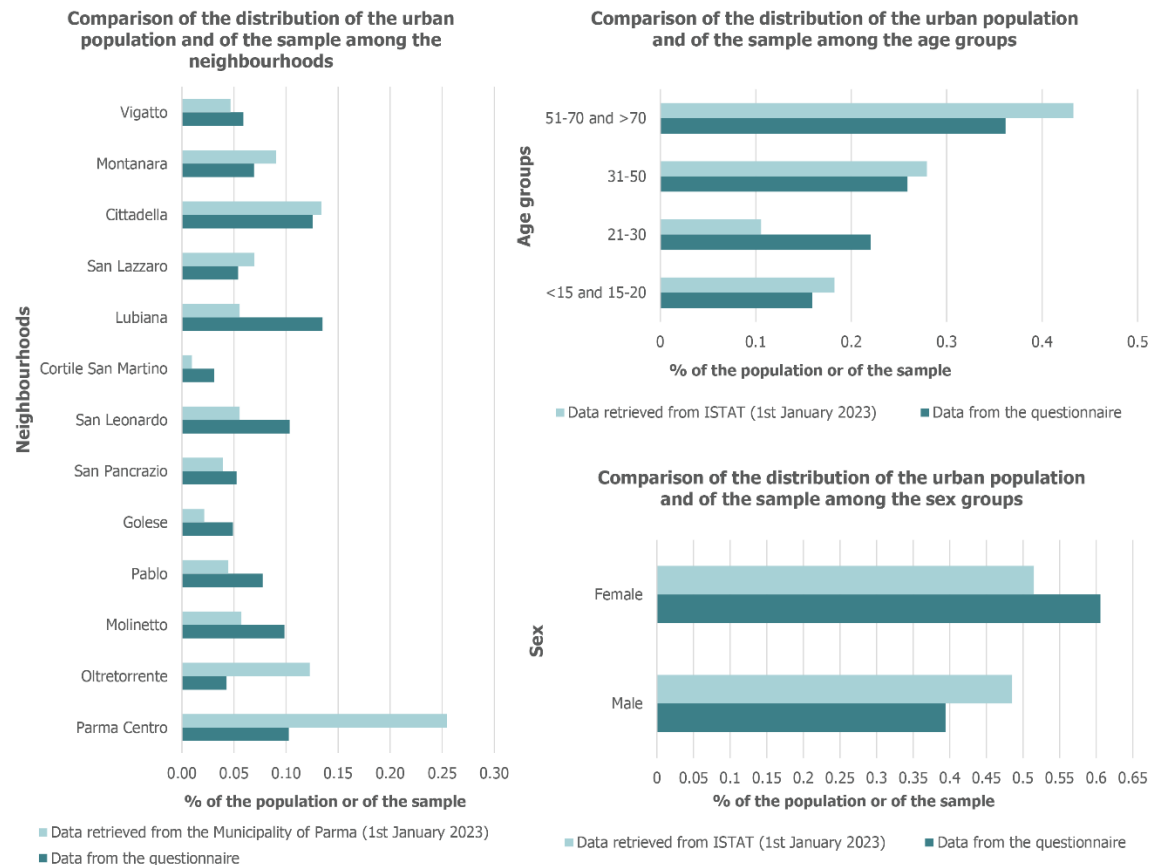
Fig.4 Comparison of the sample characteristics with those of the urban area

4.2 Climate change risks and effects variables

For what concerns the participants' perceived relevance of climate change on the regional territory (Relevance of climate change), the majority has a very clear idea (85.9%), while the remaining 14.1% are more doubtful. As shown by Tab.1, Question 8 was divided into five variables which were analysed separately. Results indicate that, for the city of Parma, 81.8% of the participants observed climate change impact on physical goods and/or properties, and 59.7% on drinking water. 62.2% of the respondents observed effects such as floodings, and 90% on health. Overall, 98.3% of the participants selected at least one answer other than "Non-significant impacts/I do not know" (None_Effects of climate change_City of Parma).

For what concerns the observed effects of climate change in their neighbourhood (Observed effects of climate change_Neighbourhood), most participants (66.7%) are doubtful if heat waves and prolonged droughts resulted in people feeling ill. This variable was therefore not further considered.

The analysis of the variable Observed effects of climate change_Neighbourhood, which investigates the respondents' observation of climate change effects in their neighbourhood, showed that 16.1% of the participants observed a high number of impacts, 30.3% a medium one, and more than half (53.1%) low or none.

4.3 Adaptation interventions variables

As shown by Tab.1, Question 12 was divided into four variables. 87.3% of the respondents believe that, concerning built-up areas, there is a need for NBSs in their neighbourhood, and 79.1% believe that it is necessary to employ grey measures (such as building rainwater storage tanks or refurbishing the aqueduct network). Among the participants, 60.6% would promote desealing. Overall, 92.5% of the respondents

selected at least one intervention. For what concerns the last variable (Perceived urgency of interventions_Green areas), 92.1% of the participants would intervene on green areas.

4.4 Results of the Chi-square tests

Chi-square tests were carried out between the independent and dependent variables listed in Table 2, according to the conceptual model represented in Fig.2 and Tab.2 provides an overview of the fulfilment of the conditions of the Chi-square tests (condition 1: less than 20% of expected counts is smaller than 5, and condition 2: there cannot be zero expected counts). All the tests except one fulfilled the aforementioned conditions. Tab.2 reports whether there is a difference between the groups which is statistically significant at a 5% significance level. Four tests resulted statistically significant.

Dependent variable	Independent variable	Are the conditions for the Chi-square test met?	Is the difference between the two groups statistically significant at a 5% significance level?
Relevance of climate change		✓	✗
Physical_Effects of climate change_City of Parma		✓	✗
Drinking water_*A/A*		✓	✗
Flooding_*A/A*		✓	✗
Health_*A/A*		✓	✗
None_*A/A*		✗	✗
Observed effects of climate change_Neighbourhood	Neighbourhood	✓	✓
NBSs_Perceived urgency of interventions_Built-up areas		✓	✗
Grey measures_*A/A*		✓	✓
Desealing_*A/A*		✓	✓
None_*A/A*		✓	✓
Perceived urgency of interventions_Green areas		✓	✗

Tab.2 Overview of the conducted Chi-square tests and their fulfilment of the chosen conditions. A/A stands for as above

Fig.s 5 and 6 encompass an overview of all the Chi-square tests results. The statistically significant tests will be described and compared with the socio-environmental data of each neighbourhood (Fig.7) in the following paragraphs, aiming to understand if and how living in and/or frequenting a neighbourhood influences the participants' answers.

The results of the Chi-square test between Observed effects of climate change_Neighbourhood and Neighbourhood show that the participants who observed most effects of climate change in their neighbourhood (Fig.5i) were from Cortile San Martino (38.5%) and San Pancrazio (34.0%). A medium level of climate change effects (Fig.5h) was mostly observed by respondents from Molinetto (41.6%) and Vigatto (41.3%), while the lowest level of effects (Fig.5g) was observed by participants from Pablo (68.3%) and San Leonardo (61.3%). The least sensitive neighbourhoods appear to be mostly the central and eastern neighbourhoods, which are also the ones with higher densities (Fig.7d). The central neighbourhoods are also those associated with higher soil consumption (Fig.7f). Medium and high numbers of effects are observed in the more peripheral neighbourhoods which show a higher percentage of agricultural and woods and seminatural area, decreased demographic densities and soil consumption (Fig.7a; 7b; 7c). The increased attention of the administration to the maintenance of central areas might be a reason for the decreased inhabitants' perception of the climate change effects.
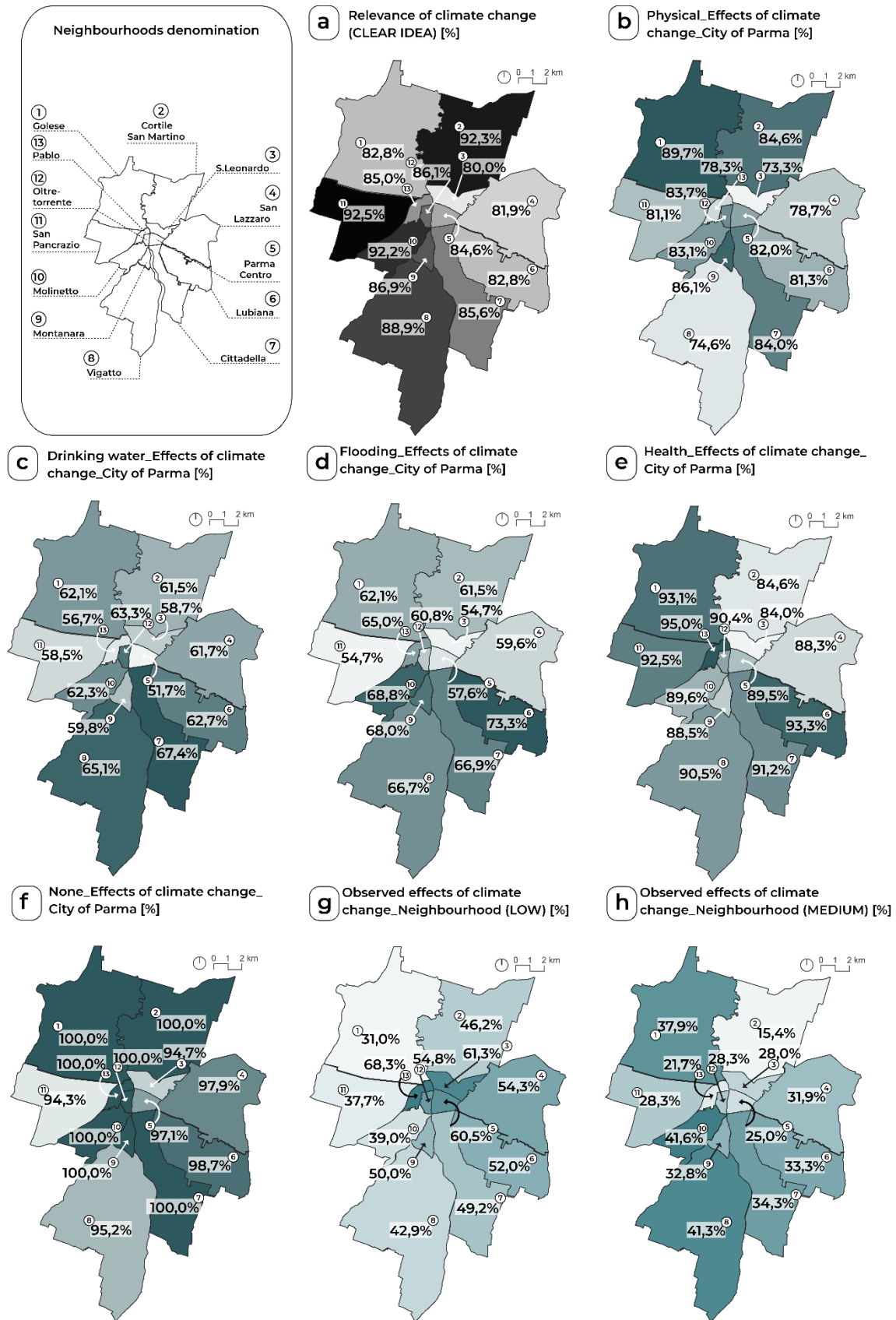
Fig.5 Results of the Chi-square tests between the Neighbourhood and the dependent variables - Part 1
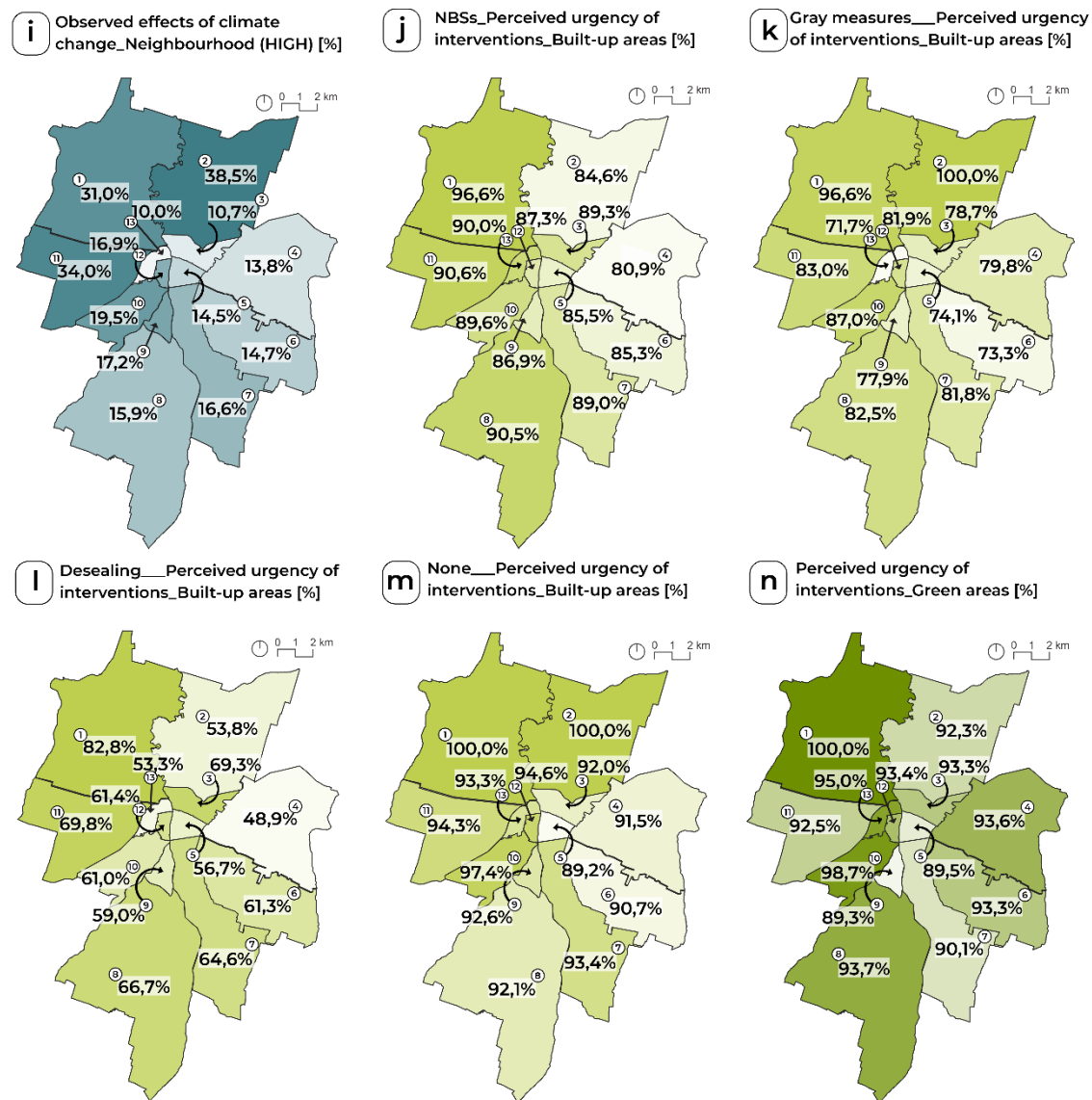
Fig.6 Results of the Chi-square tests between the Neighbourhood and the dependent variables - Part 2

Grey measures to face the climate change effects in built-up areas (Fig. 6k) appear to be needed the most by the Cortile San Martino (100%) and Golese (96.6%) inhabitants, and least desired by Pablo (28.3%) and Lubiana (26.7%).

Figure 8 shows the distribution among the neighbourhoods of people who selected zero, one, two, three, or four choices related to the urgency of grey measures on built-up spaces to face the climate change effects.

The urgency of desealing interventions (Fig.6l) is mostly perceived by Golese (82.8%) and San Pancrazio (69.8%) neighbourhoods, which show low percentages of urban greenery (Fig.7a), but not particular high demographic densities and soil consumption percentages (Fig.7d and 7f). They are however characterised by a high UHI effect (Fig.7g). More than half of the respondents from San Lazzaro (51.1%) and 46.7% from Pablo appear not to feel a particular need for desealing. San Lazzaro shows low urban greenery percentages, associated with a low UHI effect and soil consumption. On the other hand, Pablo is characterized by high soil consumption and urban greenery, and not by a very high UHI effect. The percentage of participants in each neighbourhood which perceive an urgency for desealing is lower compared to the other proposed interventions.
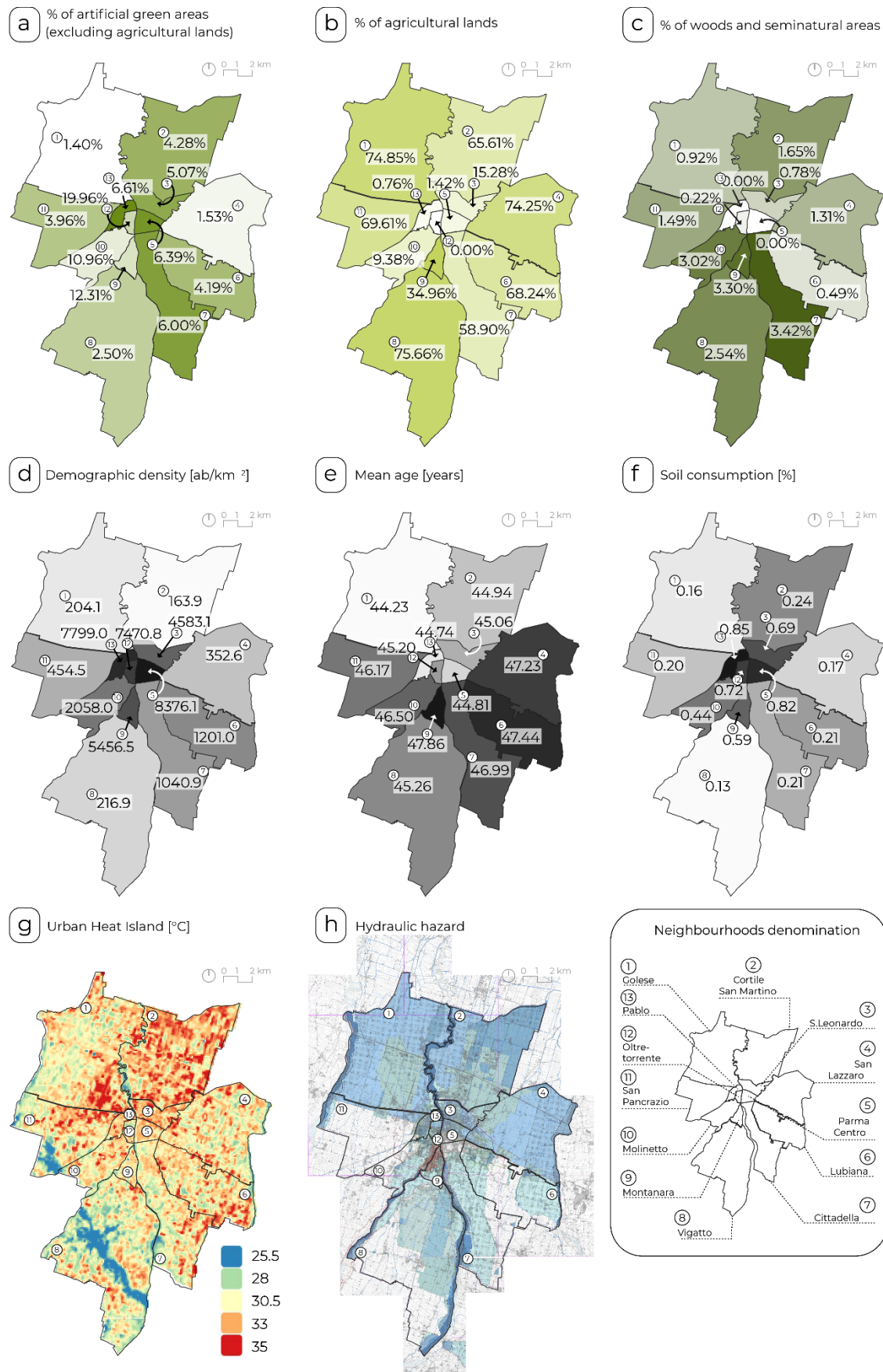
Fig.7 Socio-environmental characteristics of the neighbourhoods (the legend of Figure 7h is available on ssl.comune.parma.it with the query Delibera di Giunta n. 172 26/04/2017
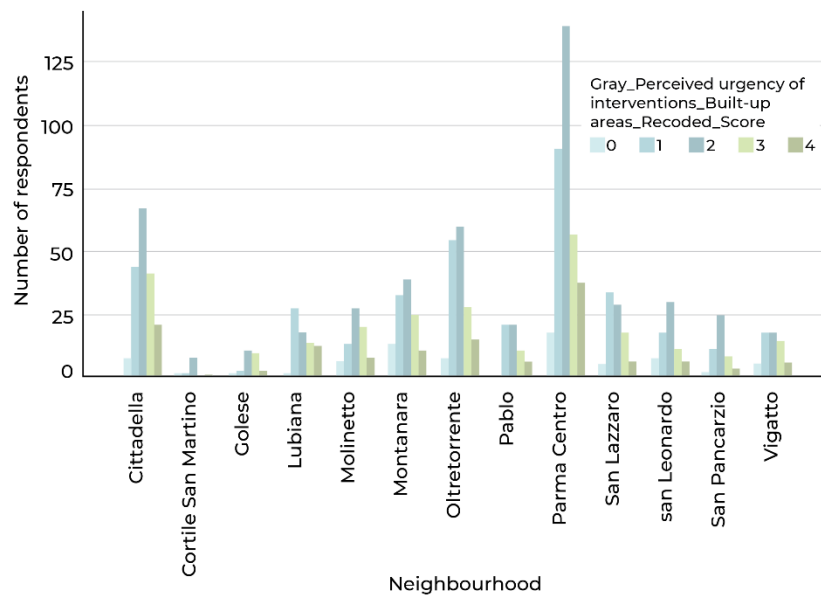
Fig.8 Distribution among the neighbourhoods of people who selected one, two, three, or four grey measures

This might be motivated by a lower knowledge about the concept of soil desealing and its benefits, being it a relatively new concept in the common citizens' knowledge: desealing was introduced in the regional legislative framework in 2017 with the Regional Law 24/2017 of the Emilia-Romagna Region.

All the neighbourhoods seem quite sensitive about the urgency of the interventions on grey areas (Fig.6j; 6k; 6l; 6m). The results of this Chi-square test show that all the respondents from two neighbourhoods (Cortile San Martino and Golese) appeared to think that at least one kind of intervention is necessary to face the climate change effects. This percentage decreases up to 89.2% for Parma Centro, where 10.8% of the participants do not feel the need for interventions in built-up areas.

In general, more than 80% of each neighbourhood respondents perceive an urgency for NBSs. The highest percentage was found in Golese, which is also the neighbourhood with the lowest urban greenery (Fig.7a). The central and eastern neighbourhoods show a lower perceived urgency of the interventions compared to the others, despite their high soil consumption and demographic density (Fig.7d and Fig.7f).

4.5 Results of the factor analyses

After carrying out Chi-square tests, factor analyses were conducted on three questions as well. Tab.3 puts into relation the analysed questions of the questionnaire with the identified factors, which emerged with the multiple-choices that were recurringly chosen together by the participants.

Question code	Factor number	Factor description	
Q8	1	Concerns about	Health and well-being
	2		Quality outdoor environment
	3		Water
	4		Degradation of public and private outdoor properties
Q12	1	Perceived urgency for	Water and rainwater-related interventions
	2		Rainwater drainage-related interventions

Question code	Factor number	Factor description
	3	Improving thermal comfort
Q13	1	Green-related interventions (green areas)
	2	Water and rainwater-related interventions (green areas)

Tab.3 Factors analyses results

5. Discussion

The results of the survey analysis allowed us to gather a general overview of the citizens' perception of climate change and its local effects. However, it appears relevant to make some further considerations.

For what concerns the survey design, it should be noted that it was initially intended as an explorative experiment, to be analysed with qualitative means. Only in the second phase, the opportunity to analyse it with quantitative methods appeared and some adjustments to the variables needed to be made.

Concerning the distribution of the survey, the resulting sample composition is a relevant matter to discuss. The analysed sample consisted mostly of students and public sector employees, almost certainly due to the University of Parma mailing list powerfulness compared to the other distribution means. The consequences on the results might be relevant, as, for instance, students might have moved to Parma only for study purposes and not have a deep knowledge of the urban area. In hindsight, it could have been appropriate to trace the access means to the survey to be able to assess if and what were the differences of the analyses results among them. Furthermore, even though some simple comparisons with the demographic characteristics of the population were carried out and showed overall positive results (Fig.4), working on increased representativeness of the urban population could be beneficial – focusing for instance on the involvement of the least considered neighbourhoods in the future steps of the bottom-up project. Furthermore, considering the voluntary nature of the survey, those who decided to participate are probably individuals who are more sensitive to climate change topics. Finally, for what concerns the survey analysis, as the soil consumption and demographic density maps (Fig.7d and 7f) highlight, it appears that central neighbourhoods show a higher soil consumption and are generally denser. It should be noted that the peripheral neighbourhoods of Parma present a heterogeneity in their urbanisation degree due to which the interpretation of the results might have been sometimes inaccurate. In this contribution, the administrative district perimeters of the Municipality of Parma were used as analysis areas, thus including also agricultural land. Future analyses and/or surveys might need to focus on the urbanised areas.

Furthermore, the qualitative discussion about the link of the Chi-square tests results with the neighbourhoods socio-environmental data could be deepened, for instance about the joined influence of the different neighbourhoods features. As observed for the perceived urgency of desealing interventions, a high soil consumption percentage in the neighbourhood associated with a high percentage of urban green areas might mitigate the perceived desealing urgency for the citizens.

Finally, the explorative and general nature of this survey might constitute a prelaminar step to more in-depth analyses of the neighbourhoods, which might involve the setup of experiments that explore the citizens' preferences for the interventions.

6. Conclusion

Considering these results, as well as the limits of online surveys in public participation processes, further steps of the project "Green in Parma" need to involve the neighbourhoods communities with in-person meetings and workshops. Urban transformation processes cannot do without the direct contact with the population, which allows to deepen the gathered insight, understand if it needs to be further investigated and/or corrected

and to capture feelings and emotions that cannot be translated into words. Therefore, the analyses results can be intended as a piece of the knowledge framework necessary to orient the future scenarios and empower the population. As highlighted by Beltramino et al. (2022), the lack of information about a system's components might hamper the effective implementation of resilient strategies, emphasising the importance of gaining information about system vulnerabilities to implement localised actions. The survey appeared to be successful in collecting information and involving the urban community, reflecting the "Green in Parma" project itself. The project showed good results in establishing communication, thus appearing to well represent - similarly to the first group of authors identified in Subsection 2.1 - a bottom-up demand for resilience actions. Technical ways to foster their concretisation may consist of pilot "demonstrative" desealing actions in the neighbourhoods most sensitive to climate change, its effects, and counteractions. Furthermore, it appears appropriate to propose participatory processes aimed at sharing and co-learning in the less sensitive ones, in a mutual knowledge exchange with the communities.

This contribution encompasses the first step results of a research methodology that aims to identify the most suitable urban areas and neighbourhoods for the implementation of soil desealing interventions, recognising the importance of promoting ecosystem services in urban planning through urban regeneration (Moraci et al., 2024). Further steps involve the setup of a stated choice experiment to investigate citizens' preferences and the proposal of co-design and co-planning workshops. The theoretical framework of this research unavoidably links the effectiveness of soil desealing interventions in limiting soil consumption (and its related issues) with urban planning measures that limit urban areas expansion while preserving natural and agricultural lands.

In this framework, the survey results relate to the decision-making process in different ways. First, they emphasise a bottom-up need of interventions with regard to climate change and its local effects, thus (hopefully) soliciting an intervention of the administration. The results may be practically translated in the knowledge framework documents of the Italian cities' urban and implementation plans. For instance, the new Parma general urban plan (PR050 - www.parma2050.eu) features extensive research about the socio-economic and environmental characteristics of the urban area. Furthermore, the survey results may guide the definition of regulations on both private space (e.g., the control over building permits or the activation of land take compensation measures or incentives for desealing actions) and public space (Lai & Zoppi, 2024): the perceived urgency of the interventions, the perception of the effects of climate change and the factors that guided the participants respondents can help determine the location, priorities, characteristics and communication strategy (and lexical choices) for the actions of the administration, also in relationship to the characteristics of the neighbourhoods.

For instance, the results concerning the observed effects of climate change may highlight the most vulnerable neighbourhoods, similarly to the perceived urgency of desealing (term which might need to be promoted among the citizens) and grey measures. The latter may also expose the neighbourhoods that would mostly welcome climate change adaptation actions and policies, thus influencing the priorities given by the administration to public interventions foreseen by, for instance, the Programmi triennali di intervento (three-year intervention programs). In the framework of the participatory processes set up by the municipalities, e.g. those of the new PR050 in the neighbourhoods, the survey results may represent an initial "gauging" of the areas.

Concrete case studies of survey implementation in urban planning practice are the cities of Bologna and Brescia. The first gathered insight from the citizens within the project Bologna Città 30, using the survey results to orient the project communication and to identify dangerous roads and public space lacking quality (Comune di Bologna, 2023). Similarly, the city of Brescia, within the implementation of its Climate Transition Strategy, asked the citizens to share, through a survey, potential areas to regenerate, and has now activated within the "SpaziAttivi" project a co-design, co-realisation, and management process for two of them (Comune di Brescia, 2024).

Acknowledgements

Attributions

The authors jointly designed and contributed to the paper. Conceptualization: I.D.N., A.K., P.W., B.C.; methodology: A.K., P.W., I.D.N.; investigation: I.D.N.; data curation: I.D.N.; validation: A.K., P.W., B.C., S.R.; writing-original draft: I.D.N; writing – review and editing: I.D.N., A.K., P.W., B.C., S.R.; supervision: A.K., P.W., B.C., S.R.; corresponding author: I.D.N.

References

Adelman, I. (1990). Factor Analysis. In J. Eatwell, M. Milgate & P. Newman (Eds.), *Time Series and Statistics*, 90-94. Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-20865-4_9

Arnstein, S. R. (1969). A Ladder Of Citizen Participation. *Journal of the American Institute of Planners*, 35 (4), 216-224. https://doi.org/10.1080/01944366908977225

Balram, S. & Dragićević, S. (2005). Attitudes toward urban green spaces: Integrating questionnaire survey and collaborative GIS techniques to improve attitude measurements. *Landscape and Urban Planning*, 71 (2), 147-162. https://doi.org/10.1016/j.landurbplan.2004.02.007

Beltramino, S., Scalas, M., Rodriguez, D. J. C., Brunetta, G., Pellerey, F., Demichela, M., Voghera, A., Longhi, A., Mutani, G., Caldarice, O., Miraglia, G., Lenticchia, E. & Riccia, L. L. (2022). Assessing territorial vulnerability. *TeMA - Journal of Land Use, Mobility and Environment*, 15 (3), 355–375. https://doi.org/10.6093/1970-9870/9069

Boglietti, S. & Tiboni, M. (2022). Public spaces critical issues analysis for soft mobility. *TeMA - Journal of Land Use, Mobility and Environment*, 131–145. https://doi.org/10.6093/1970-9870/8643

Canesi, R., D'Alpaos, C. & Marella, G. (2022). A Case of Local Community Engagement for Urban Regeneration: The South Boston Area. In F. Abastante, M. Bottero, C. D'Alpaos, L. Ingaramo, A. Oppio, P. Rosato & F. Salvo (Eds.), *Urban Regeneration Through Valuation Systems for Innovation*, 217–228. Springer International Publishing. https://doi.org/10.1007/978-3-031-12814-1_13

Ceci, M., Caselli, B. & Zazzi, M. (2023). Soil de-sealing for cities' adaptation to climate change. *TeMA - Journal of Land Use, Mobility and Environment*, 16 (1), 121–145. https://doi.org/10.6093/1970-9870/9395

Ceci, M., De Noia, I., Tedeschi, G., Caselli, B. & Zazzi, M. (2023). Soil de-sealing and participatory urban resilience actions: The "Green in Parma" case study. *UPLanD - Journal of Urban Planning, Landscape & Environmental Design*, 7 (2), Article 2. https://doi.org/10.6093/2531-9906/10116

Centro Etica Ambientale (2021). *Presentazione del Progetto di Comunità Green in Parma—Orto Botanico dell'Università di Parma 29 ottobre 2021.* CEA-Parma edizioni digitali 2021.

Cervera, M., Bell, S., Muñoz, F., Mishra, H. S., Fleming, L. E., Grellier, J., Carrasco-Turigas, G., Nieuwenhuijsen, M. J., Vert, C. & Gascon, M. (2021). A Transdisciplinary Approach to Recovering Natural and Cultural Landscape and Place Identification: A Case Study of Can Moritz Spring (Rubí, Spain). *Int. J. Environ. Res. Public Health*, 18 (4), 1709.

Charli-Joseph, L., Siqueiros-García, J., Eakin, H., Manuel-Navarrete, D. & Shelton, R. (2018). Promoting agency for social-ecological transformation: A transformation-lab in the Xochimilco social-ecological system. *Ecology and Society*, 23. https://doi.org/10.5751/ES-10214-230246

Comune di Bologna (2023). *Bologna Città 30, in 20mila hanno partecipato al questionario.* www.comune.bologna.it/notizie/bologna-citta-30-in-20mila-hanno-partecipato-al-questionario

Comune di Brescia (2024). *Spazi Attivi.* www.comune.brescia.it/aree-tematiche/urban-center/progetto-un-filo-naturale/spazi-attivi

Comune di Parma (2016). *Piano del Rischio Idraulico Comunale* [Review of *Piano del Rischio Idraulico Comunale*, by Studio Zanzucchi Srl].

Comune di Parma (2021). *La realtà socio-demografica dei quartieri di Parma al 31.12.2020*. www.comune.parma.it/comune/Statistica/quartieri-1_m1067.aspx

De Noia, I., Favargiotti, S. & Marzadri, A. (2022). *Renaturalising lands as an adaptation strategy. Towards an integrated water-based design approach. TeMA - Journal of Land Use, Mobility and Environment*. *15 (2)*. doi.org/10.6093/1970-9870/9074

Eizenberg, E. (2019). Patterns of self-organization in the context of urban planning: Reconsidering venues of participation. *Planning Theory*, *18* (1), 40-57.

Few, R., Brown, K. & Tompkins, E. L. (2007). Public participation and climate change adaptation: Avoiding the illusion of inclusion. *Climate Policy*, *7* (1), 46-59. https://doi.org/10.1080/14693062.2007.9685637

Franco, S. & Cappa, F. (2021). Citizen science: Involving citizens in research projects and urban planning. *TeMA - Journal of Land Use, Mobility and Environment*, *14* (1), 114-118. https://doi.org/10.6092/1970-9870/7892

Frantzeskaki, N., McPhearson, T., Collier, M. J., Kendal, D., Bulkeley, H., Dumitru, A., Walsh, C., Noble, K., van Wyk, E., Ordóñez, C., Oke, C. & Pintér, L. (2019). Nature-Based Solutions for Urban Climate Change Adaptation: Linking Science, Policy, and Practice Communities for Evidence-Based Decision-Making. *BioScience*, *69* (6), 455-466. https://doi.org/10.1093/biosci/biz042

García de Jalón, S., Chiabai, A., Tague, A., Artaza, N., Ayala, A., Quiroga, S., Kruize, H., Suárez, C., Bell, R. & Taylor, T. (2020). Providing Access to Urban Green Spaces: A Participatory Benefit-Cost Analysis in Spain. *International Journal of Environmental Research and Public Health*, *17*, 2818. https://doi.org/10.3390/ijerph17082818

Garda, E. (2019). Let's get dirty! Le azioni di depaving dei suoli urbani per la multifunzionalità degli spazi sottoutilizzati. *Altre Modernità*, 164-178. https://doi.org/10.13130/2035-7680/12150

Geropanta, V., Karagianni, A., Parthenios, P., Ampatzoglou, T., Fatouros, L., Simantiraki, V., Brokos-Melissaratos, O. & Eleftheriadis, D. (2022). *Digitalization of Participatory Greening - The case of UnionYouth in Chania*. 469-478. doi.org/10.52842/conf.ecaade.2022.1.469

Girard, C., Pulido-Velazquez, M., Rinaudo, J.-D., Pagé, C. & Caballero, Y. (2015). Integrating top–down and bottom–up approaches to design global change adaptation at the river basin scale. *Global Environmental Change*, *34*, 132-146. https://doi.org/10.1016/j.gloenvcha.2015.07.002

Gobo, G. (2004). Sampling, Representativeness and Generalizability. In C. Seale, G. Gobo, J. Gubrium & D. Silverman, *Qualitative Research Practice*, 405-426. SAGE Publications Ltd. https://doi.org/10.4135/9781848608191.d34

Istituto Superiore per la Protezione e la Ricerca Ambientale (2021). *Carta nazionale di copertura del suolo 2021* [dataset]. www.isprambiente.gov.it/it/attivita/suolo-e-territorio/suolo/copertura-del-suolo/carta-nazionale-di-copertura-del-suolo

Kuokkanen, K. & Palonen, Em. (2018). Post-Political Development and Emancipation: Urban Participatory Projects in Helsinki. In *Public Space Unbound*. Routledge.

Lai, S. & Zoppi, C. (2023). Factors affecting the supply of urban regulating ecosystem services. Empirical estimates from Cagliari, Italy. *TeMA - Journal of Land Use, Mobility and Environment*, 7-32. https://doi.org/10.6093/1970-9870/10194

Mayrhofer, R. (2018). Co-Creating community gardens on untapped terrain – lessons from a transdisciplinary planning and participation process in the context of municipal housing in Vienna. *Local Environment*, *23* (12), 1207-1224. https://doi.org/10.1080/13549839.2018.1541345

Meroni, A. & Selloni, D. (2022). *The Rise of Co-design Processes for Urban Commons*, 11–22. https://doi.org/10.1007/978-3-031-06035-9_2

Moraci, F., Bevilacqua, C. & Pizzimenti, P. (2024). Planning the transition of cities. Innovative research approaches and trajectories. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (1), 109-127. https://doi.org/10.6093/1970-9870/10430

Nicolini, E. & Pinto, M. R. (2013). Strategic Vision of a Euro-Mediterranean Port City: A Case Study of Palermo. *Sustainability*, *5* (9), Article 9. https://doi.org/10.3390/su5093941

Paez, D. (2003). Spatial and Temporal Representation of Environmental Policy Outcomes Using Geo-Computation: A Case Study in Victoria, …. *San Diego, USA*.

Pissourios, I. (2014). Top-Down and Bottom-up Urban and Regional Planning: Towards a Framework for the Use of Planning Standards. *European Spatial Research and Policy*, *21* (1), 83-99.

Poortinga, W., Whitmarsh, L., Steg, L., Böhm, G. & Fisher, S. (2019). Climate change perceptions and their individual-level determinants: A cross-European analysis. *Global Environmental Change*, *55*, 25-35. https://doi.org/10.1016/j.gloenvcha.2019.01.007

Puerari, E., Concilio, G., Longo, A. & Rizzo, F. (2013). *Innovating public services in urban environments: A SOC inspired strategy proposal*.

Ranjbar Nooshery, N., Taleai, M., Kazemi, R. & Ebadi, K. (2017). Developing a web-based ppgis, as an environmental reporting service. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *XLII-2-W7*, 115–121. doi.org/10.5194/isprs-archives-XLII-2-W7-115-2017

Regione Emilia-Romagna, S. S., Comunicazione, Sistemi Informativi geografici, Partecipazione. (2018). *Database uso del suolo di dettaglio 2014* (S. Corticelli, M. L. Garberi, M. Bocci, M. C. Mariani & S. Masi, Eds.).

Rota, P. (2017). *Una fragilità adattabile. Mappe climatiche e indirizzi urbanistici per la resilienza dei quartieri residenziali della città media emiliana. An adaptable fragility. Urban climatic maps and guidelines to the resiliency of the residential neighbourghoods of the middle Emilian city.* [Tesi di dottorato, Università di Parma].

Salata, K. D. & Yiannakou, A. (2016). Green Infrastructure and climate change adaptation. *TeMA - Journal of Land Use, Mobility and Environment*, *9* (1), 7–24. https://doi.org/10.6092/1970-9870/3723

Santoro, S., Balena, P. & Camarda, D. (2020). Knowledge Models for Spatial Planning: Ecosystem Services Awareness in the New Plan of Bari (Italy). *Sustainability*, *(4)*. https://doi.org/10.3390/su12041516

Schröter, B., Gottwald, S., Castro-Arce, K., Hartkopf, E., Aguilar-González, B. & Albert, C. (2023). Virtual participatory mapping of nature-based solutions in the Grande de Tárcoles River basin, Costa Rica: Connecting diverse knowledge systems in a context of physical immobility. *Science of The Total Environment*, *872*, 162195. https://doi.org/10.1016/j.scitotenv.2023.162195

Semeraro, T., Nicola, Z., Lara, A., Sergi Cucinelli, F. & Aretano, R. (2020). A Bottom-Up and Top-Down Participatory Approach to Planning and Designing Local Urban Development: Evidence from an Urban University Center. *Land*, *9* (4), Article 4. https://doi.org/10.3390/land9040098

Seve, B., Domínguez, E. R. & Martínez, Z. M. (2023). Urban notes. Conscious and participatory drawing. *EGA Expresión Gráfica Arquitectónica*, *28* (48), Article 48. https://doi.org/10.4995/ega.2023.16878

Seve, B., Redondo, E. & Sega, R. (2023). Facetas de la co-creación urbana. *ACE: Arquitectura, Ciudad y Entorno*. https://doi.org/10.5821/ace.17.51.11694

Sharifi, A., Chelleri, L., Fox-Lent, C., Grafakos, S., Pathak, M., Olazabal, M., Moloney, S., Yumagulova, L. & Yamagata, Y. (2017). Conceptualizing Dimensions and Characteristics of Urban Resilience: Insights from a Co-Design Process. *Sustainability*, *9* (6), 1-20. https://doi.org/10.3390/su9061032

Smith, L. G. (2014). Impact Assessment and Sustainable Resource Management. Routledge. https://doi.org/10.4324/9781315846187

Stelzle, B., Jannack, A. & Rainer Noennig, J. (2017). Co-Design and Co-Decision: Decision Making on Collaborative Design Platforms. *Procedia Computer Science*, *112*, 2435-2444. https://doi.org/10.1016/j.procs.2017.08.095

Stobbelaar, D. J., van der Knaap, W. & Spijker, J. (2021). Greening the City: How to Get Rid of Garden Pavement! The 'Steenbreek' Program as a Dutch Example. *Sustainability*, *13* (6), Article 6. https://doi.org/10.3390/su13063117

Strange, K., Satorras, M. & March, H. (2022). Bridging Urban Climate Justice and Participatory Governance to Explore the Transformative Capacity of Climate Resilience. In I. Ruiz-Mallén, H. March & M. Satorras (Eds.), *Urban Resilience to the Climate Emergency: Unravelling the transformative potential of institutional and grassroots initiatives*, 21–42. Springer International Publishing. https://doi.org/10.1007/978-3-031-07301-4_2

Tiellemans, N. H. M., Kemperman, A. D. A. M., Maussen, S. J. E. & Arentze, T. A. (2022). The influence of group decision making on residents' preferences for sustainable energy measures of dwellings. *Building Research & Information*, *50* (4), 410-423. https://doi.org/10.1080/09613218.2021.1992261

Vaňo, S., Stahl Olafsson, A. & Mederly, P. (2021). Advancing urban green infrastructure through participatory integrated planning: A case from Slovakia. *Urban Forestry & Urban Greening*, *58*, 126957. https://doi.org/10.1016/j.ufug.2020.126957

Verboven, R. (2021). *The preferences and willingness to pay of urban residents in the Netherlands regarding Green-Based Solutions for heat adaptation* [Eindhoven University of Technology].

Vogt, S. (2002). Citizens' participation in urban planning in Tôkyô. *Geographische Rundschau*, *54* (6), 50-53.

Voinov, V., Balakrishnan, N. & Nikulin, M. S. (2013). *Chi-squared goodness of fit tests with applications*. Elsevier/AP.

Weber, E. U. (2016). What shapes perceptions of climate change? New research since 2010. *WIREs Climate Change*, *7* (1), 125-134. https://doi.org/10.1002/wcc.377

Zagare, V. (2018). Towards a Method of Participatory Planning in an Emerging Metropolitan Delta in the Context of Climate Change: The Case of Lower Paraná Delta, Argentina. *A+BE | Architecture and the Built Environment*, *25*, Article 25. https://doi.org/10.7480/abe.2018.25.2660

Image Sources

Fig.1, 2, 3, 4: Elaboration by the authors;

Fig.5, 6: Elaboration by the authors. The perimeter of the neighbourhoods was retrieved from the Municipality of Parma open data website;

Fig.7: Elaboration by the authors, partially based on data retrieved from:
- Delibera di Giunta n. 172 26/04/2017 "Approvazione della proposta di Piano di Rischio Idraulico (PRI) del Comune di Parma" available on the website ssl.comune.parma.it for the hydraulic hazard map;
- Rota, P. (2017). Una fragilità adattabile. Mappe climatiche e indirizzi urbanistici per la resilienza dei quartieri residenziali della città media emiliana. An adaptable fragility. Urban climatic maps and guidelines to the resiliency of the residential neighbourghoods of the middle Emilian city. [Tesi di dottorato, Università di Parma]. www.repository.unipr.it/ handle/1889/3455 for the land surface temperature map (Aster/CNR-IBIMET Florence data, June 2015).
The perimeter of the neighbourhoods was retrieved from the Municipality of Parma open data website;

Fig. 8: Elaboration by the authors.

Authors' profiles

Ilaria De Noia

Building Engineer and Architect, she graduated in 2021 from the University of Trento with a thesis focused on Nature-based solutions for territorial (re)development. Since 2022, Ilaria has been pursuing a Ph.D. in Civil Engineering and Architecture at the University of Parma, exploring the role of soil desealing as an urban adaptation strategy. During her visiting semester at Eindhoven University of Technology, her research investigated the contribution of citizens involvement in this framework.

Barbara Caselli

Architect, Assistant Professor (non-tenure track) in Urban and Regional Planning at the University of Parma, PhD in Urban and Regional Planning at the University of Parma. Her current research interests concern the integration of urban planning and active mobility systems with a focus on urban accessibility and open space planning. She also deals with GIS applied to spatial planning and city management.

Astrid Kemperman

She is a Professor of Urban Planning & Healthy Living. Her area of expertise focuses on smart urban environments that promote healthy living and well-being. Her research involves integrating advanced ICT solutions in daily activity patterns to address societal challenges such as physical inactivity, social isolation, and loneliness. This integration supports active, healthier, and more liveable communities for residents and visitors.

Silvia Rossetti

Environmental Engineer, Associate Professor in Urban Planning at the University of Parma, PhD in Places and times of the city and territory at the University of Brescia (2014). Currently, she coordinates the National research PRIN 'MOVING StEPS - Moving from Street Experiments to Adaptive Planned Solutions'. Her research interests encompass Geographic Information Systems, Urban Regeneration, and Active Mobility.

Peter van der Waerden

He studied Transportation at the National Academy of Planning, Transportation and Logistics in Tilburg and Human Geography at Utrecht State University. Since 1986, he is a lecturer/researcher at the Urban Planning and Transportation group of Eindhoven University of Technology, the Netherlands. He provides education in Transportation Engineering and Geographic Information Systems. His main research areas concern the design and use of car, cycling, and pedestrian facilities with a focus on the relationship between these facilities and people's travel decisions.

TeMA

Journal of
Land Use, Mobility and Environment

The 15-minute cities concept applied to a Brazilian neighborhood: case study of the cidade universitária Pedra Branca neighborhood in Palhoça-SC

Marcela Juliana Cargnin [a*], Cintia de Castro Marino [b], Thaísa Leal da Silva [c]

[a] Postgraduate Program in Architecture and Urbanism
ATITUS Educação, Passo Fundo, RS
e-mail: arq.marcelacargninj@gmail.com
* Corresponding author

[b] Postgraduate Program in Smart Cities
UNINOVE, São Paulo, SP
e-mail: cintiacmarino@uni9.pro.br
ORCID: https://orcid.org/0000-0002-8756-6191

[c] Postgraduate Program in Architecture and Urbanism
ATITUS Educação, Passo Fundo, RS
e-mail: thaisa.silva@atitus.edu.br
ORCID: https://orcid.org/0000-0002-5356-3398

Abstract

Although the concept of 15-minute cities may be considered recent, when looking at the history of urban planning it is possible to recognize the trajectory of different paradigms that underpin it. In 2016, Carlos Moreno defined the "15-minute City" as an urban territory where inhabitants can access all their daily needs within a 15-minute walk, making it possible to live, work and access leisure spaces within a comfortable walking radius. In this context, this article aims to apply the concept of "15-minute city" in the analysis of a Brazilian neighborhood. To this end, firstly, the concept is understood through a literature review that covers theoretical and conceptual reflections on the works of authors such as Ebenezer Howard, Clarence Perry, Jane Jacobs, Gordon Cullen, among others. After the literature review, a case study of the Pedra Branca University City neighborhood in the municipality of Palhoça-SC is presented, analyzing it in light of the 15-minute City concept. Finally, this article reinforces the idea that establishing principles that reorganize urban space, mainly at the local scale of neighborhoods, as places of complex social interactions that can result in a city with a higher quality of life.

How to cite item in APA format

Cargnin, M. J., Marino, C. C. & da Silva, T. L. (2024). The 15-minute cities concept applied to a Brazilian neighborhood: case study of the cidade universitária Pedra Branca neighborhood in Palhoça-SC. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 213-229. http://dx.doi.org/10.6093/1970-9870/10314

1. Introduction

According to the "World Population Perspectives", published by the UN (2019), in the next 30 years, the world population is expected to grow by around 2 billion people, increasing further to 9.7 billion by 2050. Another important data is related to the world population that lives in urban areas, where research indicates that by 2050, 70% of the population will live in cities, whereas this figure currently represents 55% of the population (UN, 2019). The need to seek solutions that address the demands arising from this rapid urban expansion is increasingly common among public administration managers, academics and the population.

The relevance of thinking about actions that promote sustainable development is emphasized when it is noted that this urban growth occurs on a larger scale in developing countries, where the population often already lives in urban centers with inadequate infrastructure (UN, 2013). The problems mentioned above are increasingly being discussed among urban planners, society, and managers, however, this is not an issue discussed only in current times.

Among the various initiatives that aim to promote people's quality of life, in 2016, professor Carlos Moreno defined a concept called "15-minute city", describing it as an urban territory where inhabitants can access all their daily needs in about 15 minutes, making it possible to live, work and access leisure spaces within a comfortable walking radius (Moreno, 2016).

Therefore, this article aims to understand the trajectory of the "15-minute city" concept and apply it to the analysis of a Brazilian neighborhood, believing that the parameters that underlie this theory originate from the culmination of several urban planners, architects, thinkers who wrote the history of urban movements.

Thus, we approach the concept, seeking to understand it through a comprehensive literature review that encompasses theoretical and conceptual reflections by renowned authors, such as Ebenezer Howard, Clarence Perry, Jane Jacobs, Gordon Cullen, and other exponents in the field. This review serves as a solid foundation for our analysis. After recognizing the main guidelines and origins of the concept, we sought to apply it to a case study of a Brazilian neighborhood. Therefore, the work includes a detailed case study of the Cidade Universitária Pedra Branca neighborhood, located in the municipality of Palhoça. Through this study, we intend to analyze the neighborhood in light of the 15-minute City concept, exploring how this urban planning approach can be applied and its implications.

Finally, this article reinforces the central idea that establishing principles that reorganize urban space, mainly at the local scale of neighborhoods, can transform them into places of complex social interactions, contributing to the creation of a city with a significantly higher quality of life. Our research aims to deepen understanding of these principles and their practical applications, highlighting the importance of a human-centered approach to urban planning.

2. Literature review

2.1 A brief retrospective on the evolution of urban thinking

In 1898, the British urban planner Ebenezer Howard published the book "To-morrow", which later, in 1902, in its second edition was called "Garden Cities of To-morrow", in Portuguese, Cidades Jardins de Tomorrow (Howard, 1996).

In this work, Howard proposed an alternative to the poor living conditions of people who lived in cities, briefly describing a diagnosis of the consequences of overpopulation in cities, mainly as a result of migration from the countryside, defending a city model where people and nature could live harmoniously (Saboya, 2008).

Thus, Howard presented the benefits and problems of living in the countryside or the city, characterizing the city as an environment of socialization and opportunities, however, with serious problems in people's living conditions due to the high housing density. In contrast, in the countryside, it was possible to live close to nature, with an abundance of water, sun, and food production, but the lack of infrastructure, social experiences

and employment were negative issues. From these observations, an alternative called Town-Country emerged, combining the potential of each place (Saboya, 2008).

Although this thought represented a change in the conception that existed at that time, influencing the urban thinking that would come later, for Hall (2002), the description of the Garden City was made incorrectly.

This interpretation described urban space as a large isolated space in a largely rural area, when in fact Howard's (1902) proposal was exactly the opposite, where cities were built within shorter distances, so that, when a region reached its density to its maximum, another city would be created ensuring that a rural area was between the two (Hall, 2002; Saboya, 2008).

In 1929, Clarence Perry detailed the concept of "Neighborhood Unit" in a monograph entitled "*The neighborhood unit: a scheme of arrangement for Family life Community*" (Roldan, 2019).

This concept had already been presented by the author himself, at a meeting in 1923 of the American Sociological Association, based on his experience as a resident of the garden neighborhood Forest Hills Gardens, created in the early 1910s in the Queens district of New York, a neighborhood that was built on the principles of Ebenezer Howard (Hall, 1988; Rigo, 2017).

The Perry Neighborhood Unit defines that in an urban sector the population density should only be that necessary for the operation of a primary school, being approximately 800 meters from houses, so that a child can travel to school walking, without having the need to cross even one road with greater traffic (Mumford, 2000). The Neighborhood Unit, according to the concept, should accommodate four essential uses: school; leisure area and park; shops, even if small, to encourage the necessary local commerce; and residential space (Rego, 2017).

Following this line of thought, Jane Jacobs, a writer and political activist, published the book "The Death and Life of Great American Cities" (Jacobs, 1961) in 1961.

In her work, she criticized the foundations that guided the planning and reurbanization of cities at that time, which were based on the idea of isolated buildings, with zoning of functions and distancing in the circulation of pedestrians and vehicles. Cities at that time, according to Jacobs, were dominated by individualism, and people's quality of life, as well as social and economic dynamics depended of the overlapping of diverse functions and the interconnection of dense neighborhoods.

Defending the resumption of observation of real cities by modern planners, arguing about the importance of diversities in the uses of urban areas in a complex and dense way, supporting the idea that a city is happy and safe when the streets are dominated by people in a sufficiently dense concentration and when there is a relationship of cordiality and friendship between residents (Montaner, 2007).

In the same year, in Europe, Thomas Gordon Cullen, an English architect and landscaper, published "Townscape" (Cullen, 2012), where he argues that just as the grouping of people brings about other attractions for the community, the grouping of buildings fosters greater visual appeal than an isolated building.

Its publication is considered one of the most important readings regarding urban design in the 20th century, as it reinforces the importance of thinking about urban spaces, considering that the feelings of emotion and drama that emerge in people arise from everything that surrounds us, such as trees, the sky, buildings and the art of rapport. Still in the 60s of the 20th century, Christopher Alexander in his article "A City is not a Tree" (Alexander, 1965) criticized the modern way of thinking and producing cities or parts of them.

Alexander criticized the "artificial" cities planned by modern designers, which were extremely hierarchical and less complex, unlike "natural" cities, which spontaneously took shape through an abstract structure with a network of elements and uses that work in a complex way.

In 1971, the new edition of the book, called "The Concise Townscape", gives definitions and applications. In the definitions, Culler describes three categories to investigate the emotional impacts of individuals, namely: (1) Optical: derived from serial vision, it is formed by successive perceptions of vision in movement in urban spaces. The urban landscape can be captured by discoveries and experiments in the urban environment; (2)

Place: refers to the emotional forces of space and the possible appropriations of people in certain places. This category is related to the individual's reactions according to the sense of location and (3) Content: characteristics of the landscape related to the constitution of the city: colors, textures, scales, equipment, nature, personality and elements that individualize and characterize the styles and sectors of the urban fabric (Adam, 2008).

This period, from the 1960s onwards, known as the crisis of the modern movement, represents a moment of questioning and reevaluation of the principles and ideals that drove modern architecture and urbanism.

In 1980, Léon Krier in his publication "The Reconstruction of the European City" (Krier, 1978), reflects on the "Development and Progress" of the modern city, emphasizing the negative issues generated by the city's functional zoning and industrial society (Ellin, 1996).

In the same year, Donald Appleyard (1980) conducted a study in which he investigated the effects of traffic on the lives of local residents on three different streets in San Francisco, USA. Such streets were identical in many dimensions except for the amount of vehicular traffic. This research was reported in his book "Livable Streets" where he demonstrated the direct relationship between cars, traffic and people, proving the need to rethink urban spaces, especially sidewalks, considering that the feeling of community is strengthened in sidewalks (Spaces, 2008).

Appleyard was an important professor of Urban Design who, as an urban planner, was concerned with the community and environmental and public life problems, believing that cities and neighborhoods needed to become safe and livable (Appleyard, 1980).

After the crisis of the modern movement, several scholars continued to defend the need to think about man's relationship with the city and the environment, such as Jan Gehl (1987), a Danish architect and urban planner who dedicated his career to promoting the quality of life in urban areas, directing urban planning in favor of cyclists and pedestrians. Bill Hiller, in the 1980s, created the theory of Space Syntax, with the intention of describing important aspects of the urban system and its relationships between public and private space (Saboya 2007), or even Peter Calthorpe, urban architect, who was a founding member of the Congress for New Urbanism (Macedo, 2007).

New urbanism has North American references. The movement that was established in the 80s, when several urban planners and writers, through their works, criticized the configuration of cities at the time (Macedo, 2007), manifesting their frustration towards the way in which the development patterns of cities were taking place, with residential areas far from traditional centers and main roads. Thus, the movement was built around the thought that the physical environment can directly impact people's lives, making its inhabitants more or less prosperous and happy.

In 1993, the Congress of New Urbanism (CNU) took place. Three years later, the New Urbanism Charter was launched, setting out parameters touched on by the movement, exploring means for the development of North American cities (Moreira, 2021). This letter declares the concern to defend the restructuring of urban centers and cities that are in metropolitan regions; reconfigure sprawling suburbs into neighborhood communities; conserve natural environments and preserve the legacy.

To this end, the letter brings principles to be followed to guide public policies, good practices and development planning and urban design, thinking about three spheres: the region (metropolis, city and town); the neighborhood, the district and the corridor; the block, the street and the building (CNU, 2022).

Since its validation, the Charter for New Urbanism has influenced planners and developers of neighborhoods and cities around the world.

In 2009, the Canons of Sustainable Architecture and Urbanism were created by CNU members, creating principles to guide decision-making relating the art of building communities and conserving natural resources (CNU, 2022).

2.2 15-minute cities - 15-minute neighborhoods

The concept of a 15-minute city can be considered rather recent, but when looking at the history of urban planning, the advancement of the different paradigms that underlie the current concept is noticeable. In 2016, professor Carlos Moreno defined the "15-minute city", characterizing it as an urban territory where inhabitants can access all their needs within a 15-minute walk, making it possible to live, work and have leisure spaces within a comfortable walking radius (Moreno, 2016). This concept gained greater emphasis and became popular when the current mayor of Paris, Anne Hidalgo, defended it in her re-election campaign, "Paris du Quart d'Heure", can be translated as "15-minute Paris", illustrated in Fig.1.
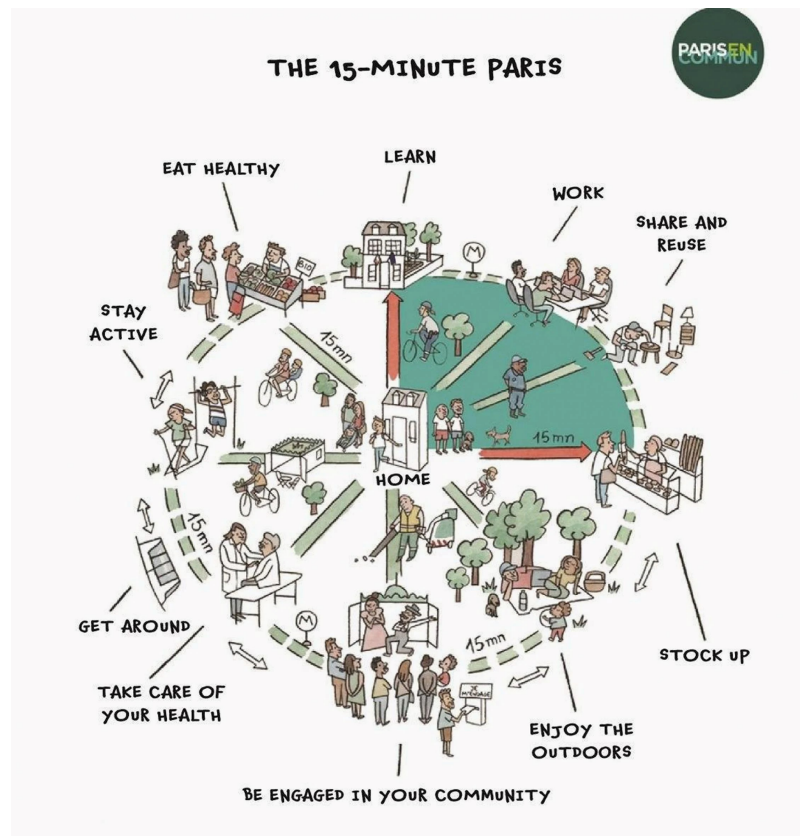
Fig.1 The 15-minute city concept

This proposal won over the citizens of Paris for being a resilient idea, as the city, like the world, had suffered the consequences caused by the COVID-19 pandemic. In this idea, Moreno (2016) argues that quality of life is related to the time that people need to meet their basic daily needs, including (a) living, (b) working, (c) studying, (d) taking care of their health, and (e) having leisure and entertainment.

Therefore, in order to achieve these five essential factors, it is necessary to build healthier urban landscapes, promoting the interaction and participation of residents that strengthen social bonds and trust. From this approach, the 15-minute City concept addresses four necessary dimensions for a city with short distances, which can be drivers for the implementation of measures to redesign cities, namely: (a) Density, (b) Proximity, (c) Diversity and (d) Digitization (Fig.2).

According to Garnier and Moreno (2020), in "Livre Blanc La ville du 1/4 d'Heure. Du concept à la mise en oeuvre", or "White Document: The City of the Quarter of an Hour. From concept to implementation", the dimensions are defined as follows:

(a) Density: relates the number of people per square kilometer. This ideal density perspective is a key element to promote the sustainability of cities in the social dimension.

(b) Proximity: is a fundamental dimension for this concept, seen as temporal and spatial. It considers within a 15-minute radius the possibility of the resident accessing the services listed as basic, within a short walk (or bicycle ride). Shared urban spaces, relaxation areas, children's playgrounds, placemaking and temporary arrangements, enhancement of local heritage and public facilities that enhance culture and promote learning and sport.

Fig.2 The 15-minute city structure

(c) Diversity: defends mixed uses in neighborhoods. To keep the urban fabric active, mixing the uses of commerce, housing and leisure, fosters the area vitality in addition to promoting proximity. Another important point in this item is the encouragement of cultural diversity in neighborhoods, through mixed service offerings that, in addition to helping the local economy, help reduce social inequalities. This dimension is characterized by the axes of action: Sociability through neighborhood networks, inclusion and citizen participation; Diversity activities in the business sector, reindustrialization, public services; Chronotopy through the functional diversity of buildings; Equality between women and men in public spaces and services and security for all.

(d) Digital Tools: The inclusion of new technologies that enable everyday activities such as online shopping, paying bills, accessing information, sharing bicycles and cars, among others. The use of digital tools is aligned with the concept of smart cities, and reinforces hyperproximity, which emphasizes a binary concept (is close/not close) and multimodal (bicycles and personal electric mobility are added) capable of expanding city coverage. neighborhood drive (1/4 mile or 5 minute walk).

The concept defended by Moreno is linked to previous concepts such as "Chronourbanism", "Chronotopia", "Tactical Urbanism", "Placemaking" and "Topophilia". On these concepts, Chronourbanism seeks to define an urbanism that prioritizes the concern for the relationship between space and time, considering the way in which space is used by individuals throughout the day, and emphasizing the importance of distance-time in understanding territories and societies (López, 2015). It refers to the way people live and experience urban spaces, based on different uses and different temporalities. Also, it can be said that chrono-urbanism prioritizes people's quality of life, through holistic, participatory and inclusive approaches. Chronotopia makes the most of existing public space and public equipment resources, avoiding building new ones, making the city more accessible and viable (Daudén; Pinedo; Moreno, 2022). Tactical Urbanism concerns specific interventions that

promote the right to the city, designed together with civil society to propose alternatives to the traditional design process within the urban sphere (Nogueira, 2016). The concept of Placemaking promotes the understanding that the construction of places should not be seen only as "Placemaking", that is, building communities, but rather seeking to meet the needs of diverse people seeking resources that promote the appropriation of space. And Topophilia, which, according to Yi-Fu Tuan in his book "Topophilia: a study of the perception, attitudes and values of the environment" (Tuan, 1974), deals with the relationship between man and his environment and cities, relating the environment physical with the social imaginary, relating landscape, culture and memory, in addition to individual experience and worldview.

Following Moreno's (2016) proposal, the city of Melbourne (Australia) initiated "Plan Melbourne 2017 - 2050" with the aim of defining the future shape of the city and state, thinking about the next 35 years. This plan is based on the "15-minute cities" proposal with the aim of implementing the 20-minute neighborhood concept (Melbourne, 2017). The goals established by the plan are to create a city made up of "20-minute neighborhoods", connected to each other. The proposal is based on the idea that people can satisfy their daily needs within short distances from their homes, which are accessible on foot, with "walkable" streets and avenues, access to public transport and safe cycle paths (Melbourne, 2017). Other urban centers have already implemented this idea, like Portland, which more than ten years ago implemented the "20-minute neighborhood" concept (McNeil, 2011).

Although there is a growing interest in this concept, some aspects generate uncertainty regarding its successful implementation. Issues related to inclusion and the right to the city arise, which cannot be neglected (Casarin, et al., 2023). In the 15-minute city concept, investments in technologies that improve people's access to information and innovation, for example, are useful for those who have electronic devices, capacity and knowledge to access information and resources that will be offered. On the other hand, those who do not have access to technologies or are not able to deal with them end up not being included in this process.

Another important point is the encouragement of active mobility through the use of bicycles, walkable streets, and other modes of travel which do not involve the use of private cars, which must be thought of in such a way that the elderly population and those who have mobility restrictions mobility can also benefit (Calafiore et al., 2022).

Another reality that may exist is the response to investment increase in infrastructure and provision of services in a given location, which often reflects an increase in the value of properties and the pricing of the region, making the population that already resides there need to move to other more peripheral regions (Bright, 2021; Glaeser, 2021; Pozoukidou and Chatziyiannaki, 2021). When private investments enter, with the aim of promoting social renewal and creating diversity, the result often found is an increase in prices (Casarin et al., 2023).

Casarin et al. (2023) mention that poverty concentrated in certain regions clearly represents social inequality and, by mixing communities, the effect can reduce the visibility of extreme poverty, however this policy only "appears" to be successful, but in fact does not contribute to improving the living situation of the disadvantaged population and can even favor community displacement, caused by gentrification. This displacement process generates new clusters of isolated groups, and is called "segregation of diversity" (Hyra, 2015), causing greater risks of social inequality (Casarin et al., 2023).

3. Methodology

The research carried out is exploratory in nature, developed with the objective of relating the concept of 15-minute cities to the case study of the planned neighborhood "Cidade Universitária Pedra Branca", located in Palhoça-SC, in Brazil.

To do this, the objective is, specifically, to understand the concept of 15-minute cities, as well as its variations, such as 15-minute neighborhoods; carry out a case study on the "Cidade Universitária Pedra Branca"

neighborhood, so that its characteristics can be related to the concept under study. Thus, scientific research is structured into methodological stages that, according to Badin (2016), allow for better understanding:

— Stage I - Bibliographical research enabled the understanding and contextualization of concepts that relate to the analysis of this article, with the aim of understanding the urban thoughts that preceded the current concept of the 15-minute city. Such references originate from studies already carried out and available in theses and dissertations accessed from the Scopus Science and Google Scholar platforms, in addition to news and information published on websites related to the object of study of this research;

— Stage II - Case study referring to the "Cidade Universitária Pedra Branca" neighborhood, where data collection was carried out through bibliographical research in secondary sources, enabling the understanding of the historical context of the place, in addition to identifying the main characteristics of the project;

— Stage III - Compilation, crossing of information collected in the previous stages, which allowed the comparative analysis of the concept of 15-minute cities, relating it to the neighborhood under study.

4. Analysis and Discussions

4.1 Case Study of the "Cidade Universitária Pedra Branca" neighborhood

Cidade Universitária Pedra Branca is located in the municipality of Palhoça, Metropolitan Region of Florianópolis, State of Santa Catarina, Brazil. The area that the neighborhood occupies was initially a family farm that stood out for its natural beauty. The neighborhood project began in 1997 in partnership with the land owner, where, meanwhile, the Campus of the University of Southern Santa Catarina was installed. In 1999, the first residential subdivision was started (Criativa, 2023).

From 2005 on, the intervention project for this neighborhood began, aligned with the "New Urbanism" concept, with the aim of improving the city for people. To develop the Pedra Branca MasterPlan, the project received consultancy from specialists such as the North American offices DPZ Latin America and Keystone, Gehl Architects from Denmark and several Brazilian offices, including Jaime Lerner Arquitetura e Urbanismo, in addition to three laboratories from Federal University of Santa Catarina.

During the development of the project, 10 principles guided the proposal: 1) Pedestrian priority; 2) Mixed use; 3) Attractive and safe public spaces; 4) Diversity of Residents; 5) Sense of Community; 6) Balanced Density; 7) Harmony between nature and urban amenities; 8) Sustainability and high performance of the built environment; 9) Connectivity and, 10) Lifestyle (Criativa, 2023).

(a)   (b)

Fig.3 (a) MasterPlan Pedra Branca and (b) Image of the current area with the project implementation

In 2009, the Pedra Branca project was selected as one of the 18 projects that would establish the Climate Positive Development Program (Ecobriefing, 2009). This program supports the development of large-scale

urban projects that demonstrate how cities can grow in a climate-friendly way. Thus, the neighborhood's real estate developments are designed to implement economically viable innovations, waste management, water management, transportation and public lighting, clean energy generation, among others.

Fig.3(a) shows the project proposal presented in 2009, and alongside, Fig.3(b) shows the neighborhood as it currently looks, 14 years later. It can be seen then that the implementation of the project is happening gradually, from the central part of the neighborhood to the rest of the area.This neighborhood was designed to receive around 40 thousand residents, being 10 thousand students and 30 thousand workers (Criativa, 2023). This neighborhood is made up of a wide variety of uses, such as schools, universities, companies, leisure and entertainment spaces, and housing.

In Fig.4, the image of the zoning proposed for this neighborhood, demonstrates the concern in concentrating this great diversity of uses. The neighborhood's infrastructure offers the opportunity to work, study, live, shop and have fun, having an urban area organized in such a way that the local community can establish greater links between residents, through attractive and safe public spaces. Furthermore, in the residential and commercial developments in the neighborhood, sustainable strategies were used such as ventilation and natural lighting, waste management, less aggressive construction materials, use of natural gas, among others (Palhoça, 2022).
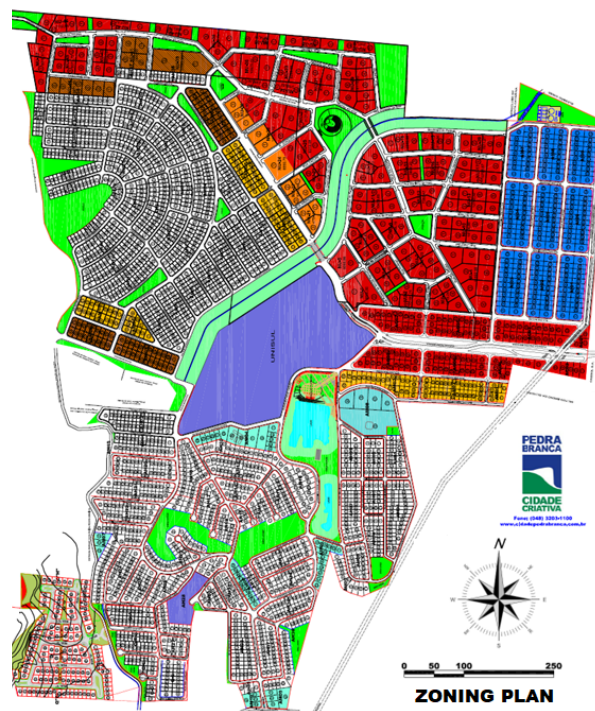
ZONING UNIVERSITY CITY PEDRA BRANCA			
MASTER PLAN	TEMPLATE	OCCUPANCY RATE	UTILIZATION RATE
AMC_7 – CENTRAL MIXED AREA 7	12 Floors	50% (A) up to 8 floors / 58% - N* (A) < 8 floors	5.2
AMC_4 – CENTRAL MIXED AREA 4	8 Floors	50% (A)	4.0
AMC_3 – CENTRAL MIXED AREA 3	8 Floors	50% (A)	3.9
AMC_2 – CENTRAL MIXED AREA 2	4 Floors	50% (A)	2.3
ARP_4 – PREDOMINANT RESIDENTIAL AREA	2 Floors	50%	1.6
MAS_2 – MIXED SERVICE AREA	15 m	80%	2.4
AMS – MIXED SERVICE AREA	4 Floors	60%	2.0
ARE – EXCLUSIVE RESIDENTIAL AREA	2 Floors	50%	1.0
ACI – INSTITUTIONAL COMMUNITY AREA	4 Floors	50%	2.3
ASE – SANITATION AND ENERGY AREA	-x-	-x-	-x-
AVL – GREEN AND LEISURE AREAS	1 Floor	5%	0.05
APP – PERMANENT PRESERVATION AREA	-x-	-x-	-x-

Observation:
(A) = Maximum occupancy rate of 80% for the ground floor or 75% for the first two floors, when intended exclusively for commercial activities, services or garage floors.
N* = Number of floors according to article 46 (Law 16/93)

Fig.4 Zoning of the Cidade Universitária Pedra Branca neighborhood

In 2014, the neighborhood had 5000 inhabitants and 5500 jobs, in addition to 7000 students (Criativa, 2023). In 2022, more than 8 thousand people lived in the neighborhood and it was estimated that the monthly floating population was 100 thousand people (Palhoça, 2022). The neighborhood is a pioneer in planning the first shared street in Brazil, known as "Passeio Pedra Branca" (Fig.5). This location has an open-air shopping mall, where more than 50 retailers drive the economy of this neighborhood.
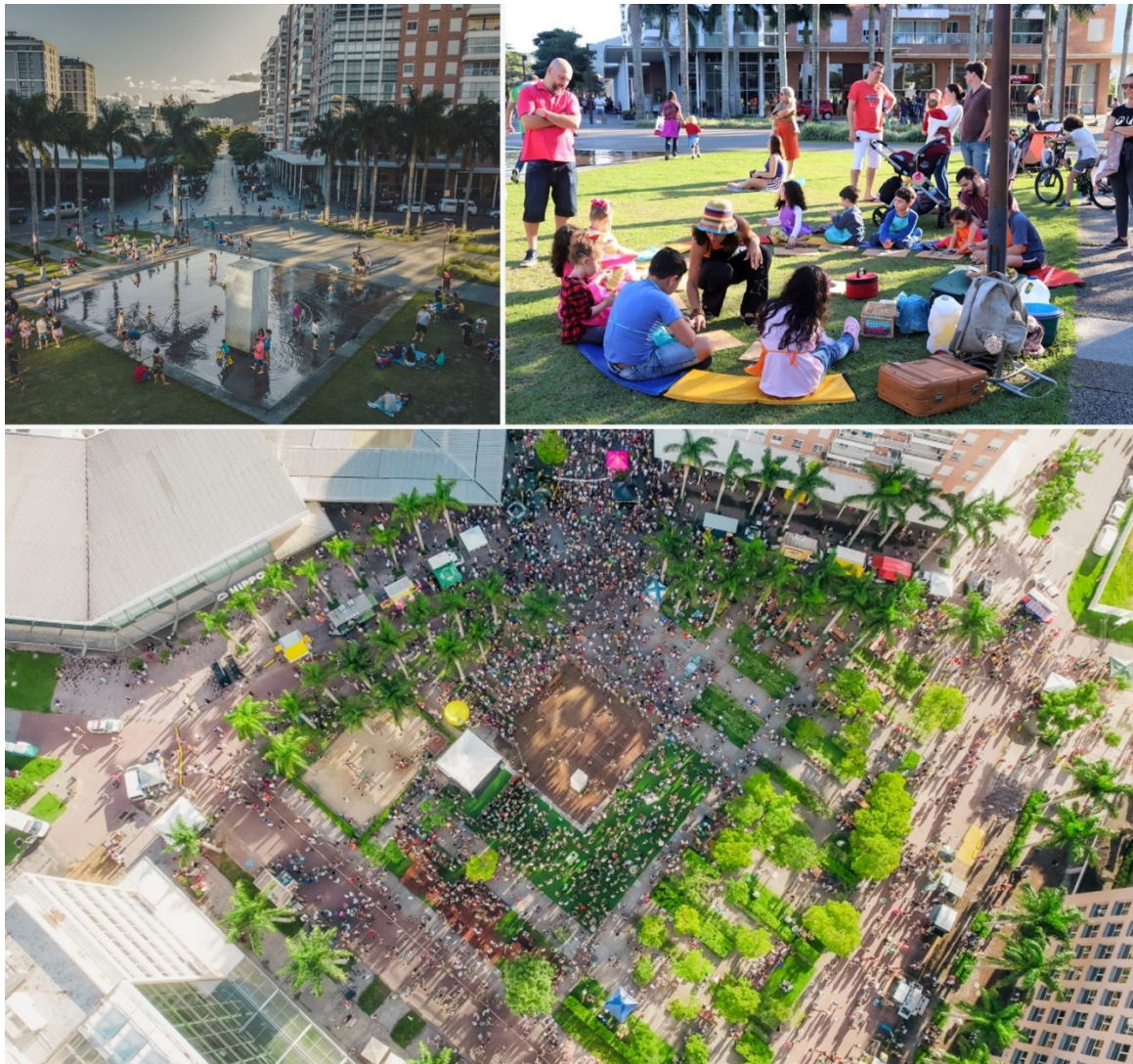
Fig.5 Shared street "Pedra Branca Walk"

4.2 The Pedra Branca neighborhood, according to the 15-minute Cities concept

The concepts of New Urbanism and Sustainable Urbanism are evident in the proposal for the Pedra Branca neighborhood. The concern with recovering the sense of place, rescuing the centrality where people can work, study, have fun and live. When analyzing the region, within the dimensions proposed by Moreno (2016): density, proximity, diversity and digital tools. The dimensions of density and proximity can be observed through the aerial images presented in Fig.6, which record the growth of the region where the neighborhood was located and its surroundings over 20 years, with images from 2003 in Fig.6(a), from 2013 in Fig.6(b) and, from 2023 in Fig.6(c). It is then observed that both the Pedra Branca neighborhood and its surroundings have grown significantly. Although this growth has occurred, in the specific study area, urban voids still predominate, showing that the ratio of people per square kilometer, which would represent the ideal density, is still in

development. The highest building densities, which suggest a greater number of people, are located in the central area of the neighborhood.
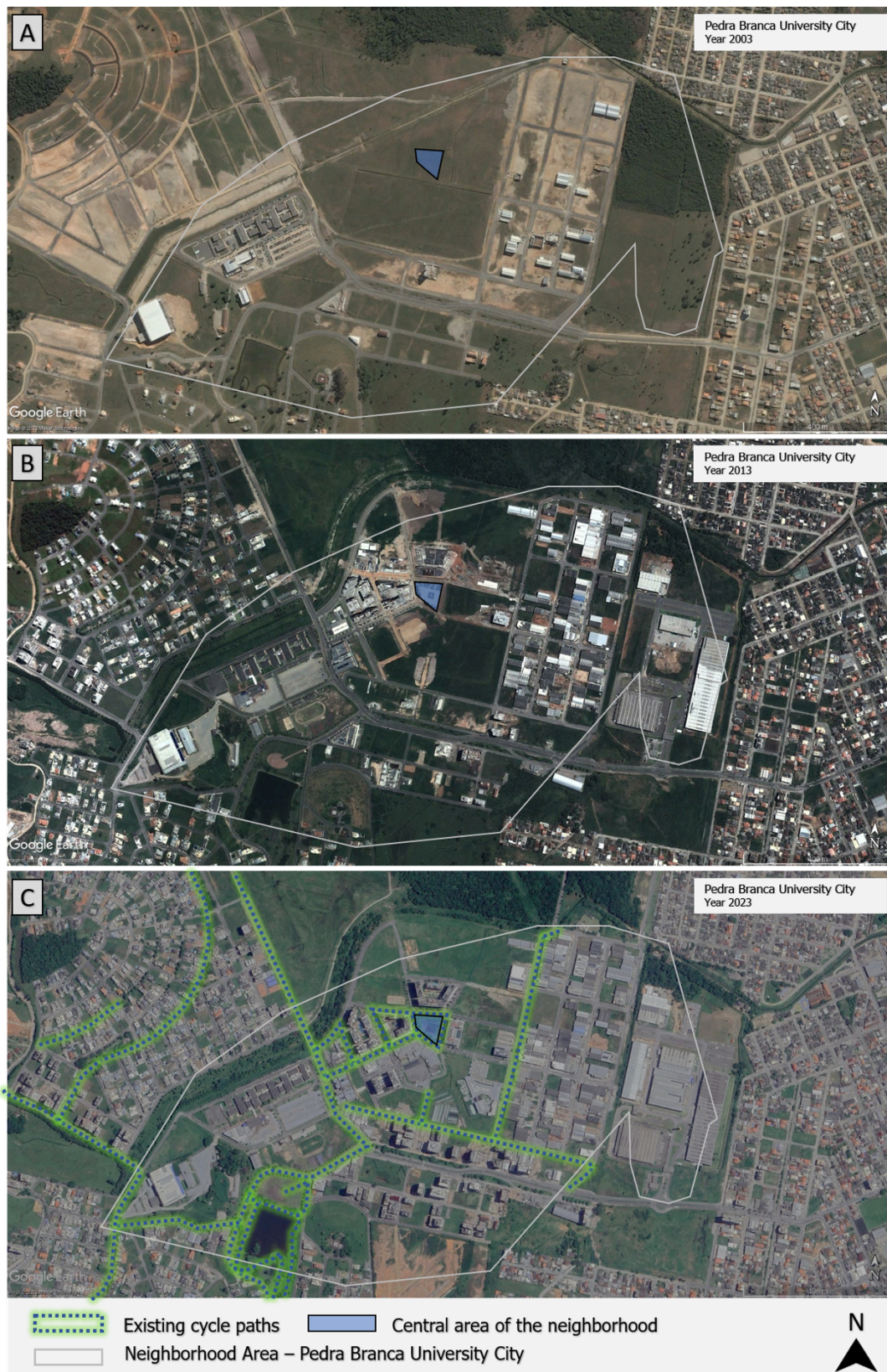
Fig.6 Sequence of images from Google Earth, in the years 2003 (a), 2013 (b) and 2023 (c) respectively, showing the growth of the region where the Pedra Branca neighborhood is located

As for proximity, relating the temporal and spatial vision within the concept of 15-minute cities, it is observed that although the neighborhood favors walkability and the use of bicycles, when analyzing the map in Fig. 6(c) in general, it is clear that it is clear that the cycling infrastructure is still quite restricted, and makes a small connection with the east side of the city, leaving the west side without any connectivity. On the other hand, the urban design of the neighborhood favors urbanity through connected public spaces, green areas, a network of public sidewalks, leisure spaces and active building facades (Fig.7). However, this urbanity is somewhat lost when analyzing the urban structure in its entirety.

(a)   **(b)**

Fig.7 Leisure and social spaces in the neighborhood

As for the diversity of uses, it is a mixed-use zone, as shown in the zoning map in Fig.4. This condition guarantees the ground floor of the buildings more connectivity with public life, and favors its intensity. The population residing in the neighborhood is made up of different age groups, and is not exclusively university students, as suggested by its name "Cidade universitária Pedra Branca". Given the diversity of uses, the local economy remains active throughout the year.

The last dimension, digitalization, is aligned with the concept of smart cities. In the Pedra Branca neighborhood, a subscription housing concept makes property rental more flexible. The use of technologies is found in all residential and commercial developments, through construction waste management, solar heating, and several other sustainable elements. The neighborhood promotes various events and meetings, and through an online community it posts information with all the neighborhood's programs.

It is concluded, then, that the proposal for the Pedra Branca neighborhood plays the role of articulator and creator of socially diverse encounters. The diversity of uses allows local residents to carry out all their necessary basic functions, within a radius comfortably reached within a 15-minute walk, just as the 15-minute City concept proposes. Furthermore, in the neighborhood under study, active mobility is highly valued through the implementation of adequate and inclusive cycle paths and public sidewalks. However, some elements are still deficient, such as the density of the location, which still has several urban voids, and the lack of connectivity with the surrounding neighborhoods and the rest of the city.

5.   Final considerations

The COVID-19 pandemic revealed the vulnerability of cities, making us energetically rethink measures to contain the spread of the virus, adapting the population's routine with new habits, so that their basic activities were guaranteed. This radical thinking about life in cities gave rise to the concept of 15-minute cities proposed by Moreno (2016). As presented in this article, the concern about cities that prioritize people over vehicles is a subject that has been widely discussed over the years.

Thinking about dense cities and neighborhoods, with a diversity of uses that meet the needs of the population, is part of the innovative ideas presented by Jane Jacobs since 1960, for example. According to Jan Gehl, "the

natural starting point of the work of designing cities for people is mobility and human senses, as these provide the biological basis of activities, behavior and communication in urban space" (GEHL, 2013, p.33). The pandemic that the world experienced in 2020 further reinforced the need to think about "cities for people" as Gehl addresses in his book (GEHL, 2013), and the importance of having quality outdoor spaces in favor of a better quality of life. The pandemic awakened feelings in people that seemed obvious, but that many took for granted, such as the importance of contact with people and living in a community. The value of having access to basic services such as health, education, leisure and transport, at distances that can be reached with a comfortable walk or even by bicycle, is something necessary and possible. All of these relationships are addressed by the 15-minute Cities concept.

Although this way of thinking about cities or neighborhoods is not something simple to implement, this concept is very broad, and much more than a guideline for designing urban spaces, this concept reflects a lifestyle that promotes environmentally friendly habits. The idea of denser neighborhoods capable of reconnecting people to these local areas establishing the life of the city, are the scope of this approach which, in general terms are based on attributes already discussed in the past by other writers, architects, and urban planners, where the mixture of uses, density, accessibility and walkability were already guidelines for designing an ideal city. The 15-minute City concept adds the dimension of proximity that highlights the self-sufficiency of a neighborhood, so that a wide range of services and uses are offered in this area instead of offering more efficient means of travel, such as public transport, to have access to such services in other regions of the city.

However, the implementation of the proposed idea for a 15-minute city may face challenges, which vary according to the location, ranging from historical issues of urban inequality, social polarization, territorial dimensions, urban population, among others. Unlike the cases mentioned in this study, such as the 20-minute neighborhoods of Melbourne and Portland, as well as the largest reference for the concept of 15-minute cities, which is Paris, the case study presented in this research refers to a planned neighborhood, which was designed from the project's conception to be a neighborhood converging with the principles of New Urbanism.

The case of the Brazilian neighborhood Pedra Branca differs from the other examples presented in some aspects, since it is a planned neighborhood and not an urban transformation of a city or consolidated location. Although it is a unitary transformation, which was initially led by a group of people who saw great potential in developing the region around the university, the project aimed to improve the city for its residents. This proposal is related to the concept of a 15-minute city, as it rescues the way of living in a community, sharing public spaces, and basic needs met within a nearby radius.

It is important to highlight that this study does not intend to compare the applicability of the concept in urban transformations in the context of a consolidated city or in projects for new urban neighborhoods. Rather, we sought to deepen the vision around the case presented, in order to understand its contributions to the city in which it is located, as an urban design project, and its positive impacts on the city as a whole.

Thus, analyzing the Pedra Branca neighborhood on a local scale, one can see its great relationship with the concept studied: in the heart of the neighborhood, leisure and coexistence spaces strengthen the daily interaction of the population; in the central area, the "Passeio Pedra Branca" square, has daily attractions for the population residing in the neighborhood, and for people who go there to enjoy the activities and infrastructure it provides; the streets are narrow and the sidewalks are wide, with the aim of discouraging the use of cars; public sidewalks are protected by trees that provide greater comfort for pedestrians; the facades are active, and the occupation of the space is mixed, favoring living, working and leisure in the same place.

Although this concept is applied to a planned neighborhood, this example reverberates throughout the rest of the city. The neighborhood borders other neighborhoods in the city, as can be seen in Fig.6, and cycle paths connect this neighborhood to other regions of the city. Furthermore, as it offers several leisure and entertainment attractions, the neighborhood is very popular with the population that lives outside of it, which

keeps the local activity and economy active throughout the year, even considering the seasonality of the academic calendar.

Thus, as Jane Jacobs (1961) argued, what brings security to the city is the presence of people circulating at different times of the day or night. It is not common in the neighborhood under study to have walls, lookouts, or gates, but rather the occupation of spaces by people. The sense of belonging connects the neighborhood's residents to the rest of the city. Although it is a developing neighborhood, it is believed that good urban planning practices can expand outside of it. Furthermore, although the neighborhood has great development potential, with the university as a driver, density is still far from expected. Many factors can contribute to this, including the fact that the neighborhood is not fully integrated with the rest of the urban fabric. Another argument that can be suggested is the possible overvaluation of real estate. Still, the neighborhood is very popular with the population of the city of Palhoça. All space reorganization actions that the concept suggests generate technical issues that need to be thought about before implementing such guidelines, redistributing the functions of the neighborhood considering geographic, economic and social principles, such as population limits and number of markets, pharmacies, schools, etc, in addition to reorganizing municipal laws. Another relevant point is the fact that having easier access to these services and the hyperproximity centers generated can contribute to the process of gentrification and real estate speculation in these regions. It is also worth highlighting the issues related to hyperlocalism which, according to some authors, is the difficulty of implementing these concepts in smaller cities or with low purchasing power and also resolving issues of social segregation, leaving these problems as suggestions for future studies. In short, every change must first be disseminated so that people can assimilate it. For this reason, this article justifies its importance, as it encourages discussions on a subject that impacts the way people will position themselves in the face of current challenges. The concept presented is not a new proposal, but rather the culmination of several years of studies and reflections to provide greater vitality and quality to cities and the people who inhabit them. Establishing principles that reorganize urban space, especially neighborhoods, as places of complex social interactions, promoting well-being from the inside in these regions, can result in a city with a higher quality of life.

Acknowledgments

References

Abdelfattah, L., Deponte, D. & Fossa, G. (2022). The 15-minute city as a hybrid model for Milan. *TeMA - Journal of Land Use, Mobility and Environment,* 71-86. https://doi.org/10.6093/1970-9870/8653

Adam, R. S. (2008). Analisando o conceito de paisagem urbana de Gordon Cullen. *Curitiba: Da Vinci, 5* (1), 61-68.

Alexander, C. (1965). A city is not a tree. *Ekistics, 139*, 344-348.

Appleyard, D. Ruas habitáveis: bairros protegidos. *ANNALS da Academia Americana de Ciências Políticas e Sociais, 451* (1), 106-117.

Appio, F. P., Lima, M. & Paroutis, S. (2019). Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges. *Technological Forecasting and Social Change, 142,* 1-14. https://doi.org/10.1016/j.techfore.2018.12.018

Bocca, A. (2021). Public space and 15-minute city. *TeMA - Journal of Land Use, Mobility and Environment, 14* (3), 395-410. https://doi.org/10.6093/1970-9870/8062

Bocca, A. (2024). Sustainable development and proximity city. The environmental role of new public spaces. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 71-87. https://doi.org/10.6093/1970-9870/10414

Bright, D. (2021). Whose 15-Minute Windy City? Evaluating Access to Walkable Places in Chicago. Chapel Hill: University of North Carolina. https://doi.org/10.17615/fcv0-cr12

Calafiore, A., Dunning, R., Nurse, A. & Singleton, A. (2022). The 20-minute city: An equity analysis of Liverpool City Region. *Transportation Research Part D: Transport and Environment, 102*, 103111. https://doi.org/10.1016/j.trd.2021.103111

Casarin, G., MacLeavy, J. & Manley, D. (2023). Rethinking urban utopianism: The fallacy of social mix in the 15-minute city. *Urban studies, 60* (16), 3167-3186. https://doi.org/10.1177/00420980231169174

The Charter of the New Urbanism (2015). Available at: https://www.cnu.org/who-we-are/charter-new-urbanism

Criativa, Pedra Branca Cidade (2023). Um Pouco de História. Available at: https://www.cidadepedrabranca.com.br/um-pouco-de-historia.

Cullen, G. (1961). Concise Townscape (1.a ed.). Oxford, England: Architectural Press.

Daudén, P. J. L., Pinedo, J. C. & Moreno, M. B. (2022). Genealogía de la ciudad de 15 minutos: aproximación a los conceptos. *Cuadernos de investigación urbanística*, (142), 29-39. https://doi.org/10.20868/ciur.2022.142.4885

Ecobriefing (2009). Pedra Branca fará parte de projeto ambiental promovido por Bill Clinton. Retrieved from: https://ecobriefing.wordpress.com/category/programa-de-desenvolvimento-positivo-do-clima/. Acesso em: 27 ago. 2023.

Ellin, N. (1996). Urbanismo pós-moderno. Cambridge; Blackwell.

Gehl, J. (2013). Cidades para pessoas. 3ª edição. Tradução de Anita Di Marco. São Paulo: Perspectiva, 276, 1-10. Retrieved from:https://www2.fag.edu.br/professores/solange/2021.1%20%20URBANISMO%20LEG.%20URBANA%20EST.%20CIDADE/BIBLIOGRAFIA/4.4%20Livro_Cidade_para_pessoas_-_Jan_Gehl_text.pdf

Gibson, D. V., Kozmetsky, G. & Smilor, R. W. (Eds.). (1992). The technopolis phenomenon: Smart cities, fast systems, global networks. Boston Way: Rowman & Littlefield. Retrieved from: https://books.google.com.br/books?hl=pt-BR&lr=&id=_NxMwZfAafYC&oi=fnd&pg=PR9&dq=Gibson,+D.+V.,+Kozmetsky,+G.,+%26+Smilor,+R.+W.+(Eds.).+(1992).+The+technopolis+phenomenon:+Smart+cities,+fast+systems,+global+networks.+Boston+Way:+Rowman+%26+Littlefield.&ots=4WZTRl4KpC&sig=2LdZ3WLJ2Led2tDkfGnjV1IELJE&redir_esc=y#v=onepage&q&f=false

Glaeser, E. (2021). The 15-minute city is a dead end - cities must be places of opportunity for everyone. LSE COVID-19 Blog. Retrieved from: https://eprints.lse.ac.uk/111277/1/covid19_2021_05_28_the_15_minute_city_is_a_dead_end_cities_must_be.pdf

Howard, E. (2003). Garden cities of To-Morrow. *Organization & environment, 16* (1), 98-107. https://doi.org/10.1177/1086026602250259

Howard, E. (1996). Cidades-jardins de amanhã. Annablume. Retrieved from: https://books.google.com.br/books?hl=pt-BR&lr=&id=aTjH3-4qUwkC&oi=fnd&pg=PA7&dq=Howard,+E.+(1996).+Cidades-jardins+de+amanh%C3%A3.+Annablume.&ots=pq5OF7KB3Q&sig=dlVLDTM_onCJ6ewxcqnOlMfWdfc&redir_esc=y#v=onepage&q&f=false

Hall, P. (2002). Cities of tomorrow: an intellectual history of urban planning and design in the twentieth century. 3rd ed. Oxford, UK?; Malden, MA: Blackwell Publishers.Retrieved from: https://books.google.com.br/books/about/Cities_of_Tomorrow.html?id=zoDEf5__BM8C&redir_esc=y

Hall, P. (1988). Cidades do amanhã. São Paulo: Perspectiva. Retrieved from: https://edisciplinas.usp.br/pluginfile.php/6011956/mod_resource/content/1/Peter%20Hall%20%20A%20cidade%20no%20jardim.pdf

Hyra, D. (2015). Greasing the wheels of social integration: Housing and beyond in mixed-income, mixed-race neighborhoods. *Housing Policy Debate, 25* (4), 785-788. https://doi.org/10.1080/10511482.2015.1042206

Jacobs, J. (1961). The Death and Life of Great American Cities. New York: Random House.Retrieved from: https://www.buurtwijs.nl/sites/default/files/buurtwijs/bestanden/jane_jacobs_the_death_and_life_of_great_american.pdf

Krier, L. (1978). The reconstruction of the city. La Reconstruction de la Ville Européenne: Architecture Rationnelle= The Reconstruction of the European City: Rational Architecture. Brussels: Archives d'Architecture Moderne.

Kon, F. & Santana, E. F. Z. (2016). Cidades Inteligentes: Conceitos, plataformas e desafios. *In Congresso da Sociedade Brasileira de* Computação, 2-49.

López, L. (2015). *Dictionary of applied and professional geography: terminology for analysis, planning and management of the territory*, 139-140.

Macedo, A. (2007). Arquitextos 082.03: A Carta do Novo Urbanismo norte-americano. São Paulo: Vitruvius. *Integração: ensino, pesquisa, extensão, 13* (48), 11-21. Retrieved from: https://vitruvius.com.br/index.php/revistas/read/arquitextos/07.082/262

Manifesty, O. R. & Park, J. Y. (2022). A Case Study of a 15-Minute City Concept in Singapore's 2040 Land Transport Master Plan: 20-Minute Towns and a 45-Minute City. International Journal of Sustainable Transportation Technology, *5* (1), 1-11. http://dx.doi.org/10.31427/IJSTT.2022.5.1.1

McNeil, N. (2011). Bikeability and the20-min neighborhood: How infrastructure and destinations influence bicycle accessibility. *Transportation research record, 2247* (1), 53-63. https://doi.org/10.3141/2247-07

Melbourne Plan (2017). Plan Melbourne 2017-2050. Australia: Planning. Retrieved from: https://www.planmelbourne.vic.gov.au/the

Montaner, J. (2007). Arquitetura e Crítica.Barcelona: Gustavo Gili. Retrieved from: https://vitruvius.com.br/pesquisa /bookshelf/book/215

Moreno, C. (2016). La ville du quart d'heure: pour un nouveau chrono-urbanisme! Retrieved from: https://hal.science/hal-03763718/document

Moreira, S. (2021). O que é o Novo Urbanismo? ArchDaily Brasil. Retrieved from: https://www.archdaily.com.br/br/955574 /o-que-e-o-novo-urbanismo

Mumford, E. P. (2002). *The CIAM discourse on urbanism, 1928-1960.* MIT press. Retrieved from: https://books.google.com. br/books?hl=pt-BR&lr=&id=C4uNElGkBoYC&oi=fnd&pg=PR7&dq=Mumford,+E.+P.+(2002).+ The+CIAM+discourse+on+ urbanism,+1928-1960.+MIT+press.&ots=NluT_NHf61&sig=CQUr37h-344mwaSdC7gOHOwVobo&redir_esc=y#v=onepag e&q=Mumford%2C%20E.%20P.%20(2002).%20The%20CIAM%20discourse%20on%20urbanism%2C%201928-1960.% 20MIT%20press.&f=false

Nogueira, P. C. E. & Portinari, D. B. (2016). Urbanismo tático e a cidade neoliberal. *Arcos Design, 9* (2), 177-188. https://doi.org/10.12957/arcosdesign.2016.29397

Palhoça, P. (2022). O Portal on-line da cidade de Palhoça – Palhoça, Portal. (2022). O Portal On-Line Da Cidade de Palhoça - Portal Palhoça. Retrieved from: https://portalpalhoca.com.br/noticias/variedades/pedra-branca-projeta-boas-praticas-ambientais-sociais-e-de-governanca.

Pozoukidou, G. & Chatziyiannaki, Z. (2021). 15-Minute City: Decomposing the new urban planning eutopia. *Sustainability, 13* (2), 928. https://doi.org/10.3390/su13020928

Sepe, M. (2014). Creating Smart Urban Landscapes. A Multimedia Platform for Placemaking. *TeMA - Journal of Land Use, Mobility and Environment.* https://doi.org/10.6092/1970-9870/2474

Spaces, Project for Public (2008). *Donald Appleyard*. Retrieved from: https://www.pps.org/article/dappleyard.

UN. (2013). UN: more than 70% of the world's population will live in cities by 2050. 2013. Retrieved from: https://brasil.un.org/pt-br/62293-onu-mais-de-70-da-popula%C3%A7%C3%A3o-mundial-viver%C3%A1-em-cidades-at %C3%A9-2050. Accessed in March 2024.

UN. (2019). World population is expected to reach 9.7 billion people by 2050, says UN report. Retrieved from: https://brasil.un.org/pt-br/83427-populacao-mundial-deve-chegar-97-bilhoes-de-pessoas-em-2050-diz-relatorio-da-onu. Accessed in September 2023.

Zali, N., Gholami, N., Karimiazeri, A. R. & Azadeh, S. R. (2016). Planning according to new urbanism: the Ostadsara neighborhood case study. *TeMA - Journal of Land Use, Mobility and Environment, 9* (3), 323-341. https://doi.org/10.6092 /1970-9870/4023

Image Sources

Fig.1: Manifesty, Odilia Renaningtyas; PARK, Jin Young. A Case Study of a 15-Minute City Concept in Singapore's 2040 Land Transport Master Plan: 20-Minute Towns and a 45-Minute City. (2022) *International Journal of Sustainable Transportation, 5* (1), 1-11.

Fig.2: Manifesty, Odilia Renaningtyas; PARK, Jin Young. A Case Study of a 15-Minute City Concept in Singapore's 2040 Land Transport Master Plan: 20-Minute Towns and a 45-Minute City. (2022) *International Journal of Sustainable Transportation, 5* (1), 1-11.

Fig.3(a): https://www.cidadepedrabranca.com.br/front/images/Book_Conheca_2019_final-compactado.pdf;
   (b): Google Earth Satellite Images;

Fig.4: https://www.cidadepedrabranca.com.br/front/images/zoneamento.pdf

Fig.5(a): https://www.cidadepedrabranca.com.br/blog/conheca-o-passeio-pedra-branca/;
   (b): https://www.nsctotal.com.br/noticias/passeio-pedra-branca-tem-programacao-especial-para-criancas-durante-temporada-de-verao;
   (c): https://www.palhocense.com.br/noticias/st-patrick-s-day-sera-neste-fim-de-semana-em-palhoca;

Fig.6: Google Earth Satellite Images;

Fig.7(a) and (b): https://ndmais.com.br/infraestrutura/passeio-pedra-branca-reune-gastronomia-lojas-servicos-lazer-e-negocios/.

Author's profile

Marcela Juliana Cargnin

She is an architect and urban planner. She has a master in Architecture and Urbanism from the ATITUS Educação, Passo Fundo/RS, Brazil (2023); and holds a bachelor's degree in Architecture and Urbanism from the Integrated Regional University

of Alto Uruguai and Missões (URI), Santo Ângelo/RS, Brazil (2017). Her research is focused on Smart and Sustainable Cities, Urban Mobility and Innovation Ecosystems.

Cintia de Castro Marino

She is an architect and urban planner. She holds a postgraduate degree in Urban Form and Territory from the Polytechnic University of Catalonia (Spain). She has a master's and a PhD in Architecture and Urbanism from Mackenzie University. She is a Professor and Researcher in Urban Planning at the Master's Program in Smart and Sustainable Cities at Uninove in São Paulo, Brazil. In her researches, she analyzes participation processes and planning instruments to promote critical reflection.

Thaísa Leal da Silva

She is a professor at the Postgraduate Program in Architecture and Urbanism (PPGARQ) and at the undergraduate courses in Architecture and Urbanism, and Computer Science at ATITUS Educação in Passo Fundo/RS, Brazil. She has a PhD in Electrical and Computer Engineering from the University of Coimbra (UC), Portugal; Master in Microelectronics from the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Brazil; and holds a bachelor's degree in computer science from the Federal University of Pelotas (UFPel), Pelotas, Brazil. She is a member of the Research Group on Sustainability and Innovation (GPS) of UFRGS, Center for Innovation and Assistive Technology in Architecture and Urbanism (NITA-AU), Laboratory of Science and Innovation for Education (InovaEdu), and Center of Studies and Research in Urban Mobility (NEPMOUR). Her research is focused on Smart and Sustainable Cities, with emphasis in Energy efficiency, Urban mobility, and Inclusive Architecture.

TeMA

Highlighting circular cities trends in urban planning. A review in support of future research tendencies

Giulia Marzani [a]*, Simona Tondelli [b]

[a] Department of Architecture
Alma Mater Studiorum - University of Bologna, Italy
e-mail: giulia.marzani3@unibo.it
ORCID: https://orcid.org/0000-0002-1199-2581
* Corresponding author

[b] Department of Architecture
Alma Mater Studiorum - University of Bologna, Italy
e-mail: simona.tondelli@unibo.it
ORCID: https://orcid.org/0000-0003-0891-7852

Abstract

Circular economy is seen as an opportunity of overcoming the traditional linear model of consumption and production based on the "take-make-dispose" model, in favour of a more sustainable use of resources. It is acknowledged that the city scale is relevant in this transition towards circularity, even if there is a lack of implementation of the circular city through plans and policies. A higher understanding of the interrelations between circular economy and urban planning is therefore needed. This study, through a scoping review and a bibliometric analysis, allowed to systematize and analyse the knowledge about the existing trends in planning circular cities and to identify gaps for future research. What emerged is that a methodology to integrate circular economy principles into urban planning tools and procedures still does not exist in literature, even though some recurrent decision-making frameworks are frequently used and the topic is currently under debate.

Keywords

Circular cities; Urban planning; Scoping review; Bibliometric analysis.

1. Introduction

United Nations announced that the 55% of the world's population lives in urban areas and that the trend is increasing, with a projection of the figure reaching almost the 70% by 2050 (United Nations Department of Economic and Social Affairs, 2019). In this scenario of growth, sustainable development depends on how successfully finite natural resources will be managed in order to meet the Sustainable Development Goals of the Agenda 2030 (United Nations, 2015). However, in the initial phase of its implementation, and in particular between the COP21 in Paris (2016) and the COP26 in Glasgow (2021), more than half a trillion tons of virgin materials were consumed going worryingly beyond the planetary safe environmental limits, depicting a framework far from being sustainable (Circle Economy Foundation, 2023). In this regard, cities have a twofold role: on one hand, they counts for the 80% of the global GDP (World Bank, 2023) and are engines for innovation but, on the other hand, they are responsible for the consumption of around 75% of global energy and material flows (United Nations Environment Programme & International Resource Panel, 2013), emit the 70% of greenhouse gases emissions and produce about the 70% of global waste, although they cover less than 3% of world's surface (Mukim & Roberts, 2023; OECD, 2020). Efforts should be made to shape a new framework for urban development that allows cities to thrive and prosper without compromising the regenerative capacity of the planet. The linear model of consumption based on the concept of take-make-dispose is not considered sustainable anymore and experts are proposing to shift and embrace circularity processes (Gillai & Ling, 2022; Jørgensen & Pedersen, 2018). Circular Economy (CE) is a concept that has gained momentum for the last decade, even though its roots are more ancient. CE has been defined in many different ways, and scholars have different - and sometimes misleading - understanding of the concept. In fact, not all the definitions conceptualize CE as a systemic change and the main focus is often on economic prosperity with a lack of consideration of the social dimension (Kirchherr et al., 2017). One of the most comprehensive and shared definition is provided by the Ellen MacArthur Foundation, a pioneer entity in the field, according to which CE is restorative and regenerative by intention and design, and is based on three principles: eliminate waste and pollution, circulate products and materials and regenerate nature (Ellen MacArthur Foundation, 2015).

The relevance of CE transition in Europe is also underlined within the policy framework. The European Union adopted the first CE Action Plan[1] in 2015 and the new CE Action Plan in 2020[2], listing specific actions to be undertaken at EU level to foster the circular transition and meet the climate target. Indeed, the new CE Action Plan is one of the building blocks of the European Green Deal and circularity has been defined as a prerequisite for climate neutrality.

Within this framework, the city-dimension of circularity is considered necessary to fully accomplish sustainable development and tackle climate change, which implies to create environmental quality, economic prosperity and social equity for current and future generations (Kirchherr et al., 2017)

As far as circular cities development is concerned, many cities are defining themselves as circular, thus they are implementing the model in different ways (Nocca & Girard, 2018; Franco, 2023), and many initiatives emerged at European level like the Circular Cities Hub and the Circular City declaration. However, it is unclear what circular cities look like and what urban circularity means in practice (Prendeville et al., 2018). Indeed, a well-established and clear definition of circular city is still lacking and often circularity in cities has been associated to the closure of resources' flow at territorial level (Federico et al., 2023) thus overlapping with the urban metabolism concept. Many existing studies mainly focus on a specific topic or Country and there is a lack of comprehensive studies about how it is possible to plan circular cities. Many action plans are enacted at city or regional/national level, but they consist of voluntary tools aimed to explain the vision of the city and its territory. Understanding how (and if) CE is addressed in the ordinary planning instruments is an open debate

---

[1]   https://environment.ec.europa.eu/topics/circular-economy/first-circular-economy-action-plan_en.
[2]   https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN.

and requires further investigation. Therefore, this study mainly aims at summarising the existing interrelations between CE and urban planning, investigating the existing trends for planning circular cities through a scoping review. The objectives of the study are: i) to quantitatively assess the literature to find out which are the knowledge domains about this topic; ii) to systematize and analyse knowledge about the existing trends in planning circular cities; iii) to identify gaps and directions for further research. These purposes have been achieved through both a bibliometric search of the literature and a qualitative assessment. Following this introduction, the methodology is presented. Section 3 presents the results both in terms of bibliometric analysis outcomes and qualitative assessment. Review findings and their discussion is presented in Section 4, followed by the conclusions reported in Section 5.

2. Methodology

As already stated in the introduction, both qualitative and quantitative assessment have been conducted in this study, offering an understanding of domains definition of knowledge areas and gaps for future research. The research has been conducted through a scoping review carried out in Scopus[3] and Web of Science[4] databases, performed from October 2022 until May 2023, to collect and assess the available scientific articles, book chapters and contribution to conferences that are dealing with the planning dimension of circularity in cities.

In order to conduct this systematic scoping review, the PRISMA methodology (Page et al., 2021) has been used. PRISMA methodology allows to report in a transparent way the process of papers selection through a flow diagram that synthetize the process; the use of this well-established guideline eases the replicability of the adopted approach. The query that has been structured includes a combination of the keywords: "circular economy", "urban planning" or "spatial planning", "circular urban development", "circular cities", "indicator". Only publications in the timeframe 01 January 2015 – 31 March 2023 (date of the last access to the two databases) have been considered.

A total of 195 reports have been sought for retrieval after the screening of the title and the abstract that allowed to identify the coherence of the addressed topics with the research scope. On this sample, a bibliometric analysis has been conducted with the support of Biblioshiny for Bibliometrix software (Aria & Cuccurullo, 2017). Among others, the software allowed to examine the temporal distribution of the publications, the most frequent journals and the most used keywords by the authors. It is particularly useful in allowing to perform the thematic analysis based on the authors' keywords, that can reveal the focus areas of the research in the field and their distribution and correlation, allowing the understanding of emerging phenomena by identifying on which topics the attention is primarily posed by academics (J. Li et al., 2022).

In a second stage, 22 records not retrieved for the unavailability of the full texts have been excluded given the impossibility of reviewing the contents. Moreover, it has been defined through the review the relevance of each remaining paper to the research scope. Therefore, the 173 retrieved records have been classified in three groups, namely "Low", "Medium" and "High" relevance. Low relevance has been assigned to those papers not dealing with circular economy practices in cites nor adopting a European focus; medium relevance is attributed to research focusing only marginally on circularity in cities with few implications for urban planning; highly-relevant papers are those interpreting circularity at urban scale according to an holistic perspective and with a strong focus on urban planning dimension. As a consequence of this refining stage, a number of 119 medium-to-high relevant papers have been included in the review and deeply assessed through the full-text analysis. The results and the selection process are shown in Fig.1. The complete list is available in the Annex.

---

[3]   https://www.scopus.com/search/form.uri?display=basic&zone=header&origin=savedsearch#basic
[4]   https://clarivate.com/products/scientific-and-academic-research/research-discovery-and-workflow-solutions/webofscience-platform/
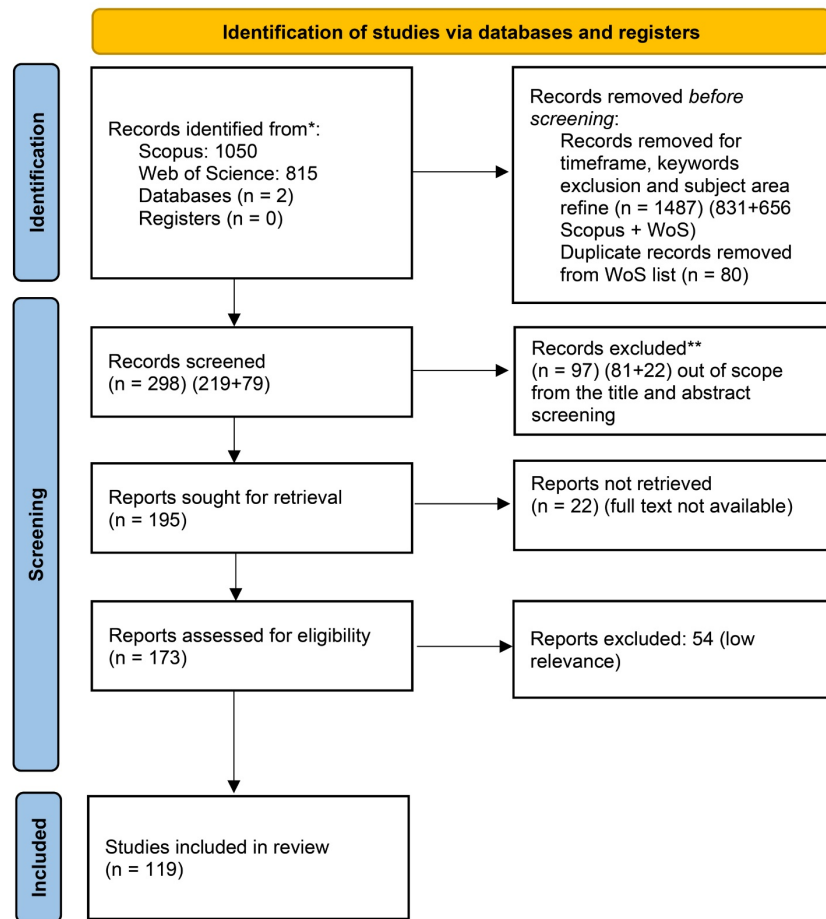
Fig.1 PRISMA 2020 flow diagram representing the selection and filtering process

3. Results

While the bibliometric review has served as a starting point to understand which themes have been associated to the circular city concept if the planning perspective is adopted, through a full text analysis a more in-depth assessment has been carried out and results have been clustered according to the planning focus categories described below. It is worth underlying that these latter have not been established a priori but have been structured according to the following outcomes of the review:

– *Specific focus areas:* if the paper is mainly addressing specific topics that are often associated with CE in the built environment like urban metabolism, natural resources recovery, waste management;

– *Spatial implications*: it is assigned to those papers that are dealing with the experimentation of circularity practices in specific urban areas and are analysing spatial consequences of those practices;

– *Monitoring*: if the paper is proposing a new monitoring framework for circular cities, theme that is central to the scientific debate;

– *Support decision-making*: tools and methodologies specifically designed in support of circularity in urban planning;

– *Participation and engagement*: if the publication is considering the social dimension of circularity and provide insights about participation in decision-making. This topic has been considered the less addressed by the literature about CE so far, but is acquiring importance in about the field of planning procedures;

– *Theoretical/methodological findings*: if the paper is proposing a methodology to interpret the circular city and how to plan for it. The same, if the publication is approaching the circular city from a theoretical perspective.

Moreover, publications have also been clustered according to the sustainability dimension they are referring to that have been extended over time to tackle the complexity of urban and territorial transformations (Sugoni et al., 2023). Social, economic, environmental, governance/institutional, cultural or multidimension are those spheres identified as relevant for the present research, based on a more comprehensive interpretation of sustainability. The two following paragraphs show the results according to the bibliometric review and the full-text analysis respectively.

3.1 Results from the bibliometric analysis

As mentioned in the methodology section, a total of 195 papers have been analysed through a bibliometric analysis, in the timeframe January 2015 – March 2023. As illustrated in Fig.2, the scientific production on CE is constantly rising from 2016 onward, with a peak reached in 2021. The boost has occurred in 2019 during which 30 papers have been published, especially if compared to the 9 published throughout 2018. Year 2021 is the most productive year with 54 publications recorded. This trajectory reflects the evolution of the European policy framework which started to focus on CE since 2015, when the first circular economy action plan has been enacted, followed by the new circular economy action plan in force since 2019. As far as the most relevant journals are concerned, the most quoted one is *Sustainability* followed by the *Journal of Cleaner Production* and *Resources, Conservation and Recycling* (Fig.3). Fig.4 shows the trend of the 5 most relevant journals production over time.
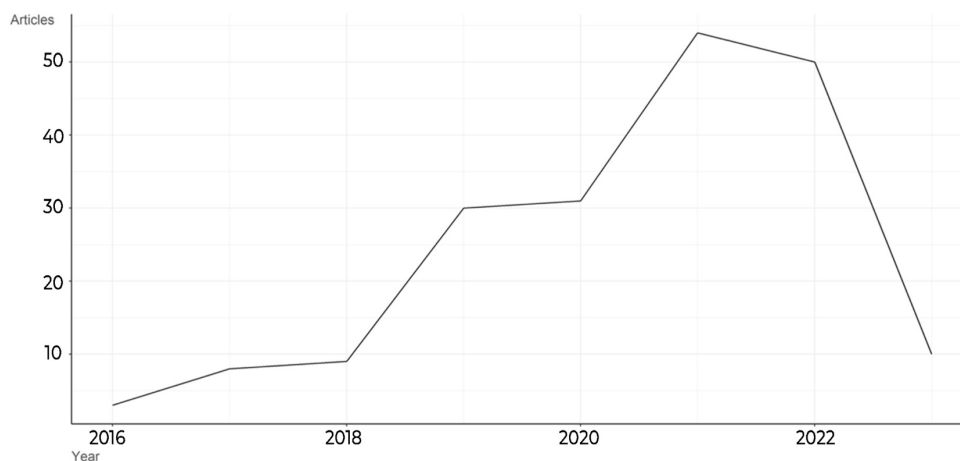
Fig.2 Annual scientific production (created with Biblioshiny)
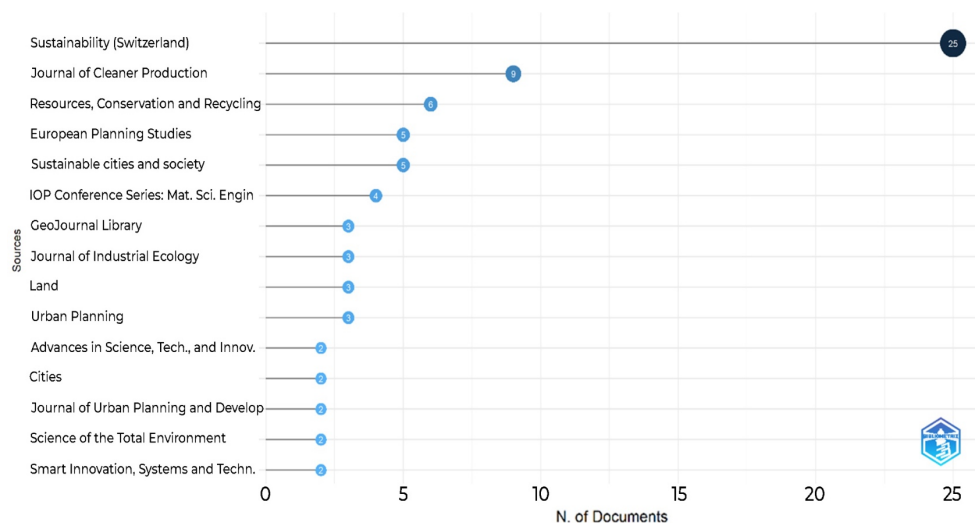
Fig.3 Most relevant journal (created with Biblioshiny)
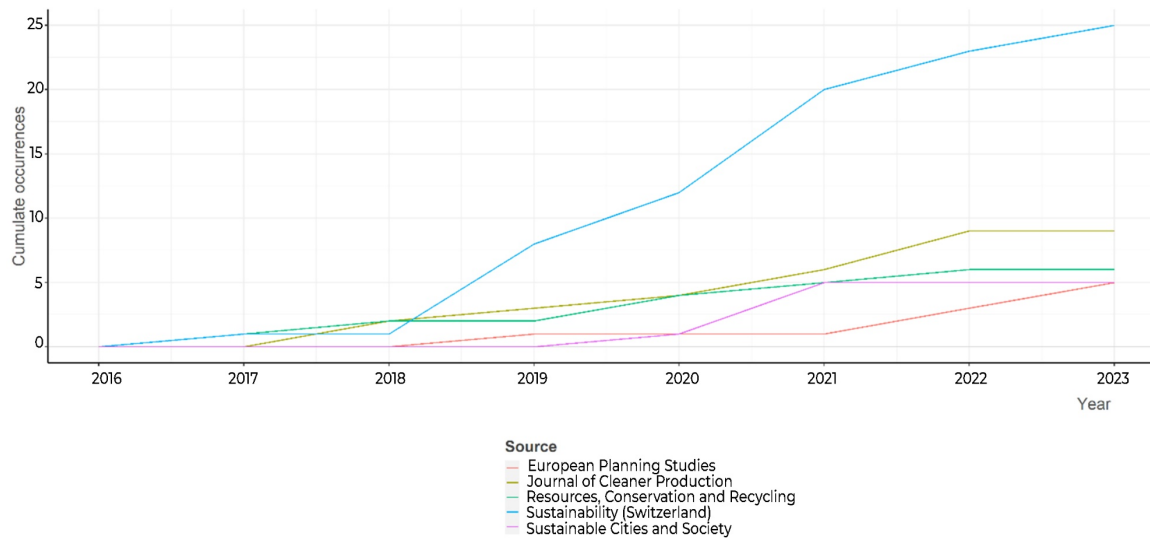
Fig.4 Journals' production over time (created with Biblioshiny)

The keywords analysis has been reported in the form of a word cloud (Fig.5) which emphasizes the most frequent keywords used by the authors associated to the concepts of circular city and urban planning. It has been found out that the most frequent ones associated with circular cities are "sustainability" and "sustainable development", "waste management", "urban metabolism" and "ecosystem services". In terms of thematic analysis, Fig.6 identifies motor themes, basic themes, emerging or declining themes and niche themes according to a thematic analysis conducted per authors' keywords (Aria et al., 2022). The algorithm is not able to cope with textual nuances like "cities" and "city" or "climate-change" and "climate change" that conceptually have the same significance but are producing different clusters. Consequently, in order to ensure clarity and the correct interpretability if the connected keywords, a list of synonyms has been created after a first keyword screening that has been manually conducted. In addition to the synonyms, the keyword "article" has been eliminated since not meaningful per se. As a result, 13 clusters are formed.

Fig.5 Word cloud based on the frequency of Authors' keyword excluding the words "circular economy", "circular cities" and "urban planning" (created with Biblioshiny)

The most central cluster is the one grouping CE, urban planning, sustainable development, urban metabolism and waste management, meaning that this cluster is linked with several other clusters. The density is high, but it is not the highest, and this can be interpreted as quite-high correlation with other clusters.

Clusters formed by buildings (associated with adaptive reuse, cultural heritage and material flow analysis), spatial planning (with urban regeneration, resource management and monitoring practices) and recycling (with

life-cycle assessment, ecology and renewable energy) have high level of centrality and density, placing those topics as the strategic core of the fields, very close to each other's and also linked to several other topics.

The clusters formed by circular city, climate change, economy and built environment are representing significant and cross-cutting issues, also among different research themes. It means that they are linked with numerous keywords, but not strongly interrelated with the other in the quadrant and can be considered quite generic but essential for a good understanding of the field (ibid.).

The group of concepts referred to ecosystem services and nature-based solutions (NBS) is placed in-between the basic and motor themes becoming more and more interrelated with the other clusters already present in the motor themes quadrant. Among the meaningful emerging or declining themes, there are the clusters formed by the systemic approach and Amsterdam metropolitan Area, and the one referring to the adoption of a new way of city planning. They represent topics that are not fully developed for the domain of research and that are still in their infancy and that can potentially originate new trends. Lastly, niche themes are those that result strongly developed but still marginal in the framework.
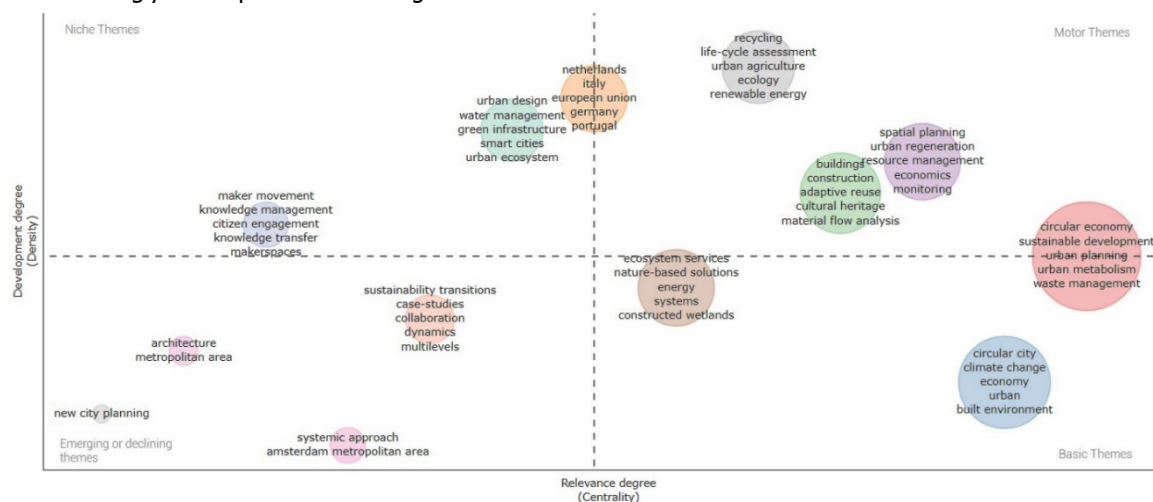
Fig.6 Thematic map of topics discussed in the period 2015 - March 2023[5]

3.2 Thematic analysis according to the full-text screening outcomes

This section is reporting the results of the full-text analysis carried out on the smaller sample of 119 medium-to-highly relevant papers. The distribution of the publications per dimensions covered by the documents are represented in Fig.7. The majority of the publications (56%) covers more than one dimension. Fig.8 provides details about the spheres touched by these latter.
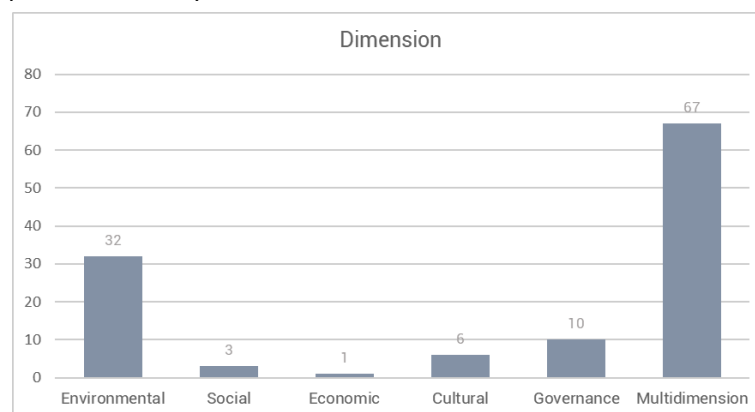
Fig.7 Distribution of the publications according to the touched dimensions

---

[5]   The keywords "circular cities" and "circular city" have been considered synonyms and the keyword "article" has been eliminated.
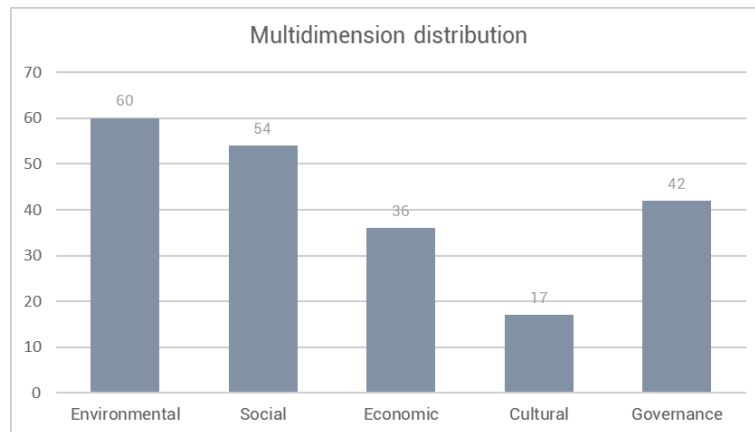
Fig.8 Dimensions considered by multi-dimension papers

As far as the planning focus is concerned, the majority of the publications (34%) are covering specific areas of investigation (see Fig.9), thus not providing a holistic picture of the circular city. Conversely, the 18% of the papers are investigating this latter concept both in terms of defining it and proposing methodologies to plan for circular cities. Participatory approach is the less represented area of analysis. Multi-perspective papers are constituting the 23% of the sample and they are mainly coupling theoretical findings with specific focus areas or monitoring proposals or methodologies for supporting decision-making (see Fig.10).
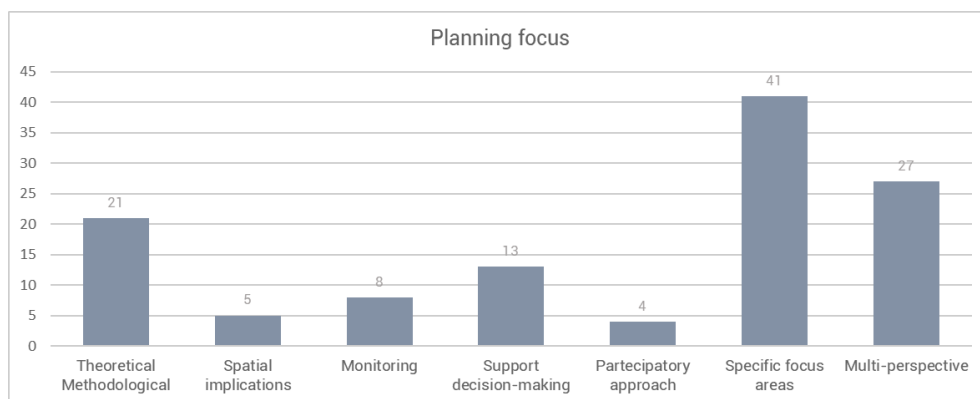
Fig.9 Distribution of the publications according to the touched planning focus
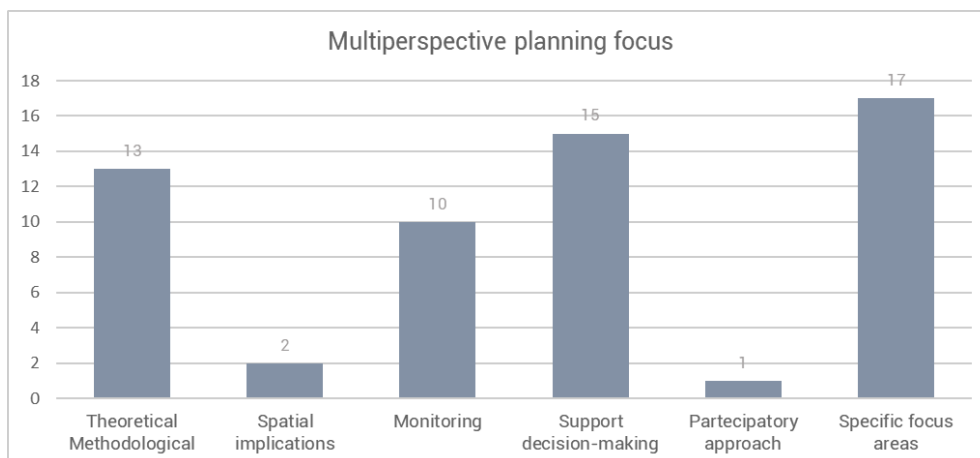
Fig.10 Aspects addressed by multi-perspective papers

4. Review findings and discussion

Based on the literature review, urban and spatial planning role in relation to CE is becoming more and more investigated in the last two years, period during which the majority of publications is considered as highly relevant. This is reflected by the evolution of the concept, since CE became relevant in the economic sector especially from 2010 when the Ellen MacArthur Foundation is born, becoming a pioneer in the field. In the first years, attention has been posed mainly to CE at micro-level and at industrial scale, while the city scale has gained attention more recently, also due to the European policy context evolution.

4.1 Highlighting the main theoretical/methodological key findings

Only 46 out of 119 papers contain the keywords "circular city" or "circular cities" and 13 of them are still dealing with sectorial approaches like recycling, NBS, ICT, material flows and urban agriculture. The lack of integration between CE and urban planning is thus confirmed, and a methodology to integrate the two dimensions still does not exist in practice. Petit-Boix et al. (2018), through a literature review, quantified the environmental balance of CE initiatives promoted at the municipal level, providing clear recommendation to increase the attention on social consumption and urban planning when addressing CE challenges that directly affect urban areas. The same recommendation of integrating CE in urban planning to further accelerate its implementation in urban areas is expressed by van der Leer (2018) while studying a vertical integration through scales (micro-meso-macro) and horizontal integration through socio-technical and socio-ecological systems and recommending that bottom-up and top-down efforts should reinforce each other (van der Leer et al., 2018). Moreover, Turcu & Gillie (2020) study the governmental aspects of CE, by analysing the planning practices and tools of 28 municipalities in London, highlighting the lack of integration of CE practices into the city Urban Plans but its potentialities (Turcu & Gillie, 2020).

As far as the conceptualization of circular cities is concerned, scholars started from highlighting the limitations of the CE frameworks and operationalisation methods when approaching the city scale (Prendeville et al., 2018; van der Leer et al., 2018; Williams, 2019a, 2021a, 2022). Williams, J. is the most recurrent author, with 6 publications in the field; her conceptualization of the circular development is based on looping, regenerative, and adaptive actions, starting from the examination of the well-known RESOLVE framework (Ellen MacArthur Foundation, 2015) and its limitations when applied to cities (Williams, 2019a). Her work depicts a clear and holistic approach towards circular urban development that is addressed also from the urban planning perspective (Williams, 2020, 2023) and through the analysis of four cities' actions: London, Paris, Stockholm and Amsterdam (Williams, 2021a). Benefits and challenges to circular urban development have also been assessed (Williams, 2019b, 2021b, 2022). Another holistic framework is the one proposed by (Girard & Nocca, 2019) who acknowledge the role of the circular city to tackle social inequalities and the ecological crises in a systemic perspective proposing a definition that goes in this direction, highlighting the need of holding together the objectives of environmental sustainability and the social justice.

The social dimension results as one of the less represented and premature (Prendeville et al., 2018) and only recently it is gathering more and more attention, with an increasingly number of publications integrating social aspects while applying CE in cities, at least in theoretical and methodological framework development. This is confirmed by both the quantitative and qualitative analysis: the social dimension is considered in many papers of the scoping review but only three are addressing it as the main topic of discussion, and it is clustered among the niche themes, meaning that it is strongly developed but still marginal in the framework.

Campbell-Johnston et al. (2019) analysed the Dutch key municipal instruments and noted that they include public procurement, zoning laws, capacity building and knowledge exchange as practices to be applied to municipal purchases. However, many limitations are presented in the study, concluding that multi-level policy integration is needed to change value chains enabling reduction in material input and changes in consumption practices (Campbell-Johnston et al., 2019).

4.2 Trends in supporting decision-making processes and citizens' engagement

According to the clustering made by the authors, decision-making processes supporting the development of circular cities appears from 2019 in literature both in the form of insights for policymakers or policy recommendation and as tools or models. GIS has been used by a few authors only and mainly to integrate CE principles in the built environment, including the historical part of the cities. The need of adopting a multi-disciplinary perspective for achieving circular cities is acknowledged (Chang & Chang, 2020; Paiho et al., 2021). The use of multi-criteria decision-making models goes towards this direction, trying to assess specific issues (e.g. mobility alternatives (Pamucar et al., 2021), optimal green areas location (Nesticò et al., 2022), alternative regenerative strategies (Cerreta et al., 2020)) but taking into consideration the effects on different spheres, like the social, economic and cultural ones. Among the most recurrent methodologies adopted by academics (Augiseau & Kim, 2021; Domenech & Borrion, 2022; Q. X. Li et al., 2022), the Sankey diagrams (Hanzl et al., 2020), the scenario-building methodology and the use of PROMETEE tool and its adaptation (Cerreta et al., 2020; Cerreta et al., 2020; Della Spina, 2022). In general, these are useful tools for investigating the state of the art of the considered territories; indeed, the results coming from the flows mapping allow cities to identify the priorities of intervention and possible actions based on what sector impacts the most in the city, however, how to integrate the results in urban planning tools and regulations is still to be recognised.

Another trend to highlight is the stakeholders' involvement in the decision-making processes, as a crucial factor for pursuing a holistic transition towards circularity in cities. Geodesign decision support environment and living labs (Arciniegas et al., 2019), semi-structured interviews (Yalcin & Foxon, 2021), collaborative spaces like makerspaces (Premyanov et al., 2022) are the methodologies used for the engagement of relevant stakeholders, citizens and policy makers towards a switch from a linear to a circular vision of the future in cities. However, the studies on this topic are still in their infancy, given the low numbers of results coming from the literature review. More efforts are needed to foster cross-sectorial collaboration, especially inside the public administrations and through an increasing of citizens' participation. In fact, bottom-up and top-down processes are complementary for a vision of a future-proof city (Prendeville et al., 2018; van der Leer et al., 2018). People's choices, behaviours and lifestyles plays an important role in achieving sustainable development, however only few papers address the challenges of developing community-driven initiatives providing recommendations for cities to address sustainability issues under the lens of CE, developing a human-centred framework (Bosone & Ciampa, 2021; Coskun et al., 2022; Ouillon et al., 2017).

4.3 The importance of establishing a monitoring procedure

Several monitoring frameworks have been proposed by scholars, starting from a review of the existing ones and embracing holistic visions of a circular city (Balletto et al., 2022; Birgovan et al., 2022; de Ferreira & Fuso-Nerini, 2019; Girard & Nocca, 2019; Paiho et al., 2020; Paoli et al., 2022; Papageorgiou et al., 2021).

However, the absence of a well-established and consolidated system of indicators is a critical point that reflects the complexity of the phenomenon and the absence of a consolidated definition of circular city. It is difficult to monitor something that is not well defined and for which a shared definition still does not exist. In particular, focusing on the urban planning perspective and the possibility of integrating CE principles into urban planning tools, much more effort is needed to select few but significant indicators, to allow the public administration in charge of planning and monitoring the transformation to effectively apply and manage them.

A first proposal of indicators for urban planning and circularity is offered by Girard & Nocca (2019) trying to embrace the different sectors of the discipline in a comprehensive way. Many other monitoring framework are proposed, but they focus only on specific sectors of CE in cities (e.g. social indicators, waste management, industrial symbiosis, adaptive reuse of cultural heritage) (Bosone et al., 2021; Bosone & Ciampa, 2021; Domenech & Borrion, 2022; Feiferytė-Skirienė & Stasiškienė, 2021; Gravagnuolo et al., 2019; Vanhuyse et al.,

2021), confirming the fragmentation of the approaches in the field and the necessity of establishing a common reference framework with different levels of details, according to the addressed scale and specificities.

This approach would allow to make the results aligned and comparable among the European cities, thus maintaining their specificities and acknowledging the different territorial needs.

4.4 Focus areas. What is discussed the most?

The majority of the collected medium-to-high relevant publications are addressing a specific topic and, in particular, these publications cover all the clusters present among the motors and basic themes depicted in Fig.6. To draw some considerations, three areas of investigation will be followed: material flows, built environment and natural capital.

When it comes to this latter, a great attention is posed on NBS which is well explained considering that nature regeneration is one of the pillars of the CE. Therefore, scholars have assessed the potentialities of regeneration practices based on nature under a CE perspective, highlighting the role of NBS especially on resources recovery (Katsou et al., 2020; Kisser et al., 2020; Langergraber et al., 2020, 2021) and water management (Oral et al., 2021).

As for the built environment, many pieces of research are focusing on it since it is considered the sector that pollutes the most and consumes the major quantities of resources (Pomponi & Moncaster, 2017). Therefore, the transition towards a circular built environment is considered very relevant for achieving sustainability goals, introducing the concept of urban mining and life-cycle assessment as powerful tools for the analysis of the status quo and for providing interesting insights for policies (Balletto et al., 2021). However, even though some circular city frameworks are based on the conceptualisation of a circular built environment, they do not deepen the typology of the needed instruments and do not address how these policies can be operationalized, and which would be the dialogue with urban planning tools for their effective implementations (Ancapi et al., 2022). The adaptive reuse of cultural heritage buildings (as presented in Bosone et al., 2021; Foster, 2020; Foster & Saleh, 2021a; Giannakopoulos et al., 2022; Nocca & Angrisano, 2022; Pintossi et al., 2021) is considered coherent with an holistic vision of a circular city, especially concerning the adaptive actions and reuse practices that are mentioned in some methodological framework proposed (Foster & Saleh, 2021b; Girard & Nocca, 2019; Gravagnuolo et al., 2021; Nocca & Angrisano, 2022; Pintossi et al., 2021).

Another relevant sector is related to the study of resource flows and waste management, given the importance that every CE initiative gives to the closure of waste-resources cycles. Urban metabolism and circular urban metabolism are the translation at urban scale of these studies, even though there is the need not only to know which are the flows of the city but where the flows actually occur. In this regard, mobility and transports are only marginally addressed by scholars with few papers in the collection.

Given the low numbers of publications addressing the role of ICT in the paradigm shift, it can be argued that digital technology is theoretically recognized as a powerful driver for the circular transition, but still with a marginal role when it comes to CE in urban planning. This is also coherent with the thematic analysis reported above, in which smart cities are included in the cluster of urban design in the niche themes. In fact, they are well developed and relevant concepts but still marginal in the analysed research domains.

4.5 Spatial implication of CE in cities. What is the scale to be considered?

In a city, the definition of the scale matters, since scales implies different urban players and competences. The analysis of spatial implications connected to the application of the CE in cities brings up interesting reflections upon the role of urban planning, even if only few papers have been clustered as specifically dealing with the topic. This is also confirmed by the fact that case studies are among the niche themes in the bibliometric review, still having a marginal role in the framework.

Marin & De Meulder (2018) is interpreting circularity at regional level, asserting that landscape design is the discipline capable of addressing multi-scalarity and place-specificity in the circular transition. Their research is based on the flows' analysis. Some pieces of research are also focusing on lower scale like the district one, as Andreucci & Croci (2021) who provided outcomes from projects and case studied to test and validate circularity at local scales. Van den Berghe & Vos (2019) claim that there is a lack of clear definition of circularity in reference to spatial planning and area development and that different approaches are adopted. The cases studies of the research are in Amsterdam and Utrecht and the results show that circularity is not emphasizing the organization of space in a circular way, but it is accelerating the transformation of urban industrial areas into circular-built residential and commercial areas only. The authors stress the importance of coupling physical transformations pursuing circularity with circular functioning of the areas. Verga & Khan (2022) are analysing spatial factors fostering or hampering the embedding of urban circularity practices, stressing that their enablers are the re-thinking of land use preserving valuable urban functions (e.g. agriculture and fertile soil), exploiting public support (e.g. regulations, taxations, specific selection criteria in tendering) and embracing and fostering a cultural shift towards more frugal and inclusive behaviours. Therefore, urban planners have the role and the potentiality to assess projects according to their contribution in fostering urban circularity practices and ambitions.

5. Conclusions and research limitations

The present research has the main aim of understanding the state of the art about the interrelations between the concept of the circular city and the urban planning sphere, identifying the actual trends of discussion and further lines of research.

Even though the closure of resources' flow at territorial level is often paired with the application of CE principles at city scale (Federico et al., 2023), the first research trend that emerged from the review is the multi-disciplinarity of the topic, given the many different applications of the CE concept at city scale and the role of urban planning that is dealing with multi-dimensional transformations of the cities. Besides the material flows and waste management practices, other dimensions as NBS and cultural heritage adaptive reuse emerged. The interest in the social impacts of CE applications in cities is also increasing in respect to 2018 (Girard & Nocca, 2019), although it is still marginal in the framework. The same is true for participation processes, still not widely addressed in the publications, but considered as an important topic.

As also argued Franco S. (2023) it is proven that a unique definition and interpretation of the circular city concept is still missing, and it is verified also as far as the urban planning sphere is concerned. The necessity of establishing a shared framework with different levels of detail, according to the addressed scales and specificities is confirmed. In terms of scale, the analysis highlighted that the closure of resources and waste cycles can be hardly managed at city level, requiring synergies that have to be identified beyond the administrative boundaries of the municipality. Indeed, according to many academics, some of the cycles can be closed only at regional or even at national and European level. Conversely, to foster the transition towards circularity at city scale, the focus on the built environment and the natural capital of the city appears more relevant, as well as the role of citizens in being adaptive and supporting the transition. A change in social behaviour and values is indeed required. However, a one-size-fits all approach is not the solution to simplify and systematize the operationalization of the circular city concept. What should be instead pursued, is a flexible approach that serves as a guidance to fix the fundamental concepts of circularity in cities, but allowing the tailoring to the local specificities in its translation to the reality. Diversity and specific social values have to be preserved and maintained for a successful transition, which has to be shared with the citizens to effectively accomplish it.

Although this research aims at presenting a holistic analysis of circular cities studies and identified future directions, it has some limitations. First, only two databases have been selected and all the initiatives coming

from the implementation of cities circular strategies are not included in the repository as well as the grey literature. In addition, articles may be missing during filtering process through limitation of subject areas or keyword exclusion. Moreover, the authors analysed papers with full text available only, with the possibility of having missed relevant publications.

Nevertheless, it can be argued that the integration of CE principles into urban planning tools and practices is under discussion and a methodology in support of policymakers is not yet defined: in this regards, policy insights and recommendations are provided based on the analysis of specific case studies and usually dealing with one specific asset of the city.

References

Ancapi, F.B., Van den Berghe, K. & van Bueren, E. (2022). The circular built environment toolbox: A systematic literature review of policy instruments. *Journal of Cleaner Production*, *373*. https://doi.org/10.1016/j.jclepro.2022.133918

Andreucci, M.B. & Croci, E. (2021). Assessing Integrated Circular Actions as Nexus Solutions Across Different Urban Challenges: Evidence Toward a City-Sensitive Circular Economy. In A. Bisello, D. Vettorato, H. Haarstad & B.B.J (Eds.). *Smart and Sustainable Planning for Cities and Regions*. Springer Science and Business Media Deutschland GmbH.

Arciniegas, G., Šileryté, R., Dąbrowski, M., Wandl, A., Dukai, B., Bohnet, M. & Gutsche, J.-M. (2019). A geodesign decision support environment for integrating management of resource flows in spatial planning. *Urban Planning*, *4* (3), 32–51. https://doi.org/10.17645/up.v4i3.2173

Aria, M. & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11* (4), 959-975. https://doi.org/10.1016/j.joi.2017.08.007

Aria, M., Cuccurullo, C., D'aniello, L., Misuraca, M. & Spano, M. (2022). Thematic Analysis as a New Culturomic Tool: The Social Media Coverage on COVID-19 Pandemic in Italy. *Sustainability*, *14* (6). https://doi.org/10.3390/su14063643

Augiseau, V. & Kim, E. (2021). Inflows and outflows from material stocks of buildings and networks and their space-differentiated drivers: The case study of the Paris Region. *Sustainability*, *13* (3), 1-21. https://doi.org/10.3390/su13031376

Balletto G., Borruso G., Mei G. & Milesi A. (2021). Recycled aggregates in constructions. A case of circular economy in Sardinia (Italy). *TeMA - Journal of Land Use, Mobility and Environment*, *14* (1), 51-68. https://doi.org/10.6092/1970-9870/7354

Balletto, G., Ladu, M., Camerin, F., Ghiani, E. & Torriti, J. (2022). More Circular City in the Energy and Ecological Transition: A Methodological Approach to Sustainable Urban Regeneration. *Sustainability*, *14* (22). https://doi.org/10.3390/su142214995

Birgovan, A.L., Lakatos, E.S., Szilagyi, A., Cioca, L.I., Pacurariu, R.L., Ciobanu, G. & Rada, E.C. (2022). How Should We Measure? A Review of Circular Cities Indicators. *INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH*, *19* (9). https://doi.org/10.3390/ijerph19095177

Bosone, M. & Ciampa, F. (2021). Human-centred indicators (HCI) to regenerate vulnerable cultural heritage and landscape towards a circular city: From the Bronx (NY) to Ercolano (IT). *Sustainability*, *13* (10). https://doi.org/10.3390/su13105505

Bosone, M., De Toro, P., Girard, L.F., Gravagnuolo, A. & Iodice, S. (2021). Indicators for Ex-Post Evaluation of Cultural Heritage Adaptive Reuse Impacts in the Perspective of the Circular Economy. *Sustainability*, *13* (9). https://doi.org/10.3390/su13094759

Campbell-Johnston, K., ten Cate, J., Elfering-Petrovic, M. & Gupta, J. (2019). City level circular transitions: Barriers and limits in Amsterdam, Utrecht and The Hague. *Journal of Cleaner Production, 235*, 1232-1239. https://doi.org/10.1016/j.jclepro.2019.06.106

Cerreta, M., di Girasole, E.G., Poli, G. & Regalbuto, S. (2020). Operationalizing the Circular City Model for Naples' City-Port: A Hybrid Development Strategy. *Sustainability*, *12* (7). https://doi.org/10.3390/su12072927

Cerreta, M., Mazzarella, C., Spiezia, M. & Tramontano, M.R. (2020). Regenerativescapes: Incremental evaluation for the regeneration of unresolved territories in East Naples. *Sustainability*, *12* (17). https://doi.org/10.3390/SU12176975

Chang, A.P. & Chang, S.L. (2020). Build up circular city planning index with EAM. *2020 3rd International Conference of Green Buildings and Environmental Management*, *531*. https://doi.org/10.1088/1755-1315/531/1/012016

Circle Economy Foundation (2023). *Circularity Gap Report* 2023. Retrieved at: https://www.circularity-gap.world/2023#download

Coskun, A., Metta, J., Bakirlioglu, Y., Cay, D. & Bachus, K. (2022). Make it a circular city: Experiences and challenges from European cities striving for sustainability through promoting circular making. *Resources Conservation and Recycling*, *185*. https://doi.org/10.1016/j.resconrec.2022.106495

de Ferreira, A.C. & Fuso-Nerini, F. (2019). A framework for implementing and tracking circular economy in cities: The case of Porto. *Sustainability*, *11* (6). https://doi.org/10.3390/SU11061813

Della Spina, L. (2022). Urban Regeneration Strategies According to Circular Economy: A Multi-criteria Decision Aiding Approach. In F. Calabrò, L. Della Spina, M.J. Piñeira Mantiñán (Eds.). *New Metropolitan Perspectives. Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages Perspectives*. 482 LNNS. Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-3-031-06825-6_64

Domenech, T. & Borrion, A. (2022). Embedding Circular Economy Principles into Urban Regeneration and Waste Management: Framework and Metrics. *Sustainability*, *14* (3). https://doi.org/10.3390/su14031293

Ellen MacArthur Foundation (2015). *Growth within a circular economy vision for a competitive Europe*. Retrieved from: https://www.mckinsey.com/capabilities/sustainability/our-insights/growth-within-a-circular-economy-vision-for-a-competitive-europe#/

Federico K., Di Giustino G., Ferraioli E. & Lucertini G. (2023). Circular and metabolic perspectives in urban contexts. Integrated flows analysis for an ecological transition. *TeMA - Journal of Land Use, Mobility and Environment*, (2), 143-157. https://doi.org/10.6093/1970-9870/10196.

Feiferytė-Skirienė, A. & Stasiškienė, Ž. (2021). Seeking circularity: Circular urban metabolism in the context of industrial symbiosis. *Sustainability*, *13* (16). https://doi.org/10.3390/su13169094

Foster, G. (2020). Circular economy strategies for adaptive reuse of cultural heritage buildings to reduce environmental impacts. *Resources, Conservation and Recycling*, *152*. https://doi.org/10.1016/j.resconrec.2019.104507

Foster, G. & Saleh, R. (2021a). The Adaptive Reuse of Cultural Heritage in European Circular City Plans: A Systematic Review. *Sustainability*, *13* (5). https://doi.org/10.3390/su13052889

Foster, G. & Saleh, R. (2021b). The Circular City and Adaptive Reuse of Cultural Heritage Index: Measuring the investment opportunity in Europe. *Resources Conservation and Recycling*, *175*. https://doi.org/10.1016/j.resconrec.2021.105880

Franco, S. (2023). Circular economy in urban areas: evidence from global cities. *TeMA - Journal of Land Use, Mobility and Environment*, *16* (1), 239-243. https://doi.org/10.6093/1970-9870/9821

Giannakopoulos, D., Karekou, Z., Menegaki, E., Tsilimantou, E., Ioannidis, C., Maistrou, E., Giannikouris, A. & Moropoulou, A. (2022). Reuse of Historic Buildings in the Medieval City of Rhodes to Comply with the Needs of Sustainable Urban Development. *Land*, *11* (8). https://doi.org/10.3390/land11081214

Gillai, B. & Ling, C. Y. (2022). *White Paper | The Road Toward a Circular Value Chain*. Stanford graduate school of business — Value Chain Innovation Initiative. Available at: https://www.gsb.stanford.edu/sites/default/files/publication/pdfs/whitepaper-2022-jul-road-toward-circular-value-chain.pdf

Girard, L.F. & Nocca, F. (2019). Moving towards the circular economy/city model: Which tools for operationalizing this model? *Sustainability*, *11* (22). https://doi.org/10.3390/su11226253

Gravagnuolo, A., Angrisano, M. & Girard, L.F. (2019). Circular economy strategies in eight historic port cities: Criteria and indicators towards a circular city assessment framework. *Sustainability*, *11* (13). https://doi.org/10.3390/su11133512

Gravagnuolo, A., Micheletti, S. & Bosone, M. (2021). A Participatory Approach for "Circular" Adaptive Reuse of Cultural Heritage. Building a Heritage Community in Salerno, Italy. *Sustainability*, *13* (9). https://doi.org/10.3390/su13094812

Hanzl, M., Geerse, A., Guschl, L. & Dewan, R. (2020). Urban metabolism and land use optimization: In quest for modus operandi for urban resilience. In P. Pinto Santos, K. Chmutina, J. Von Meding, E. Raju (Eds.). *Understanding Disaster Risk: A Multidimensional Approach.* 109-130. Amsterdam: Elsevier. https://doi.org/10.1016/B978-0-12-819047-0.00007-X

Jørgensen, S. & Pedersen, L.J.T. (2018). The Circular Rather than the Linear Economy. In S. Jørgensen & L.J.T. Pedersen (Eds.). *RESTART Sustainable Business Model Innovation.* 103-120. Springer International Publishing. https://doi.org/10.1007/978-3-319-91971-3_8

Katsou, E., Nika, C.E., Buehler, D., Maric, B., Megyesi, B., Mino, E., Almenar, J.B., Bas, B., Becirovic, D., Bokal, S., Dolic, M., Elginoz, N., Kalnis, G., Mateo, M.C.G., Milousi, M., Mousavi, A., Rincic, I., Rizzo, A., Rodriguez-Roda, I., … Atanasova, N. (2020). Transformation tools enabling the implementation of nature-based solutions for creating a resourceful circular city. *Blue-Green Systems*, *2* (1), 188-213. https://doi.org/10.2166/bgs.2020.929

Kirchherr, J., Reike, D. & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling, 127*, 221-232. https://doi.org/10.1016/j.resconrec.2017.09.005

Kisser, J., Wirth, M., De Gusseme, B., Van Eekert, M., Zeeman, G., Schoenborn, A., Vinneras, B., Finger, D.C., Repinc, S. K., Bulc, T.G., Bani, A., Pavlova, D., Staicu, L.C., Atasoy, M., Cetecioglu, Z., Kokko, M., Haznedaroglu, B.Z., Hansen, J., Istenic, D., … Beesley, L. (2020). A review of nature-based solutions for resource recovery in cities. *Blue-Green Systems*, *2* (1), 138-172. https://doi.org/10.2166/bgs.2020.930

Langergraber, G. & Atanasova, N. (2020). Editorial for the "Towards Circular Cities - Nature-based solutions for creating a resourceful circular city" Special Issue. *Blue-Green Systems*, *2* (1), 137. https://doi.org/10.2166/bgs.2020.001

Langergraber, G., Castellar, J.A.C., Pucher, B., Baganz, G.F.M., Milosevic, D., Andreucci, M.B., Kearney, K., Pineda-Martos, R. & Atanasova, N. (2021). A Framework for Addressing Circularity Challenges in Cities with Nature-Based Solutions. *Water*, *13* (17). https://doi.org/10.3390/w13172355

Li, J., Mao, Y., Ouyang, J. & Zheng, S. (2022). A Review of Urban Microclimate Research Based on CiteSpace and VOSviewer Analysis. In *International Journal of Environmental Research and Public Health, 19* (8). https://doi.org/10.3390/ijerph19084741

Li, J., Sun, W., Song, H., Li, R. & Hao, J. (2021). Toward the construction of a circular economy eco-city: An emergy-based sustainability evaluation of Rizhao city in China. *Sustainable Cities and Society*, *71*. https://doi.org/10.1016/j.scs.2021.102956

Li, Q. X., Gummidi, S. R. B., Lanau, M., Yu, B. L. & Liu, G. (2022). Spatiotemporally Explicit Mapping of Built Environment Stocks Reveals Two Centuries of Urban Development in a Fairytale City, Odense, Denmark. *Environmental Science & Technology*, *56* (22), 16369–16381. https://doi.org/10.1021/acs.est.2c04781

Marin, J. & De Meulder, B. (2018). Interpreting Circularity. Circular City Representations Concealing Transition Drivers. *Sustainability*, *10* (5). https://doi.org/10.3390/su10051310

Mukim, M. & Roberts, M. (Eds.) (2023). *Thriving: Making Cities Green, Resilient, and Inclusive in a Changing Climate*. http://hdl.handle.net/10986/38295

Nesticò, A., Passaro, R., Maselli, G. & Somma, P. (2022). Multi-criteria methods for the optimal localization of urban green areas. *Journal of Cleaner Production*, *374*. https://doi.org/10.1016/j.jclepro.2022.133690

Nocca, F. & Angrisano, M. (2022). The Multidimensional Evaluation of Cultural Heritage Regeneration Projects: A Proposal for Integrating Level(s) Tool - The Case Study of Villa Vannucchi in San Giorgio a Cremano (Italy). *Land*, *11* (9). https://doi.org/10.3390/land11091568

Nocca, F. & Girard, L. F. (2018). Circular city model and its implementation: towards an integrated evaluation tool. *BDC. Bollettino Del Centro Calza Bini*, *18* (1). https://doi.org/10.6092/2284-4732/6058

OECD (2020). *The Circular Economy in Cities and Regions*. Paris: OECD. https://doi.org/10.1787/10ac6ae4-en

Oral, H. V, Radinja, M., Rizzo, A., Kearney, K., Andersen, T. R., Krzeminski, P., Buttiglieri, G., Ayral-Cinar, D., Comas, J., Gajewska, M., Hartl, M., Finger, D.C., Kazak, J.K., Mattila, H., Vieira, P., Piro, P., Palermo, S.A., Turco, M., Pirouz, B., … Carvalho, P.N. (2021). Management of Urban Waters with Nature-Based Solutions in Circular Cities-Exemplified through Seven Urban Circularity Challenges. *Water, 13* (23). https://doi.org/10.3390/w13233334

Ouillon, S., Dibb, S. & Peck, D. (2017). Understanding the societal, entrepreneurship and economic aspects of developing a circular economy in cities: a case study of coventry in the UK. In C. Bakker & R. Mugge (Eds.), *Product Lifetimes and the Environment (Plate),* 329-333. https://doi.org/10.3233/978-1-61499-820-4-329

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. In *The BMJ, 372*. BMJ Publishing Group. https://doi.org/10.1136/bmj.n71

Paiho, S., Maki, E., Wessberg, N., Paavola, M., Tuominen, P., Antikainen, M., Heikkila, J., Rozado, C.A. & Jung, N. (2020). Towards circular cities-Conceptualizing core aspects. *Sustainable Cities and Society*, *59*. https://doi.org/10.1016/j.scs.2020.102143

Paiho, S., Wessberg, N., Pippuri-Makelainen, J., Maki, E., Sokka, L., Parviainen, T., Nikinmaa, M., Siikavirta, H., Paavola, M., Antikainen, M., Heikkila, J., Hajduk, P. & Laurikko, J. (2021). Creating a Circular City-An analysis of potential transportation, energy and food solutions in a case district. *Sustainable Cities and Society*, *64*. https://doi.org/10.1016/j.scs.2020.102529

Pamucar, D., Deveci, M., Gokasar, I., Işık, M. & Zizovic, M. (2021). Circular economy concepts in urban mobility alternatives using integrated DIBR method and fuzzy Dombi CoCoSo model. *Journal of Cleaner Production*, *323*. https://doi.org/10.1016/j.jclepro.2021.129096

Paoli, F., Pirlone, F. & Spadaro, I. (2022). Indicators for the Circular City: A Review and a Proposal. *Sustainability*, *14* (19). https://doi.org/10.3390/su141911848

Papageorgiou, A., Henrysson, M., Nuur, C., Sinha, R., Sundberg, C. & Vanhuyse, F. (2021). Mapping and assessing indicator-based frameworks for monitoring circular economy development at the city-level. *Sustainable Cities and Society*, *75*. https://doi.org/10.1016/j.scs.2021.103378

Pintossi, N., Kaya, D.I. & Roders, A.P. (2021). Assessing Cultural Heritage Adaptive Reuse Practices: Multi-Scale Challenges and Solutions in Rijeka. *Sustainability*, *13* (7). https://doi.org/10.3390/su13073603

Petit-Boix, A. & Leipold, S. (2018). Circular economy in cities: Reviewing how environmental research aligns with local practices. Journal of Cleaner Production, 195, 1270–1281. https://doi.org/10.1016/j.jclepro.2018.05.281

Pomponi, F. & Moncaster, A. (2017). Circular economy for the built environment: A research framework. *Journal of Cleaner Production*, *143*, 710-718. https://doi.org/https://doi.org/10.1016/j.jclepro.2016.12.055

Premyanov, N., Metta, J., Angelidou, M., Tsoniotis, N., Politis, C., Athanasiadou, E.R. & Tsolakis, A.C. (2022). Circular Makerspaces as entrepreneurship platforms for smart and sustainable cities. In P. Solic, S. Nizetic, … T. Perkovic, L. Catarinucci & L. Patrono (Eds.). *2022 7th International Conference on Smart and Sustainable Technologies (SpliTech)*. Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.23919/SpliTech55088.2022.9854289

Prendeville, S., Cherim, E. & Bocken, N. (2018). Circular Cities: Mapping Six Cities in Transition. *Environmental Innovation and Societal Transitions*, *26*, 171-194. https://doi.org/10.1016/j.eist.2017.03.002

Turcu, C. & Gillie, H. (2020). Governing the Circular Economy in the City: Local Planning Practice in London. *Planning Practice and Research*, *35* (1), 62-85. https://doi.org/10.1080/02697459.2019.1703335

Sugoni, G., Assumma, V., Bottero, M.C. & Mondini, G. (2023). Development of a Decision-Making Model to Support the Strategic Environmental Assessment for the Revision of the Municipal Plan of Turin (Italy). *Land*, *12* (3). https://doi.org/10.3390/land12030609

United Nations (2015). *Transforming our world: the 2030 Agenda for Sustainable Development.* New York: United Nations. https://wedocs.unep.org/20.500.11822/9814.

United Nations - Department of Economic and Social Affairs (2019). *World Urbanization Prospects. The 2018 Revision*. New York: United Nations. Retrieved from: https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf

United Nations Environment Programme & International Resource Panel (2013). *City-level decoupling: urban resource flows and the governance of infrastructure transitions*. https://wedocs.unep.org/20.500.11822/8488.

Van den Berghe, K. & Vos, M. (2019). Circular area design or circular area functioning? A discourse-institutional analysis of circular area developments in Amsterdam and Utrecht, The Netherlands. *Sustainability*, *11* (18). https://doi.org/10.3390/su11184875

van der Leer, J., van Timmeren, A. & Wandl, A. (2018). Social-Ecological-Technical systems in urban planning for a circular economy: an opportunity for horizontal integration. *Architectural Science Review*, *61* (5), 298-304. https://doi.org/10.1080/00038628.2018.1505598

Vanhuyse, F., Fejzić, E., Ddiba, D. & Henrysson, M. (2021). The lack of social impact considerations in transitioning towards urban circular economies: a scoping review. *Sustainable Cities and Society*, *75*. https://doi.org/10.1016/j.scs.2021.103394

Vanhuyse, F., Haddaway, N.R. & Henrysson, M. (2021). Circular cities: an evidence map of research between 2010 and 2020. *Discover Sustainability*, *2* (1). https://doi.org/10.1007/s43621-021-00059-2

Verga, G.C. & Khan, A.Z. (2022). Space Matters: Barriers and Enablers for Embedding Urban Circularity Practices in the Brussels Capital Region. *Frontiers in Built Environment*, *8*. https://doi.org/10.3389/fbuil.2022.810049

Williams, J. (2019a). Circular cities. *Urban Studies*, *56* (13), 2746-2762. https://doi.org/10.1177/0042098018806133

Williams, J. (2019b). Circular Cities: Challenges to Implementing Looping Actions. *Sustainability*, *11* (2). https://doi.org/10.3390/su11020423

Williams, J. (2020). The role of spatial planning in transitioning to circular urban development. *Urban Geography*, *41* (6), 915-919. https://doi.org/10.1080/02723638.2020.1796042

Williams, J. (2021a). *Circular Cities: A Revolution in Urban Sustainability*. Abingdon – New York: Taylor and Francis Inc.

Williams, J. (2021b). Circular Cities: What Are the Benefits of Circular Development? *Sustainability*, *13* (10). https://doi.org/10.3390/su13105725

Williams, J. (2022). Challenges to implementing circular development - lessons from London. *International Journal of Urban Sustainable Development*, *14* (1), 287-303. https://doi.org/10.1080/19463138.2022.2103822

Williams, J. (2023). Circular cities: planning for circular development in European cities. *European Planning Studies*, *31* (1), 14-35. https://doi.org/10.1080/09654313.2022.2060707

World Bank (2023). Urban Development. *https://www.worldbank.org/en/topic/urbandevelopment/overview*.

Yalcin, N. G. & Foxon, T. J. (2021). A systemic approach to transitions towards circular economy: The case of Brighton and Hove. *Cleaner Environmental Systems*, *3*. https://doi.org/10.1016/j.cesys.2021.100038

Image Sources

All images are from the authors. Images 2 to 6 have been created with Biblioshiny.

Authors' profile

Giulia Marzani

Architectural engineer and urban planner. She is research fellow and PhD candidate in Architecture and Design Cultures at the University of Bologna where she graduated in 2017. Her research focuses on the integration of circular economy

principles into urban planning tools through the development of a methodology that supports decision-making. In 2020, she was research fellow at the Centre for applied research - Buildings and Construction of the University of Bologna working in the framework of the H2020 SHELTER project which aims to increase the resilience of cultural heritage and reduce its vulnerability to natural and anthropic risks. Her research fields also concern the analysis of urban features and dynamics and the definition of sustainable policies and strategies for urban regeneration.

Simona Tondelli

Full professor of Urban and Regional Planning in the Department of Architecture of the University of Bologna, she is currently the Deputy Rector of Alma Mater. She is the President of the Clust-ER Urban Economy of the Emilia-Romagna Region and member of the Board of Director of the foundations FIU, ICSC, Ce.U.B., Museo interreligioso in Bertinoro, Bottrigari. Her research field concerns urban and territorial planning, with particular focus on urban and rural regeneration, sustainability practices and NBS, urban health, the relation between transports and land use, social housing and inclusiveness, participation and innovative models of governance. She is the coordinator of numerous Horizon and Interreg projects and of various third mission research activities. She is author of over 150 scientific publications.

TeMA Journal of Land Use, Mobility and Environment

Right-based approach to urban accessibility: analysis of user perspective

Cihan Erçetin

Spatial Applications Division Leuven (SADL)
KU Leuven, Leuven, Belgium
e-mail: cihanercetin@gmail.com
ORCID: https://orcid.org/0000-0002-8715-3696

Abstract
To access urban services, the spatial components of urban space must enable every possible trip route to be devoid of any barriers, including those relating to the legal framework, metropolitan area, society, and administration. The right to access is for understanding the barriers to accessibility. Therefore, what is the required state necessary to put forth the significance of the motto, "accessibility for all"? Is it only making urban space accessible, or is it also a matter of perceiving accessibility as a right?
The research aims to reveal the deficiencies of the perception that accessibility is a human right. The research question is, "how do the barriers prevent people with disabilities from obtaining their right to access?" In the user perspective analysis, twelve focus group discussions were conducted in Ankara with various members of persons with reduced mobility (PRM). The primary finding from both the theoretical review and these discussions is that accessibility must be perceived as an integrated concept with the inclusiveness of urban spaces, emphasizing the social and spatial dimensions of the issue. It is an inclusive right that unequivocally must be extended to all individuals, encompassing every individual of PRM.

Keywords
Mobility; The right to the city; Accessibility; Right to access; Disabled.

1. Introduction

A city is a dynamic space where individuals live, behave, and interact, with urban activities interconnected through mobility and accessibility. Accessibility serves as the link between individuals and public spaces, establishing the conditions necessary for the right to access. Without an inclusive urban environment ensuring access and mobility for all, it is impractical to discuss the appropriation of urban space, participation in social networks, and the production of urban space. Thus, the concepts of the right to the city and accessibility form a critical connection between persons with reduced mobility (PRM) and a rights-based approach.

Human beings have essential social and physical needs, with mobility being crucial for accessing shelter, food, employment, and social interactions. Mobility facilitates activities like shopping, working, socializing, and participating in public life, all of which contribute to self-actualization (Kenyon et al., 2002). However, limited mobility can impede access to both formal and informal social networks, exacerbating isolation and reducing engagement with goods, services, social activities, family, and friends. This highlights the critical role of mobility in fostering an inclusive and connected urban environment.

Urban conflict and the Right to the City are interconnected concepts explored by Harvey (2008) through the lens of class, capitalist production, and urbanization, and by Castells (2015) through class and urban social movements. Lefebvre (1996) initially introduced the concept, emphasizing the transformation and reproduction of urban space. Harvey (2008) further argued that urban space is both shaped by and shapes the people. Achieving these rights requires mobility capabilities within the framework of equality, human rights, and freedom. Consequently, accessibility, transport equity, and mobility justice are essential for addressing systemic inequalities and promoting social justice in transport planning and policymaking. (Murray and Davis, 2001; Pereira et al., 2017; Verlinghieri & Schwanen, 2020). However, merely possessing mobility capabilities as an able-bodied individual is insufficient. The right to access necessitates an accessible urban environment and sustainable social quality, supported by urban policies that ensure the longevity and inclusivity of settlements.

The research aims to establish a foundation by addressing the question: What conditions are necessary to underscore the importance of the motto "accessibility for all"? Is it solely about making urban spaces accessible, or does it also involve perceiving accessibility as a fundamental human right?

2 From the right to the city to the right to access

According to Lefebvre (1996), the Right to the City entails overcoming the alienation of urban space and reintegrating social connections, allowing inhabitants to appropriate urban spaces. This concept involves residents collectively inhabiting and utilizing urban areas for social interaction and self-actualization. Purcell (2013) expands on Lefebvre's idea (2015), suggesting that appropriation redefines rightful ownership, proposing that the city belongs to its inhabitants. Thus, urban spaces become areas for learning, interaction, and connectivity, fundamentally owned by those who live in them.

The Right to the City concept, as noted by Purcell (2002, 2013), encompasses two fundamental rights: the right to participation, enabling citizens to actively engage in policymaking and social connections, and the right to appropriation, allowing urban dwellers to gain control over cities and urban processes, fostering collective interaction and free expression. Harvey (2008) elaborated on this concept, highlighting that the right to the city goes beyond individual access to urban resources, encompassing a collective capacity to reshape urbanization and, consequently, societal norms. This is fundamental yet often neglected and has the potential to unify diverse social movements globally by highlighting the connections between urbanization, social justice, and marginalization. The Right to the City has the potential to unite various social movements globally by emphasizing the interconnections among urbanization, social justice, and marginalization. Şen (2012) and Mackett et al. (2004) further contends that the exclusion of certain groups from society not only results in their exclusion from social life but also from becoming recognized as fully participating individuals within

society. Castells (1977) advanced the Right to the City concept through the lens of space production, critiquing Lefebvre's ideas (2015) on spatial appropriation and production. Like Harvey (2003), Castells (2015) views the right to the city as a collective rather than an individual right, emphasizing its goal of achieving a just and more equitable urban environment for all individuals. In short, Lefebvre (1996), Harvey (2008), and Castells (2015) underscore that the Right to the City involves the equitable appropriation of urban benefits by residents, their active participation in decision-making processes, and the realization of fundamental rights and freedoms for all inhabitants.

Urban mobility plays a crucial role in both social and economic development by enabling individuals to access various city amenities, including services, employment opportunities, education, social interactions, and recreational activities (UN-Habitat, 2008), which indicates that mobility is significant in obtaining the Right to the City in participation and appropriation practices. Enhanced mobility, however, can alleviate multiple issues associated with social exclusion by facilitating access to opportunities that can enhance individuals' economic prospects, improve their well-being, and promote a lively social environment, all of which contribute to fostering a sense of inclusion among individuals (Roger et al., 2009). This comprehensive understanding of urban mobility underscores its pivotal role in promoting inclusive mobility, a concept that emphasizes equitable access to mobility systems and urban opportunities for all, thereby addressing social disparities and fostering a more inclusive urban fabric. Inclusive mobility encompasses two interpretations (Jeekel, 2018): the weaker one focuses on reducing social exclusion through improved transport systems, while the stronger interpretation aims to enhance community interaction and cohesion by promoting shared travel experiences and public modes of urban mobility. In this context, the right to mobility refers to the entitlement to move freely and be mobile within urban space, ensuring accessibility to urban functions and opportunities.

The right to mobility is a fundamental aspect of urban equity, significantly influencing access to essential services and opportunities within cities. Ensuring mobility rights is crucial for advancing social inclusion and economic development. In line with this, accessibility, defined as the ease of reaching desired destinations, is central to this concept. Recent research emphasizes that improving urban mobility infrastructure can enhance accessibility, thereby reducing social exclusion and promoting inclusive urban communities, as noted by Cargiulo (2018), Manfredini & Di Rosa (2018) and Battarra (2018). For example, enhancements in public transportation systems and the design of pedestrian-friendly urban spaces have been shown to increase access to employment, education, and healthcare for marginalized populations (Lucas, 2012; Papa et al., 2017). Therefore, urban policies that incorporate the right to mobility with an emphasis on enhancing accessibility are crucial for creating equitable and vibrant cities (Bertolini et al., 2012; Geurs et al., 2016) The close relationship between the right to mobility and accessibility underscores the centrality of movement within and between urban services, social capital, and public spaces as essential for participating in urban processes. Accessing and experiencing the appropriation of urban space are fundamental aspects of this dynamic. At a foundational level, engaging in public spaces constitutes a democratic exercise by experiencing and interacting with the city and society (Castaneda, 2019; Ferreira & Batey, 2007). Essentially, every individual possesses the right to access urban assets and resources, thereby encompassing the right to mobility within the right to accessibility. When considering the production processes of urban space, the right to mobility extends the trajectory of the Right to the City further, as active participation in the collective production of space necessitates mobility and access to urban assets and the city itself (Hannam et al., 2006).

There is a body of literature that examines the interrelationship between mobility rights and accessibility across diverse thematic frameworks. Coggin & Pieterse (2015) argue that executive policy choices regarding the provision and regulation of public transport should be assessed through a rights-based prism and should be subjected to dialogic interaction with the judiciary, within a substantive, rights-based understanding of mobility and urban accessibility. This perspective underscores the necessity for a legal framework that integrates mobility rights with urban planning to enhance accessibility. Lid (2010) discusses universal design, advocating

for it as a strategy to reduce architectural barriers and promote accessibility and equality. This aligns with Jackson's (2018) argument that built environment practitioners must recognize the disabling effects of current practices and engage directly with people with disabilities to better understand accessibility needs. Similarly, Levine and Karner (2023) identify four opportunities to address the needs of disabled people in transportation planning in the United States, emphasizing the importance of inclusive planning practices. Moreover, Tudzi et al., (2017) provide recommendations for universities to protect the rights of students with disabilities, highlighting the need for policies and accreditation standards that enforce accessibility. Gready (2008) also contributes to this discourse by exploring rights-based approaches to development, emphasizing the added value of such frameworks in promoting social inclusion and accessibility. These contributions highlight the stance of a rights-based approach in enhancing social inclusion and accessibility, demonstrating its critical role in reshaping urban planning and transportation policies.

The ideal urban mobility structure is free from barriers to reaching public transport vehicles, stops, stations, and platforms. Access to these components must be guaranteed for universal use (Heiser, 1995). For instance, Odame (2022) highlights that public transport plays a critical role in ensuring access to facilities like schools and hospitals, especially for those in the low and middle-income range who have limited private car ownership. Unfortunately, the conditions of the physical environment, including transport services, do not cater to the needs of minority travelers. Therefore, accessibility must begin at the point of origin and extend to the destination within the city. Achieving such a seamless mobility flow necessitates the implementation of sustainable transport policies and design solutions. Ensuring accessibility in the urban environment and public transport requires careful design of urban spaces and consideration of socio-spatial solutions. However, urban planning and transport design can sometimes create accessibility issues and become exclusionary towards PRMs. (Barnes, 1991; Zajac, 2016). A significant portion of travellers face limitations or physical impairments, navigate with baby strollers or luggage, or encounter cities with complete unfamiliarity. On average, 12-16% of a country's population is considered disabled, and an additional 20-25% experience mobility difficulties. Consequently, urban transport systems and the physical environment must be designed to be user-friendly and accessible, adhering to universally accepted principles of universal design and the right to access for all. This approach ensures that the entire transport system is accessible and easy to use for people with disabilities and others with mobility challenges (Hultgren, 1995; Ling Suen & Mitchell, 2003).

From a rights-based perspective, accessibility extends beyond urban spatial policies for individuals with disabilities and applies universally. Recognizing the right to access as a fundamental human right invokes the essence of the first article of the Universal Declaration of Human Rights (United Nations, 1948) emphasizing inherent dignity and equal rights for all individuals. This broader interpretation underscores the importance of inclusive urban mobility and equitable access for everyone, not just those with disabilities. The rights and equality dimension imply that accessibility is an outcome of the combination of spatial, societal, and administrative policies and implementations, and accessibility is a matter for not only a specific group of people with disabilities but also for any person having reduced mobility. Once it is accepted that everyone is equal no matter what the cultural, ethnic, socio-economic condition or level of ability to access is, it becomes inevitable that the right to access is for all-encompassing needs and demands of different groups of PRM. To ensure the needs and demands of various beneficiaries of accessibility, the platforms to obtain their ideas about what their experiences are considering barriers against the right to access need to be provided by administrative authorities. Before having such a participatory decision-making platform to discuss their right to access, local and government policymakers must be considerate to PRMs as equally as all others. Another most prominent example legal document is the U.S., The American with Disabilities Act (ADA), which states the characteristics of accessibility in section 4.3.2 under the title of "Accessibility Guidelines for Buildings and Facilities". The definition emphasizes that accessibility should not be limited to urban space (e.g., optimum standards for

sidewalk width, ramps, and crossings); it needs to be considered for all the components of the city that a person could encounter while commuting from one point to another in the city (ADA, 2005).

In 2010, Strategy for the Rights of Persons with Disabilities 2021-2030 was published by the European Union, emphasizing the rights of people with disabilities and their participation in social life and economic activities without facing any discrimination and social exclusion. Under the Strategy titled "Equal Access and Non-discrimination," the concept of accessibility was addressed in relation to access to justice, freedom, social protection, goods and services, art, culture, recreation, and leisure. (European Commission, 2010). In other words, the Strategy implies the Right to the City in accordance with the Right to access the city. United Nations (2013) also notes that accessibility of places, services, or any physical component of the urban environment for people with disabilities means that anyone can easily reach, enter, exit, and use without facing barriers. It is essential to ensure that individuals with disabilities can exercise all rights within the city, thereby guaranteeing their freedom and equal participation in society alongside others.

In recent decades, contemporary debates have increasingly aligned with the United Nations Sustainable Development Goals (SDGs) to guide nations towards a more sustainable and resilient future (UITP, 2019; Hidayati, 2021; Oviedo et al., 2022). Accessibility is a matter of the sustainable future of cities mentioned under the 11th goal (Sustainable Cities and Communities) as Creating accessible cities and water resources, affordable, accessible, and sustainable transport systems, providing universal access to safe, inclusive, accessible, and green public spaces" (United Nations, 2015). The implications of UN accessibility within the framework of the SDGs closely resonate with the objectives of this research, although notable discrepancies persist. SDG-11 places a strategic emphasis on accessible urban environments, transport, and public spaces, centralizing spatial accessibility. However, accessibility transcends spatial considerations, as societal and administrative barriers equally influence its definition. This suggests that a robust conceptualization of accessibility must extend beyond mere physical access and legal frameworks, incorporating a broader spectrum of determinants to encompass the multifaceted nature of accessibility comprehensively.

This research highlights the essential role of urban mobility and accessibility in fostering social inclusion and economic development. It underscores the intrinsic connection between the right to mobility and the right to access, emphasizing the need for sustainable transport policies and inclusive design solutions. By adhering to universal design principles, urban environments can better serve individuals with disabilities and mobility challenges. This approach supports the broader concept of the right to the city, facilitating participation in urban processes and promoting a just and equitable urban landscape where all individuals can exercise their rights and freedoms. Hence, the formulation of urban policies that integrate the right to mobility with a strategic focus on enhancing accessibility is imperative for the development of equitable and dynamic urban environments.

3. Methodology

In this part, how the research findings are produced is explained. First, the aim and research question are mentioned. Then, the research method is described, including the philosophical approach, sample group, case area selection, and data collection.

3.1 Aim and research question

In this research, the user perspective represents prominent members of PRM which is to obtain qualitative data through focus group discussions with an interpretivist approach. Within this perspective, data obtaining is a subjective process generated by participants' contributions, discussions, argumentations, and compromises.

The research aims to reveal the deficiencies of the perception that accessibility is a human right. The research question is, "How do the barriers prevent people with disabilities from obtaining their right to access?"

3.2 Research method

Interpretivism (or phenomenology) is the philosophical approach to complement the data obtained from case study research. The interpretivism philosophy entails researchers interpreting study elements by incorporating human factors into the analysis. Interpretive researchers believe that only social constructions such as language, consciousness, shared meanings, and instruments provide access to given or socially constructed reality (Myers, 2009; Dudovskiy, 2021). In line with this, focus group discussions are group interviews in which participants are asked to discuss specific themes in a somewhat casual setting to reveal underlying issues and concerns about norms, beliefs, and values (Bloor et al., 2001). This qualitative research method aims to gain a deeper understanding of social issues. Rather than a statistically representative sample of a larger population, the approach tries to acquire data from a purposefully selected group of individuals (Nyumba et al., 2018).

In the analysis of user perspective, 12 focus group discussions were carried out between 04.03.2021-05.05.2021 in Ankara with different members of PRM. Survey questions were discussed within groups, and valuable outputs were generated, contributing to the formation process for accessibility problem definition.

Rationale of sample group and case area selection

Ankara, the capital city of Turkey, is situated in the heart of the Anatolian region, known for its expansive and varied geography. The city's topography includes hills and plateaus, influencing its urban development and transportation infrastructure. Ankara's urban planning has historically focused on accommodating its growing population and expanding metropolitan area, leading to a mix of modern developments and historic neighborhoods. Challenges remain, particularly in addressing physical barriers such as uneven sidewalks and inadequate public transportation facilities. The mobility context in Ankara is characterized by a network of buses, metro lines, and a developing light rail system, aimed at improving connectivity across the city. These efforts are aligned with Ankara's goal of promoting sustainable mobility solutions and enhancing the overall urban experience.

The first criterion for participants in focus group discussions was in the category of PRM in Ankara. Thirty-six people were registered as the focus group participants' candidates, and discussions were carried out with 32 participants in 12 focus group discussions. The reason for stopping the number of focus group discussions at 12 is that the scope of the discussions to obtain the required answers satisfactorily regarding accessibility and right to access reached its saturation level. The participants' details are given in Tab.1, including which focus group discussions include which kinds of people with disabilities.

	The number of participants of focus group discussions	Which focus group discussion (FGD) includes which disability types
The ones responded positive to register discussions	36	--
The total number of participants attended	32	--
Physically impaired	21	FGD-1, FGD-2, FGD-3, FGD-5, FGD-6, FGD-7, FGD-8, FGD-9, FGD-10, FGD-11
Visually impaired	7	FGD-1, FGD-4, FGD-7, FGD-9
Parents with baby stroller	4	FGD-12

Tab.1 Number of participants to focus group discussions with disability types

The participants of focus group discussions were randomly selected from the people living in Ankara who have different reduced mobility characteristics as:

− Physical impairment: Persons with a wheelchair or walking stick (or using both);

− Visual impairment: Persons with at most 20% or no visual ability;

— Parents with baby stroller: Parents using the single baby stroller and twin baby stroller.

Among people with disabilities in Türkiye, those with physical and visual impairments have the highest population percentage.

Selected PRMs are living in Ankara, in differentiated parts of the city. The reason for choosing Ankara as a case study area for the focus group survey is that Ankara hosts many non-governmental organizations (NGOs) related to disability. The challenge of finding the most relevant participant for focus group discussions has been minimized by contacting related NGOs in Ankara. Some specific participants of focus group discussions were selected as the Head of the Ankara Provincial Disability Assembly, the Head of Yenimahalle Disability Assembly, the Head of the Orthopedically Disabled Solidarity Association, the Head of Türkiye Confederation of People with Disabilities, the Head of the Association of People with Disabilities Working in the Public Service, Member of METU without Barriers Student Club, Head of the *Memursen* Disability Commission, and Head of Active Visually Impaired Association.

The participants' opinions of focus group discussions are presented in the text without mentioning their names. Instead, pseudonyms, such as F1-A, are read as 'first focus group discussion-opinion of the participant A (A is the first letter of the participant's name) to respect personal privacy principles. In some focus group discussions, more than one participant could have a name starting with the same first letter. In such cases, the pseudonym is formed as F1-K1 and F1-K2.

Data Collection

The user perspective was examined through focus group discussions, which were deemed an effective method for capturing the viewpoints of directly affected groups of PRMs. Conducting group discussions, rather than individual in-depth interviews, is justified by the potential of face-to-face interactions and discussions to generate new ideas and approaches from the diverse perspectives and interactions among participants. Accessibility in Türkiye is a contentious issue influenced by various interest groups, conflicting ideas, socially exclusive behaviors, and urban transport policies. Therefore, the interaction among PRM participants within group discussions was anticipated to create a new learning environment, fostering the emergence of new ideas and questions.

Some specific steps defining characteristics of focus group discussions are as follows:

— All focus group discussions were conducted through online meetings in case of the COVID-19 pandemic;

— Making groups with a mix of people with physical and visual impairment was prioritized. Only the last meeting was composed of four parents using a baby stroller;

— The optimum number of participants was determined for each meeting as three people. In some discussions, the number of participants became four and sometimes two due to absent participants;

— Each meeting lasted for about 60 to 120 minutes, depending on the number of participants and content of the discussions.

The questions asked during focus group discussions are separated into two categories: spatial accessibility and open discussion questions about the social, administrative, and right-based context of accessibility in the second part, the aim is to open discussions about the underlying reasoning behind accessibility barriers are, and how to consider accessibility as a right; in this article, the part of data related to 'the right-based approach of accessibility' is presented and discussed.

4. Findings

Accessibility refers to the ease or difficulty of accessing urban services. If an individual successfully reaches their destination, the route is deemed 'accessible'; conversely, if they cannot, it is considered 'inaccessible.' The primary determinant of accessibility is urban space itself. However, a rights-based approach to accessibility

challenges this notion by questioning whether there are other underlying factors that impede access. This perspective prompts a deeper examination of the systemic and structural barriers that may exist, thereby broadening the scope of accessibility beyond mere physical proximity. In this respect, this part demonstrates how collected qualitative data to be classified under certain themes related to right to access.

Re-defining accessibility: is it only accessing from one point to another?

The concept of accessibility extends beyond the simplistic notion of moving from one point to another. It encompasses various dimensions, including spatial, societal, and administrative factors, which together define the comprehensive and multifaceted nature of seamless accessibility. In this research, user perspective contributed to the discussion of how to define accessibility, as also noted by Stauskis (2018). Participant F9-E2 highlights the relationship with respect. "Accessibility means respect to all; to any able-bodied individual and any single person with a disability, respect to a mother with the baby stroller to get on the elevator, and respect to us." Related with defining accessibility, Participant F8-V emphasizes societal barriers.

Accessibility is the removal of barriers that society puts against us. Without barriers, we could be anywhere. In working life, entertainment life, and socializing with people... Accessibility can be called the removal of societal barriers. When there is no barrier, we aim to live on equal terms with everyone in society.

Furthermore, participant F5-F focuses on the beneficiaries of accessibility policies by mentioning societal and administrative aspects.

We are not disabled. We have some shortages with our capabilities. The cause of our accessibility problems is those who created disabler cities for us. There might be a deficiency with my feet, but it does not mean I cannot sustain my own life. Societal and governmental barriers need to be eliminated. They should not seize our rights.

The user perspective underscores a rights-based approach, aligning with the contributions of Sager (2006) and Harvey (2008), who assert that mobility should be regarded as a fundamental right intrinsically linked to the social needs of every individual within society. In line with this, the concept of accessibility revealed several interconnected themes. Primarily, accessibility is framed as an issue of respect for all individuals, encompassing both those with and without disabilities. This perspective broadens the traditional view of accessibility beyond mere spatial aspect to include societal dimension and behaviors. Additionally, the removal of societal barriers is emphasized as a critical component, suggesting that seamless accessibility involves dismantling societal norms and structures that hinder equal participation. Furthermore, the discussion highlights the significant role of administrative and policy-related barriers in creating what can be termed "disabler cities." This underscores the necessity for comprehensive policy interventions aimed at eliminating these barriers to ensure equitable access

Barriers hindering the exercise of the right to mobility can be categorized into three primary domains, as (Kett et al. (2020) indicated: institutional factors (such as legislation, political will, and policies), environmental factors (including infrastructure, vehicles, and information), and attitudinal factors (involving transport staff, fellow passengers, and insufficient accessible information). In practice, these categories frequently intersect. Collectively, these themes suggest that accessibility is a multifaceted concept that requires a holistic approach, integrating physical, societal, and administrative dimensions to create inclusive urban environments and policies that promote equality for all individuals. In line with this, the research supports this approach by putting a right-based point of view to accessibility with interdependently related legal, spatial, societal, and administrative aspects.

Accessibility and the right to access

Adopting a rights-based approach necessitates recognizing accessibility as a fundamental human right within the context of disability and accessibility perceptions. The persistent examination of accessibility through its

interdependent dimensions—spatial, societal, and administrative—underscores the importance of addressing this concept from a rights-based perspective. Obtaining the right to access requires active citizenship, where individuals engage in collective action to advocate for their needs. The social aspects of accessibility involve fostering community support and raising awareness, while the administrative aspects demand effective policy implementation and enforcement. Both aspects are crucial to ensuring that accessibility is not only a legal mandate but also a lived reality for all citizens.

The right to access represented a central part of focus group discussions. The right-based approach to accessibility is a commonly accepted fact despite unification problems among people with disabilities. Participant F4-S establishes the link between rights and accessibility.

It is necessary to act from a right-based approach. If accessibility is examined from a religious point of view, we get a different definition from a cultural point of view again different. However, it needs to be examined from the perspective of the rights of people with disabilities. If there is no right-based approach, someone else decides on our behalf of us.

Participant F1-K2 also exemplifies the acquisition of the right to access through demonstrations as one of the pioneers leading the enacting process of the legislative framework for people with disabilities as active citizens.

I have served as the general chairman of the Orthopedically Disabled Solidarity Association for 28 years. I have contributed to 90% of the enacted laws about the rights of people with disabilities in Türkiye. As a representative of the association and the Ministry of Environment, Urbanization and Climate Change, I put much effort into the legislative framework in Türkiye. Protests are necessary to win rights. Our association was an activist one. We held demonstrations in Kızılay, closed the Metro, and chained ourselves in front of the prime minister's office. In other words, rights were not given to us; we obtained our rights ourselves. Now people with disabilities are worried about if something wrong happens to our rights or if we lose the rights we have won. The fear of losing them is the most significant barrier for people with disabilities in their future struggles.

Another example of an active citizen who defines herself/himself as:

I am a member of an association that puts forward specific standards on accessibility and struggles for the sake of the rights of people with disabilities. We have also created a platform named 'keep struggle' to avoid being disabled. Sometimes, we do activities, events, and protests.

Similarly, Participant F4-S puts being an active citizen from a right-based approach.

I have had visual impairment from birth. I am a psychology graduate from Middle East Technical University and am retired now. I am a manager at the Turkish Federation of the Visually Impaired. My struggle in disability organizations is a right-based struggle, and I carry out struggles in the field of women, especially disabled women.

The reflection of Harvey's (2008) collective thinking and action concepts predominantly emerged within the user perspective. Participant F1-K2 stated that there are plenty of NGOs with varying interests.

Hundreds of associations are working on the same issue for people with disabilities. We are not united even within ourselves. We cannot take action without being united. We need to be together, but we cannot. Right now, we have two confederations, very interesting, one closer to one political view and the other closer to the other. In this sense, people with disabilities also act according to their interests. Most people either establish an association or become members for their benefit, and everyone generally pursues their interests.

From another outlook, Participant F1-C explicitly emphasizes the need for collective action and urban social movement, as Castells (1977) and Harvey (2012) discussed.

We are doomed to creep as long as we do not raise our voices unless we unite and do demonstrations. I am a member of the executive committee of Ankara's first disabled assembly. While defending the rights of people with disabilities, they seem as if they can do any demonstrations or protests, but there has been no action—shame on those who seek the rights of people with disabilities in this way.

These contributions examine the intersection of rights advocacy and activism within the disability community, focusing on key themes that emerged from focus group discussions. Participants underscore the necessity of a rights-based approach to accessibility, arguing that decisions regarding accessibility should be grounded in human rights principles rather than cultural or religious perspectives. The article highlights the instrumental role of activism and demonstrations in securing legislative frameworks and advancing the rights of people with disabilities, as exemplified by one of the participants' statements that *"protests are necessary to win rights."* There is also significant concern expressed about the potential regression or loss of rights gained, serving as a barrier to future progress. Internal disagreements within the disability community were also identified as a challenge to collective action, with calls for unity and cohesive advocacy efforts to amplify their voices effectively. Overall, the complexities and challenges of disability rights advocacy, advocating for a continued rights-based approach and collective action to safeguard and advance the rights of people with disabilities were highlighted.

Another discussion topic that emerged from the user perspective is participation as a right paving the path towards obtaining the right to access. Participation in decision-making processes and inspection systems enable people with disabilities to express their daily spatial experiences to policy-makers and implementers. Plenty of participants of focus group discussions put forth their opinions in this respect. Participant F3-Y mentioned the significance of participation: "Policy-makers should involve people with disabilities in processes. But, policy-makers need to make the call. Otherwise, individual efforts of people with disabilities do not work". In addition, participant F4-S, as a visually impaired person, gives an idea about how the process should be and should not be.

Participation is very important in decision-making. Policy-makers should make invitations to disabled groups and involve them in the processes. However, it should not be like 'invite disabled groups, listen to them, then ignore what they say and implement what we planned as before.' Participation also needs to be free from political biases while selecting the participants.

The inspection system was also stated as an administrative barrier from the user's perspective. Participation in inspection processes is valued by participants F1-K2.

Inspections are carried out in some buildings about the accessibility of people with disabilities, but we are not called Yenimahalle City Council Disabled Assembly representatives; we are not informed. We search and sometimes find such inspections and attend.

Similarly, participant F3-K expresses her/his desire to participate in infield analyses directly.

Municipalities design tactile pavement. However, it goes, then a tree emerges, tactile pavement is interrupted, and then continues from the other side of the tree. No. Municipalities should invite people like me or me to design together. I can express what I feel; they cannot know.

This is in line with the contribution made by Purcell (2013), stating that participation in decision-making can be considered an awakening making participants feel embedded into social and urban spatial relations. Being both the beneficiary and a part of decision-making will probably result in a new dignified urban well-being. Participant F7-V made the last contribution as a suggestion on how to arrive at a consensus and participate in budget management allocated to disability policies.

What is missing in this process is that there is no consensus and unity among NGOs. I think what is needed is a disability administration institution that takes action as a whole unit and has the authority to inspect and act as an expert. Moreover, NGOs will be able to come together under this institution to discuss the allocated budget, the money we have, and our needs and priorities.

The outcomes from the focus group discussions revealed that policymakers and scholars typically conceptualize accessibility primarily through a spatial lens. This narrow focus often results in urban space interventions that lack comprehensive and sustainable impacts. For instance, while constructing elevators for overpasses or ramps may address physical barriers, the absence of an effective maintenance and inspection mechanism renders these solutions inadequate. Similarly, providing lifts on buses to comply with public transport

accessibility rules is insufficient if drivers are unaware of their operational status. Furthermore, administrative policies aimed at benefiting people with disabilities frequently carry an unintended stigmatizing effect, making these individuals feel marginalized.

To formulate effective accessibility policies, it is crucial to integrate spatial, societal, and administrative aspects. For example, the construction of new sidewalks with tactile pavements must not only adhere to spatial standards but also ensure uniform width and appropriate slope to avoid societal repercussions, where individuals with disabilities require assistance. Additionally, administrative strategies should encompass comprehensive planning and sensitive design, addressing accessibility not just in isolated places but across entire urban area. Without such an integrative approach, solutions remain fragmented, creating disruptions in the accessibility chain, such as inaccessible bus stops or non-functional lifts, ultimately hindering the daily mobility of individuals.

As a result, persistent cycles of inaccessibility obstruct PRMs from exercising their right to access. Without adopting a rights-based approach that prioritizes the right to access in the development of accessibility policies in Türkiye, it will remain impossible to create urban environments where accessibility is achieved seamlessly and without barriers

Independent mobility and right to access

Independent mobility is crucial for the right to access, as human rights are universal and each individual is equal. Therefore, everyone must have the right to access, facilitated by independent mobility. However, ensuring the right to access is not the only precondition. Spatially and societally sustainable rights to access are the two others -and related -components. Firstly, urban space, along with its public transport infrastructure, needs to be accessible, which represents spatial accessibility. Without spatially sustainable accessibility, the accessibility chain for PRMs is often disrupted, leading to frequent failures in their urban trips. For example, consider an individual who decides to attend a theater performance and secures a front-row ticket (inspired by the story told by participant F9-E2). This person independently checks the bus schedule online, walks to the bus stop, boards the bus, and then navigates the theater building and hall, including descending the stairs, entirely on their own. This scenario illustrates the successful integration of various components of an accessibility chain, emphasizing the importance of managing each step independently, which signifies independent mobility. As noted by Meşhur (2016), barriers significantly hinder the elderly and disabled from moving freely without assistance, adversely affecting their full participation in urban and social life. Therefore, independent mobility is a critical aspect of the right to access, denoting the ability to utilize urban services without requiring assistance from others. The aforementioned example should represent a typical experience for any individual in society, reflecting a rights-based approach to accessibility

User perspective made remarkable contributions to the discussion of independent mobility. Participant F6-M sincerely desires independent mobility in daily trips and stated: "Sometimes I say, I wish I could be able to do my daily work without being helped. I would like not to be dependent on a parent. This is exactly what accessibility is. However, I need help. I wish I could handle my work without help". A similar contribution came from a visually impaired person, participant F9-E1.

They planted many trees in the middle of the sidewalk, and the sidewalks are high. I cannot get down, and I have to ask for help. For example, I hesitate to ask someone for help while getting down from the pavement, except for my family. I would love to be able to do it myself.

The general understanding in Türkiye is that once a person with a disability is seen, s/he indeed needs help. However, this is the issue that persons with visual impairment specifically complain about. Participant F3-Y gives an interesting example of such a situation.

Perception must change. Otherwise, this system will stay the same. People's point of view is sometimes bizarre; sometimes their only problem is to take my arms and help while walking. He thinks he has to do that. I say I do not need it; I can do it myself. He says no, I will take your arm. Why?

The misunderstanding on under what conditions people with disabilities are helped was also mentioned by another visually impaired participant, F4-S.

Since I do not trust traffic lights, I always cross streets with the help of someone else. Even if there are audible lights, I do not trust them because drivers do not obey the traffic rules in Türkiye. However, there is another problem. The fact that people want to take the arm of the visually impaired while crossing the street is not actually a behavior for the benefit of the visually impaired. On the contrary, the effort of the helper is to seem pleasant to ease her/his conscience.

Lastly, the definition of accessibility is linked with independent mobility by participant F5-E from a rights-based perspective.

Accessibility is the ability for all people to live independently. This is what each individual deserves. Everybody needs to be free and without dependence on anyone in each aspect of life. In other words, accessibility is a right like the right to education and housing.

User perspectives reveal that needing assistance from other passengers or drivers when boarding a bus can cause social embarrassment for people with disabilities, highlighting the importance of enabling independent, unassisted mobility. Instances indicate that individuals with increased vulnerability, such as women, children, the elderly, and those with physical disabilities, encounter difficulties in undertaking journeys away from home. These difficulties are attributed to factors such as financial constraints, inadequate road infrastructure, and the deficiencies of public transport in terms of quality and reliability (Salon and Gulyani, 2010; Diaz Olvera et al., 2013). Consequently, PRMs may become reluctant to leave their homes, leading to social isolation. In this respect, socially sustainable accessibility entails creating accessibility chains that do not impose social consequences due to inaccessible urban spaces. Independent mobility is crucial for achieving social sustainability in accessibility.

To ensure independent mobility, the right to access must be accompanied by spatially and socially sustainable urban mobility trips. Given that everyone is equal, groups such as people with disabilities, elderly individuals, and parents with baby strollers should be able to access any urban service independently. However, the cultural inclination of Turkish people to offer help, while well-intentioned, can sometimes have the opposite effect, negatively impacting the independent mobility of PRMs. This deeply ingrained culture of assistance can inadvertently undermine the autonomy that is crucial for PRMs to navigate urban spaces independently. Persistent cycles of inaccessibility impede PRMs from exercising their right to access, highlighting the need for a rights-based approach that prioritizes access in Türkiye's accessibility policies. Securing this right requires active citizenship and collective action, where individuals advocate for their needs. The social dimensions of accessibility involve community support and awareness, while the administrative aspects demand effective policy implementation and enforcement. These measures are essential to ensure that accessibility is not only a legal mandate but also a living reality for all citizens. Therefore, spatial and social structures must be designed to facilitate independent mobility for everyone, ensuring that accessibility chains are seamless and barrier-free.

5. Conclusion and discussion

This research examines the right-based approach to accessibility by exploring the concept of accessibility, the right to access, and independent mobility. In the context of Türkiye, societal barriers appear to be as significant a challenge as physical barriers. People with disabilities experience a cycle of social exclusion and embarrassment due to the cumulative effect of spatial and societal obstacles. A simple task like running errands or commuting, which might take an able-bodied person five minutes on foot, can transform into a complex

socio-spatial challenge for someone with reduced mobility. While an able-bodied individual can navigate the sidewalk and reach their destination with ease, a person with limited mobility must engage in extensive pre-planning and strategize for potential obstacles. These obstacles include uneven sidewalks, malfunctioning bus lifts, unpredictable driver attitudes, and even the potential for social judgment from bystanders. All these social and spatial barriers collectively impede the fundamental right of access.

Passive individuals, neo-liberal urbanization, ignorance of policymakers, as well as other reasonings can all be the sources of the problem for not having the right to access; however, the primary concern of this research is the person who has been passivized along with inaccessible urban space and the societal consequences they face. Accessibility is a right for all, before the right to mobility, the right to the city, and the right to appropriation and participation.

Individuals with disabilities have the right to participate equally in daily life and professional settings, similar to able-bodied individuals. Embracing a rights-based approach to accessibility begins with recognizing the fundamental right to access. Focus group discussions highlighted that individuals with disabilities experience social exclusion and embarrassment primarily in professional environments and during public transport journeys. Addressing spatial accessibility barriers requires acknowledging that individuals with disabilities are no different in social life from others, regardless of their level of access ability. Although spatial barriers often necessitate assistance, offering help without being asked can inadvertently perpetuate social exclusion. This act of assistance can lead to emotional and psychological consequences, exacerbating challenges faced by individuals with disabilities. To counteract this cycle of embarrassment and social exclusion, there is a critical need for a perceptual shift among able-bodied individuals, beginning with viewing people with disabilities and other PRMs as equal to everyone else. Central to this perceptual paradigm shift is the recognition that accessibility is a universal right, regardless of an individual's level of mobility.

The reasoning behind inaccessibility, particularly for Persons with Reduced Mobility (PRMs), raises important questions about societal values, urban planning priorities, and policy implementation. While legal frameworks often mandate accessibility, the persistent barriers suggest a deeper issue. One might question whether there is sufficient political will to enforce these laws effectively. Moreover, there's a cultural aspect where societal attitudes towards disability and assistance influence the experiences of PRMs. Additionally, the economic cost of retrofitting existing infrastructure versus building accessible structures from scratch can be prohibitive, leading to delays or inadequate accessibility measures. Furthermore, the fragmented nature of policymaking and urban planning can result in disjointed efforts that fail to comprehensively address accessibility. Finally, the lack of representation of PRMs in decision-making processes can perpetuate these issues, highlighting the need for more inclusive policies that prioritize the rights and needs of all citizens. Above all, a perceptual shift is crucial regarding the accessibility and perception of PRMs, challenging societal norms and fostering greater inclusivity in urban environments.

The findings underscore the importance of adopting a rights-based approach to accessibility, emphasizing the need for inclusive urban planning and policy-making that prioritize the needs of PRMs. However, the scope of applicability of the study may be limited by its focus on a specific cultural context, Türkiye, and its findings may not be fully generalizable to other regions with different socio-cultural backgrounds and urban infrastructures. Future research endeavours could consider conducting comparative studies across various cultural settings and urban geographies to enhance the broader applicability of the findings and deepen our understanding of accessibility issues faced by PRMs. The study acknowledges certain methodological limitations, including potential influences in participant selection and data collection methods, which may affect the validity and reliability of the findings. Future research could address these limitations by conducting comparative studies across diverse cultural contexts and employing mixed method approaches to achieve a more comprehensive understanding of the challenges faced by PRMs. Furthermore, exploring the effectiveness of specific policy interventions and technological innovations in improving accessibility could provide actionable

insights for policymakers and urban planners worldwide. In summary, while the study offers valuable contributions to the discourse on urban accessibility, future research efforts should strive to expand its scope and address methodological limitations to enhance the applicability and impact of its findings.

References

ADA (2005). Proposed ADA Standards for Accessible Design. United States Department of Justice Civil Rights Division. Retrieved October 15, 2019, from https://www.ada.gov/archive/NPRM2008/ada_standards/proposedadastds.htm

Barnes, C. (1991). Disability and Discrimination in Britain. London, England: Hurst and Co. Ltd.

Battarra, R., Zucaro, F. & Tremiterra, M. R. (2018). Smart mobility and elderly people. Can ICT make the city more accessible for everybody?. *TeMA - Journal of Land Use, Mobility and Environment*, 23-42, https://doi.org/10.6092/1970-9870/5768

Bertolini, L., Curtis, C. & Renne, J. (2012). Station area projects in Europe and beyond: Towards transit oriented development? *Built Environment, 38* (1), 31–50. http://dx.doi.org/10.2148/benv.38.1.31

Bloor, M., Frankland, J., Thomas, M. & Robson, K. (2001). Focus groups in social research. London, England: Sage Publications.

Castaneda, P. (2019). From the right to mobility to the right to the mobile city: Playfulness and mobilities in Bogotá's cycling activism. A Radical Journal of Geography, 52(1), 58-77, https://doi.org/10.1111/anti.12581

Castells, M. (1977). The urban question: A Marxist approach. Cambridge, MA: MIT Press.

Castells, M. (2015). Networks of outrage and hope: Social movements in the internet age. John Wiley and Sons.

Coggin, T. & Pieterse, M. (2015). A right to transport? Moving towards a rights-based approach to mobility in the city. *South African Journal on Human Rights, 31* (2), 294-314. https://doi.org/10.1080/19962126.2015.11865248

Diaz Olvera, L., Plat, D. & Pochet, P. (2013). The puzzle of mobility and access to the city in Sub-Saharan Africa. *Journal of Transport Geography, 32*, 56-66, https://doi.org/10.1016/j.jtrangeo.2013.08.009

Dudovskiy, J. (2021). Business research methodology. Interpretivism (interpretivist) research philosophy. Retrieved January 12, 2022, from https://research-methodology.net/research-philosophy/interpretivism/#_ftn1

European Commission. (2010). European Disability Strategy 2010-2020.

Ferreira, A. & Batey, P. (2007). Re-thinking accessibility planning: A multi-layer conceptual framework and its policy implications. *The Town Planning Review, 78* (4), 429-458, https://doi.org/10.3828/tpr.78.4.3

Gargiulo, C., Zucaro, F. & Gaglione, F. (2018). A set of variables for the elderly accessibility in urban areas. *TeMA - Journal of Land Use, Mobility and Environment*, 53-66, https://doi.org/10.6092/1970-9870/5738

Gready, P. (2008). Rights-based approaches to development: what is the value-added?. *Development in practice, 18* (6), 735-747, https://doi.org/10.1080/09614520802386454

Hannam, K., Sheller, M. & Urry, J. (2006). Editorial: Mobilities, immobilities and moorings. *Mobilities, 1* (1), 1-22, https://doi.org/10.1080/17450100500489189

Harvey, D. (2003). The right to the city. *International Journal of Urban and Regional Research, 27* (4), 939-941.

Harvey, D. (2008). The right to the city. New Left Review, 23-40.

Harvey, D. (2012). Rebel cities: From the right to the city to the urban revolution. London, England: Verso.

Heiser, B. (1995). The nature and causes of transport disability in Britain and how to overcome it. London, England: Research Report-Policy Studies Institute.

Hultgren, K. (1995). Increased quality of railway passenger service by means of the adaptation to the claims of the handicapped. *Mobility and Transport for Elderly and Disabled People*, 1, 273-287.

Jackson, M. A. (2018). Models of disability and human rights: Informing the improvement of built environment accessibility for people with disability at neighborhood scale? *Laws, 7* (1), 10, https://doi.org/10.3390/laws7010010

Jeekel, H. (2018). Inclusive transport: Fighting involuntary transport disadvantages. Elsevier.

Kenyon, S., Lyons, G. & Rafferty, J. (2002). Transport and social exclusion: investigating the possibility of promoting inclusion through virtual mobility. *Journal of Transport Geography, 10* (3), 207-219, https://doi.org/10.1016/S0966-6923(02)00012-1

Kett, M., Cole, E. & Turner, J. (2020). Disability, mobility and transport in low- and middle-income countries: A thematic review. *Sustainability, 12* (2), 589, https://doi.org/10.3390/su12020589

Lefebvre, H. (1996). Writings on cities. Cambridge, MA: Blackwell.

Lefebvre, H. (2015). The right to the city. Istanbul, Turkey: Sel Publishing. (Translated by Ergüden, I.)

Levine, K. & Karner, A. (2023). Approaching accessibility: Four opportunities to address the needs of disabled people in transportation planning in the United States. *Transport Policy, 131*, 66-74, https://doi.org/10.1016/j.tranpol.2022.12.012

Lid, I. M. (2010). Accessibility as a statutory right. Nordic Journal of Human Rights, 28(1), 20-38.

Ling Suen, S. & Mitchell, C. (2003). Accessible transportation and mobility. Transportation Development Centre: Transport Canada. Paper A1E09: Committee on Accessible Transportation and Mobility.

Lucas, K. (2012). Transport and social exclusion: Where are we now? *Transport Policy, 20*, 105-113, https://doi.org/10.1016/j.tranpol.2012.01.013

Mackett, R., Paskins, J. & Titheridge, H. (2004). The incorporation of social inclusion into policies in Local Transport Plans (LTPs). AUNT-SUE Scoping Study Report. Retrieved from http://www.londonmet.ac.uk/aunt-sue/publications.html

Manfredini, F. & Di Rosa, C. (2018). Measuring Spatial Accessibility for Elderly. An Application to Subway Stations in Milan. *TeMA - Journal of Land Use, Mobility and Environment*, 85-94, https://doi.org/10.6092/1970-9870/5800

Meshur, H. F. A. (2016). Evaluation of urban spaces from the perspective of universal design principles: The case of Konya/Turkey. *TeMA - Journal of Land Use, Mobility and Environment, 9* (2), 191–208. https://doi.org/10.6092/1970-9870/378

Murray, A. T. & Davis, R. (2001). Equity in regional service provision. *Journal of Regional Science, 41* (4), 557-600

Myers, M. D. (2009). Qualitative research in business and management. London, England: SAGE Publications.

Nyumba, T. O., Wilson, K., Derrick, C. J. & Mukherjee, N. (2018). The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and Evolution, 20* (32), https://doi.org/ 10.1111/2041-210X.12860

Odame, P. K. (2022). Travel mode choice and its responsiveness to the needs of commuters with disability in the Accra Metropolitan Assembly. *TeMA - Journal of Land Use, Mobility and Environment, 15* (3), 431-445. http://dx.doi.org/ 10.6092/1970-9870/9062

Oviedo, D., Cavoli, C., Levy, C., Koroma, B., Macarthy, J., Sabogal, O., Arroyo, F. & Jones, P. (2022). Accessibility and sustainable mobility transitions in Africa: Insights from Freetown. *Journal of Transport Geography, 105*, 103464, https://doi.org/10.1016/j.jtrangeo.2022.103464

Papa, E., Silva, C., te Brömmelstroet, M. & Hull, A. (2017). Accessibility instruments for planning practice: A review of European experiences. *Journal of Transport Geography, 60*, 167-178, https://doi.org/10.5198/jtlu.2015.585

Pereira, R. H., Schwanen, T. & Banister, D. (2017). Distributive Justice and Equity in Transportation. *Transport Reviews, 37* (2), 170-191, https://doi.org/10.1080/01441647.2016.1257660

Purcell, M. (2002). Excavating Lefebvre: The right to the city and its urban politics of the inhabitant. *GeoJournal, 58*, 99-108, https://doi.org/10.1023/B:GEJO.0000010829.62237.8f

Purcell, M. (2013). Possible worlds: Henri Lefebvre and the right to the city. *Journal of Urban Affairs, 36* (1), 141-154.

Roger, L. M., Kamalasudhan, A. & Titheridge, H. (2008). AMELIA: A tool to make transport policies more socially inclusive. *Transport Policy, 15* (6), 372-378, https://doi.org/10.1016/j.tranpol.2008.12.007

Sager, T. (2006). Freedom as mobility: Implications of the distinction between actual and potential traveling. *Mobilities, 1* (3), 465-488, https://doi.org/10.1080/17450100600902420

Salon, D. & Gulyani, S. (2010). Mobility, poverty, and gender: Travel 'choices' of slum residents in Nairobi, Kenya. *Transport Reviews, 30* (5), 641–657, https://doi.org/10.1080/01441640903298998

Stauskis, G. (2018). Monitoring user-based accessibility assessment in urban environments and in public buildings. *TeMA-Journal of land use, mobility and environment, 11* (1), 89-106, https://doi.org/10.6092/1970-9870/5426

Şen, S. (2012). Kentlilik üzerine düşünmek. Eğitim, Toplum ve Bilim Dergisi, 110-117.

Tudzi, E. P., Bugri, J. T. & Danso, A. K. (2017). Human rights of students with disabilities in Ghana: Accessibility of the university built environment. *Nordic Journal of Human Rights, 35* (3), 275–294. https://doi.org/10.1080/18918131. 2017.1348678

UITP (2019). Mobility and the SDGs: A safe, affordable, accessible and sustainable transport system for all. Brussels: the International Association of Public Transport (UITP). Tratto il giorno May 31, 2024 da https://cms.uitp.org/wp/wp-content/uploads/2021/04/190520-UITP-UCLG_on_Mobility_and_SDGs.pdf

UN-Habitat (2008). State of the world's cities 2010/2011: Bridging urban divide. Earthscan Publishing, London.

United Nations (1948). Universal Declaration of Human Rights. United Nations. Retrieved from: http://www.un.org/en/udhrbook/pdf/udhr_booklet_en_web.pdf

United Nations (2013). New Global Partnership: Eradicate Poverty and Transform Economies through Sustainable Development. New York: United Nations Publications

United Nations (2015). Sustainable Development Goals: 2030 Agenda for Sustainable Development. Retrieved from: https://www.un.org/disabilities/documents/sdgs/disability_inclusive_sdgs.pdf

Verlinghieri, E. & Schwanen, T. (2020). Transport and mobility justice: Evolving discussions. *Journal of Transport Geography, 87*, https://doi.org/10.1016/j.jtrangeo.2020.102798

Zajac, A. P. (2016). City Accessible for Everyone – Improving Accessibility of Public Transport Using the Universal Design Concept. *Transportation Research Procedia, 14*, 1270-1276, https://doi.org/10.1016/j.trpro.2016.05.199

Author's profile

Cihan Erçetin

He is a post-doctoral researcher at the Department of Earth & Environmental Sciences, Spatial Applications Division Leuven – SADL. He currently works under UPPER – Unleashing the Potential of Public Transport in Europe – Horizon Europe project with a special emphasis on the Serious Games publication as a co-creation practice from UPPER, project manager of the partner in Türkiye for the 15 Minutes City ERA-NET proposal for Driving Urban Transition (DUT) Call, modal share calculation and user satisfaction assessment methods, and transition pathways of UPPER cities' measures related to the Theory of Change. He is also working on research articles about cycling policy assessment in the city of Leuven and innovative co-creation methods. Cihan's expertise also involves working as a teaching assistant at the Middle East Technical University, City and Regional Planning Department (2011-2022), and as a consultant/sectoral expert in the projects about Green City Action Plan, Cycling Masterplan, accessibility of public transport, institutional mapping (Google Mymaps), and accessibility barriers mapping (ArcGIS Online). He also has academic research experiences on urban design, urban mobility policy discussions, bike-sharing system planning and management, and legal-spatial-societal-administrative accessibility barriers of Persons with Reduced Mobility, and co-defining the barriers during his Master's and PhD.

TeMA

Managing local knowledge about NBS in spatial planning. A group model building approach

Stefania Santoro [a]*, **Giulia Mastrodonato** [b], **Domenico Camarda** [c]

[a] IRSA - CNR
Water Research Institute of Italian Research Council
Bari, Italy
e-mail: stefaniasantoro@cnr.it
ORCID: https://orcid.org/0000-0001-6277-6056
* Corresponding author

[b] DICATECh
Polytechnic University of Bari, Italy
e-mail: julie.mastrodonato@gmail.com
ORCID: https://orcid.org/0000-0002-6959-9002

[c] DICATECh
Polytechnic University of Bari, Italy
e-mail: domenico.camarda@poliba.it
ORCID: https://orcid.org/0000-0001-6311-3289

Abstract

Nature-based solutions (NBS) are increasingly adopted as measures for enabling climate change mitigation and adaptation, reducing flood risks and enhancing urban ecosystems. However, several barriers hinder the implementation of NBS in urban areas, in planning activities and strategies. These include the inadequacy of some existing methods based on hard and top-down approaches, the complexity and uncertainty associated with the network of citizens involved and the structuring of the knowledge deriving from that, in urban strategies. Local knowledge could help to understand the success or failure of actions designed only by expert knowledge.

To this aim, this paper contributes to a current debate about methodological approaches to knowledge assessment to adopt in urban planning processes. Specifically, this paper proposes a Group Model Building approach for one of the activities carried out within the planning process for the Master Plan draft of the city of Brindisi, to support NBS implementation.

The results, among others, highlight three important aspects: the importance of building a model to support the elicitation of participants' knowledge, the need to create a well-structured process leading to consensus, and the need to involve the young population in the participatory processes.

How to cite item in APA format:

Santoro, S., Mastrodonato, G. & Camarda, D. (2024). Managing local knowledge about NBS in planning. A Group Model Building approach. *TeMA - Journal of Land Use, Mobility and Environment, 17* (2), 265-283. http://dx.doi.org/10.6093/1970-9870/10810

1. Introduction

The climate variations linked to climate change significantly impact modern cities, subjecting them to new and unprecedented challenges. The resilience of urban contexts, understood as the interconnection of environmental, cultural, economic, political, and institutional processes, is put to the test by the disasters generated by such changes. Extreme weather events, droughts, sea-level rise, coastal erosion, heatwaves, or floods constantly undermine natural and human-altered environments. In a vicious circle, the temperature increase generates a greater energy demand, resulting in higher greenhouse gas emissions and, consequently, further temperature rise and worsening conditions that promote climate change. (Lee, 2018; Sinatra et al., 2023).

The concentration of dark surfaces and the lack of vegetation, replaced by buildings and roads, lead to a gradual increase in air temperature observed in many cities worldwide, resulting in the generation of "urban heat islands". The prevalence of asphalt surfaces, which absorb solar radiation, contributes to the overheating of the air, also reducing soil permeability. Similarly, non-reflective roofs increase the demand for cooling buildings during the summer. Akbari et al. (2001) estimated that in the centre of Los Angeles, from 1930 to 1990, temperatures increased by 0.5°C per decade, leading to an increase of about 500 megawatts (MW) in air conditioning demand per degree in the Los Angeles basin. These phenomena influence the climate, exacerbate energy consumption, and impact the livability of cities, with consequences for health. In essence, urban areas do not benefit from the natural cooling effect of vegetation (Akbari et al., 2001). The structure and configuration of urban environments also heavily influence urban microclimates and surrounding areas, affecting physical environmental parameters such as temperature, humidity, airflow, etc. (Howard, 2012; Sinatra et al., 2023).

The Mediterranean basin, vulnerable to such changes, experiences prolonged droughts, an increase in the frequency of floods, changes in solar radiation, and demographic surges due to often inadequately controlled urbanization processes, leading to an increase in traffic and pollution (Pelorosso et al., 2015).

Over the next 50 years, an average increase in global temperatures of about 3°C is predicted in metropolitan areas (Balletto et al., 2018; Morabito et al., 2021). In Italy, temperatures have increased by over 2°C in the last 60 years, increasing environmental and structural vulnerability and endangering the well-being of citizens (Sinatra et al., 2023).

The resulting increase in territorial fragility has translated into a growth in the Italian surface potentially subject to landslides and floods, according to ISPRA data (2022), from 4% to 19% in just 4 years. Italy is particularly prone to hydrogeological instability due to its endemic geomorphological and structural characteristics, as well as its climatic and topographic features. The situation has worsened due to the lack of adequate planning, impacting not only the environment and the well-being of the population but also the immense cultural heritage, infrastructure, economy, and communities (Bangash & Passuello, 2013).

In this context, there is a need to establish a connection between local and global aspects, adopting risk monitoring and mitigation strategies and a planning process capable of significantly influencing the complex climate-city system (Sinatra et al., 2023). Urban planners cannot tackle the challenge by simply assessing the economic and technological issues of projects, the ability to provide goods and services to human society, and the ability of ecosystems to complete their cycles (Bangash & Passuello, 2013). To better predict risks, an interdisciplinary approach is necessary, requiring the involvement of communities and local institutions, as well as strengthening social learning from past disaster experiences (Imperiale & Vanclay, 2023). In fact, social behaviours can heavily influence future scenarios (Blečić et al., 2023), while knowledge co-production processes can promote greater social resilience (Carnelli & Pedoth, 2023). For these reasons, citizens need to become increasingly attentive to the environment and reclaim the regenerated spaces in which they live.

In this context, the risk mitigation action can be effectively carried out by ecosystem structures, including urban ones, such as green areas (gardens, urban vegetable gardens, spontaneous vegetation) and blue areas

(surface watercourses, lakes) capable of introducing more sustainable urban transformations (Pelorosso et al., 2015; Lai et al., 2021; De Noia et al., 2022). Numerous studies indeed demonstrate that the presence of these infrastructures mitigates the impacts of negative stressful events on physical and mental health; nature acts as a protective barrier against the effects of life's stressors (Hazer, 2010; Houlden & Weich, 2018; Poortinga et al., 2021; Van den Berg, 2010). To balance the negative impacts induced by conflicts between nature and human action, and to reduce exposure to disasters, current urban regeneration projects are being called upon to consciously design Nature-Based Solutions (NBS) that protect and manage natural resources. NBS have a wide range of uses across different settings. In cities, urban parks and rooftop gardens act as green lungs, reducing pollution and providing gathering or meeting spaces. In agriculture, sustainable cultivation practices can regenerate soil and enhance crop resilience. Along coastlines, the establishment of natural barriers such as mangroves can provide protection against storms and erosion. Hydrological protection systems can be introduced such as green roofs, permeable surfaces, and artificial wetlands capable of acting on the urban microclimate, for example by mitigating the effects of the heat island or improving the ecological network so increase biodiversity. The benefits introduced by these NBS are not limited to producing pleasant landscapes but add value to the complex and dynamic architectural project of the urban context, bring social and ecological value, improve conditions of comfort and well-being, offer recreational services, play spaces and increase the tourist attractiveness. Ultimately, they contribute to the increase of the social capital (Poortinga, 2021). From this point of view, NBS must be recognized as having an essential multifunctional role in the achievement of higher levels of socio-ecological resilience (Zurlini et al., 2013). Their design must be located into a network of ecosystems integrated with the built environment, engineered, and capable of producing circular approaches that go beyond the traditional problem-solving of structural engineering, providing different solutions that, from time to time, adapt to the particular environmental and landscape context (Recanatesi et al., 2017). Furthermore, a correct methodological approach to these problems requires an effective and efficient plan that adopts a holistic perspective that allows integrating not only ecological aspects but also cultural and social issues.

To this aim this paper shows a multi-step methodology adopted during the drafting of the preliminary programmatic document (DPP), the first document of the master plan (PUG) process, for the city of Brindisi (Italy) aimed at taking advantage of a multi-agent cognitive support system. Its implementation attempts to elicit and exchange participants' perceptions, their knowledge and to promote NBS strategies.

The following section introduces the role of the participatory approach in planning strategies. Chapter 3 presents materials and methods adopted, related to the research effort. Chapter 4 shows the results achieved, including an overall discussion about them. Chapter 5 ends up the paper with some closing remarks.

2. Participatory approach for planning strategies

Given the increasingly intricate relationship between humans and nature, urgent management and protection of ecosystems, natural and urban landscapes, and the conservation of natural resources (water, soil, air) are emphasized. The project and management of multifunctional green infrastructure for the sustainable development of cities are deemed unavoidable.

The planning and implementation of actions for disaster risk reduction have become essential to cope with the increasing frequency of such events. The need for international collaboration is recognized, along with the promotion of investments that respect environments and natural habitats. Nations can intervene in reducing climate change and its resulting environmental damage by adopting policies and measures aimed at curbing land consumption, promoting more controlled and cautious land use, encouraging early warning measures, and improving infrastructure to reduce vulnerability (Velarde et al., 2017). Institutions, governments, and companies are called to encourage the adoption of preventive behaviours capable of mitigating environmental risk. Even citizens' behaviours play a pivotal role as they can influence the impact and recovery time before,

during, and after a disaster (Lee, 2018; IPCC). In this context, disaster planning is not merely a complex exploratory process that provides generic procedures to manage unforeseen impacts but should be able to produce carefully constructed scenarios capable of revealing the needs that will arise downstream of foreseeable risks (Aerts, 2018).

Addressing a disaster thus becomes a social process that necessitates an integrated perspective between structural engineering and social sciences on resilience and its construction, involving public support and promoting the participation of a wide range of stakeholders, including technical experts, responders, and citizens. The scientific community now recognizes that reducing social vulnerability to risk is essential for sustainable development. This can be achieved by integrating a socio-psychological perspective into the planning phase. Understanding the viewpoints of these stakeholders regarding mitigation solutions and increasing their awareness enhances the social acceptability of adopted measures (Alexander, 2015). The governance tools employed so far have often prioritized technical aspects rather than encouraging community involvement, despite extensive literature showing that greater awareness of risk prevention and mitigation measures would lead to increased acceptance by communities (Martín et al., 2020).

As a result, alongside more purely engineering factors, it becomes crucial to establish a knowledge base that is independent of planning techniques and regulatory standards, capable of contributing to the construction of a comprehensive knowledge framework. Indeed, the development of technical-scientific methodologies struggles to address the growing complexity of urban systems and socio-ecological interactions due to the high degree of uncertainty arising from continuous territorial transformations and processes of global climate change.

In this context, the development of an emergency plan is similar and parallel to urban and territorial planning processes. Emergency planning is a multi-agency process of systematic preparation for future contingencies, including severe incidents and disasters (Aerts; 2018) which requires the integration of collective participation processes and territorial governance. To this end, the scientific community's interest in involving citizens and their local knowledge has grown. This knowledge, encompassing various cultural and economic aspects, poses the challenge of overcoming the intellectual impasse related to its integration into the domains of risk management and related decision-making processes. On the one hand, this consolidated negligence is the result of technical-methodological criticalities linked to the intrinsic complexity of local, widespread, and multiple knowledge. This proves to be not well-suited for computational treatment and is difficult to translate into structured knowledge for practical use. On the other hand, negligence is the outcome of the importance attributed to more traditional approaches that emphasize expert knowledge, relegating and assigning a secondary role to local knowledge. These methods have promoted rational approaches based on deterministic models that often highlight the limitations caused by uncertainties and the instability of the natural system (Gardner, 2002; Lee et al., 2018). However, the transition to the new method has entailed having to face new challenges in the field of knowledge understanding and management since, particularly in community contexts, information comes from multiple agents generating complex systems of knowledge. To address these complexities, new integrated spatial planning approaches have been developed that combine different calculation methods and tools to interpret the linguistic and semantic differences (so-called "Babel effect") that often occur in participatory situations (Camarda, 2010; Hewitt, 1983). The effectiveness of participatory planning in managing the complexity of territorially extended systems, characterized by territories on a regional scale or by urban contexts of a metropolitan nature, is still being evaluated as these systems involve a vast amount of data coming from a kaleidoscope of agents, representing a particular challenge in defining a method (De Liddo & Concilio, 2017; Lichfield, 1998). According to Khakee et al. (2000), there is a recognized urgent need to draw upon a resilient heritage of social and environmental knowledge, fueled by interactive cognitive processes within the community itself, alongside more conventional knowledge structures. Local-level knowledge goes beyond the physical attributes of places; it also encompasses established spatial relationships,

social and economic dynamics, as well as how vital environments within the community are used and protected. This kind of knowledge, far richer and more intricate than initially assumed, stems from direct experience of places or from the observation of urban dynamics and territorial evolution, often remaining undisturbed by institutional constraints. To promote a strategic and effective vision, this socio-environmental complexity requires dedication to conceiving future development scenarios within multi-agent contexts capable of generating interactions that facilitate the elicitation and exchange of such cognitive knowledge contents. The resulting informal knowledge could be hardly obtained otherwise (Borri et al., 2014). In planning instruments, processes are needed to implement technical aspects related to the design and implementation of green measures and consider the complexity associated with their implementation by citizens. In processes of urban transformation and redevelopment that involve the integration of public green spaces, it is necessary to understand which qualities of green spaces are truly appreciated and important to the residents (Heft, 2013). In this context, our hypothesis, supported by the literature, is that it becomes important to enhance citizens' knowledge and understand how people live and perceive urban green spaces and the presence of Nature-Based Solutions (NBS). This contributes to the structuring of a participatory process that provides useful elements for planning choices. This work aims to propose a methodological approach towards a conscientious planning and design of NBS for urban ecosystem services, to achieve a sustainable integration between human activities and environmental considerations. The case study presented in the following sections represents an attempt to introduce a participatory approach to define a complex environmental, ecological, and social system, aimed at gathering and eliciting local knowledge about Nature-Based Solutions (Heft, 2013). The complexity in defining this system depends on several factors such as the number of elements involved, the number of interrelationships among the elements, and the cross-functional connection among the elements of the system (Sterman, 2000). Interactions among the various elements of a system generate complex behaviours (Limburg, 2002) and nonlinear relationships generate dynamic transformations (Morçöl, 2005). Many conceptual frameworks have been developed to support the knowledge and complexity modelling process, emphasizing the direct involvement of participants in the modelling process (Akkermans & Vennix, 1997; Andersen & Richardson, 1997; Rouwette et al., 2002). They are conceptual frameworks that develop dynamic models in which, however, the involvement of participants during the model design process presents several methodological challenges. For example, Andersen, Richardson and Vennix (1997) note that "group model building is still more art than science." To this end, this paper contributes to the current debate on methodological approaches to knowledge assessment to be adopted in urban planning processes. Specifically, this paper proposes a Group Model Building (GMB) approach based on a Causal Loop Diagram (CLD) building for one of the activities carried out as part of the planning process of the draft Master Plan of the city of Brindisi, to support the implementation of NBS. In this context, due to the adopted systemic approach based on knowledge elicitation, it suggests to the administration a tool for mutual social learning, which can provide the urban plan with both a substantive structure and the implementability of participatory and shared visions (Schön & Argyris, 1996).

3. Materials and methods

3.1 Case study: physical framework

Brindisi is a coastal city situated in the southeastern part of the Puglia region in Southern Italy, with a population exceeding 85,000 residents and covering a geographic area of 333 square kilometers (Figg. 1a and 1b). In terms of hydrology, the city encounters a significant hydraulic risk, stressed out in the current regional hydrological plan (PAI) (Fig.1), due to the presence of watercourses.
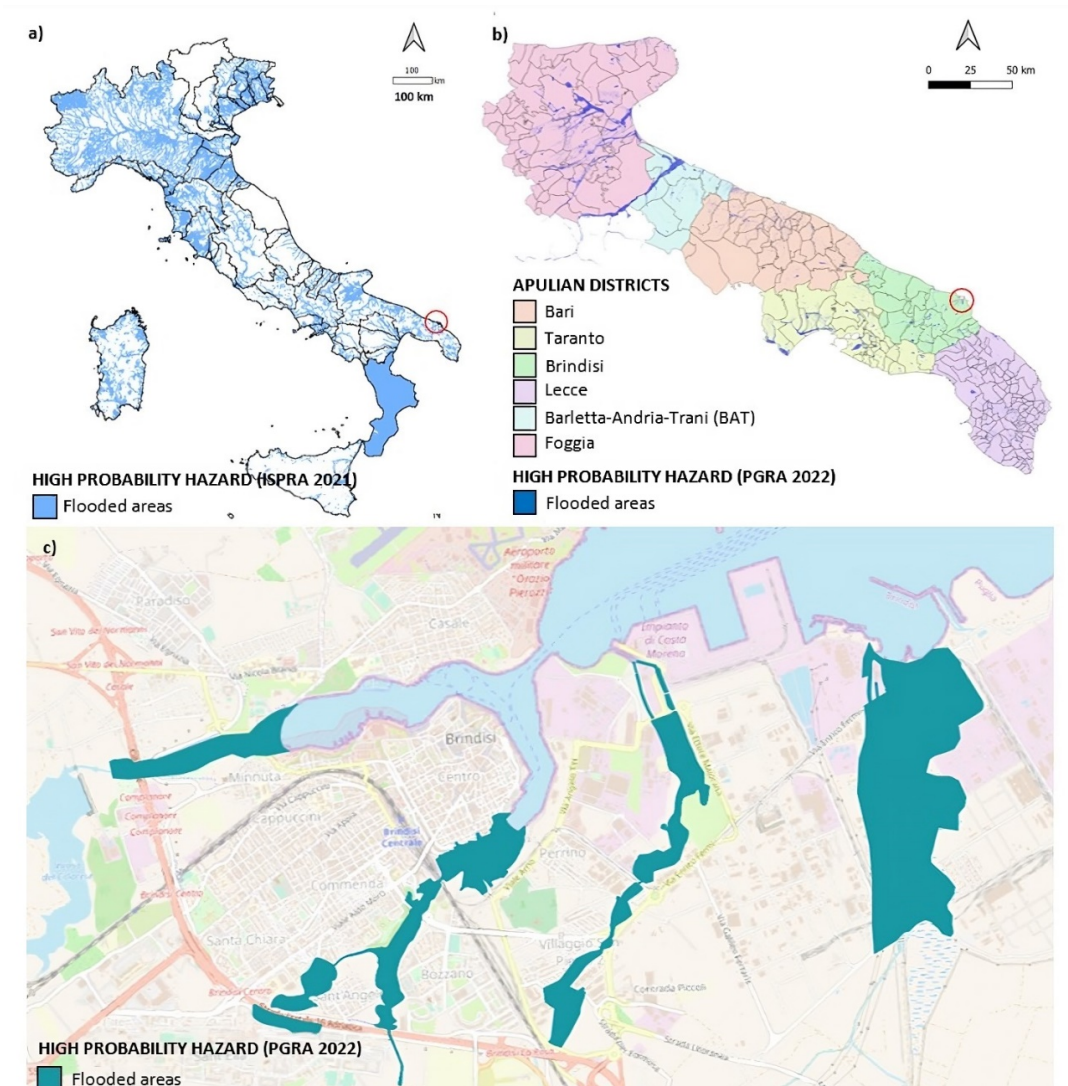
Fig.1 Flood hazard maps (return period: 30 years): (a) national scale; (b) regional scale; (c) urban scale. Source: authors' elaboration

Morphologically, the city features a wide natural inlet that has facilitated the development of a port since the times of the Roman Empire. The urbanized area has grown around the main watercourses, i.e.: the Cillarese Canal, characterized by the presence of the homonymous dam along its embankment, the Patri Canal, primarily linked to the urban fabric and, in the industrial area, the Fiume Piccolo and Fiume Grande watercourses (Fig.1c). The intersection of watercourses with the geomorphological attributes of the region, along with the intricate urban network, has led to numerous instances of flooding throughout the years. For further information regarding flood occurrences, see Santoro et al. (2022). The impacts observed during flood events increasingly require urgent hydraulic mitigation measures. While steps are being taken in this direction, the implementation of green solutions remains significantly far from being realized.

3.2 Case study: planning framework

From the point of view of urban planning, the process of the new master plan of the city of Brindisi (Italy), started in the early 2000s, was interrupted in 2011 with a draft of the so-called preliminary programmatic document (DPP) required by the legislation of the Apulia Region. The new Municipal Administration (MA) elected in 2017 resumes the urban planning process with an inclusive and knowledge-oriented approach. The purpose is to intercept the numerous instances of complexity of the urban system through the construction of

interactive knowledge bases with the community. The path defined by the MA, now incorporated in the previous process, is defined in Fig.2.
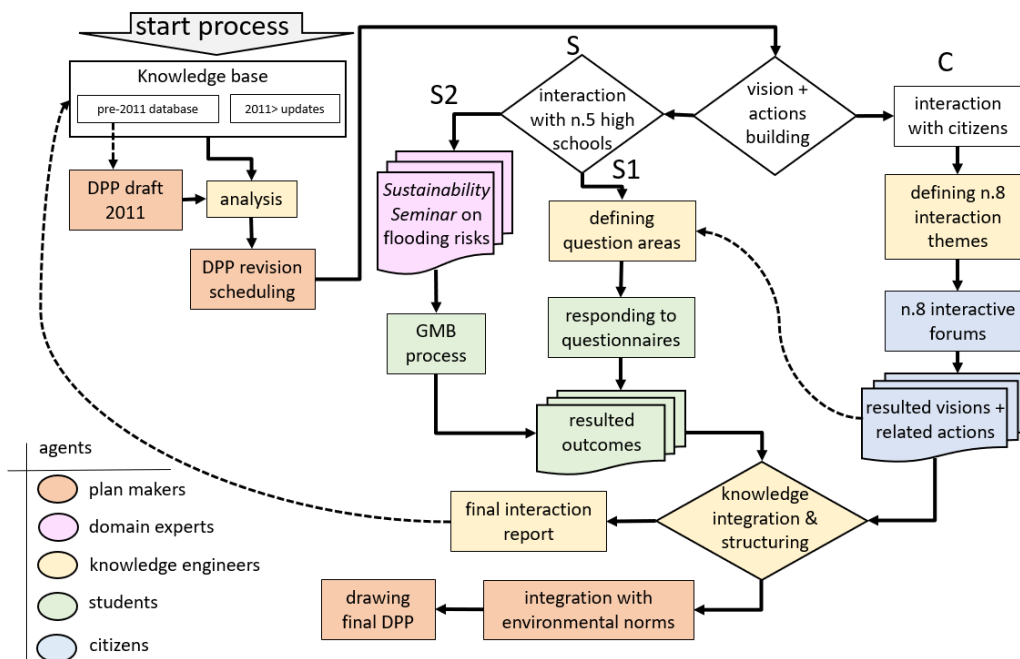
Fig.2 Workflow of the participative process to define the new master plan of the city of Brindisi. Source: authors' elaboration

This process revolves around the pivotal and substantial contribution of cognitive participation. It culminates in the formulation of an updated edition of the DPP, serving as an essential cornerstone for the forthcoming real plan. A spectrum of diverse agents takes part in this process, each assuming distinct roles and carrying out different tasks. Fig.2 visually underscores the most pertinent agent categories through distinct colors. However, it's implied that each category includes a further differentiation among agents. Although apparently irrelevant, at times, yet agents can wield functional roles in shaping the outcomes of the diverse phases of this process, much like the customary occurrences in group behaviors and dynamics (Ferber et al., 2009).

On startup, the process layout defines a phase of analysis of the knowledge base and documentation related to the old draft DPP. Subsequently, it shows the program of the successive phases of the participatory construction of future visions. This is the organization of cognitive exchange arenas, in which the flow of knowledge develops a multidirectional evolution (Schön & Argyris, 1996).

In fact, on the one hand, the knowledge agents gathered in this process learn the general tools and purposes underlying the MA initiative. On the other hand, they express knowledge and needs that are useful for defining contents and strategies for an inclusive and effective plan. Moreover, it is also a horizontal exchange of knowledge between the participating agents themselves, useful for completing a framework of mutual social learning that gives a substantive and implementation structure to the plan (Schön & Argyris, 1996). In the lexicon coming from consolidated experiments and case studies on this topic, the process is mainly oriented towards generating visions of the future and possible actions useful for building paths to achieve those visions (Bell, 2003; Camarda, 2018).

The first phase of interaction is the flow marked in the Fig.2 with the letter C. It develops through a series of 8 structured interactive forums on 8 topics, namely: (i) Territory and city: history and future developments; (ii) Environment, ecology and sustainable development of the territory; (iii) Sustainable infrastructures of the territory; (iv) Agriculture and the city; (v) City, sea and port; (vi) Territory, quality of life and health; (vii) Urban regeneration and new forms of quality; (viii) Towards the smart city: knowledge society and development.

These forums are inspired by the so-called *future workshop* experiences born in the 1990s as an evolution of strategic planning experiments developed by the Tavistock Institute in the UK in the 1970s (Friend, 1969). Brindisi forums are more organizationally simplified, as compared to original future workshops: however, they are still focused on establishing a mutual learning environment between participants, oriented towards building the futures of the community. The 8 thematic forums have developed with the support of semi-computerized environments. In them, knowledge is mutually exchanged in hybrid form, oral and written (via computer or smartphone) and dynamically shown on screen to the participants. Concerning the specific aspects, advantages, and limits of this methodology there is a consolidated and continuously updated literature – which can be referred to for further information (Khakee et al., 2002; Santoro et al., 2020).

In the context of the experiments in Brindisi, the approach has proven to be well-suited for stimulating and effectively exchanging extensive and diverse contents, as well as forms of knowledge. An important advantage of computer-based hybridization is the ability to yield a database at the end of the cycle. This comprises a repository of perspectives and potential lines of action that can be readily consulted for further planned activities. Particularly, upon concluding the activities within flow C, the resulted database was utilized as a primary source by analysts, industry experts, and knowledge engineers to augment the structure of questionnaires at the outset of the subsequent phase.

This second phase corresponds to the streams labelled with letter S in the figure, and it was developed as a cognitive interaction involving students from five high schools in Brindisi. Flow S1 engaged students from the final two academic years (IV and V classes), while flow S2 only involved the students from the last academic year. Flow S1 started with a meeting between the knowledge engineers who defined the areas of investigation, based on the acquired knowledge and structured the questionnaires. The interaction then took place on five different days, one for each school. It was developed by entering the answers in forms prepared on the web portal of the Municipality of Brindisi. The answers were then structured by topic and reported in the final repository as results obtained. Subsequently, after a few months, flow S2 took place – which is discussed more specifically below.

Once all the sub-processes of cognitive interaction were concluded, the outcomes were amalgamated and integrated into a final structured body of knowledge. One notable result is that this database has now evolved into a valuable augmentation of feedback for the initial knowledge repository, so further fueling it for subsequent analytical needs. However, the primary function of this structured knowledge is to facilitate a substantial enhancement of the initial DPP documents, incorporating innovative elements of inclusivity—both in terms of knowledge and widespread requirements. This enhancement was then finalized and actualized in the concluding phase through integration with regional environmental regulations. This culminated in the formulation of the new DPP, which was approved in 2023.

4. Methodology

The adopted methodology used the GMB-CLD. It is a participatory approach for extracting knowledge through formal and facilitated activities (Hernantes et al., 2012). It has the advantage of helping participants to define, clarify and organise their ideas into a shared vision (Château et al., 2012). GMB can be traced within the Theory of System Thinking to a broader process known as the Designing thinking process.

According to Brown (2008), the Design Thinking process provides a structured and systematic approaches to problem solving and is divided into two phases (Fig.3). The divergent thinking phase, which represents the problem space in which multiple different pieces of information are contained, and the convergent thinking phase, which represents the solution space in which, based on existing problems and constraints, shared solutions and strategies are devised.

The Design Thinking process is composed by a three-stage cycle: *inspiration, conception or ideation* and *implementation*. The inspiration stage aims to identify and describe the problem to be addressed. The

information from this stage is formalised and submitted to the ideation stage. This stage provides a unique opportunity to involve stakeholders in the ideation process. The implementation phase focuses on the evaluation of proposed solutions and potential scenarios (Brown, 2008).
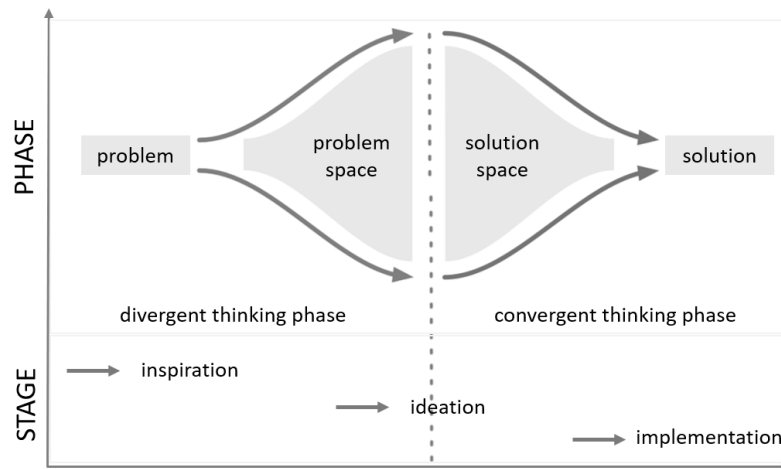
Fig.3 Design Thinking Process. Source: authors' elaboration. Adapted from Brown (2008)

Among several useful models for structuring the process, the Causal Loop Diagram (CLD) was chosen. According to Sterman, 2000, CLDs are very helpful in assisting non-expert stakeholders in developing a better understanding of the main interconnections in a complex system.

As can be seen from Fig. 4, a CLD consists of four basic elements: the variables, the links between them, the signs on the links (showing how the variables are interconnected. The CLDs are connected by arrows with polarity either positive (+) or negative (−) to indicate their interdependency and the ring sign (indicating the type of behaviour the system will produce).

The construction of the CLD took place according to the following six steps (Hördur Haraldsson, 2004): (i) identification of the variables, (ii) determine causality between variables, (iii) assess a link, (iv) assess a polarity of a link, (v) write the feedback, (iv) write the loop behaviour: reinforced feedback loop (R) or balance feedback loop (B).
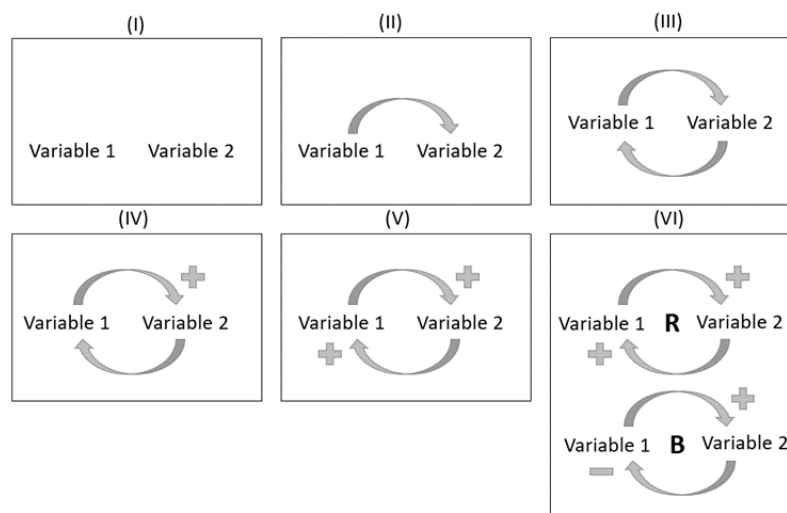
Fig.4 The Causal Loop Diagram building process. Source: authors' elaboration. Adapted from Hördur V. Haraldsson, 2004

Specifically, according to the type of connections, the variables can be divided into ordinary (with incoming and outgoing connections), drivers (outgoing connection) and receivers (incoming connection).

The variables can also be classified according to the degree index. Specifically, the sum of incoming and outgoing connections generates the centrality index. The outgoing connection generates the outdegree index

and the incoming connection generates the indegree index. These indices therefore generate a ranking of the most representative variables in the model (Freeman et al., 1991). The activities of GMB have been organised in three phases: pre-meeting activities, activities during the modelling sessions and follow-up activities (Bérard, 2010).

The pre-meeting activities are part of the *inspiration stage* and are aimed at structuring the situation. To this end (i) a literature analysis and construction of the theoretical framework of the CLD model were created.

The students' activities represented the *ideation stage* in which storytelling; working group were carried out; this phase also included the *implementation stage* which was adopted through implementation and validation of the model; generation of future scenarios.

During the follow up activities scenarios, measures and strategies for the implementation of the NBS were developed by the analyst from the results achieved.

The GMB activities are summarized in Fig.5.

DESIGN THINKING PROCESS	DESIGN THINKING PHASES	divergent		convergent
	DESIGN THINKING STAGES	inspiration	ideation	implementation
GROUP MODEL BUILDING PROCESS	GROUP MODEL BUILDING ACTIVITIES	pre-meeting	during meeting	after meeting/ follow up
		literature review CLD theoretical model building	storytelling working group CLD implementation and validation	scenario building measures and strategies for NBS implementation in urban planning

Fig.5 The application of GMB activities in Design Thinking Process. Source: authors' elaboration

5. Results and discussion

A model was constructed concerning the benefits of implementing Nature-Based Solutions in the urban context, drawing from the literature. At the end of the activity, students were requested to present the outcomes of their process in a collective discussion. The information developed by both groups was deliberated upon, and the connections within the model were jointly validated. The model validation and implementation activity resulted in the incorporation of new variables highlighted in Fig.8. Through the group exercise, students highlighted the outcomes of urban regeneration, which would encourage the adoption of maintenance actions in public spaces, both diminishing impermeable surfaces and recovering abandoned buildings. Urban regeneration was also perceived as a non-structural and socially engaging measure to address delinquency.

More specifically, urban regeneration would contribute to the reduction of impermeable areas, referring to surfaces that don't absorb water and consequently amplify runoff in two specific areas: Perrino (yellow ring n.4, Fig.9) and Larosa (yellow ring n.3, Fig.9). This factor stands as a notable contributor to flood risk, an issue acutely felt in the city. According to a study conducted by Santoro et al. (2022), based on the dataset of Italian Vulnerable Areas (AVI Project), there were sixty-four flood events recorded between 1951 and 1999. Subsequently, from 1999 onward, an average of a couple of flood events annually has been registered (Santoro et al., 2023). Among the urban regeneration activities that enhance the feasibility of implementing NBS, there's the revitalization of abandoned buildings. As acknowledged in the literature, these solutions bring benefits not only to the microclimate of the structures but also to the surrounding environment, promoting cooling, mitigating the urban heat island effect, and enhancing air quality (Gunawardena et al., 2017). According to discussions among the students, the neighborhoods where this type of intervention is needed include Paradiso (yellow ring n.1 Fig.9), Sant'Elia (landmark n.2 Fig.9) neighborhoods.
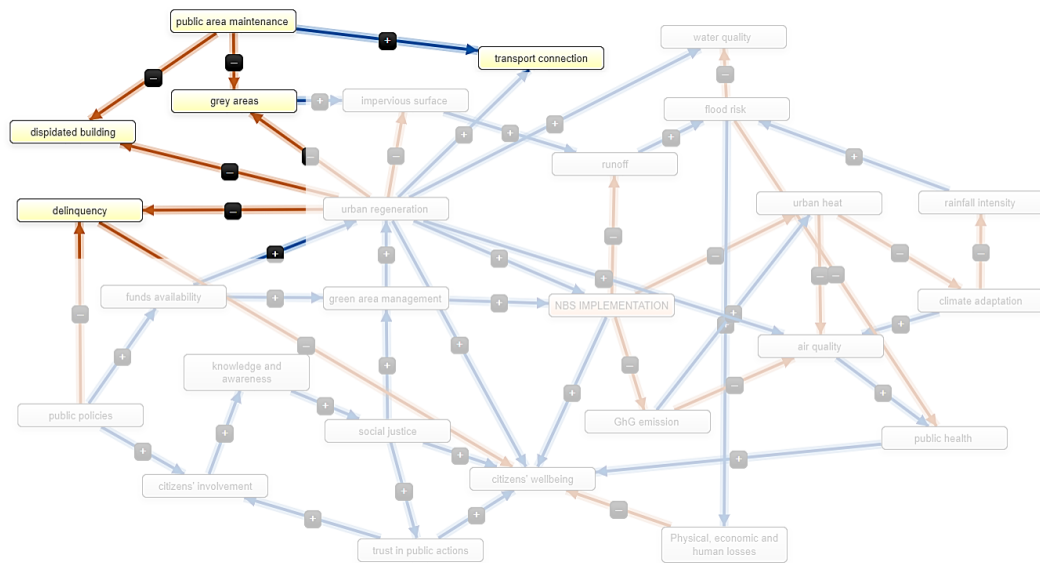
Fig.8 CLD resulted from plenary discussion. The portion about the theoretical model is slightly obscured. Source: authors' elaboration

Furthermore, as emerged from the discussion, urban regeneration can have significant implications for reducing delinquency. This concept is in line with the integrated approach to urban regeneration, which combines economic and environmental spheres with social and cultural elements (Alpopi & Manole, 2013). Another aspect arising from the public discussion is the enhancement of the transportation network, a desirable outcome of proper management of public areas. A concern spanning the entire city but amplified in the Larosa (yellow ring n.3, Fig.9) and Paradiso (yellow ring n.1, Fig.9). Rocha et al. (2023) provide policymakers insights into incentives that could more effectively boost the use of public transportation. The adoption of such strategies not only strengthens services but also reduces environmental impact, improves air quality, and reduces city congestion stemming from car traffic.
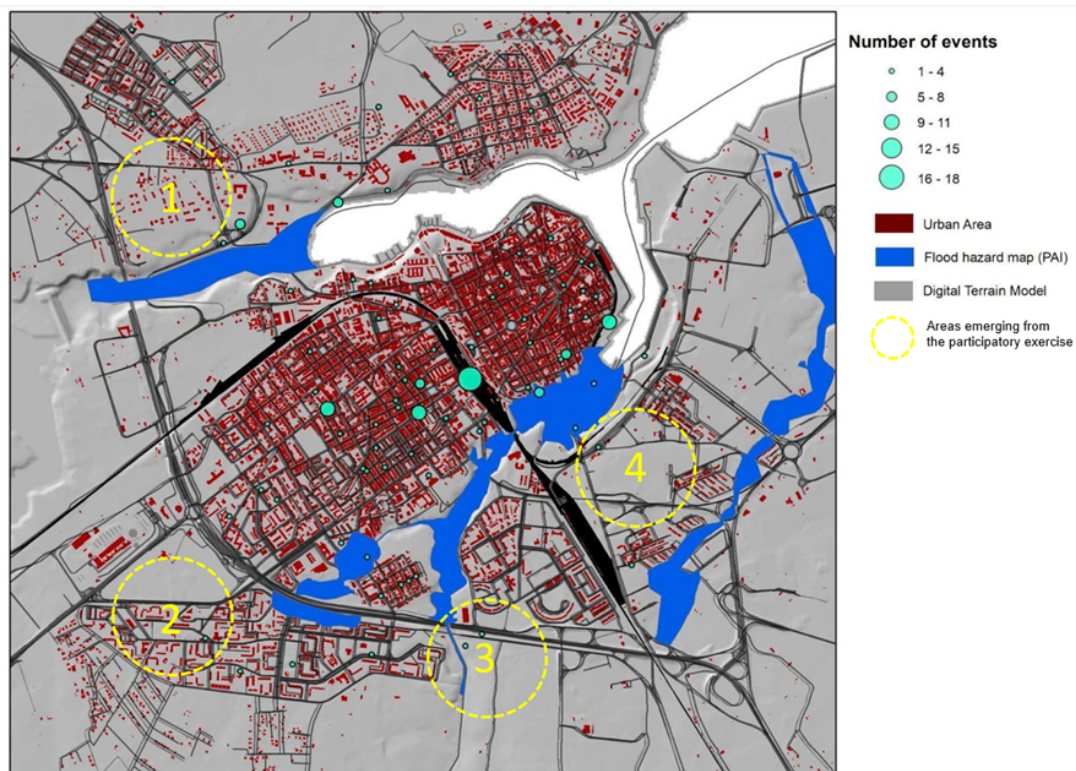
Fig.9 Geolocalised historical flood event. The size of the sphere indicates the number of events recorded. Source: authors' elaboration

Looking at the centrality indices (Tab.3) it is possible to note that the ranking of the variables remains almost unchanged. The urban regeneration indices (from 7 to 11) and citizens' well-being (from 6 to 7) have improved. To underline the validation of the theoretical framework of CLD.

Component	Indegree	Outdegree	Centrality	Type
urban regeneration	2	9	11	ordinary
citizens' wellbeing	7	0	7	receiver
air quality	4	1	5	ordinary
flood risk	2	3	5	ordinary
green area management	2	2	4	ordinary
social justice	1	3	4	ordinary
urban heat	2	2	4	ordinary
delinquency	2	1	3	ordinary
public area maintenance	0	3	3	driver
grey areas	2	1	3	ordinary
impervious surface	2	1	3	ordinary
trust in public actions	1	2	3	ordinary
public policies	0	3	3	driver
GhG emission	1	2	3	ordinary
funds availability	1	2	3	ordinary
public health	2	1	3	ordinary
citizens' involvement	2	1	3	ordinary
climate adaptation	1	2	3	ordinary
runoff	2	1	3	ordinary
dispidated building	2	0	2	receiver
transport connection	2	0	2	receiver
rainfall intensity	1	1	2	ordinary
Physical, economic and human losses	1	1	2	ordinary
water quality	2	0	2	receiver
knowledge and awareness	1	1	2	ordinary

Tab.3 Variables' index of theoretical CLD

The after-meeting activities provided a scenario analysis. Specifically, two types of scenarios were constructed. Business and Usual (BAU) scenario and Optimistic scenario.

The BAU scenario describes the situation in the event that the implementation of NBS is not adopted. To do this, the polarity of the NBS implementation variable was set to the value -1. For the creation of the optimistic scenario, the variable assumed polarity +1.

Fig.10 illustrates in red the variation of the variables according to a BAU scenario while in green the optimistic scenario with the implementation of NBS. Examining the scenarios, it appears that the BAU scenario paints a picture of the existing situation. The flood risk is alarmingly high (0.97), and all environmental and social parameters register negative values. However, through the cause-and-effect relationship with the assumptions of NBS implementation, a noteworthy decline in flood risk, urban heat island effect, and air quality degradation is achievable, leading to enhanced climate adaptation. This, in turn, boosts public safety and citizen well-being. A notable aspect to improve lies in citizen involvement.

Given the city's history with flood risk, one might have thought that the implementation of NBS would serve solely as risk mitigation. Instead, the knowledge that emerged from the students also suggested other types of functions.

These results confirm once again that the structuring of a participatory model in a decision-making plan process can improve both the quality of design choices and promote greater urban sustainability. In this sense,

in recent years, numerous academic studies have underlined the importance of the significant involvement of citizens and urban planning, highlighting that an effective participatory model can play a fundamental role in promoting democracy, equity and sustainability in planning choices (Ernst, 2019; Friedmann, 1992; Forester, 1999; Innes & Booher, 2004; Healey, 2003; Sandercock, 2003).
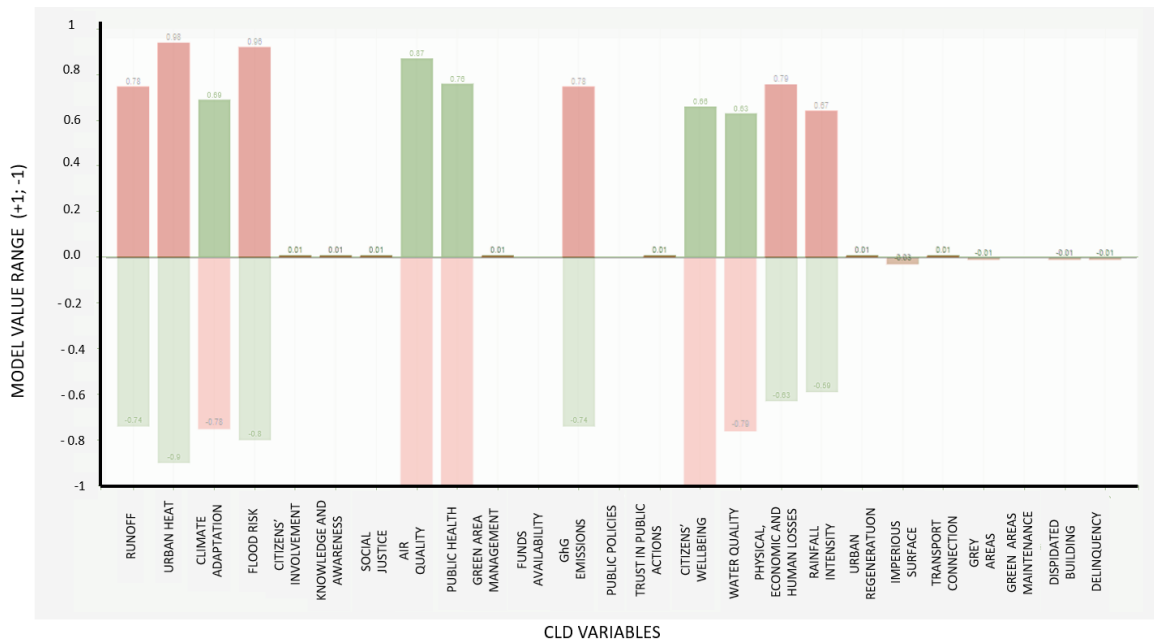
Fig.10 Scenario building. Source: authors' elaboration

A recent literature review study by Puskàs et al. (2021) on the topic argues that the role of landscape architects and urban planners should go beyond the role of experts to become facilitators and motivators, to enable broader and deeper participation of communities in defining of their future.

It is with this aim that this work seeks to contribute to sector studies by highlighting the potential and importance of participatory approaches and offering a methodology that develops a replicable model to facilitate participation at various levels and offer practical and usable knowledge on the application.

6. Conclusions

The path toward widespread adoption of NBS is not without challenges, as it requires a holistic approach. Lack of awareness, the need for integration across different sectors, and evaluating long-term effectiveness are all critical aspects. Furthermore, designing and managing NBS demands a deep understanding of local ecosystems. A substantial body of research now indicates that engagement processes and active participation are key factors in effectively adopting solutions to contrast climate change. Transformations toward effective local sustainability require strategies that enhance social learning (Armitage et al., 2017; Berke & Ross, 2013; Imperiale & Vanclay, 2023; Samaraweera, 2013).

Adopting an interdisciplinary approach that combines traditional engineering with behavioral and socio-ecological sciences has led to the emergence of "social resilience thinking" over the past decades as a crucial element for risk reduction and disaster impact mitigation. Nonetheless, numerous cultural and political-institutional obstacles make the necessary processes for achieving these goals challenging (Imperiale & Vanclay, 2023). However, there is a growing awareness that disaster risk reduction must extend beyond vulnerability reduction and paternalistic technical assistance. It must consider communities' perceptions and experiences of risks, take into account social capital, and adopt transparent communication, resource sharing, technology sharing, and shared responsibility.

More recently, the benefits of distributed information resources (GIS systems) can be used on digitally enhanced participatory workshops involving communities to facilitate the creation of future scenarios and co-production processes of risk knowledge, with the aim of building community resilience in disaster-prone areas (Carnelli & Pedoth, 2023; Samaraweera, 2013).

This work represents an effort in this direction undertaken during the planning process in Brindisi. From this perspective, it is evident that the experience described in this article has enabled the enhancement of locally constructed knowledge.

It has been a significant component within a process entirely structured around the exchange of distributed knowledge. In this regard, the approach demonstrates that compared to a traditional process solely reliant on expert knowledge, certain aspects are more relevant.

The first pertains to expanding the knowledge base, bringing together non-expert, common-sense, and experiential forms of knowledge that are extremely valuable and otherwise not available in formalized terms. The second concerns knowledge that proceeds in the opposite direction, enhancing the cognitive interactivity of the process by inducing dynamic self-learning within the local community. A third aspect relates to knowledge shaped towards implementation, as it manages to include perceptual, emotional, and behavioral elements crucial for transforming knowledge into practical activities—particularly useful in scenarios such as flood risk.

A fourth aspect strengthen the critical importance of models and structuring architectures for exchanged data, especially those of informal nature. This latter point, in particular, opens the way for the creation of platforms to support informed, and even dynamic, policy decision-making during plan implementation.

The challenge in this context is ensuring that the relational articulation and richness of the collected databases are maintained. This places issues within the broader matter of managing cognitive and environmental complexity, which remains vividly present in our disciplinary debates.

Ontological modeling approaches, for example, are increasingly seen as a promising perspective, especially regarding environmentally based systems. Our research group's focus is oriented in this area and will be further explored as a future outlook.

On the other hand, important limitations that hindered this type of approach must be considered, too. One of them, particularly clear in our case study and in many research-in-action contexts, is the complex administrative reality from which these processes are supposed to be stimulated and driven. In the case of Brindisi, in fact, an articulate phase of citizenship involvement in general had been planned (phase C). This, however, had only a very partial development due to local political and administrative difficulties. Consequently, the analysis of the interaction protocols, participating profiles and the study of the related results had to be set aside and could not complement the GMB methodology development.

Furthermore, just when the local administration was ready to start a new political effort toward operationally implementing results, it entered into a political crisis. The new elections then brought about a government that was basically opposed to an knowledge-inclusive approach, preferring a traditional top-down regulatory framework. As a matter of facts, these are known and recurring problems in medium-long term planning processes - often facing decisions that are sudden and subject to the short times and ways of politics.

Overall, however, it is useful here to mention the substantive value of the results obtained in the experimental process, which suggest the importance of the transition of administrations towards knowledge-based decision support models in risk conditions. From this point of view, the approach used by this study was fortunately (yet deliberately - being driven by research aims) developed with the objectives of building replicable system architectures, and not of exclusively area-based analysis.

Starting from this point it will therefore be possible to more substantially develop further experiments, thus generating useful contextual follow ups in the future.

References

Aerts, J. C. J., H, Botzen, W. J., Clarke, K. C., Cutter, S. L., Hall, J. W., Merz, B., Michel-Kerjan, E., Mysiak, J., Surminski, S. & Kunreuther, H. (2018). Integrating human behaviour dynamics into flood disaster risk assessment. *Nature Climate Change*, *8 (3)*, 193–199.

Akbari, H. (2005). Energy Saving Potentials and Air Quality Benefits of Urban Heat Island Mitigation. *Lawrence Berkeley National Laboratory*, Berkeley, CA, H_Akbari@lbl.gov, http://HeatIsland.LBL.gov/

Akkermans, H.A. & Vennix, J.A.M. (1997) "Clients' opinion on group model-building: an exploratory study". *System Dynamics Review, 13* (1), 3-31. https://doi.org/10.1002/(SICI)1099-1727(199721)13:1<3::AID-SDR113>3.0.CO;2-I

Alexander, D. (2015). Disaster and Emergency Planning for Preparedness, Response, and Recovery. *Oxford Research Encyclopedia of Natural Hazard Science*, Oxford University Press: Oxford, 1-20. https://doi.org/10.1093/acrefore/9780199389407.013.12

Alpopi, C. & Manole, C. (2013). Integrated Urban Regeneration – Solution for Cities Revitalize. *Procedia Economics and Finance*, *6*, 178-185. https://doi.org/10.1016/S2212-5671(13)00130-5

Andersen, D.F. & Richardson, G.P. (1997). Scripts for group model building. *System Dynamics Review*, *13* (2), 107-129. https://doi.org/10.1002/(SICI)1099-1727(199722)13:2<107::AID-SDR120>3.0.CO;2-7

Armitage, D., Dzyundzyak, A., Baird J., Bodin, O., Plummer, R. & Schultz, L. (2017). Approach to Assess Learning Conditions, Effects and Outcomes in Environmental Governance, Environmental Policy and Governance. Wiley online Library, https://doi.org/10.1002/eet.1781

Balletto, G., Borruso, G. & Donato, C. (2018). City dashboards and the Achilles' heel of smart cities: putting governance in action and in space. In *Computational Science and Its Applications, Proceedings of ICCSA 2018*, Melbourne, VIC, Australia, July 2-5, 2018. https://doi.org/10.1007/978-3-319-95168-3_44

Gervasi, O., Murgante, B., Misra, S., Stankova, E., Torre, C. M., Rocha, A. M. A., Taniar, D., Apduhan, B. O., Tarantino, E., & Ryu, Y. (2018). Computational Science and its Applications – ICCSA 2018. In *Lecture notes in computer science*. https://doi.org/10.1007/978-3-319-95165-2

Bangash, R. F., Passuello, A., Sanchez-Canales, M., Terrado, M., López, A., Elorza, F. J., Ziv, G., Acuña V. & Schuhmacher, M. (2013). Ecosystem services in Mediterranean river basin: Climate change impact on water provisioning and erosion control. *The Science of the Total Environment*, 458-460C, 246–255. http://dx.doi.org/10.1016/j.scitotenv.2013.04.025

Bell, W. (2003). *Foundations of Futures Studies: History, Purposes, and Knowledge*; Transaction Publishers: New Brunswick (NJ).

Bérard, C. (2010). Group Model Building Using System Dynamics: An Analysis of Methodological Frameworks. *The Electronic Journal of Business Research Methods, 8* (1), 35 - 46. Available online at: https://academic-publishing.org/index.php/ejbrm

Berkes, F. & Ross, H. (2012). Community Resilience: Toward an Integrated Approach. *Society & Natural Resources*,*26* (1), 5–20. https://doi.org/10.1080/08941920.2012.736605

Blečić, I., Carrus, A.S., Muroni, E., Saiu, V. & Saliu, M.C. (2023). Engagement and Inclusion Experiences for Energy Communities. An Ongoing Case Study in Cagliari, Italy. In: Gervasi, O., et al. Computational Science and Its Applications – ICCSA 2023 Workshops. ICCSA 2023. *Lecture Notes in Computer* Science. 14109. Springer, Cham. https://doi.org/10.1007/978-3-031-37120-2_33

Borri, D., Camarda, D. & Pluchinotta, I. (2014). Planning for the microclimate of urban spaces: Notes from a multi-agent approach. In *Cooperative Design, Visualization, and Engineering,* Luo Y (ed.); Springer, Berlin, Germany, 179-182. https://doi.org/10.1007/978-3-319-10831-5_27

Brown, T. (2008). Design thinking. Harvard Business Rev. *86* (6), 84-95.

Brown, T. (2019). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. 2nd ed. New York. NY: Harper Business.

Camarda, D. (2010). Beyond citizen participation in planning: Multi-agent systems for complex decision making. In *Handbook of research on e-planning: ICTs for urban development and monitoring*, Nunes Silva, C., Ed.; IGI Global: Hershey PA, 195-217.

Camarda, D. (2018). Building sustainable futures for post-industrial regeneration: the case of Taranto, Italy. *Urban Research & Practice, 11*, 275-283, doi:10.1080/17535069.2018.1498196.43

Carnelli, F. & Pedoth, L. (2023). Enhancing Risk Governance by Addressing Key Risk Communication Barriers during the Prevention and Preparedness Phase in South Tyrol (Italy). *Sustainable Development*, Wiley online Library.

Château, P. A., Chang, Y. C., Chen, H. & Ko, T. T. (2012). Building a stakeholder's vision of an offshore wind-farm project: A group modeling approach. *Science of the Total Environment*, *420*,43-53.

Chen F., Yang X. & Zhu W. (2014). WRF simulations of urban heat island under hot-weather synoptic conditions: The case study of Hangzhou City, China. *Atmospheric research*, *138*, 364-377. https://doi.org/10.1016/j.atmosres.2013.12.005

De Liddo, A. & Concilio, G. (2017). Making decision in open communities: Collective actions in the public realm. *Group Decision and Negotiation*, *26*, 847-856, doi:10.1007/s10726-017-9543-9

De Noia, I., Favargiotti, S. & Marzadri, A. (2022). Renaturalising lands as an adaptation strategy. Towards an integrated water-based design approach. *TeMA - Journal of Land Use, Mobility and Environment*, *15* (2), 263-286. https://doi.org/10.6093/1970-9870/9074

Ernst, A. (2019). Review of factors influencing social learning within participatory environmental governance. *Ecology and Society*, *24* (1). https://www.jstor.org/stable/26796921

Farrugia, S., Hudson, M. D. & McCulloch, L. (2013). An evaluation of flood control and urban cooling ecosystem services delivered by urban green infrastructure. *International Journal of Biodiversity Science, Ecosystem Services & Management*, *9* (2), 136–145. https://doi.org/10.1080/21513732.2013.782342

Ferber, J., Stratulat, T. & Tranier, J. (2009). Towards an integral approach of organizations in multi-agent systems. In Handbook of Research on MultiAgent Systems: Semantics and Dynamics of Organizational Models, Dignum, V., Ed.; IGI: Hershey, 51-75. https://doi.org/10.4018/978-1-60566-256-5.ch003

Forester, J. (1999). *The deliberative practitioner: Encouraging participatory planning processes*. MIT Press.

Freeman, L. C., Borgatti, S. P. & White, D. R. (1991). Centrality in valued graphs: A measure of betweenness based on network flow. *Social networks*, *13* (2)*,* 141-154. https://doi.org/10.1016/0378-8733(91)90017-n

Friedmann, J. (1992). *Empowerment: The politics of alternative development*. John Wiley & Sons.

Friend, J.K. & Jessop, W.N. (1969)*. Local Government and Strategic Choice*. Tavistock: London.

Gardner, J. (2002). Natural Hazards Risk in the Kullu District, Himachal Pradesh, India*. The Geographical Review*, *92* (2)*,* 282-306. https://doi.org/10.1111/j.1931-0846.2002.tb00008.x

Gunawardena, K. R., Wells, M. J. & Kershaw, T. (2017). Utilising green and bluespace to mitigate urban heat island intensity. *Science of The Total Environment*, Volumes 584–585, 1040-1055. https://doi.org/10.1016/j.scitotenv.2017.01.158

Haraldsson, Hördur V. (2004). *Introduction to System Thinking and Causal Loop Diagrams*. Lund: Lund University.

Hazer, M., Formica, M. K., Dieterlen, S. & Morley, C. P. (2018). The relationship between self-reported exposure to greenspace and human stress in Baltimore, MD. *Landscape and Urban Planning*, *169*, 47–56. https://doi.org/10.1016/j.landurbplan.2017.08.006

Healey, P. (2003). Collaborative planning in perspective. *Planning Theory*, *2*, 101-123. https://doi.org/10.1177/14730952030022002

Heft, H. (2013). Environment, cognition, and culture: Reconsidering the cognitive map. *Journal of Environmental Psychology*, *33*, 14-25. https://doi.org/10.1016/j.jenvp.2012.09.002

Hernantes, J, Labaka, L., Laugé, A., Sarriegi, J. M. & Gonzalez, J. J. (2012). Group model building: a collaborative modelling methodology applied to critical infrastructure protection. *International Journal of Organisational Design and Engineering, 2* (1), 41-60. https://doi.org/10.1504/IJODE.2012.045904

Hewitt, K. (1983). The idea of calamity in a technocratic age. In *Interpretations of Calamity from the Viewpoint of Human Ecology*, 1st ed.; K. Hewitt ed; Routledge, London, UK.

Houlden, V., Weich, S., Porto de Albuquerque, J., Jarvis, S. & Rees, K. (2018). The relationship between greenspace and the mental wellbeing of adults: A systematic review. *PloS ONE*,*13* (9)*.* https://doi.org/10.1371/journal.pone.0203000

Howard, E., Hubelbank, J. & Moore, P. (1989). Employer evaluation of graduates: use of the focus group. *Nurse Educator 14* (5)*,* 38–41. 10.1097/00006223-198909000-00019

Howard, L. (2012). *The Climate of London: Deduced from Meteorological Observations*, vol. 1, Cambridge University Press, Cambridge.

Imperiale, A., J. & Vanclay, F. (2023). Re-designing Social Impact Assessment to enhance community resilience for Disaster Risk Reduction, Climate Action and Sustainable Development. *Sustainable Development*, Wiley online Library. https://doi.org/10.1002/sd.2690

Innes, J.E. & Booher, D.E. (2004). Reframing public participation: Strategies for the 21st century. *Planning Theory & Practice, 5*, 419-436. https://doi.org/10.1080/1464935042000293170

ISPRA (2023). https://www.isprambiente.gov.it/it/istituto-informa/comunicati-stampa/anno-2022/dissesto-idrogeologico-quasi-il-94-dei-comuni-a-rischio-frane-allu-vioni-ed-erosione-costiera (accessed on 26 June 2023)

Khakee, A., Barbanente, A. & Borri, D. (2000). Expert and experiential knowledge in planning. *Journal of the Operational Research Society*, *51*, 776-788. https://doi.org/10.2307/253959

Khakee, A., Barbanente, A., Camarda, D. & Puglisi, M. (2002). With or without? Comparative study of preparing participatory scenarios using computer-aided and traditional brainstorming. *Journal of Future Research 6*, 45-64.

Kitzinger, J. (1994). The methodology of Focus Groups: the importance of interaction between research participants. *Sociology of Health & Illness 16* (1), 103–121. https://doi.org/10.1111/1467-9566.ep11347023

Lafortezza, R., Chen, J., Van Den Bosch, C. K. & Randrup, T. B. (2018). Nature-based solutions for resilient landscapes and cities. *Environmental research*, *165,* 431-441. https://doi.org/10.1016/j.envres.2017.11.038

Lai, S., Isola, F., Leone, F. & Zoppi, C. (2021). Assessing the potential of green infrastructure to mitigate hydro-geological hazard. *TeMA - Journal of Land Use, Mobility and Environment*, *Special Issue*, 109-133. https://doi.org/10.6093/1970-9870/7411

Lee, J., Burton, H. & Lallemant, D. (2018). Adaptive decision-making for civil infrastructure systems and communities exposed to evolving risks. *Structural Safety*. *75*, 1-12. https://doi.org/10.1016/j.strusafe.2018.05.001

Lee, Y. J. (2018). Relationships among Environmental Attitudes, Risk Perceptions, and Coping Behavior: A Case Study of Four Environmentally Sensitive Townships in Yun-lin County, Taiwan. *Sustainability, 10* (8), 2663. https://doi.org/10.3390/su10082663

Lichfield, N. (Ed.) (1998). Evaluation in planning: facing the challenge of complexity, 47, Springer Science & Business Media.

Limburg, K.E., O'Neill, R.V., Costanza, R. & Farber, S. (2002) "Complex systems and valuation", *Ecological Economics, 41*, 409-420. https://doi.org/10.1016/S0921-8009(02)00090-3

Martín, E. G., Giordano, R., Pagano, A., Van Der Keur, P. & Costa, M. M. (2020). Using a system thinking approach to assess the contribution of nature-based solutions to sustainable development goals. Science of the Total Environment. 738, 139693. https://doi.org/10.1016/j.scitotenv.2020.139693

Mazzeo, G. & Polverino, S. (2023). Nature-based solution for climate change adaptation and mitigation in urban areas with high natural risk: Proposals of possible measures for a municipality in the Vesuvius area. *TeMA - Journal of Land Use, Mobility and Environment, 16* (1), 47-65. https://doi.org/10.6093/1970-9870/9736

Merton, R.K., Fiske, M. & Kendall, P.L. (1990). *The Focused Interview: A Manual of Problems and Procedures*, 2nd edn. Free Press, New York.

Morabito, M., Crisci, A., Guerri, G., Messeri, A., Congedo, L. & Munafò, M. (2021). Surface urban heat islands in Italian metropolitan cities: tree cover and impervious surface influences. *Sci. Total Environ*, *751*, 142334. https://doi.org/10.1016/j.scitotenv.2020.142334

Morçöl, G. (2005). A new systems thinking: implications of the science of complexity for public policy and administration, *Public Administration Quarterly*, *29*, 297-320.

Pelorosso, R., Gobattoni, F., Geri, F., Monaco, R. & Leone, A. (2015). Evaluation of Ecosystem Services related to Bio-Energy Landscape Connectivity (BELC) for land use decision making across different planning scales. *Ecological Indicators, 61.* http://dx.doi.org/10.1016/j.ecolind.2025.01.016

Poortinga, W., Bird, N, Hallingberg, B., Phillips, R. & Williams, D. (2021). The role of perceived public and private green space in subjective health and wellbeing during and after the first peak of the COVID-19 outbreak, *Landscape and Urban Planning*, *211*.

Puskás, N., Abunnasr, Y. & Naalbandian, S. (2021). Assessing deeper levels of participation in nature-based solutions in urban landscapes—A literature review of real-world cases. *Landscape and Urban Planning, 210,* 104065. https://doi.org/10.1016/j.landurbplan.2021.104065

Recanatesi, R., Petroselli, A., Ripa, M. N. & Leone, A. (2017). Assessment of stormwater runoff management practices and BMPs under soil sealing: A study case in a peri-urban watershed of the metropolitan area of Rome (Italy). *Journal of Environmental Management,* 201- 6-18. https://doi.org/10.1016/j.jenvman.2017.06.024

Rocha, H., Filgueiras, M., Tavares, J.F. & Ferreira, S. (2023). Public Transport Usage and Perceived Service Quality in a Large Metropolitan Area: The Case of Port. *Sustainability*, *15* (7), 6287. https://doi.org/10.3390/su15076287

Rouwette, E.A.J.A., Vennix, J.A.M. & van Mullekom, T. (2002) "Group model building effectiveness: a review of assessment studies". *System Dynamics Review*, *18* (1), 5-45. https://doi.org/10.1002/sdr.229

Samaraweera, H. U. S. (2023). Exploring complexities of disaster risk and vulnerability: Everyday lives of two flood-affected communities in Sri Lanka. *Sustainable Development*, Wiley online Library, https://doi.org/10.1002/sd.2723

Sandercock, L. (2003). Out of the closet: The importance of stories and storytelling in planning practice. *Planning theory & practice, 4* (1), 11-28. https://doi.org/10.1080/1464935032000057209

Santoro, S., Totaro, V., Mastrodonato, G. & Balena, P. (2023). Mapping Citizens' Knowledge and Perception. What Support for Flood Risk Planning? Some Tips from Brindisi Case Study. In: Gervasi, O., et al. Computational Science and Its Applications – ICCSA 2023 Workshops. ICCSA 2023. *Lecture Notes in Computer Science*, vol 14109. Springer, Cham. https://doi.org/10.1007/978-3-031-37120-2_2362

Santoro, S., Totaro, V., Lovreglio, R., Camarda, D., Iacobellis, V. & Fratino, U. (2022). Risk perception and knowledge of protective measures for flood risk planning. The case study of Brindisi (Puglia region). *Safety science, 153*, 1057961. https://doi.org/10.1016/j.ssci.2022.105791

Santoro, S., Stufano Melone, M.R. & Camarda, D. (2020). Building strategic scenarios during Covid-19 lockdown. *TeMA - Journal of Land Use, Mobility and Environment*, *13*, 229-240. https://doi.org/10.6092/1970-9870/6917

Schön, D.A. & Argyris, C. (1996). *Organizational Learning II: Theory, Method and Practice*; Addison-Wesley: Reading MA.

Sinatra, F., Balletto, G. & Borruso, G. (2023). Minimum Environmental Criteria and Climate Issue in the Metropolitan Urban Ecosystem. In *Computational Science and Its Applications*, Proceedings of ICCSA 2023, Athens, Greece, July 3 – 6, 2023 Gervasi O., Murgante B., Rocha A.M. A. C., Garau C., Scorza F., Karaca Y., Torre C.M (Eds.), *Springer Nature Switzerland AG*, 49-65. https://doi.org/10.1007/978-3-031-37120-2_4

Sterman, J.D. (2000). *Business dynamics: systems thinking and modeling for a complex world*, New York: Irwin-McGraw-Hill.

Tayefi Nasrabadi, M. (2022). How do nature-based solutions contribute to urban landscape sustainability? *Environment, Development and Sustainability, 24(1),* 576-591. https://doi.org/10.1007/s10668-021-01456-3

The Intergovernmental Panel on Climate Change (IPCC): The United Nations body for assessing the science related to climate change, https://www.ipcc.ch/ (accessed on 12 June 2023)

Twinn, S. (1998). An analysis of the effectiveness of focus groups as a method of qualitative data collection with Chinese populations in nursing research. *Journal of Advanced Nursing 28* (3)*,* 654–661. https://doi.org/10.1046/j.1365-2648.1998.00708.x

Van den Berg, A. E., Maas, J., Verheij, R. A. & Groenewegen, P. P. (2010). Green space as a buffer between stressful life events and health. *Social Science & Medicine, 70* (8), 1203–1210. https://doi.org/10.1016/j.socscimed.2010.01.002

Velarde, Ma. D., Fry, G. & Tveit, M. S. (2017). Health Effects of Viewing Landscapes – Landscape Types in Environmental Psychology. *Urban Forestry & Urban Greening, 6* (4)*,* 199-212. https://doi.org/ 10.1016/j.ufug.2007.07.001

Zurlini, G., Petrosillo, I., Jones, K.B. & Zaccarelli, N. (2013). Highlighting order and disorder in social -ecological landscapes to foster adaptive capacity and sustainability. *Landscape Ecology, 28* (6), 1161-1173.

Image Source

Fig.1: authors' elaboration;

Fig.2: authors' elaboration;

Fig.3: authors' elaboration. Adapted from Brown (2008);

Fig.4: authors' elaboration;

Fig.5: authors' elaboration. Adapted from Hördur V. Haraldsson, 2004;

Fig.6: authors' elaboration;

Fig.7: photo;

Fig.8: authors' elaboration;

Fig.9: authors' elaboration;

Fig.10: authors' elaboration.

Author's contribution

Conceptualization: S.S., D.M, G.M; methodology: S.S.; software: S.S.; data collection: S.S.; data curation and analysis: S.S.; writing—original draft preparation: S.S.; writing—review and editing: sect.1: G.M, S.S.; sect 2: G.M, S.S.; sect. 3.1: S.S.; sect.3.2: D.C.; sect.3.2.2: S.S.; sect. 4: S.S; sect.5: S.S., G.M. and D.C.
All authors have read and agreed to the published version of the manuscript.

Authors' profile

Stefania Santoro

She is Ph.D., Doctor of Philosophy in Risk and environmental, territorial and building development, University Polytechnic of Bari, Italy. She has a master's degree in civil engineering and a Master of Art in Town and Environment Planning; she has been involved in several European projects concerning natural hazard mitigation and biodiversity conservation. She is currently a research fellow at Water Research Institute of National Research Council (IRSA - CNR) in Bari.

Giulia Mastrodonato

She is researcher, Ph.D., Doctor of Philosophy in Town and Country Planning, University Polytechnic of Bari, Italy. She has a master's degree in civil engineering and a Master of Art in Town and Environment Planning; she has been Professor Assistant in Materials Technology and Applied Chemistry and Professor in Analysis and Modeling of Spatial Knowledge of the Territory at Politecnico di Bari, Italy. With research interests in environmental planning, navigation, spatial cognition, behavioural strategies in orientation, landscape analysis.

Domenico Camarda

PhD, MS in Economics, master's degree in civil engineering, he is full professor at University Polytechnic of Bari, Italy, where he teaches Spatial planning and engineering. His research interests are Environmental planning, Spatial cognition models in planning, multi-agent planning models, Decision-support systems. He published about 80 papers in international journals and conference papers, 1 authored book, 5 edited books and book chapters and several informational articles.

The relationship between walkability and landscape values in transportation. Examination of landscape values in urban area transportation axes

Zeynep Pirselimoğlu Batman [a]*, Elvan Ender Altay [b], Sena Şengül [c]

[a] Department of Landscape Architecture, Faculty of Agriculture
Bursa Uludağ University, Bursa, Turkey
e-mail: zeynepbatman@uludag.edu.tr
ORCID: https://orcid.org/0000-0003-2145-2682
* Corresponding author

[b] Department of Landscape Architecture, Faculty of Agriculture
Bursa Uludağ University, Bursa, Turkey
e-mail: elvanender@uludag.edu.tr
ORCID: https://orcid.org/0000-0001-5933-1611

[c] Department of Landscape Architecture, Graduate School of Natural and Applied Science
Bursa Uludağ University, Bursa, Turkey
e-mail: ssenasengull@hotmail.com
ORCID: https://orcid.org/0000-0003-3167-5628

Abstract

The most critical components of walkability, which expresses walking opportunities in cities, are activities and uses in the neighborhood or around neighborhoods for pedestrian areas integrated with the natural, cultural and social environment, accessibility, structuring of neighborhood street networks, pedestrian safety, attractiveness of streets for users and user density of streets. Considering that the transportation systems in cities are connected to the systems and the walkable areas integrated with these areas are a part of the city, they must be integrated with the landscape values associated with the urban identity. In this accordance, the study aimed to determine the relationship of walkability in transportation-based areas with the landscape values and to determine the potential of the area. In this context, the landscape values of Atatürk Street, which is located in the city core of Bursa and has both touristic, social, and commercial functions in pedestrian transportation, were evaluated based on walkability on the sidewalks, and a partially sufficient result was reached. As a result, landscape plans should be developed to support the use of streets that can be easily experienced by all user groups, where urban identity is emphasized in transportation axes and can respond to transportation values.

How to cite item in APA format

Pirselimoğlu Batman, Z., Ender Altay, E. & Şengül, S. (2024). The relationship between walkability and landscape values in transportation. Examination of landscape values in urban area transportation axes. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 285-308. http://dx.doi.org/10.6093/1970-9870/10462

1. Introduction

Transportation is one of the essential components of cities. Discussing transportation as a complementary element in making cities livable is possible. While Accessibility is a critical issue for urban life, streets are essential public spaces accessible to everyone, where daily actions are carried out and communication and interaction are provided. With the increase in vehicle roads, avenues, and alleys, which make up eighty percent of urban public spaces, they have begun to turn into transition areas and have lost their functions related to pedestrian use. As the world becomes more urbanized, cities becoming less walkable comes to the fore. This situation has made us forget that pedestrians are one of the main elements in transportation. Being on foot is the most natural form of transportation and the basis of urban transportation. All journeys within the city begin and end on foot. With the emergence of different types of transportation, some problems have emerged between various modes of transportation. Vehicle-oriented planning and designs push pedestrians into the background, causing adverse effects on the shaping of urban space and the sustainability of urban landscapes. To increase urban livability and sustainability in spatial shaping in planning and design studies, pedestrians should be prioritized in transportation and circulation systems. In other words, the transportation areas of livable cities are developed by planning alternative transportation systems in which the use of private vehicles is restricted, public transportation is created, and land use decisions are made based on walking distances. Walkability is an essential element in evaluating the sustainability of urban landscapes (Beyazıt, 2007; Erel, 2007; Demir, 2008; Şenkaynak, 2010; Kaplan & Deniz, 2016; Tarakçı Eren et al., 2018; Fan et al., 2018). Walkability is a term widely used worldwide to describe the suitability of an urban walking environment (Zayed, 2016).

Walking has always been one of the essential means of transportation all over the world. Recently, walking has been supported again as one of the urban transportation methods. Solutions are being sought through research studies and professional practices to rehabilitate urban areas to make walking easier.

The focus has been mainly on macro-scale factors such as land use and street network planning. However, landscape elements such as micro-scale measures can also be essential in achieving this goal (Zayed, 2016). Some improvements should be considered to benefit from walking in urban areas. These improvements should be made in line with specific standards, considering the possibilities of the city or area where they will be implemented (Beyazıt, 2007). In this regard, some basic features exist for a walkable road network on pedestrian roads. This connectivity of the road network both locally and within the larger urban settlement, connection with other transport systems (bus, tram, metro, train), specifically for local service uses, finely fragmented and diverse land use patterns, safety from both traffic and social crime. It is the context of the road, which includes the quality of the road, including width, pavement, green spaces, marking and lighting, street design, visual interest of the built environment, transparency, spatial definition, landscaping, and general exploration (Southworth, 2005). While pedestrian transportation is supported transportation, on the other hand, regaining the green areas lost in today's cities and providing convenient, comfortable, and safe transportation opportunities for pedestrians should also be supported (Şişman & Etli, 2007). It will be possible to improve the harmful and destructive effects of the human-made environment and to emerge landscape-oriented space production practices (Baş Bütüner & Çavdar Sert, 2021).

To make cities accessible, planning studies should be carried out as a whole, together with landscape values (Yılmaz Türkoğlu, 2010). With this understanding, while creating walkable areas in cities and considering the walkability of streets, integrating each building block and landscape values should be prioritized.

In its basic conceptualization, landscape is interpreted as the environment or tool produced by the changing relationship between nature and culture.

While landscape expresses a system of spaces shaped by human construction or human intervention, it also describes the natural and cultural processes in which all living things share the same environment and shape it together. It will be possible to improve the harmful and destructive effects of the human-made environment

and to emerge landscape-oriented space production practices. Natural and cultural landscape values, socio-cultural structures, and historical features of cities form the city's identity. Urban identity should also be considered when developing transportation systems, which are essential for the town. Urban identity is defined by the city's natural and artificial resource values and the people's socio-cultural characteristics (Zorlu et al., 2010; Baş Bütüner & Çavdar Sert, 2021). In this regard, walkability in transportation should also be integrated with the urban landscape and identity.

In transportation-based areas within cities, roads, pedestrian paths, avenues, alleys, etc. Studies have been conducted to measure walkability and its relationship with landscape values and emphasize urban identity. For this purpose, Arslan et al. (2018), El kébir & Ghédira (2024), Ender (2011), Ender Altay & Pirselimoğlu Batman (2019), Ender Altay & Pirselimoğlu Batman (2021), Ersoy (1994), Gültekin & Altunkasa (2008), Gündoğdu & Dinçer (2020), Harris & Dines (1998), Lee (2016), Özkaynak & Korkmaz (2019), Pellicelli et al. (2022), Pirselimoğlu Batman & Ender Altay (2020), Spadaro et al. (2023), Southworth (2005), Woldeamanuel & Kent (2016), Yin (2013), Yıldırım & Küçük (2020), Carra et al. (2020), Lehmkühler et al. (2020), Kaplan (2021a) and Kaplan (2021b), provide examples based on walkability. Pedestrian-based areas are essential points for decarbonizing cities and providing healthier environments. In addition, landscape values and elements related to urban identity, walking areas integrated with transportation in towns, and related systems are essential parts of the city.

There is a research gap in transportation-based studies that emphasizes the relationship between walkability, landscape values, and urban identity and evaluates them as a whole. In this direction, the study was discussed based on evaluating walkability in transportation, variables in transportation, and landscape features that define these variables as a whole. It is a critical study to reveal the parameters related to the landscape values of accessible urban areas and evaluate their progress. This study determined the potential of walking in transportation-based areas by showing the relationship with landscape values. For this purpose, the walkability of the pedestrian sidewalks of Atatürk Street, which is on an important historical, cultural, commercial, and social route in Bursa, and their contribution to the urban identity with their landscaping potential were evaluated.

The study questioned the suitability of the pedestrian axes of Bursa Atatürk Street for pedestrian use and walkability. In addition, the existence and suitability of landscape values on walkable streets and their relationship with urban identity were questioned.

2. Material and Method

2.1 Material

Atatürk Street, located in the center of Bursa City, has a tourist, social, and commercial function. The study area has significant potential with the historical and touristic places it has and interacts with, and these places are used extensively in terms of pedestrian and vehicle traffic throughout the day (Fig.1).

When the climatic characteristics of Bursa province are evaluated, the average highest temperature is 34 °C, and the average lowest temperature is -4 °C. The month with the least rain is December, with 66 mm, and the month with the most rain is August, with 12 mm. The month with the most snowfall is February, with 49 mm. The windiest month is February, with 13.4 km/h. The windiest month is May (10.3 km/h).

The wind direction is NE>E>SW, the muggiest month due to humidity is July, and the least humid month is February (Bursa İklimi, Aylık Hava Durumu, Ortalama Sıcaklığı (Türkiye) - Weather Spark, n.d.).

Bursa is located where earthquake activity has been observed for many years, originating from the North Anatolian Fault System and the faults in the Southern Marmara region.

The most critical fault that can cause an earthquake is the Bursa fault. Bursa fault is an east-west trending forward-slip fault, approximately 45 km long, located between Derekızık - Burhaniye villages in the east and Uluabat in the west (IRAP, 2022).

Soğukpınar, Kaplıkaya, Değirmendere, and Madendere in Bursa and Gökdere (Fig.2), Kırkpınar and Balıklı streams originating from the north of Uludağ all join Nilüfer and flow into the Marmara Sea (Nilüfer Çayı, 2024).

The stream is at risk of drying up. At a point close to Atatürk Street is the historical Irgandı Bridge over the stream. The land slope in this area is 0-2% (Çetinoğlu Çınar, 2023) (Fig.2).

Fig.1 Atatürk Street location

When the residential areas and neighborhoods around the study area and interacting are examined, their populations are Şehreküstü District: 419 inh., Tahtakale District: 1,356 inh., Orhanbey District: 272 inh., Alacamescit District: 309 inh., Kayhan District: 1,175 inh., Hocaalizade District: 1,803 inh., Maksem District: 4,426 inh., Alipaşa District: 2,380 inh., İvazpaşa District: 2,796 inh., Pınarbaşı District: 2,301 inh., Kavaklı District: 1,304 inh., İbrahimpaşa District: 2,214 inh., Mollagürani District: 800 inh., Nalbantoğlu District: 1,446 inh., Tuzpazarı District: 358 inh., Ebu İshak District: 1,014 inh. (Fig.2) (Türkiye Nüfusu İl İlçe Mahalle Köy Nüfusları, 2023).

The historical buildings around the study area that interact with each other are Pirinç Han, Koza Han, İpek Han, Kapan Han, Emir Han, Fidan Han, Tuz Pazarı Han, Uzun Çarşı, Ulu Mosque, Kubbeli Han, Çukur Han, Balibey Han, Geyve Han, Orhan Mosque, Tayyare Cultural Center, Metropolitan Municipality Historical Building, Sculpture Clock Tower, Çakır Bath, Şengül Bath, Galle Pazarı Inn (Fig.2).

The means of transportation around and on Atatürk Street are tram, minibus, bus, taxi, and private vehicles.

Fig.2 Current status of study area

2.2 Method

In the study, an evaluation was made on the relationship with landscape values based on the main headings of walkability in transportation. In this direction, Ersoy (1994), Harris & Dines (1998), Southworth (2005), Gültekin & Altunkasa (2008), Ender (2011), Yin (2013), Ender Altay & Pirselimoğlu Batman (2019), Gündoğdu & Dinçer (2020), Pirselimoğlu Batman & Ender Altay (2020), Ender Altay & Pirselimoğlu Batman (2021), according to the studies of the relationship with landscape values and the measurement of walkability (in pedestrian transportation) in the street, which is a transportation-based area, was discussed. In this line, the idea of an original method in which landscape values are scored in the walkability criteria in transportation has been developed. In the content of the method, the cııteria for walkability in transportation are associated with the landscape character integrity and landscape values by the variables.

The study consists of two parts in which qualitative and quantitatıve evaluations are made. In the first chapter, data were obtained by using on-site observation, survey, literature research, and user interview techniques to present the current data of the field. These data are the mainland use type in accessibility, the presence of showcases in accessibility, pedestrian use in accessibility, security in accessibility, spatial aesthetics in accessibility, obstacle-free roads, and equipment elements in accessibility. To be accessible, the live material has been published in the titles. In the second part, based on the studies of Ersoy (1994), Harris & Dines, (1998), Southworth (2005), Gültekin & Altunkasa (2008), Ender (2011), Yin (2013), Zayed (2016), Ender Altay & Pirselimoğlu Batman (2019), Gündoğdu & Dinçer (2020), Pirselimoğlu Batman & Ender Altay (2020), Ender Altay & Pirselimoğlu Batman (2021), the variables of the walkability status of the area in transportation are determined, and the related features emerge it has been placed.

The importance level scores of the criteria created by the relationships were questioned using a scale ranging from -1 to 5. One is the lowest severity score, and 5 is the highest importance score. After this process, the highest score for the Street was determined, and the proportional value (%) was calculated according to the total result. This value determined the street's adequacy regarding walkability and landscape values. In this

line, the highest value a field can receive is 35 points and 100% qualification. This qualification is considered in line with the three-three range value. According to the proportional value of the score obtained, 0-35% was evaluated as inadequate, 36-70% as partially adequate, and 71-100% as sufficient (Tab.1).

The relationship and adequacy of landscape values in pedestrian transportation			
Walkability in transportation	**Variables**	**Assessment features**	
Land use type for accessible area	**Activities** Restaurants and other food and beverage areas, grocery stores, retail stores, parks, parkways, schools, libraries, bicycle paths, hospitals, tree-lined streets, cultural centers, parking lots, historical areas	The situation of the existence of food and beverage areas, sales units, cultural centers, historical areas, public areas, public buildings, libraries, museums, bicycle paths, car parks, schools, and hospitals at the same time in the area.	5
		The situation in which some of the food and beverage areas, sales units, cultural centers, historical areas, public spaces, public buildings, libraries, museums, bicycle roads, car parks, shops and hospital exist in the area at the same time.	4
		The existence of restricted public areas in the area	3
		The case of only privately owned areas existing in the area	2
		The situation of the existence of a protected/protection priority area/limited use situation in the area	1
Showcase presence in accessible area	**Sociability** Area usage diversity, Number of people using the area Street appeal and popularity among users	The high density of users in the showcase area	5
		Medium density of users in the showcase area	4
		The low density of users in the showcase area	3
		A sparse number of users in the showcase area	2
		User density is not in the showcase area but has no connection with the showcase area	1
Pedestrian use in accessible area	**Accessibility** Connectivity, Integration, Street connections, 10 min., Areas within walking distance	Number of intersections and connections 5 and more per 200 m along the street boundaries	5
		4 intersections and number of connections per 200 m along the street boundaries	4
		3 intersections and number of connections per 200 m along the street boundaries	3
		2 number of intersections and connections per 200 m along the street boundaries	2
		1 number of intersections and connections per 200 m along the street boundaries, or the existence of areas without intersections and connections	1
Security in accessible area	**Image and security** Crime statistics, vacant lots, derelict vacant buildings Safety on the sidewalk	According to the actions related to use, there should be no crime statistics, empty parcels, or abandoned vacant buildings. Physically, the pedestrian pavement is arranged by the standards and is very safe for use	5
		According to the actions related to use, there should be very few crime statistics, empty parcels, and abandoned vacant buildings. Physically, the pedestrian pavement is arranged according to the standards and is safe for use	4
		According to usage-related actions and crime statistics, empty parcels and abandoned vacant buildings are low. The standards physically arrange the pedestrian pavement, which is moderately safe for use	3

The relationship and adequacy of landscape values in pedestrian transportation			
Walkability in transportation	**Variables**	**Assessment features**	
		Use-related actions include crime statistics, vacant parcels, derelict vacant buildings, and the middle of the road; physically, the pedestrian pavement is arranged by the standards and is less safe for use	2
		The presence of crime statistics according to the activities related to the use, the presence of vacant parcels, abandoned vacant buildings, physical pedestrian pavements not being arranged by the standards, and the absence of a safe area	1
Spatial aesthetics in accessible area	**Urban identity**	The presence of a high level of comfort and attractiveness elements align with the uses within the area's boundaries and the presence of many elements that contribute to the urban identity	5
		The presence of elements of medium-level comfort and attraction by the uses within the area borders and the presence of at least one element that supports the urban identity	4
		The presence of elements of low level of comfort and attraction by the use within the limits of the area	3
		Within the area's limits are images that restrict comfort, noise, odor, etc. Finding the conditions	2
		Use within the limits of the area: image, noise, odor, etc. That negatively affect comfort. Finding negatives	1
Barrier-free roads and equipment in accessible area	Pavement width on boulevards and streets connecting to the area Available pavement widths Availability of disabled accessibility: Road widths suitable for physically disabled transportation. Pedestrian path width according to TSE 12576 standards Ramps suitable for physically disabled transportation. According to TSE 12,576 standards, the width of the ramps is min. It should be 90cm and the slope should be 8% (Ender, 2011). Suitability of the selected material for use in transportation - Floor coverings,	Areas completely separated from motor vehicle traffic, suitable for pedestrian use, compliant with design criteria for everyone, with appropriate street and sideway width, with suitable surface and materials, and with sufficient reinforcement elements	5
		Areas suitable for closing vehicle traffic at certain hours and pedestrian use, partially meeting design criteria for everyone, partly with appropriate street and sideway width, partly with suitable surface and materials, partly with sufficient reinforcement elements	4
		Areas suitable for a separate pedestrian lane arrangement, with insufficient design criteria for everyone, with irregular street and sideway width, with the presence of unsuitable irregular surfaces and materials, and with insufficient reinforcement elements	3
		Reinforcement elements that are not suitable for a separate pedestrian strip, without design criteria for everyone, with inappropriate street and sideway width, with defective surfaces and materials	2

The relationship and adequacy of landscape values in pedestrian transportation			
Walkability in transportation	**Variables**	**Assessment features**	
	Suitability of material properties Seating units, Lighting elements, Border elements, Plastic objects (sculptures, etc.), Covering Units, Guidance-signs, Garbage bins, Flowerpots, Water features, Fountains, Service units (Sales units, kiosks, flagpoles, etc.) , Stops for public transport, border elements	Not suitable for organizing a separate pedestrian lane, not having enough space to design for everyone, ideal for lane regulation, insufficient design criteria for everyone, having inappropriate street and sideway width. Areas with defected surfaces and materials and no reinforcement elements	1
Live material in accessible area	**Plant material** Emphasizing with plants shading with plants Distinguishing between plants and pedestrian and vehicle traffic Taking precautions to alleviate accidents with plants	Presence of dense trees within the area boundaries, maintenance areas, suitable species selection, having vegetation design criteria by street standards	5
		Presence of medium dense trees within the area boundaries, well maintained areas, appropriate species selection, having appropriate vegetation design criteria	4
		The area has sparse trees, well-maintained areas, and partially suitable vegetative design criteria	3
		There are shrubs within the area's boundaries, poorly maintained areas, and irregular vegetative design features.	2
		Within the area limits no road afforestation, non-maintenance areas, no vegetable design features	1
		Total	**35**
		Total Score	**100%**

Tab.1 Observation Form and Evaluation Criteria [Ersoy (1994), Harris & Dines (1998), Soutworth (2005), Gültekin & Altunkasa (2008), Ender (2011), Yin (2013), Zayed (2016), Düzenli et al. (2017), Ender Altay & Pirselimoğlu Batman (2019), Gündoğdu & Dinçer (2020) Pirselimoğlu Batman & Ender Altay (2020), Ender Altay & Pirselimoğlu Batman (2021)]

3. Results

Within the scope of the research, Atatürk Street, located in the city core of Bursa, was evaluated according to land use, suitability for pedestrian use, security, spatial aesthetics, presence of showcases, barrier-free roads, equipment and living material factors based on walkability in transportation.

3.1 Land use type for accessible area

The predominant land use type is generally commercial, religious, and historical. Many historical buildings house different commercial activities and serve tourism. To the south of the Street, towards the slopes of Uludağ, a dense residential texture can be seen. The commercial buildings south of the Street had 7-8 floors (Demir, 2019). Accessibility to existing land use types is easily possible on foot and in transportation. However, due to the combination of many functions, there is much density at some times of the day, especially after work hours (Fig.3). Food and beverage venues on the street (restaurants, patisseries, cafes, etc.), shopping units (clothing stores, home-furniture sales stores, etc.), banks, cultural centers, historical and cultural areas,

and buildings, theaters, exhibitions, parking lots, etc.) while residences, schools, etc. The uses are located in areas where the street interacts.

In this case, according to the evaluations in Tab.3, according to the presence of activities in the area: "food and beverage areas, sales units, cultural centers, historical areas, public areas, public buildings, libraries, museums, bicycle paths, parking lots, schools, hospitals, some of them are in the area at the same time. It answers, "the case of happening".
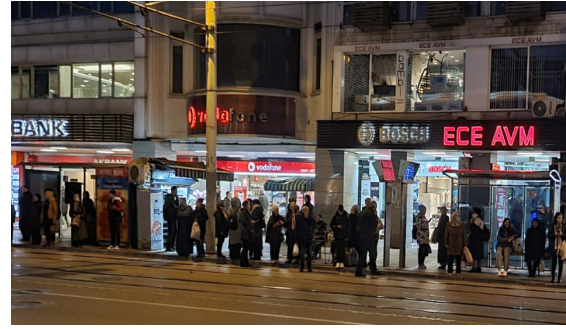
(a)   (b)

Fig.3 (a) Atatürk Street - Ulu Mosque and (b) Atatürk Street - Bus Stops (Office hours)

3.2 Showcase presence inaccessible area

The presence of showcases on the Street encourages users to walk. Places such as bakeries, cafeterias, and ready-to-wear commercial stores encourage walking more than other uses. While there are primarily ready-made clothing stores and banks on the ground floors of the buildings in the southern part of Atatürk Street, there are food and beverage venues and banks on the northern side. In this regard, some uses can encourage walking along the Street (Demir, 2019). The presence of a showcase during night use of the Street encourages users to walk safely and comfortably in the area with lighting solutions. It also contributes to aesthetic value (Fig.4). With a showcase in Accessibility, the number of people using the area will increase directly to its value. With its window appeal, the area will be used more intensively. It will be a transit axis, and time will be spent there. The attractiveness of pedestrian paths on the Street and the popularity of existing stores affects the use density. Additionally, with the lighting factor, it will be possible to use the area at night. Since the Street is located in the city center, it is hectic after work, on weekends and holidays.

(a)   (b)

Fig.4 (a) Showcase presence and (b) night view

Observations made along the Street in our area (detections were made at some points within the area in the morning-noon-evening on weekends, morning/noon/evening on weekdays; in front of the Teyyare Cultural Center-in front of the post office front of the Ahmet Vefik Pasha Theatre, at the connection points of the Ulucami-Orhangazi Square on the Street). It has been determined that weekends and rush hours are the busiest. There are many elements of high attractiveness in the area. These: historical and cultural buildings

(Ulucami – Kozahan - Orhangazi Square), public institutions (Historical town hall), Tayyare Cultural Center, Kebapçı İskender, Ahmet Vefik Pasha Theatre, patisseries, sculpture, post office, banks, hotel, shopping (clothing-furniture-white goods etc.) stores. Equal intense use has not been detected in the area at all hours and days. In this case, the social dimension of the area has been evaluated as "a medium density of users in the showcase reach", according to the evaluation in Tab.3.

3.3 Pedestrians use in accessible areas

When the pedestrian use situation for Atatürk Street is evaluated, the pedestrian possibility is pavement. Green areas on the pavement do not constitute an obstacle to pedestrian flow. The tram line and the pedestrian path are side by side. There are parking lots, side roads, etc., on both sides of the carriageway. There are sidewalks divided in this way. Pedestrian facilities are fragmented on both sides of the Street (Demir, 2019). There are 4 underpasses on the Street: Atatürk Underpass, Osmangazi Underpass, Yıldırım Beyazid Underpass and Orhangazi Underpass. There are various commercial spaces inside the underpasses (Fig.5).

When pedestrian use is evaluated in terms of Accessibility for the area, the connection and integration feature on the Street and the axes connecting the Street to different streets and the points where it meets can be evaluated. The streets support this situation at the beginning and end of Atatürk Street (Cemal Nadir Street and İnönü Street). In addition, the connection and integration feature can be expressed as integrating pedestrian paths with squares (Orhangazi Square, Ataturk Statue and its surroundings). Similarly, entrances and exits on the pedestrian paths of underpasses support the connection and integration feature. There are underpasses with shopping units on both sides of the road. Pedestrian crossings are areas where pedestrians and vehicles intersect (TS 12576; TS 9111). Again, 3 street connection points connect perpendicularly to the street on both sides. These are roads and streets with vehicle-pedestrian use and highways and streets with pedestrian use only (Fig.6). Atatürk Street is also where historical and cultural values are located in the city center. Important historical and cultural values for Bursa are also located on the Street and its surroundings. These are located within a 10-minute walk. Orhangazi-Osmangazi Tombs, Tophane Clock Tower, Green Tomb, Irgandi Bridge, some inns, Grand Bazaar, shopping areas, shopping center, city museum, etc. The presence of these features intensifies pedestrian flow in the area.

(a)

(b)

(c)

(d)

Fig.5 Atatürk Underpass: (a) Osmangazi Underpass, (b) Orhangazi Underpass, (c) Yıldırım Beyazid Underpass

When the intersections on Atatürk Street are taken into consideration, pedestrian flow axes on both sides of the traffic flow are considered separately. When these data in the area are evaluated, based on accessibility, it was evaluated as "3 number of intercessions and connections per 200 m along the street boundaries".

3.4 Security in accessible area

Security is an essential factor for Accessibility. Being in an unsafe place, especially as a pedestrian, is a situation that people do not prefer. Exposure to crime while walking on the Street also negatively affects walking activity. For users to move quickly on pedestrian sidewalks, there should be no negativities that may pose a risk. In pavement arrangements, irregular level differences in floor coverings, differences in flooring, visually impaired people, wheelchair users, children's strollers, canes, etc. There should be no incorrect grill applications that may pose a danger to users. In addition, there should not be parking chains stretched across the road or any compelling or obstructive elements that would stop walking in the flow or change direction. Shop items overflowing onto the pedestrian path should not obstruct human movement (Çetinkale Demirkan, 2020). Pedestrian sideways going parallel to vehicle traffic must be created to appropriate standards.

The fact that business owners and tradespeople on Atatürk Street close their shops at early hours (around 21:00 o'clock) affects night walking and creates a feeling of insecurity for the users at those hours. The fact that buildings have street frontage and that the streets can be viewed from the buildings is a factor that reduces criminal activities. The density of pedestrians and vehicles during the day creates a deterrent feature. Deserted at night creates an environment for crime (Demir, 2019). There are no vacant parcels or vacant buildings in our first-degree impact area. In crime statistics, general city statistics were evaluated.
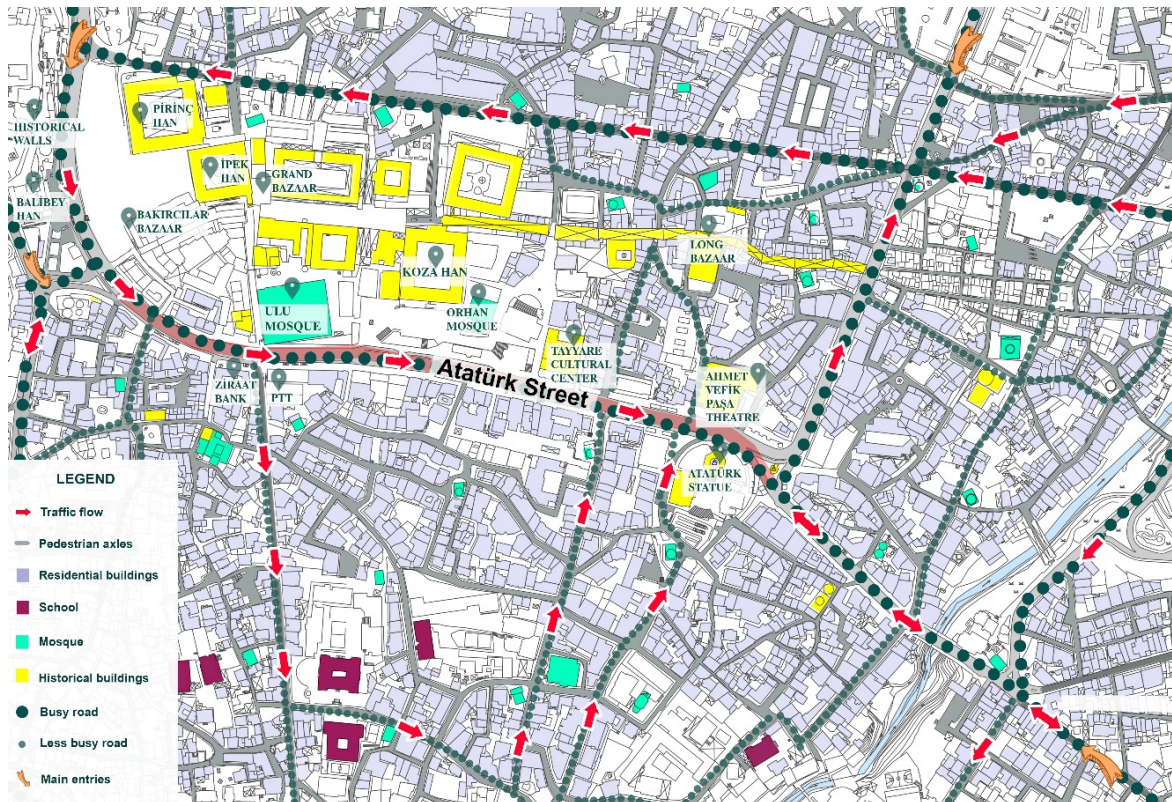
Fig.6 Pedestrian axes

Deformations on the ground and the lack of continuity of pavements negatively affect walkability. Vehicles use streets and intersections for parking purposes in the region, and the lack of organized bicycle paths disrupts the fluidity in terms of functionality and walkability (Çetinoğlu, 2023).

Based on these data, the street has been evaluated based on image and safety variables according to Tab.3: "Crime statistics, empty parcels, and abandoned vacant buildings are deficient according to usage-related actions. The standards arrange physical pedestrian pavements and are safe for use".

3.5 Spatial aesthetics in accessible area

Urban equipment elements should integrate with the city and contribute visually and aesthetically (Çetinkale Demirkan, 2020). Urban facilities and plant materials contribute to the urban identity. Visual, aesthetic values, and landscape are other criteria that increase pedestrians' desire to walk. These values are of profound importance for a touristic region. When people see visuals that can contribute to and enjoy the place, it increases the number of visitors. Increasing the number of visitors provides economic benefits. Since the Khans area is one area that forms the urban identity, spatial aesthetics should be at the forefront. Since Atatürk Street passes almost over this region, it has a high potential to affect the urban identity. All historical buildings on Atatürk Street create an aesthetically attractive area. Buildings such as the Clock Tower and Atatürk Statue on the Street also contribute to the Street aesthetically. These elements encourage people to walk. The frequent lack of vegetal designs, green areas on the Street, and heavy traffic negatively affect spatial aesthetics and Accessibility. Again, the sinister appearance of the facades of some buildings on the Street negatively impacts the aesthetic value (Fig.7).

According to these data, according to the values in Tab.3 based on city identity, the answer is "the presence of medium level comfort and attractive elements by the use within the area boundaries, and the presence of at least one element that supports the urban identity".

(a)　　　　　　　　　　　　　　　　　　　　　**(b)**

Fig.7 (a) Clock Tower and (b) Atatürk Statue

3.6 Barrier-free roads and equipment in accessible areas

There are different uses where pedestrian-vehicle separation exists in the horizontal plane. These are pedestrian paths on pavements, roads closed to vehicles in traditional texture, roads designed for pedestrians only, pedestrian paths along streams, and pedestrian axes indoors in shopping malls (Kılınçasalan, 2017).

Our area has a pedestrian feature on the sidewalks, depending on the usage of these pedestrian paths. In this case, the features and criteria of pedestrian paths on the pavement were evaluated.

Paved pedestrian paths are applied on both sides of the vehicle roads. On roads with a property width of 15 m, the carriageway is determined as 11 m. The sidewalk widths on both sides are regulated as 2 m. Or sidewalk at most 1.5 m. While sidewalks can be 2.5 m in areas with high pedestrian density, this width must be 4.5 m in commercial areas. In addition, there are road warning signs, road lighting poles, fire water pumps, bus and tram stops, sales units, seating units, green areas, etc., constantly located along the sidewalks. Although all of these serve a purpose, they are equipment that prevents walking on the sidewalks and narrows the road. Pavement widths should be considered by considering these reinforcements (Kılınçaslan, 2017).

Pedestrian paths and sidewalks should be safe, understandable, barrier-free, and of appropriate dimensions and provide transportation for everyone. TS 12576 urban roads - design rules for structural measures and markings on streets, avenues, squares, and roads for disabled and older adults require a 50 cm safety strip, including a 25 cm curb stone next to the property, and the net size of the pedestrian sidewalks. Road widths should be considered when arranging pedestrian sidewalks, considering wheelchair maneuvering areas for disabled individuals and wheelchair users. In addition, for comfortable use, the slope of the road should not be less than 2% (Çetinkale Demirkan, 2020).

The materials used for surface coverings on sidewalks and pedestrian paths are essential for ease of walking, durability, and visuality. The materials mainly used in floor coverings are concrete, asphalt, brick, and stone coverings (Kılınçaslan, 2017). Materials must have surface properties that do not affect pedestrian use (excessive roughness, potholes, bumps, etc.), appropriate joint spacing and density, reflection properties on the surface (albedo), have properties suitable for rainy weather (not being slippery), and ensure that the road constructed has appropriate infrastructure features (they must have features such as compressed soil, stabilized fill, blocking, etc. (Ender, 2011). According to TS 12576, surface coverings on pedestrian sidewalks must prevent slipping and facilitate navigation. The floor must be level. Steps, maintenance hole covers on the road surface, etc. Such structures should not create height differences or sudden elevation differences. The ground must be continuous and level. Uncompressed-free gravel surfaces should not be preferred; for the visually impaired, perceptible surfaces should be designed with colored natural guidelines parallel to the curb stone, where they can move quickly with a cane. United Nations (2004) guide tracks for the visually impaired should be arranged and understandably. Again, the criteria they determined for this purpose are that it should be parallel to the main pedestrian movement, be 60 cm wide, be located away from maintenance holes or drainage channels, be contrasted with other surface colors, and be at a height that will not hinder wheelchair users (Çetinkale Demirkan, 2020). Considering the material properties, the surfaces should not restrict pedestrian use (excessive roughness, potholes, bumps, etc.), Appropriate joint density and width, Reflection feature of the surface (albedo), Not slippery in rainy weather, Adequacy of the road infrastructure (compacted ground, stabilized filling or blocking, etc.) Criteria such as these are discussed (Ender, 2011).

Along with road widths and materials, ramps are another critical issue for pedestrian paths and sidewalks. Ramps are arranged to appeal to all user types to overcome the elevation differences encountered in pedestrian use easily. The dimensions of the ramps to be built vary depending on the elevation difference and the kind of ramp chosen that aligns with the land conditions. According to TS 12576, ramps should not exceed 8% slope. If there is a level difference of more than 20mm from the floor level, it is recommended to build a ramp (Çetinkale Demirkan, 2020; Ender, 2011). There are elements of urban equipment on pedestrian paths that do not disrupt the flow and support walking and transportation. These include seating units, lighting components, garbage bins, fountains, bus stops, garbage bins, border elements, plastic objects, cover units, directional signs, flower beds, and water elements.

Reinforcement elements used on pedestrian paths and sidewalks should be designed based on design principles for everyone. On this basis, there should be reinforcement elements of appropriate standards and sizes that everyone can easily access and use.

Considering the principle of equality between individuals, which is the basis of modernity, a modern state must offer opportunities for all its citizens to live humanely, without any discrimination. For this reason, the problems of disabled people, who are an integral part of social life, must be addressed realistically and integrated into society (Özcan, 2008).

Pedestrian opportunities on Atatürk Street are fragmented on both sides of the Street. Surface quality and width were evaluated as sufficient. It is seen that the pavements are fragmented in some parts of the area (Demir, 2019). Although it is seen that the pavements on Atatürk Street are broad, they are narrow in places where there are historical buildings. On average, the sidewalks north of the Street are between 3.5 and 4.5

meters, and a narrowing is observed towards the sidewalks in front of Ulucami. The sidewalks in the south are, on average, between 4.5 and 5.5 meters. Equipment designed for disabled individuals (floor coverings, auditory aids, ramps, etc.) should be available everywhere. It is observed that sufficient precautions are not taken for disabled individuals on Atatürk Street. There are no adequate solutions for disabled individuals in the underpasses on the Street (Fig.8). There are ramps and embossed floors at tram stops, but they end at the point where the stop ends.

In this context, pavement width on the boulevards and streets connected to the area, accessibility for the disabled, suitability of the material chosen for transportation, reinforcement elements over variables area "suitable for a separate pedestrian lane arrangement, insufficient design criteria for everyone, with irregular street and sideway width, unsuitable irregular surface and presence of materials and insufficient equipment are assessed as "areas with elements".

(a)　　　　　　　　　　　　　　　　　　　**(b)**
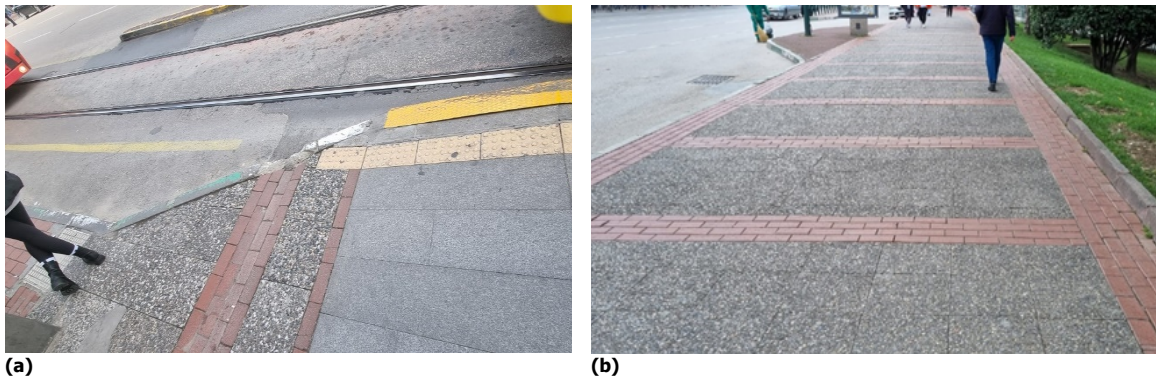
Fig.8 (a) End point of the tram stop and (b) suitability for pedestrian use

3.7 Live material in accessible areas

Vegetated areas on the roads and squares within the city are essential open and green areas in the development of cities. Trees constitute living material in forming city pedestrian zones and are the most critical design element. Road afforestation contributes to traffic technique, urban health, and urban landscape.

To understand planting on pedestrian sidewalks and along the roadside, species and forms suitable for climatic conditions, compatible with the environment, support accessibility, and easy to use should be used. Pedestrian paths and sidewalks are open to climate and weather conditions. This is the factor that affects pedestrians' comfort and transportation preferences. Planting on pedestrian paths and sidewalks, which are spatial channels, not only protects the climatic characteristics but also supports green system continuity along road intersections, creating microclimates, reducing heat island effects, increasing air quality, and being resistant to situations such as wind and storm (Hamamcioğlu & Akın, 2015; Kaplan & Deniz, 2016; Sandal Erzurumlu, 2020). In this case, the use of trees with a frequency appropriate with the sideway dimensions should be preferred. Tree density on the street is related to the planning spacing and tree number. Planting interval crown structure, crown height, effect on structure lighting, vehicle, and pedestrian road width, relationship between the maximum height of the tree and the average building height along the road and the expected design effect from the tree and the speed at which the tree reaches this effect. It is being fired. Accordingly, there is a varying range between 6-15 m (Şahin & Kurum, 2006). Urban road afforestation created at appropriate spaces according to selected species will provide a dense texture.

The characteristics that plant material must have in the use of living material to be accessible (Döllük, 2005):

— to create a natural and aesthetic texture, to create a color effect that changes according to the seasons, and to provide the opportunity to observe the seasons;

— creating a sense of orientation and movement, encouraging walking by creating alleys, emphasizing the transitions in vehicular and pedestrian connections, the presence of planting and signaling means that the plants should be designed to make the entrances clear and to have a guiding feature along the road;

— protection from the harmful rays of the sun in the space with shading;

— separating pedestrian and vehicle traffic, providing safe transportation for pedestrians;

— to alleviate accidents, create a barrier, prevent adverse effects from the environment;

— to screen the harsh, wrong views of buildings.

It is not in direct contact with the Street. It is also possible to see street trees (about 80) in the land use of the Street.

It is possible to see one-sided tall trees along the borders of our working area. It is not possible to see a dense and continuous enough wood texture. It has been determined that the vegetable materials used along the street are not arranged according to appropriate design features. In this case, the area was evaluated according to the vegetable material variable as "presence of sparse trees within the area boundaries, maintenance areas, partly having suitable vegetable design criteria".

The relationship and Adequacy of landscape values in pedestrian transportation and walkability in transportation were determined on Atatürk Street and calculated in line with the observation form and evaluation criteria (Tab.2).

Walkability in transportation	Variables	Assessment features		
Land use type for accessible area	**Activities** Restaurants and other food and beverage areas, grocery stores, retail stores, parks, parkways, schools, libraries, bicycle paths, hospitals, tree-lined streets, cultural centers, parking lots, historical areas	The situation of the existence of food and beverage areas, sales units, cultural centers, historical areas, public areas, public buildings, libraries, museums, bicycle paths, car parks, schools, and hospitals at the same time in the area.	5	4
		The situation in which some of the food and beverage areas, sales units, cultural centers, historical areas, public spaces, public buildings, libraries, museums, bicycle roads, car parks, shops and hospital exist in the area at the same time.	4	
		The existence of restricted public areas in the area	3	
		The case of only privately owned areas existing in the area	2	
		The situation of the existence of a protected/protection priority area/limited use situation in the area	1	
Showcase presence in accessible area	**Sociability** Area usage diversity, Number of people using the area Street appeal and popularity among users	The high density of users in the showcase area	5	4
		Medium density of users in the showcase area	4	
		The low density of users in the showcase area	3	
		A sparse number of users in the showcase area	2	
		User density is not in the showcase area but has no connection with the showcase area	1	

Walkability in transportation	Variables	Assessment features		
Pedestrian use in accessible area	**Accessibility** Connectivity, Integration, Street connections, 10 min., Areas within walking distance	Number of intersections and connections 5 and more per 200 m along the street boundaries,	5	3
		4 intersections and number of connections per 200 m along the street boundaries,	4	
		3 intersections and number of connections per 200 m along the street boundaries,	3	
		2 number of intersections and connections per 200 m along the street boundaries,	2	
		1 number of intersections and connections per 200 m along the street boundaries, or the existence of areas without intersections and connections	1	
Security in accessible area	**Image and security** Crime statistics, vacant lots, derelict vacant buildings Safety on the sidewalk	According to the actions related to use, there should be no crime statistics, empty parcels, or abandoned vacant buildings. Physically, the pedestrian pavement is arranged by the standards and is very safe for use.	5	4
		According to the actions related to use, there should be very few crime statistics, empty parcels, and abandoned vacant buildings. Physically, the pedestrian pavement is arranged according to the standards and is safe for use.	4	
		According to usage-related actions and crime statistics, empty parcels and abandoned vacant buildings are low. The standards physically arrange the pedestrian pavement, which is moderately safe for use.	3	
		Use-related actions include crime statistics, vacant parcels, derelict vacant buildings, and the middle of the road; physically, the pedestrian pavement is arranged by the standards and is less safe for use.	2	
		The presence of crime statistics according to the activities related to the use, the presence of vacant parcels, abandoned vacant buildings, physical pedestrian pavements not being arranged by the standards, and the absence of a safe area.	1	
Spatial aesthetics in accessible area	**Urban identity**	The presence of a high level of comfort and attractiveness elements align with the uses within the area's boundaries and the presence of many elements that contribute to the urban identity.	5	3
		The presence of elements of medium-level comfort and attraction by the uses within the area borders and the presence of at least one element that supports the urban identity	4	
		The presence of elements of low level of comfort and attraction by the use within the limits of the area	3	
		Within the area's limits are images that restrict comfort, noise, odor, etc. Finding the conditions	2	

Walkability in transportation	Variables	Assessment features		
		Use within the limits of the area: image, noise, odor, etc. That negatively affect comfort. Finding negatives	1	
Barrier-free roads and equipment in accessibLe area	Pavement width on boulevards and streets connecting to the area Available pavement widths Availability of disabled accessibility: Road widths suitable for physically disabled transportation. Pedestrian path width according to TSE 12576 standards Ramps suitable for physically disabled transportation. According to TSE 12576 standards, the width of the ramps is min. It should be 90cm and the slope should be 8% (Ender, 2011). Suitability of the selected material for use in transportation Floor coverings, Suitability of material properties Seating units, Lighting elements, Border elements, Plastic objects (sculptures, etc.), Covering Units, Guidance-signs, Garbage bins, Flowerpots, Water features, Fountains, Service units (Sales units, Kiosks, flagpoles, etc.), Stops for public transport, Border elements	Areas completely separated from motor vehicle traffic, suitable for pedestrian use, compliant with design criteria for everyone, with appropriate street and sideway width, with suitable surface and materials, and with sufficient reinforcement elements,	5	3
		Areas suitable for closing vehicle traffic at certain hours and pedestrian use, partially meeting design criteria for everyone, partly with appropriate street and sideway width, partly with suitable surface and materials, partly with sufficient reinforcement elements	4	
		Areas suitable for a separate pedestrian lane arrangement, with insufficient design criteria for everyone, with irregular street and sideway width, with the presence of unsuitable irregular surfaces and materials, and with insufficient reinforcement elements,	3	
		Reinforcement elements that are not suitable for a separate pedestrian strip, without design criteria for everyone, with inappropriate street and sideway width, with defective surfaces and materials.	2	
		Not suitable for organizing a separate pedestrian lane, not having enough space to design for everyone, ideal for lane regulation, insufficient design criteria for everyone, having inappropriate street and sideway width. Areas with defected surfaces and materials and no reinforcement elements	1	
Live material in accessible area	**Plant material** Emphasizing with plants Shading with plants	Presence of dense trees within the area boundaries, maintenance areas, suitable species selection, having vegetation design criteria by street standards.	5	3
		Presence of medium dense trees within the area boundaries, well maintained areas, appropriate	4	

Walkability in transportation	Variables	Assessment features		
	Distinguishing between plants and pedestrian and vehicle traffic	species selection, having appropriate vegetation design criteria		
		The area has sparse trees, well-maintained areas, and partially suitable vegetative design criteria.	3	
	Taking precautions to alleviate accidents with plants	There are shrubs within the area's boundaries, poorly maintained areas, and irregular vegetative design features.	2	
		Within the area limits no road afforestation, non-maintenance areas, no vegetable design features	1	
		Total	**68.5%**	**24**
		The Overall Total	**100%**	**35**

Tab.2 The relationship and Adequacy of landscape values in pedestrian transportation of Atatürk Street

4. Discussion and Conclusion

It is possible to think together with the urban identity when arranging the roads, pedestrian paths, and pedestrian areas shaped by the natural structure and topography of the city. Also these areas, roads, connections etc. The equipment that will provide integrity should also be considered in relation to the city's natural, cultural, and historical structure. While walkable cities make the city more livable, planning and designs should be carried out by keeping the city's identity in the foreground. Pedestrian roads, pedestrian zones, and pedestrianized area arrangements that will integrate with the natural resource values of the city will support revealing the city's identity. Again, the integration of these pedestrian-intensive areas with cultural venues and building environments, color, texture, form, etc. Planning it holistically will reveal more of the identity structure of the city. When planning pedestrian-dense areas, walkability criteria such as the connections of the roads, their directness, continuity, landscape values, quality of the streets, visual diversity, security, and types of land use should be considered. Arranging urban equipment elements as a whole with walkability variables, which will be developed by the city identity and applied in the plans and designs of pedestrian-dense areas, will further support the walkability of the areas (Pirselimoğlu Batman & Ender Altay, 2020). It is essential that areas such as sidewalks, streets, or squares, which belong only to pedestrians and offer safe and comfortable movement away from the adverse effects of traffic, are accessible to everyone (Kul & Tutal, 2016). This importance will lead to the effective use of design elements for landscape planning and design studies with holistic planning, starting from pedestrian transportation areas and including vehicle transportation areas. As a result, it will be possible to see designs that are integrated with transportation in cities and have binding and continuity (Yılmaz Türkoğlu, 2010).

When Forsyth (2015) examined the studies including the expression of walkability, he detected that the areas that included walkability are better and preferred areas than many areas. The study shows that walkability represents a holistic solution in the improvement of urban areas, defining slower pace, more human scale, healthier, happier areas. In his study, Zayed (2016) emphasized the importance of walkability for pedestrian roads. The researcher stated that the foundations of walkability depend on micro-scale factors more than macro-scale factors. At this point, it has been revealed that in addition to macro factors such as land use distribution and street network planning, road profile, road anotomy, and landscape elements are more noticed by pedestrians and affect them directly.

Supporting pedestrian transportation is the most crucial step for urban transportation to be functional for city livability (Beyazıt, 2007). For this purpose, Gündoğdu & Dinçer (2020) determined the walkability criteria in their study. In line with these criteria, the importance of pedestrian movement formation and the relationship

between urban formation characteristics and pedestrian movement has been revealed. Gültekin & Altunkasa (2008) revealed the criteria determining the suitability level for pedestrian use on urban roads. In their study, Bekçi & Sipahi (2023) evaluated whether pedestrian accessibility can be achieved by walking in urban landscape areas and, if so, what the accessibility criteria are on the pedestrian route with different user groups. Bursa-Atatürk Street was evaluated to examine walkable areas in transportation areas in terms of landscape architecture and reveal the potential of the walkable regions in Accessibility. Within the scope of the evaluation, the Adequacy of the Street in terms of walkability was revealed by presenting criteria, variables, and evaluation features based on walkability in transportation. According to the evaluation, the first criterion regarding walkability in transportation is predominantly land use. The area used on Atatürk Street (restaurants, shops, cultural centers, etc.) was determined and received "4 points" according to the evaluation features scoring. The second criterion in evaluation is the presence of a showcase in Accessibility. With this criterion, the diversity of area usage, the number of people using the area, street attractiveness, and popularity among users were evaluated in the context of the sociality of the area. In this evaluation, the study area received "4 points". The third criterion for Accessibility is pedestrian use. At this point, Accessibility for pedestrian use; connection, integration, street connections, 10 min. When evaluated within the scope of the presence of areas within walking distance, it received "3 points". The fourth criterion is security in Accessibility. This criterion was evaluated in the context of image and security and received "4 points". The fifth criterion in evaluation is Spatial aesthetics in Accessibility.

In this regard, when Atatürk Street was evaluated in terms of living and inanimate elements reflecting the urban identity, it received "3 points". The sixth criterion is Accessibility and barrier-free roads and equipment. In this criterion, the existing sidewalk width on the boulevards and streets connecting to the area, the presence of disabled Accessibility, and Road widths suitable for transportation of the physically disabled. Pedestrian path width according to TS 12576 standards. Ramps are ideal for the transportation of the physically disabled. Width of ramps according to TS 12576 standards. Min. It should be 90cm, and the slope should be 8% (Ender, 2011).

Suitability of the selected material for use in transportation - floor coverings, material properties suitability, seating units, lighting elements, border elements, plastic objects (sculptures, etc.), cover units, directional signs, garbage bins, flower beds, water elements, fountains, service units (sales units, kiosks, flagpoles, etc.), stops for public transportation, and border elements were evaluated. According to these variables, Atatürk Street received "3 points". The seventh and final criterion in evaluation is the presence of living material in Accessibility. In line with this criterion, the presence of living material was evaluated in line with variables such as emphasizing plants, shading with plants, separating pedestrian and vehicle traffic with plants, and taking measures to alleviate accidents with plants. As a result of the evaluation, this criterion received "3 points". In this regard, the overall Adequacy of the area is "24 points" based on the area's walkability in transportation and its relationship with landscape values. In this case, it was concluded that it was partially sufficient with 68.5%.

As a result, Atatürk Street shows a vibrant structure in terms of land use since it is both in the city center and a historical and cultural region. In addition, the density of storefronts on the Street due to the use of space increases the area's attractiveness. Again, since the Street is in the city core and a historical and cultural zone, it causes attractive land uses not only on the Street but also within a 10-minute walk of the Street. This situation has caused the number of street users to increase. It is possible to see intense human use on weekdays and weekends due to the presence of workplaces and historical-cultural-touristic places. User density on the pedestrian paths on both sides of the Street. It is possible to see both vehicle and pedestrian connection points on the Street. However, the number of connections with sufficient permeability is not available. There are no empty or abandoned buildings or spaces in the area. However, when viewed on a walking basis, it is possible to see sidewalks that do not separate vehicles and pedestrians.

Regarding comfort and attractiveness on the Street, it does not offer integrity with its land uses, landscape values, structural solutions, and historical and cultural values. This solution, which is unique to each of them, does not offer visual appeal. The presence of essential elements that support the urban identity endorses understanding the area as walkable.

Liu et al. (2016) found in their study that there are strong relationships between street centrality and land use density. While expressing the existence of spatial heterogeneity, they stated that street centrality plays an essential role in shaping the urban structure and land use density and supporting the formation of urban textures. Ding et al. (2016) stated in their study that Accessibility has a significant and positive effect on the development of shopping activity, which is related to the presence of storefronts. They emphasized that such land use should take into account human spatio-temporal constraints.

Shuvo et al. (2021) state in their studies that an ideal living space should be green and walkable. Besides this, Fan et al. (2018) stated that walkability is an important element in assessıng urban landscapes ' sustainability. Variables such as the barrier-free Accessibility of the roads and the ease of use by everyone were evaluated on the field. Pavement width on the boulevards and streets connecting to the area, Existing pavement widths, Disabled Accessibility: Road widths suitable for Physically Disabled Transportation, Ramps suitable for Physically Disabled Transportation, Suitability of the selected material for use in transportation - Floor coverings, Material properties suitability variables are discussed within the boundaries of the study area. Since the Street is located within the old city fabric, the pedestrian paths perpendicular to the Street connecting to the Street vary from place to place. However, the pedestrian connections are wide enough for an average of 1 person to walk. In the changing streets and roads following the Street, the pedestrian sidewalk width has a feature that is continuous with the current state of the Street. In the current state of the Street, pedestrian sidewalk widths vary from place to place and range between (3.5 m - 5.5 m). As for disabled Accessibility, although the road widths are suitable, there is no continuity in other elements that will support physically disabled individuals and visually impaired individuals. Guide tracks to help visually impaired people in walking are only available at the tram stop.

Moreover, these guide tracks need more continuity on the pavements. There are no ramps for physically disabled people at the starting and ending points of the sidewalks. This situation not only challenges people with disabilities but also applies to older people and pedestrians with baby strollers. In this regard, the sidewalks on both sides of the Street must have sufficient features. In addition, disabled, elderly, individuals with baby strollers, children, etc., who want to cross from one side of the Street to the other. There is only one elevator connected to an underpass. In the study of Bekçi (2012), in ergonomic and accessible outdoor arrangements, standards-compliant uses such as pedestrian sidewalks, floor coverings, signs and lighting signs, intersections, stairs, ramps, etc., that will provide comfortable use of physical obstacles should be recommended. In addition, he emphasized that the physical environmental arrangements to be made for disabled individuals should ensure that they are accessible not only to physically disabled people but also to people with temporary disabilities, such as the elderly, pregnant women, strollers, children, etc.

Standards should be considered in the design and application of road landscapes, which are essential city elements (Polat & Önder, 2012). When the materials are evaluated, it is seen that the material properties are not restrictive, such as roughness, potholes, bumps, etc., when pedestrians use the area. When the appropriate joint density and width feature is evaluated, rare situations do not progress in a particular order and differ occasionally. Additionally, the surface has no reflection property (albedo). No adverse effects were detected in rainy weather. The adequate road infrastructure (compacted soil, stabilized filling or blocking, etc.) is at an appropriate level. Another element that supports surface elements is drainage. No drainage problems that prevent walking on the Street have been detected.

To work efficiently, some issues need to be considered in transportation planning for living and non-living materials on the roads with high vehicle and pedestrian density in cities. These are trust in users, convenience, ecological benefit, and comfort parameters (Yılmaz Türkoğlu, 2010).

Considering the walkability of the working boundaries along with the presence of reinforcement elements for Accessibility, such as seating units, stops, flower beds, garbage bins, lighting components, border elements, notice and direction boards, traffic lights, poles for trams, sales units, cover units, plastic objects. There are many donor people. Although this situation increases the walkability value of the area, these donors need to show a holistic approach. Each of them has a different character. In addition, in this area, located in the city core and is an important historical and tourist center, the donors need a common language and an approach that reflects the city's identity.

An essential component of the urban open green space system is road trees. While road trees give identity and continuity to the city and the route it creates, they create the effect of continuity and occupancy. It eliminates the boredom of the roads, adds interest to them, and makes effective routes. In addition, when road trees are used correctly, they will positively contribute to the urban ecosystem (Kurdoğlu & Pirselimoğlu, 2011). Seyidoğlu Akdeniz et al. (2019), in their study on urban boulevards, emphasized that plants in road afforestation are essential regarding their design features and other factors such as temperature, salt, drought, and pollution. They stressed the importance of ecological suitability, the suitability of plants, and design features.

Another substantial landscape supporting walking inaccessibility is the area integrated with plant material. Emphasizing plants, shading with plants, separating pedestrian and vehicle traffic with plants, and taking precautions to alleviate plant accidents are essential variables related to street plant materials. In this regard, when the boundaries of the study area were evaluated, the emphasis on the road with plants could have been made more effective. There is a presence of trees that can be interpreted as sparse. It has also been observed that a practical shade effect cannot be achieved with trees. Pedestrian and vehicle separation is not provided with plant material. There is no use of any herbal material to prevent or alleviate accidents. Plant material is most densely seen around the Statue, its surroundings, and the Ulu Mosque-Kozahan-Historical Municipality Building. Very few of these have an impact on the Street.

As a result, Atatürk Street and its surroundings are preferred areas for people living in Bursa and visiting Bursa, as it is in the city center and has historical and tourist areas and structures. Shopping, dining, visiting historical sites, participating in cultural activities, socializing, bank visits, public institution-related work, etc. It is possible to see many different usage purposes. It is an area with many users for various purposes. This Street, which has pedestrian axes broad enough for its intensive users, is not fully adequate regarding walkability variables. This area, at an important historical and cultural point, cannot reflect the city's identity. In this case, the fact that the donated elements display different characters does not support the emphasis on urban identity. It is seen that transportation values and urban identity are not integrated. Plant material and structural material are not used in balance and do not provide a comfortable walking area for pedestrians. At the same time, it does not contribute to the landscape ecology in this area, where there is dense construction and hard surfaces. At the same time, the use of the Street does not comply with the design criteria for everyone. In this case, it does not support comfort and safety in pedestrian use. Based on these negativities, if the Street is walkable for transportation, it should be recommended to use a street that reflects the urban identity, creates a green corridor with a vegetal axis moving with the pedestrian axis, and is based on comfort and safety while walking.

References

Bursa iklimi, aylık hava durumu, ortalama sıcaklığı (Türkiye) - Weather Spark. (n.d.). Weather Spark. https://tr.weatherspark .com/y/96052/Bursa-T%C3%BCrkiye-Ortalama-Hava-Durumu-Y%C4%B1l-Boyunca#Figures-Color Temperature

Bekçi, B. (2012). Fiziksel Engelli Kullanıcılar için En Uygun Ulaşım Akslarının Erişilebilirlik Açısından İrdelenmesi: Bartın Kenti Örneği, *Bartın Orman Fakültesi Dergisi,* 14, Özel Sayı, 26-36.

Bekçi, B. & Sipahi, M. (2023). Investigation of Spatial Accessibility on the Scale of Pedestrian Areas. *Journal of the Faculty of Engineering and Architecture of Gazi University 38* (4), 2155-2165. https://doi.org/10.17341/gazimmfd.812513

Baş Bütüner, F. & Çavdar Sert, S. (2021). Kentsel Peyzajın Değişen Kavramsal Çerçevesi: Ankara Üzerine Değerlendirmeler. *Ankara Araştırmaları Dergisi, 9* (1), 89-107. https://doi.org/10.5505/jas.2021.27146

Beyazıt, E. (2007). Kent Yaşanabilirliğini Artıran Yaya Mekanlarının Türlerarası Ulaşım Sistemi İçinde İrdelenmesi: Kabataş Örneği, Yüksek Lisans Tezi, Şehir ve Bölge Planlaması Anabilimdalı, İstanbul Teknik Üniversitesi, İstanbul.

Carra M., Rossetti S., Tiboni M. & Vetturi D. (2022). Urban regeneration effects on walkability scenarios. *TeMA - Journal of Land Use, Mobility and Environment*, 101-114. https://doi.org/10.6093/1970-9870/8644

Çetinkale Demirkan, G. (2020). Herkes için Tasarım Kapsamında Kentlerde Peyzaj Erişebilirliği, Bölüm 11, Editör: Doç.Dr. Yıldız Aksoy, Nobel Akademik Yayıncılık, 267-296.

Çetinoğlu Çınar, E. (2023). Tarihi kent merkezlerinde yaşam kalitesini kent morfolojisi açısından incelemek: Bursa Hanlar bölgesi örneği. Yüksek Lisans Tezi. Bursa Teknik Üniversitesi, Lisansüstü Eğitim Enstitüsü, Kentsel Tasarım Ana Bilim Dalı.

Demir, Ü. (2008). Peyzaj Tasarımında Yaya Bölgeleri Antakya Hürriyet Caddesi Yayalaştırma Örneği, Yüksek Lisans Tezi, Peyzaj Mimarlığı Anabilimdalı, Mustafa Kemal Üniversitesi, Hatay.

Demir, Z. (2019). Mekânsal Planlamanın Fiziksel Aktivite ve Yürünebilirlik Üzerine Etkisi: Bursa Cumhuriyet ve Atatürk Caddeleri. *Sosyal Bilimler Araştırma Dergisi, 8* (1), 115-127. https://dx.doi.org/10.5505/planlama.2016.53825

Ding, Y., Lu, H. & Sun, X. (2016). Impact of Improved Accessibility on Shopping Activity: Person-Based Measure. *Journal of Urban Planning and Development, 142* (3), 04016006. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000325.

Döllük, G. (2005). Yayalaştırılmış Sokakların Kent Peyzajına Katkısı, Yüksek Lisans, İstanbul Teknik Üniversitesi, İstanbul.

Düzenli, T., Yılmaz, S. & Özkan, D.G. (2017). Peyzaj Mimarlığı Eğitiminde Donatı-Mekan İlişkisinin Kurgulanması. *Uluslararası Sosyal Araştırmalar Dergisi, 10* (48), 478-485.

El kébir, M. & Ghédira, A. (2024). Gender analysis of urban mobility behaviours in the Tunisian Sahel region. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 23-49. https://doi.org/10.6093/1970-9870/10415

Ender, E. (2011). Adana İli Çukurova İlçesi Aktif Yeşil Alanlarının Nitelik ve Nicelik Açısından İrdelenmesi (Master's thesis). Çukurova University, Adana.

Ender Altay E. & Pirselimoğlu Batman Z. (2019). Investıgatıon of Accessıbılıty In Recreatıonal And Leısure Areas, *Bursa-Turkey Fresenius Environmental Bulletin, 28*, 1811-1822.

Ender Altay E. & Pirselimoğlu Batman Z. (2021). Yaya Mekanlarında Erişim ve Kullanım Olanakları, Peyzaj Mimarliğinda (Planlama, Tasarim Ve Peyzaj Bitkileri) Güncel Çalişmalar, Murat Zencirkıran, Editör, Gece Yayınevi / Gece Publishing, 91-102, 2021.

Erel, B. (2007). Kentsel Açık Alan Kavramı Bağlamında İskele Meydanlarının İncelenmesi, İstanbul Örneği, Yüksek Lisans Tezi, Yıldız Teknik Üniversitesi, İstanbul.

Ersoy, M. (1994). Kentsel Alan Kullanım Normları, Orta Doğu Teknik Üniversitesi, Mimarlık Fakültesi Yayınları, ODTÜ Mimarlık Fakültesi, 301.

Fan, P., Wan, G., Xu, L., Park, H., Xie, Y., Liu, Y., Yue, W. & Chen, J. (2018). Walkability in Urban Landscapes: a Comparative Study of Four Large Cities in China. *Landscape Ecology, 33*, 323-340. https://doi.org/10.1007/s10980-017-0602-z

Forsyth, A. (2015). What is a Walkable Place? The walkability debate in Urban Design. *Urban Design International, 20* (4), 274-292. https://doi.org/10.1057/udi.2015.22

Gültekin, B. & Altunkasa,F. (2008). Kent İçi Yolların Yaya Kullanımına Yönelik Değerlendirilmesinde Çözümlemeli Bir Yaklaşım: Adana Örneği, Ç.Ü Fen Bilimleri Enstitüsü Yıl:2008 Cilt:17-3

Gündoğdu, H.M. & Dinçer, E. (2020). Tekirdağ Kent Merkezinin "Yürünebilirlik" Açısından Değerlendirilmesinde Bir Yöntem Araştırması, *Planlama 2020, 30* (3), 478–507. https://doi.org/10.14744/planlama.2020.50570

Hamamcıoğlu, C.C. & Akın O. (2015). Çevre ve Toplum Yaşamına Duyarlı Kentsel Yaklaşımlar Bağlamında Yaya Erişimi ve Yürünebilirlik (Kadıköy Örneği), 11. Ulaştırma Kongresi, TÜRKİYE, 27-29 Mayıs, 447-457.

Harris, C.W. & Dines, N.T. (1998). Time-Saver standards for Landscape Architecture: Design and Construction Data, McGraw-Hill Education, New York.

IRAP, İl Afet Risk Azaltma Planı (2022), https://bursa.afad.gov.tr/kurumlar/bursa.afad/Bursa-IRAP.pdf, Accessed: 11.07.2024

Kaplan, H. (2021a). Kentsel Ulaşımın Mekansal Temelleri-Giriş Konuları, Kentsel Tasarım, Kuram, Örnekler ve Uygulamaları, Editör: Dr. Burcu İmren Güzel, 23-73.

Kaplan, H. (2021b). Kentiçi Ulaşım Düzenlenmesinde Alan, Aktivite, Trafik Akımı ve Mekan İlişkileri Temel Bilgisi, Kentsel Tasarım, Kuram, Örnekler ve Uygulamaları, Editör: Dr. Burcu İmren Güzel, 75-117.

Kaplan, H. & Deniz, H. D. (2016). Yaya Yolu Sürekliliğinde Peyzaj Kalitesinin Artırılması: Ankara Yüksel Caddesi Örneklem Alan Çalışması, 1. Ulusal Ankara Ü. Peyzaj Mimarlığı Kongresi, Ankara Üniversitesi Basımevi 266-276. ISBN: 978-605-136-243-4

Kılınçasalan, T. (2017). Bisiklet ve Yaya Yolları Otoparklar, Kentsel Ulaşım, Ulaşım Sistemi-Toplu Taşım, Planlama-Politikalar, Derleyen: Prof. Dr. Tülay Kılınçaslan, Ninova Yayınları, 109-154.

Kul, H., Tutal, O., (2016). Yaya Alanlarının Erişilebilirliği: Eskişehir Porsuk Çayı Kıyısı Örneği, 3. Ulusal Yapı Kongresi ve Sergisi, Teknik Tasarım, Güvenlik ve Erişilebilirlik, 24-26 Kasım 2016, TMMOB Mimarlar Odası Ankara Şubesi, Ankara.

Kurdoğlu, B.Ç. & Pirselimoğlu, Z. (2011). Yol Açağlarının Anlamsal Değerlendirilmesine Yönelik Bir Çalışma, A Study for Semantic Evaluation of Street Trees, A study for Sementic Evaluation of Street Trees, *Artvin Çoruh Üniversitesi Orman Fakültesi Dergisi, 12* (2), 211-221.

Lee, J. (2016). Impact of Neighborhood Walkability on Trip Generation and Trip Chaining: Case of Los Angeles. *Journal of Urban Planning and Development, 142* (3), 05015013. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000312

Lehmkühler, S., Büttner, A., Kiso, C. & Schaefer, M. (2020). The Berlin mobility lab Flaniermeile Friedrichstrasse. *TeMA - Journal of Land Use, Mobility and Environment, 13* (2), 125-148. https://doi.org/10.6092/1970-9870/6785

Liu, Y., Wei, X., Jiao, L. & Wang, H. (2016). Relationships between Street Centrality and Land Use Intensity in Wuhan, China. *Journal of Urban Planning and Development, 142* (1), 05015001. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000274

Nilüfer Çayı (2024, May 20). https://tr.wikipedia.org/wiki/Nil%C3%BCfer_%C3%87ay%C4%B1

Özcan, Y. (2008). Engelli Standartlarının Adana Kenti Açık ve Yeşil Alanlarında Analizi ve Uygulama Önerileri, Yüksek Lisans Tezi, Fen Bilimleri Enstitüsü, Çukurova Üniversitesi, Adana.

Özkaynak, M. & Korkmaz, S.Z. (2019), Yayalaştırılan Alanlardaki Sorunların Konya Zafer Meydanı Örneği Üzerinden Değerlendirilmesi. *Online Journal of Art and Design, 7* (4), 173-189.

Pellicelli, G., Rossetti, S., Caselli, B. & Zazzi, M. (2022). Urban regeneration to enhance sustainable mobility. *TeMA - Journal of Land Use, Mobility and Environment*, 57-70. http://dx.doi.org/10.6092/1970-9870/8646

Pirselimoğlu Batman, Z. & Ender Altay, E., (2020). An Examination of the Relationship Between Walkability in Transportation and Landscape Architecture. *Trends in Landscape Agriculture, Forest and Natural Science*, 108-121, Cambridge Scholars Publishing.

Polat, A.T. & Önder, S. (2012). Kentsel Peyzaj: Tasarım ve Uygulamaya Yönelik Bazı Öneriler, Kentsel Peyzaj Alanlarının Oluşumu ve Bakım Esasları Semineri, 19 Mayıs 2012, 97-116, Konya.

Sandal Erzurumlu, G. (2020). Kamu Alanlarının Peyzaj Tasarımında Kullanılan Bitkisel Elemanlar, Mimarlıkta Peyzaj Tasarımı, Bölüm 12, Editör: Doç.Dr. Yıldız Aksoy, Nobel Akademik Yayıncılık, 297-312.

Seyidoğlu Akdeniz, N. Tumsavas, Z. & Zencirkiran, M. (2019). A Research on the soil characteristics and woody plant species of urban boulevards in Bursa, Turkey. *Journal of Agricultural Science and Technology 21* (1), 129-14. https://doi.org/ 20.1001.1.16807073.2019.21.1.17.6

Shuvo, F. K., Mazumdar, S. & Labib, S. M. (2021). Walkability and Greenness Do Not Walk Together: Investigating Associations between Greenness and Walkability in a Large Metropolitan City Context. *International Journal of Environmental Research and Public Health, 18* (9), 4429. https://doi.org/10.3390/ijerph18094429

Southworth, M. (2005). Designing the Walkable City. *Journal of Urban Planning and Development, 131* (4), 246-257, https://doi.org/10.1061/(ASCE)0733-9488(2005)131:4(246)

Spadaro I., Rotelli C. & Adinolfi P. (2023). Sustainable mobility for urban regeneration. *TeMA - Journal of Land Use, Mobility and Environment, 16* (2), 255-277. https://doi.org/10.6093/1970-9870/9722

Şahin, Ş. & Kurum, E. (2006). Kent İçi Yol Ağaçlandırmasında Planlama Ve Tasarım. Kentiçi Ağaçlandırma Çalışmalarında Teknikler ve Sorunlar (Ankara Örneği). Paneli, Kırsal Çevre ve Ormancılık Sorunları Araştırma Derneği, Bildiriler Kitabı, s. 48-63, 11 Kasım, Ankara.

Şenkaynak, P. (2010). Yaya Bölgelerinin kentsel Peyzaj Planlama Açısından Önemi ve İstanbul'daki Bazı Örneklerinin İncelenmesi, Yüksek Lisans Tezi, Peyzaj Mimarlığı Anabilimdalı, İstanbul Üniversitesi, İstanbul.

Şişman, E. E., Etli, B., (2007). Tekirdağ Kent Merkezindeki Yaya Bölgelerinin Belirlenmesi ve Projelendirilmesi, *Tekirdağ Ziraat Fakültesi Dergisi, 4* (3), 327-338.

Tarakçı Eren, E., Düzenli, T. & Akyol, D. (2018). Kent Merkezinde Caddelerin Yayalaştırılması: Trabzon Kahramanmaraş Caddesi Örneği. *Megaron, 13* (3), 480-491. https://doi.org/10.5505/MEGARON.2018.17362

TS 12576 Şehir İçi Yollar - Özürlü ve Yaşlılar İçin Sokak, Cadde, Meydan ve Yollarda Yapısal Önlemlerin Tasarım Kuralları Standardı.

TS 9111 Özürlüler ve Hareket Kısıtlılığı Bulunan Kişiler için Binalarda Ulaşılabilirlik Gerekleri (November, 2011).

Türkiye Nüfusu İl İlçe Mahalle Köy Nüfusları, Bursa (2023). https://www.nufusune.com/osmangazi-ilce-nufusu-bursa

Vural Arslan, T., Durak, S., Dizdar Gebesce, F. and Balcik, B. (2018), Assessment of factors influencing walkability in shopping streets of tourism cities: case of Bursa, Turkey, *International Journal of Tourism Cities, 4* (3), 330-341. https://doi.org/10.1108/IJTC-11-2017-0071

Woldeamanuel, M. & Kent, A. (2016). Measuring Walk Access to Transit in Terms of Sidewalk Availability, Quality, and Connectivity. *Journal of Urban Planning and Development, 142* (2). https://doi.org/10.1061/(ASCE)UP.1943-5444.0000296

Yıldırım, A. & Küçük, V. (2020). Yayalaştırılmış Bölge Kafeler Caddesi'nin (Isparta) Peyzaj Mimarlığı Açısından İrdelenmesi, Mimarlık Bilimleri ve Uygulamaları Dergisi, *MBUD 2020, 5* (1), 81-92. https://doi.org/10.30785/mbud.669463

Yılmaz Türkoğlu, N. (2010). Kent Merkezinde Yaya ve Taşıt Ulaşım Alanlarının Peyzaj Mimarlığı Açısıdan İrdelenmesi; Konya Örneği, Yüksek Lisans Tezi, Peyzaj Mimarlığı Anabilimdalı, Selçuk Üniversitesi, Konya.

Yin, L. (2013). Assessing Walkability in the City of Buffalo: Application of Agent- Based Simulation. *Journal of Urban Planning and Development, 139* (3), 166-175. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000147

Zayed, M. A. A. (2016). The Effect of Landscape Elements on Walkability in Egyptian Gated Communities. *Archnet-IJAR, 10* (2), 113-129. https://doi.org/10.26687/archnet-ijar.v10i2.956

Zorlu T., Aydıntan, E. & Engin, E. (2010). Kent Kimliği: Tanjat ve Karadeniz Sahil yollarının Trabzon Kent Kimliğine Etkileri, Kentsel Müdahale, Mimarlık, 352, Mart-Nisan-2010. http://www.mimarlikdergisi.com/index.cfm?sayfa=mimarlik&DergiSayi=366&RecID=2331

Image Sources

Fig.1: Personal elaboration;

Fig.2: Personal elaboration;

Fig.3: Original content;

Fig.4: Original content;

Fig.5: Original content;

Fig.6: Personal elaboration;

Fig.7: Original content;

Fig.8: Original content.

Author's profile

Zeynep Pirselimoğlu Batman

She graduated from Karadeniz Teknik University, Department of Landscape Architecture in 2003. She completes his master's and doctorate degrees at Karadeniz Teknik University on rural landscape planning. She has been working as an associate professor at the Department of Landscape Architecture at Bursa Uludağ Universit since 2015. She has several academic studies in her expertise area as urban landscape planning, rural landscape planning, and landscape design. She conducts landscape design, and landscape planning courses and also takes part in landscape projects of different scales.

Elvan Ender Altay

She graduated from Cukurova University, Department of Landscape Architecture in 2008. She completes his master's and doctorate degrees at Cukurova University on open and green spaces. She has received different awards in urban design competitions. She has been working as an associate at Bursa Uludag University Department of Landscape Architecture since 2014. She conducts landscape design courses and also takes part in landscape projects of different scales. She has several academic studies in her expertise area as landscape design and landscape planning.

Sena Şengül

She is a graduate student at the Department of Landscape Architecture at Bursa Uludağ University. She is studying landscape design. She takes part in landscape projects of different scales.

TeMA

A scoping review of urban design and planning studies on the Covid-19 pandemic and elements of the built environment

Pouria Boujari [a*], Sarah Ghamar [a], Mahdi Nasirian [a], Fateme Ghapanchian [a], Mahtab Khajavi [a], Atieh Qasemi [a], Mohsen Bahari [b], Yasin Delavar [c], Hamideh Garrousi [d]

[a] School of Art and Architecture,
Tarbiat Modares University, Tehran, Iran
*e-mail: boujaripouria@modares.ac.ir

[b] School of Architecture,
Shahid Chamran University, Ahvaz, Iran

[c] Collage of Design, Construction and planning,
University of Florida, USA

[d] Urban design and planning department
Iran University of Science and Technology, Tehran, Iran

Abstract

Human life has faced fundamental challenges in many aspects due to the spread of the Coronavirus disease in the world, resulting in rethinking urban design and planning policies and theories to make cities more resilient and healthier. Numerous studies have been conducted in this field due to the pivotal role of the built environment in improving public health. The present study aims to assess the role of the influential components of the built environment in the outbreak of Covid-19 by conducting a systematic literature review. The studies were searched through the Scopus database and screened and reviewed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Totally, 145 studies among 13,002 met the predetermined criteria. The results were expressed in 11 themes including mobility, density, soundscape, public spaces, green spaces, housing, land use, socio-economic qualities, environmental qualities, tourism, and smartness.

How to cite item in APA format

Boujari, P., Ghamar, S., Nasirian, M. et al. (2024). A scoping review of urban design and planning studies on the Covid-19 pandemic and elements of the built environment. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 309-337. http://dx.doi.org/10.6093/1970-9870/10427

1. Introduction

The spread of infectious and contagious diseases can create great challenges and make societies face temporary or even long-term changes in all spheres of life (Pinheiro & Luís, 2020). A type of Coronavirus called SARS-CoV-2 spread globally at an alarming rate at the beginning of 2020, resulting in taking a wide range of measures around the world to prevent its transmission and reduce future morbidity and mortality from Coronavirus disease.

The restrictions and policies applied to cope with Covid-19 affected cities positively and negatively. A large number of principles related to the organization of social life, healthcare, public safety, and urban planning should be reviewed due to the significant and widespread risks of the Covid-19 pandemic (Jasiński, 2022).

Urban planning plays a significant role in the changes in the consequences related to infectious diseases since cities can aggravate the spread of the virus. To control and mitigate the challenges caused by the Covid-19 pandemic, future policies and strategies of urban planning and design should be introduced through the lens of public health (Majewska et al., 2022) since built environments can play a critical role in boosting the general health of citizens. Since the beginning of the pandemic, numerous studies have been conducted to investigate the impact of various environmental factors on the transmission of Covid-19. Due to the high number of papers and contracting results, a number of review articles have been also developed to consolidate the findings from these studies.

However, these studies focusing on the impact of Covid-19 on urban areas have typically only explored a few aspects of urban planning, or in more comprehensive analyses, have grouped findings in ways that do not fully encompass all the key elements influencing city quality.

For instance, Eltarabily & Elghezanwy (2020) overlooked aspects like soundscape, environmental considerations, and active transportation (walking and cycling). Taking the study by Sharifi & Khavarian-Garmsir (2020) as an example, which examined the impacts of Covid-19 on cities related to four major themes, namely, environmental quality, socio-economic impacts, management and governance, and transportation and urban design.

They integrated transportation and urban design and restricted the dimensions of urban design to density only. Another review article also focused on six factors including transport and land use, urban nature, public space, facilities and services, housing, and (ICT) (Mouratidis, 2021). Sharifi (2022) also examined a large number of articles on the pandemic's effects on cities and identified six main themes: air quality, climatic factors, human-made environmental influences, transportation, socio-economic disparities, and smart city initiatives. Similarly, Alidadi & Sharifi (2022) explored the pandemic's impact on various urban factors but omitted discussions on green spaces, public places, soundscape, tourism, and urban governance in their key findings. Roosta et al. (2023) conducted a comprehensive review of early urban studies conducted during the pandemic, highlighting a narrow focus on resilient urban landscape and design. Alizadeh et al. (2023) concentrated their research solely on the social repercussions of Covid-19, providing insights for resilience, management, planning, and urban design.

Hernández et al. (2023) explored various themes including social equality, health-oriented urban spaces, sustainable transportation, and economic aspects in their review article.

To address this gap, this study, unlike previous review articles, seeks to give a more holistic view of the role of all influential components of the built environment in the spread of Covid-19 in the context of urban planning and designing. To do so, the review explored 11 dimensions of urban design and planning, including mobility, density, soundscape, public spaces, green spaces, housing, land use, socio-economic qualities, environmental qualities, tourism, and smartness.

The findings of the study can be helpful in improving the quality of the cities and making them resilient when facing pandemic diseases such as Covid-19.

2. Methodology

2.1 Eligibility criteria

First, we selected studies developed in the context of urban design and planning, excluding articles conducted through the lens of other disciplines. Second, we removed studies at the architectural and building level, including ones that conducted at neighborhood level, city level, and above. Thirdly, as the study aimed to concentrate on urban design and planning studies exclusively, the expertise of the authors played a crucial role in article selection. We primarily chose articles authored by experts in the fields of urban design, planning, and landscape architecture. Furthermore, we specifically selected studies that provided recommendations for policy and practice within the realm of urban design and planning. Lastly, we limited our inclusion criteria to journal articles written in English.

2.2 Search strategy

We conducted a series of literature searches using the Scopus database throughout 2022 and early 2023. To find almost all possible urban design and planning studies about the Covid-19 Pandemic, several groups of keywords searched in the title and keyword in the database (see Table. 1). The keywords were selected based on the element of urban form (land use, density, layout, transportation infrastructure, building/housing type) which is categorized by (Dempsey et al., 2010). Two limiters set in all database searches contained: (1) written in English; and (2) published in peer-reviewed journals or conference proceedings as a full article.

Categories	Search string
Built Environment	TITLE(covid) AND TITLE(environmental AND design) OR TITLE(city AND planning) OR TITLE(urban AND design) OR TITLE(Urban AND planning) OR KEY(environmental AND design) OR KEY(city AND planning) OR KEY(urban AND design) OR KEY(Urban AND planning)
Urban Form	TITLE (covid) AND TITLE (urban AND sprawl) OR TITLE (urban AND density) OR TITLE (building AND density) OR TITLE(urban AND form) OR TITLE(compact AND city) OR TITLE(compact AND development) OR TITLE (urban AND morphology) OR TITLE (urban AND fabric) OR TITLE (smart AND growth) OR KEY (urban AND sprawl) OR KEY (urban AND density) OR KEY (building AND density) OR KEY(urban AND form) OR KEY(compact AND city) OR KEY(compact AND development) OR KEY(urban AND morphology) OR KEY(urban AND fabric) OR KEY(smart AND growth)
Urban Space	TITLE(covid) AND TITLE(public AND space) OR TITLE(Urban AND space) OR TITLE(public AND place) OR TITLE(collective AND space) OR TITLE(street) OR TITLE(square) OR TITLE(Underground AND Space) OR TITLE(city AND center) OR TITLE(Neighborhood) OR KEY(public AND space) OR KEY(Urban AND space) OR KEY(public AND place) OR KEY(collective AND space) OR KEY(street) OR KEY(square) OR KEY(Underground AND Space) OR KEY(city AND center) OR KEY(Neighborhood)
Landscape	TITLE(covid) AND TITLE(urban AND landscape) OR TITLE(streetscape) OR TITLE(facade) OR TITLE(soundscape) OR TITLE(smellscape) OR KEY(urban AND landscape) OR KEY(streetscape) OR KEY(facade) OR KEY(soundscape) OR KEY(smellscape)
Mobility	TITLE(covid) AND TITLE(mobility) OR TITLE(cycling) OR TITLE(public and transportation) OR TITLE(biking) OR TITLE(walking) OR TITLE(walkability) OR TITLE(commuting) OR KEY(mobility) OR KEY(cycling) OR KEY(public and transportation) OR KEY(biking) OR KEY(walking) OR KEY(walkability) OR KEY(commuting)
Land use	TITLE(covid) And TITLE(land AND use) OR TITLE(Residential) OR TITLE(housing) OR TITLE(Infrastructure) OR TITLE(Green AND space) OR TITLE(Blue AND space) OR TITLE(park) OR TITLE(Dwelling) OR TITLE(mix AND use) OR KEY(land AND use) OR KEY(Residential) OR KEY(housing) OR KEY(Infrastructure) OR KEY(Green AND space) OR KEY(Blue AND space) OR KEY(park) OR KEY(Dwelling) OR KEY(mix AND use)
Urban Quality	TITLE(covid) And TITLE(sustainable AND city) OR TITLE(sustainable AND development) OR TITLE(livability) OR TITLE(Air AND quality) OR TITLE(social AND interaction) OR TITLE(Urban AND Resilience) OR TITLE(smart AND city) OR TITLE(inclusiveness and city) OR TITLE(tourism) OR TITLE(creative AND city) OR TITLE(urban AND health) OR KEY(sustainable AND city) OR KEY(sustainable AND development) OR KEY(livability) OR KEY(Air AND quality) OR KEY(social AND interaction) OR KEY(Urban AND Resilience) OR KEY(smart AND city) OR KEY(inclusiveness) OR KEY(tourism) OR KEY(creative AND city) OR KEY(urban AND health) OR KEY(smart AND city)

Tab.1 Scopus database search string

2.3 Screening process

Figure 1 exhibits the article screening and identification process, following the Preferred Reporting Items specified in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline (Moher et al., 2009). 13002 records were identified for further eligibility screening (see Figure 1). 12755 records were excluded during the title, and abstract screening, and 247 articles were excluded at the stage of full-text assessment. Finally, 145 studies remained in this review. Five reviewers performed the selection process independently. Disagreements were resolved through consensus discussions between the reviewers.
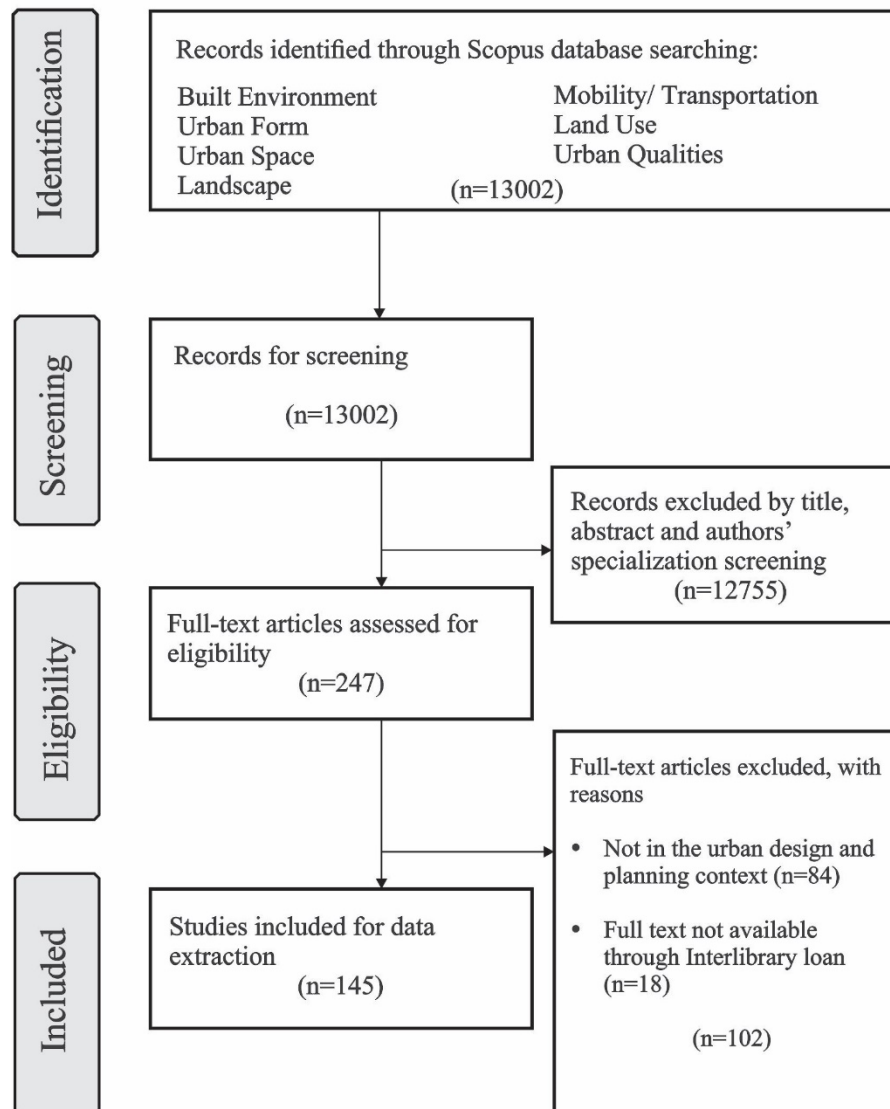
Fig.1 PRISMA flow diagram

2.4 Data extraction

Define Data Extraction Variables: Data from each selected study were extracted for five key dimensions: descriptive information, goals, methodology, findings, and limitations. Specific study characteristics extracted included first author, publication year, study area, study design, data source, data analysis methods, key conclusions, and limitations. *Develop Data Extraction Form:* Create a standardized form or template to systematically record the extracted data from each article. We developed a Microsoft Excel sheet and extracted information in detail. *Training and Calibration:* It is important to calibrate the reviewers to ensure that they are interpreting and extracting data in a consistent manner. We made several video calls and all necessary points were outlined by the first author about which parts of article they should read and how they should

extract data. *Data Extraction Process:* The papers were divided among all authors so that they independently conducted data extraction. The collected information was later synthesized to report the results presented in the next section. *Quality Control:* To ensure the accuracy and reliability of the extracted data, we double-checked a random sample of extracted data for consistency. *Data Synthesis:* Once all data has been extracted, they were synthesized and analyzed to identify patterns, trends, and themes across the selected articles.

To pinpoint the main themes, our initial approach involved organizing the articles into categories related to urban form elements such as density, transportation, layout, housing, and land use as outlined by Dempsey et al. (2010). Ultimately, we were able to pinpoint 11 distinct themes including mobility, density, soundscape, public spaces, green spaces, housing, land use, socio-economic qualities, environmental qualities, tourism, and smartness.

4. Results

4.1 Characteristics of reviewed studies

Tab.2 illustrates that over half of the articles utilized quantitative methods, while approximately 39% employed qualitative methods. Surveys (questionnaires and interviews) were conducted in only around 33% of the studies, whereas secondary data was utilized in about 60% of them. Upon categorizing the articles, it was revealed that the highest proportion focused on mobility and density, accounting for approximately 22% and 15%, respectively. Conversely, articles related to soundscape and smartness had the lowest representation, each comprising around 6%. Approximately 51% of the articles were cited between 0-10 times, while only 16.5% received more than 50 citations. China and the United States were the countries with the highest number of articles in this field, with approximately 15% and 12%, respectively. Notably, Sustainability and the International Journal of Environmental Research and Public Health were identified as the journals with the most published articles in this area.

Study characteristics	No.	%	Study characteristics	No.	%	Study characteristics	No.	%
Publication Year			**Themes**			**Citations**		
2020	33	22.7	Mobility	32	22.1	0-10	75	51.7
2021	98	67.5	Density	15	10.3	11-20	26	17.9
Early 2022	14	09.6	Soundscape	6	04.1	21-50	20	13.7
Study Design			Urban public spaces	7	04.8	+50	24	16.5
Quantitative method	76	52.4	Green spaces	22	15.2			
Qualitative method	57	39.3	Housing	15	10.3			
Mixed method	12	08.2	Land use and activity	13	08.9			
Outcome Data Sources			Socio-economic qualities	13	08.9			
Secondary data	86	59.3	Environmental qualities	8	05.5			
Questionnaire	36	24.8	Tourism	8	05.5			
Interview	12	08.2	Smartness	6	04.1			
Study areas								
North America	29	14.1	Czech Republic	1	00.5	Bangladesh	1	00.5
United States of America	25	12.2	Ireland	1	00.5	India	1	00.5
Canada	4	02.0	Israel	1	00.5	Palestine	1	00.5
South America	5	02.4	Norway	1	00.5	Philippine	1	00.5
Brazil	3	01.5	Scotland	1	00.5	Thailand	1	00.5
Colombia	2	01.0	Serbia	1	00.5	UAE	1	00.5
Europe	56	27.3	Switzerland	1	00.5	Vietnam	1	00.5
England	14	06.8	Turkey	1	00.5	*Australia*	8	03.9
Italy	11	05.4	*Asia*	71	34.6	Australia	6	02.9

Study characteristics	No.	%	Study characteristics	No.	%	Study characteristics	No.	%
Spain	5	02.4	China	31	15.1	New Zealand	2	01.0
Germany	4	02.0	Iran	10	04.9	*Africa*	5	02.4
Austria	3	01.5	Japan	5	02.4	Egypt	3	01.5
Poland	3	01.5	Singapore	5	02.4	Nigeria	1	00.5
Belgium	2	01.0	Indonesia	4	02.0	South Africa	1	00.5
Greece	2	01.0	South Korea	4	02.0	*Without case study*	28	15.1
Netherlands	2	01.0	Malaysia	3	01.5			
Sweden	2	01.0	Hong Kong	2	01.0			
Journals with the most published articles								
Sustainability	18	12.4	Sustainable Cities and Society	10	06.8	PLoS ONE	5	03.4
International Journal of Environmental Research and Public Health	13	08.9	Cities	9	06.2	Town Planning Review	5	03.4

Tab.2 Characteristics of the reviewed studies

4.2 Mobility and Covid-19

The results of studies in this field can be divided into three categories including the relationship between Covid-19 and public transportation, walking during the pandemic, and the association between the spread of Covid-19 and cycling.

The Covid-19 pandemic has significantly impacted mobility patterns due to the virus's transmission and the implementation of social distancing protocols (Ravagnan et al., 2022). Unlike other modes of transportation, public transportation suffered the most damage during the pandemic (Tully et al., 2021). Using public transport declined in a large number of countries during the first wave of the pandemic, leading to a decrease in people's willingness to travel by public transport even after removing the restrictions (Babalık, 2021; Basu & Ferreira, 2021; Bohman et al., 2021; Campisi et al., 2020; Guzman et al., 2021; Liu et al., 2020; Q. Liu et al., 2021; Monahan & Lamb, 2022; Mouratidis & Papagiannakis, 2021; Munawar et al., 2021; Tully et al., 2021). In addition, people, especially those who live in developing countries have switched from public transportation to private cars (Babalık, 2021; Tully et al., 2021) (Habib & Anik, 2021; Jasiński, 2022). Poor transport systems, fear of contracting Covid-19, and remote work are among the reasons for the decrease in traveling by public transportation during the pandemic. Therefore, a significant part of mandatory and optional travel has been replaced by telecommuting and other remote online activities (Basbas et al., 2021). For example, 60% of people in Australia tend to work remotely with the highest online shopping record (Basbas et al., 2021; Munawar et al., 2021). In addition, the pandemic represents social injustice and led to an increase in the incidence rate among low-income people due to their high dependence on public transportation (Dueñas et al., 2021; Lak et al., 2021; Monahan & Lamb, 2022).

A significant relationship is observed between the spread of Covid-19 and the number and duration of travel by public transportation. For example, Lak et al. (2021) indicated that public transportation infrastructures such as bus stations in Tehran affect the spread of Covid-19 significantly and a moderate association is reported between metro stations and the incidence rate in neighborhoods. In addition, AbouKorin et al. (2021) argued that the suspension of public transportation services was among the factors to reduce the spread of Covid-19 in Chinese cities, especially during the first week of the pandemic. However, Zhang et al. (2021) claimed that restricting the use of public transportation is not regarded as the only method to reduce the spread of the disease since only 48% of the transfer restrictions have been effective.

Based on the results, the rate of people using bicycle has increased in countries such as China, Sweden, the USA, Australia, and Iran, during the first and second waves of the pandemic, indicating the resilience of cycling

during the crisis (Buehler & Pucher, 2021; Chai et al., 2021; Heydari et al., 2021; Nurse & Dunning, 2020; Paydar & Fard, 2021; Shaer et al., 2021). The study by Fenu (2021) examines the urban policies of five cities (Barcelona, Bogota, Brussels, Milan, and Paris) and evaluates the measures taken during the initial lockdown from February 2020 to May 2020. Across all cities, there was an increase in the use of bicycles and improvements in bicycle infrastructure. The Covid-19 pandemic demonstrated that the bicycle is the safest and most effective mode of urban transportation. Further, Wali and Frank (2021) investigated the business trips and asserted that an adverse relationship is observed between active commuting including cycling and walking with the rate of death and hospitalization during the Covid-19 pandemic. The results indicate that the number of cyclists, the number of male/female users, the time duration of cycling, the type of bicycle (shared and electric), and the travel destination differ depending on the time and place during the pandemic. For example, using bicycle declined significantly during the early months of the pandemic in some regions such as China. A significant decrease has been observed in bicycle trips to metro stations, commercial plazas and squares, and religious places, as well (Chai et al., 2021; Shaer et al., 2021). However, factors such as shared and electric bicycles, as well as the smart bike system and smart mobile phone applications have led to an increase in the use of bicycles during the pandemic (Heydari et al., 2021; Kazemzadeh & Koglin, 2021; Paydar & Fard, 2021). Regarding gender, although the duration of cycling for both men and women has risen compared to the pre-pandemic era, men have cycled more than women (Campisi et al., 2020; Paydar & Fard, 2021). A large number of countries have seen the pandemic as an opportunity to improve cycling infrastructure by designing bicycle paths (Vancouver, Budapest, Rome, and Brussels) and converting roadways and parking lots into pedestrian streets and bicycle lanes (Paris, Melbourne, and Amsterdam) (Nurse & Dunning, 2020).

The results indicated that walking, especially during the first and second wave of the pandemic has declined with the imposition of restrictions and does not exhibit a significant relationship with a definite reduction in the mortality rate (Campisi et al., 2020; Enoch et al., 2022; Hunter et al., 2021; Shaer et al., 2021; Tully et al., 2021; Wali & Frank, 2021). For instance, Tully et al. (2021) declared that only 10% of Covid-19 outbreaks have been reported in parks, meaning that going to parks and public spaces, as well as reducing walking and cycling activities cannot affect the spread of the disease significantly. The studies attribute the amount and pattern of walking to various factors such as age, gender, time of virus outbreak, trip destination, economic and social conditions and built environment conditions. For example, Q. Liu et al. (2021) studied the movement of the elderly in the city of Kunming, China, during the first two months of the pandemic and indicated that the rate of elderly people who go walking for religious activities, and daily shopping, has not decreased, and such age group has not decreased the movement in the whole city.

In addition, the method of transportation in developing countries and poorer regions has been less affected by the pandemic and people have to move by any type of transportation (Dueñas et al., 2021; Lak et al., 2021). Hunter et al. (2021) and Guzman et al. (2021) believed that the pandemic significantly reduced the amount of walking among underprivileged citizens, who are at risk of contracting Covid-19 with far fewer options for moving around the city, while residents in high-income areas go walking in their leisure time and walk more compared to the pre-pandemic era. In addition, leisure and shopping trips have seen a rise, especially among men, while business, educational, and religious trips have decreased (Bohman et al., 2021; Shaer et al., 2021). Moreover, the patterns of walking have changed in order to maintain social distancing (Li & Xu, 2021).

To promote sustainable and resilient cities, some recommendations were outlined. The most significant of these include:

1) planning and designing 15-minute cities, 10-minute neighborhoods, and developing mixed-use neighborhoods to tackle spatial and social injustices (Basbas et al., 2021; Guzman et al., 2021; Kang et al., 2020);

2) using modern technologies to control the transmission of the virus in public spaces;

3) applying policies such as introducing parking charge and fines to reduce the use of private cars in order to encourage people to walk and bike (Basbas et al., 2021; Bohman et al., 2021; Rakhmatulloh et al., 2020);

4) applying movement restrictions based on the point of interest (POI) index and newly formed movement patterns (Li & Xu, 2021);

5) increasing access to parks and outdoor spaces with a focus on promoting active transportation infrastructure (Bohman et al., 2021);

6) efforts to improve non-motorized transportation should prioritize the development and planning of new public spaces and infrastructures for pedestrian mobility within the urban layout (Cirianni et al., 2022);

7) Streets can be reshaped in resilient infrastructure capable of responding to new forms of mobility and ever-changing mobility (Deponte et al., 2020);

8) policy-making and planning for justice to develop more flexible and sustainable urban systems.

A certain number of limitations were identified in this field:

– lack of generalizability of results to other cities and countries since movement in any city is related to the spread of the disease, online activities, urban form, spatial planning, social awareness about the future of cities, decision-making and policy-making systems in the city (Mouratidis & Papagiannakis, 2021);

– limitation in the time of conducting studies to the first and second waves of Covid-19 and the need for more extensive studies during the next waves (Campisi et al., 2020; Kazemzadeh & Koglin, 2021; Munawar et al., 2021; Shaer et al., 2021; Zhang et al., 2021);

– restriction in the use of accurate transportation data including spatial and temporal and the need for more detailed studies utilizing data from automatic passenger counting systems or smart cards (Heydari et al., 2021; Hunter et al., 2021; Li & Xu, 2021; Liu et al., 2020; Munawar et al., 2021; Nian et al., 2020);

– and limitation in interviewee groups, methods of interviewing, and conducting questionnaires, as well as the need for more detailed studies through face-to-face interviews instead of online ones (Zhang et al., 2021).

4.3 Density and Covid-19

The results of studies that have measured the relationship between density and the spread of the pandemic are somehow contradictory. A group of studies reported a negative/no relationship between density and Covid-19. Hamidi et al. (2020a; 2020b) indicated a significant and negative relationship was observed between density (population and occupation densities) and mortality rate in the USA. They claimed that connectivity affects the spread and mortality of Covid-19 more than density and that the mortality rate has been lower in high-density areas due to better access to health services and easier management. In addition, Khavarian-Garmsir et al. (2021) argued that residents in densely populated areas with better access to urban infrastructure and services can enjoy a safe environment by changing their lifestyles. Based on the results, the overcrowding of places is regarded as the driving force in the transmission of Covid-19, which can occur in both densely and sparsely populated areas. Further, Jasiński (2022) claimed that Covid-19 spreads mostly based on people's behavior at the community level. In fact, the existing inequalities in society such as the level of access to amenities and public health infrastructure is among the main reasons for the spread of Covid-19, and density alone cannot exacerbate the pandemic. Furthermore, Carozzi (2020) asserted that density affects the time of disease outbreak, not the incidence and mortality rate.

Unlike the above-mentioned results, Lak et al. (2021) found that building density among the elements of urban form affects the spread of Covid-19 in Tehran. In fact, higher building density means smaller housing size, which increases the probability of disease outbreaks due to the lack of social distancing. According to Choerunnisa et al. (2020), both building and population density affect the spread of Covid-19 directly, and the

possibility of such spread is higher in slums. Jo et al. (2021) believed that although urban density plays a significant role in the spread of Covid-19 in Korea, connectivity affects more than density and more attention should be paid to movement restrictions between cities. The study by Z. Liu et al. (2021) shows that there is a relationship between walk score and density and mortality rate. It does not mean that walking increases the rate of contagion but indicated that places with greater availability of urban amenities are potentially more contagious. In addition, Mouratidis (2022) focused on urban density through the lens of mental health and the perception of citizens and analyzed the negative impact of high-density areas on the mental health and the perception and satisfaction of citizens during the pandemic. High-density areas during the pandemic have led to a decrease in life satisfaction, happiness, and leisure satisfaction, especially due to the smallness of houses and traveling by public transportation among residents of densely populated areas.

Based on the relationship between urban density and Covid-19, some studies have presented various contradictory recommendations in this area for post-pandemic cities. The most significant of these include 1) developing compact cities with regard to its advantages in environmental, transportation, health, and economic dimensions (Hamidi et al., 2020a; Lima et al., 2021); 2) designing smaller-scale residential areas instead of large-scale urban units because shortage and inequality in basic services will be ended with the distribution of vital, diverse services and facilities (Jabareen & Eizenberg, 2021). However, McFarlane (2021) argued that revaluing density is a multi-scale and multi-sector challenge. The realization of which requires a wide range of changes involving those in housing policies, as well as infrastructure and resources, regulatory changes in urban development, participatory budgeting, and the creation of alliances between residents, activists, and governance structures, and the formation of integrated urban management between cities, regions, and central states. Finally, the study by Boujari et al. (2023) showed that Supporting or opposing urban development initiatives such as compact cities may be premature given the conflicting findings of existing studies, and further research is needed to resolve these uncertainties.

The most significant recommendations for future studies in this field include dealing with a wider sample of predictive variables and urban characteristics (Hamidi, Sabouri, et al., 2020; Lima et al., 2021), considering social, economic, ethnic, and racial indices (Lima et al., 2021), including indices related to health (Lima et al., 2021), focusing on the local scale and analyzing variables at different scales in order to assess inequalities in a single city (Hamidi et al., 2020; Khavarian-Garmsir et al., 2021; Lima et al., 2021), comparing densely populated cities around the world and evaluating the components in different social, cultural, and spatial contexts (Khavarian-Garmsir et al., 2021; Mouratidis & Yiannakou, 2022), applying longitudinal data to find causal relationships between variables (Lima et al., 2021; Mouratidis & Yiannakou, 2022), and considering the impact of control policies during the pandemic in the analysis model (Jo et al., 2021).

4.4 Soundscape and Covid-19

The results of studies showed a change in the level of noise and in the perceptions of soundscapes during the pandemic. Some studies conducted on the soundscape in cities represent the change in the noise level during the quarantine period. Hornberg et al. (2021) indicated that the average overall noise reduction during the pandemic in Germany was about 5.1 dB, while noise levels in each area fluctuated based on various factors such as human behavior, animals, vegetation, and the like. The weakest noise reduction was observed in "Main Street" (3.9 dB), and the strongest in "Urban Forest", "Green Space", and "Residential Area" (5.9 dB each). According to Basu et al. (2021), a significant decrease in the hourly average equivalent sound level and the minimum hourly sound level was seen in 12 stations during the quarantine period in Dublin. However, Lenzi et al. (2021) claimed that eventfulness, as well as acoustic complexity and richness, have increased significantly during the period, while the amount of technological sounds has decreased. Changes in the activities and behavior of people in open spaces, the gradual return of street life, and the use of personal transportation vehicles can be among the reasons for the clear increase in eventfulness and loudness. In

addition, Sakagami (2020) reported that the change in noise level in a small residential area in Japan was considered as small. The difference between the results of this study and previous ones may stem from the smallness of the studied area.

A number of studies have analyzed the change in the perception of urban soundscapes. For instance, Mitchell et al. (2021) asserted that natural sounds predominated over human sounds in all of the studied areas during quarantine in London and Venice in 2020, making those places previously dominated by traffic sound more pleasant. In addition, Aletta and Van Renterghem (2021) found that the participants who were more inclined to avoid public transport due to Covid-19 rated the soundscape related to the studied public space in the city of Antwerp as less lively. Plus, from the perception of participants who were more concerned about Covid-19, the acoustic environment was filled more with natural sounds and traffic noise coming from local roads. They also declared that environmental issues such as air quality and environmental noise play a more significant role, meaning that people may care more about the environmental quality of public space since the start of the pandemic. Further, Lenzi et al. (2021) argued that human activities in the interior are shared through open windows during the pandemic, and birdsong has emerged as a new element of the local urban soundscape, as well.

The results indicated that improving active transportation infrastructure such as walking and cycling can help reduce urban noise and increase public health (Basu et al., 2021; Hornberg et al., 2021). Some key limitations of reviewed studies and recommendations for future studies include: 1) considering demographic characteristics, personal attitudes, and changing environmental and contextual conditions of places when it comes to assessing soundscapes by people (Aletta & Van Renterghem, 2021; Mitchell et al., 2021); 2) recording sound in different places with diverse land use to achieve a comprehensive understanding of the urban sound environment (Hornberg et al., 2021); 3) utilizing longitudinal data to find the casual relationships between different variables (e.g., personal attitude influencing the soundscape, or vice versa) (Aletta & Van Renterghem, 2021); 4) comparing the amount of noise in different seasons (Hornberg et al., 2021).

4.5 Urban public spaces and Covid-19

The reviewed studies investigated the effects of Covid-19 on urban spaces and their role in critical situations. The results indicated that Covid-19 has made some changes in the method of using urban public spaces, resulting in altering the lifestyle of people in the world into two categories before and after the pandemic. Yong et al. (2021) believed that public spaces have been affected during the pandemic since the built environment in the pre-pandemic era was used without borders and clear zoning, as well as any control and supervision, while real and symbolic boundaries were applied after Covid-19 quite clearly for further surveillance, along with signs such as maintaining social distance and wearing a mask. Quarantine has created an opportunity for the emergence of virtual open spaces. Training classes and ceremonies are held virtually due to facilities such as the Internet and various multimedia applications (Shawket, 2020).

In addition, Shawket (2020) measured the popularity of public spaces such as "mediated by space" and "constrained by space" after the pandemic and claimed that the character of the first category (urban public spaces demarcated and controlled by natural urban forms) leaves a positive meaning such as a sense of belonging, happiness, and security for users after the pandemic, while the second one (where the physical environment hinders human activities) is regarded as a space in which users exhibit the least positive feelings towards the environment. According to some studies, Covid-19 can affect the social needs of the people, reduce the desire of pedestrians to commercial spaces, and decrease noise and air pollution in addition to its direct impact on public health (Askarizad et al., 2021; Honey-Rosés et al., 2020). Further, Bonomi Bezzo et al. (2021) reported that Covid-19 can affect the level of intimacy and sense of attachment to public places among children and adolescents significantly because people in such spaces have romantic or cultural experiences which lead to more social isolation of young people and their absence in urban public spaces when the

pandemic continues and other infectious diseases in the future. However, public spaces are still considered as a place for social interactions during the pandemic. For example, large green spaces in London, Vancouver, and New York were converted into emergency and field hospitals, indicating the main role of public spaces in making cities resilient (Honey-Rosés et al., 2020).

Some recommendations outlined for public spaces to control Covid-19 better include creating one-way circulation in the space, allocating checkpoints to maintain security and creating limited access nodes for managing public places better, closing secondary public places, limiting certain activities in public places (Cheshmehzangi, 2020), and using smart technologies to improve the quality of urban public spaces (da Fonseca & Kistmann, 2021).

4.6 Green spaces and Covid-19

The results can be divided into two categories including the role of green spaces in the citizens' health during the pandemic and the change in the quality of people's presence in such spaces after the outbreak of Covid-19. Some studies have investigated the effect of green spaces on public health during the pandemic. Access to green space in urban areas improves physical activity, healthy habits and behaviors, as well as the well-being of residents (Ahmadpoor & Shahab, 2021). The results indicated that the communities with less access to green spaces exhibit a higher incidence rate. Generally, inequality in accessibility to nature affects the citizens' health and social interactions negatively (Majewska et al., 2022; Spotswood et al., 2021; Sridhar, 2021). In addition, access to private gardens, shared spaces, parks within a 10-minute walk, or green buffers within 250 meters reduce the possibility of disease transmission in addition to improving the citizens' mental health due to the lower density of the audience and lack of need to travel and interact with others (Heckert & Bristowe, 2021; Pan et al., 2021; Poortinga et al., 2021; Robinson et al., 2021). Cheng et al. (2021) also asserted that citizens with more access to urban and small-scale parks such as pocket parks are regarded as happier (Cheng et al., 2021). Forest recreational services affect physical and mental health in addition to urban green spaces since they can reduce psychological pressures and relieve stress (Bamwesigye et al., 2021).

Some other studies have focused on the change in the quality of people's presence in green spaces during the pandemic. The study conducted on the presence of American students in urban parks indicates that the activity in urban open spaces and parks has decreased during the early stages of the disease outbreak, especially among racial minorities (Larson et al., 2022). However, most Chinese students tend to return to green spaces for social interactions and psychological recovery (Liu et al., 2021). Based on the results, the significance of green spaces in people's opinions has changed positively. For instance, most Polish and Chinese citizens have become increasingly interested in urban green spaces and believe that visiting such spaces during the Covid-19 pandemic has reduced their fear and stress levels (Luo et al., 2021; Noszczyk et al., 2022) although some ordinary people avoid visiting urban green spaces due to the fear of their parents and children getting infected (Luo et al., 2021). In addition, participation in passive activities in urban parks and local areas in Palestine has either decreased significantly or does not show any change compared to home gardens. There are two possible factors in this regard. In fact, the number of people allowed to move into such areas decreased during the quarantine, and the shops and recreational activities in the city parks were closed, resulting in eliminating a major opportunity for people to visit and relax in such spaces. Such results are incongruent with those elsewhere, which increase the use of urban parks as long as they remain open (Dawwas & Dyson, 2021). In addition, Li et al. (2021) found that green space quantity alone does not suffice to benefit. Rather, factors such as education level, income, gender, and place attachment affect people's perception of the health benefits of urban green spaces during the Covid-19 pandemic, as well Zhang & Schwartz (2020).

In order to increase the accessibility of residents to green spaces, the reviewed studies have proposed some recommendations, the most significant of which include: 1) designing pocket parks to increase access to green spaces for all of the urban population, especially when large-scale parks are closed due to the pandemic (Liu

& Wang, 2021); 2) changing the attitude towards parks as an essential part of urban infrastructure and reviewing the method of funding, designing, and managing urban green spaces (Dempsey & Dobson, 2021); 3) reusing and retrofitting abandoned urban spaces to create small green ones (Luo et al., 2021); 4) diversifying urban green spaces in terms of activities that can be done by users (Dempsey & Dobson, 2021); 5) increasing the construction of different types (vertical gardens, green roofs, etc.) of public green spaces in high-density areas with an elderly population to reduce commuting time for the elderly (Ahmadpoor & Shahab, 2021; Luo et al., 2021); 6) making workplaces greener to decrease stress and fatigue in built environments (Xie et al., 2020).

The reviewed studies have faced various limitations. For example, the population mainly includes young people in the studies where the data are collected through social networks (Cheng et al., 2021). The data taken from the interviewees' postal codes do not necessarily specify the location of their access to green spaces (Larson et al., 2022). The distinction between utilizing green spaces by local and non-local residents cannot be identified in the reviewed studies (Liu et al., 2021). The citizens' presence in urban green spaces during different months of the year depends on the weather, which should be included in future studies (Robinson et al. 2021).

4.7 Housing and Covid-19

Some studies investigated the quality of living in different types of housing and residential areas during Covid-19. For example, the residents of informal settlements and communal houses, especially in densely populated areas, have suffered from the most damage compared to other types of housing due to the weakness in meeting their basic needs (Corburn et al., 2020) since employment, housekeeping, and social, physical and mental health of citizens became dependent on the quality of housing during the Covid-19 pandemic (Horne et al., 2021). Raynor & Panza (2021) declared that 47% of Australian residents have faced financial difficulties, changed their homes, returned to their parents' houses, or lived in crowded environments. In addition, the Covid-19 pandemic has increased the feeling of fear and insecurity in gated communities in China. On the contrary, other studies revealed that people living in high-rise condominiums located in high-density planned residential complexes (unlike low-rise ones in low-density, unplanned, and organic neighborhoods) did not have any distress due to the feeling of security and highly controlled private entrances (Kang et al., 2021; L. Li et al., 2021).

A number of studies have focused on the significance of interior space parameters and their prioritization. Factors such as thermal and acoustic comfort of interior spaces, adaptability and flexibility of spaces to do a certain number of activities during the Coronavirus disease (Hizra & Dewi, 2021; Tajani et al., 2021), natural light, view and scenery, and the presence of open and semi-open spaces can increase the tolerance of the residents to cope with Covid-19 (D'alessandro et al., 2020; Zarrabi et al., 2021). In fact, such factors can affect mental health. In addition, Amerio et al. (2020) indicated that a strong relationship is observed between the low quality of housing and the symptoms of moderately severe depression in Milan so apartments without the aforementioned parameters have affected the mental health of people with such depression more than other people. Further, social isolation, living in crowded places, and living 24 hours a day in small apartments without a clear boundary between workplace and leisure time may lead to a decrease in productivity and threaten their health conditions (Cheshmehzangi, 2021).

A number of studies have reflected the relationship between Covid-19 and the housing market. For instance, Bentley and Baker (2020) argued that the housing system is considered an effective factor in the incidence rate of Covid-19 and economic vulnerability, which affects the quality of people's living places. According to the results, an increase in the value of local housing raises the incidence rate. In addition, Kang et al. (2020) identified the instability of housing costs as a major threat to the low-income class during the pandemic and

proposed that in order to ensure housing stability and prevent market stagnation in the short term, providing discounts on costs or taxes can help reduce the burden of housing costs.

Housing, as Keenan (2020) believed, can be effective in improving the resilience of cities. Thus, some recommendations are outlined for the architectural design of a healthy and sustainable housing in the post-pandemic era include: 1) making interior spaces more flexible to new needs; 2) making residential areas greener; 3) using ancient principles to achieve thermal comfort and improve indoor air quality; 4) managing water and sewage consumption; 5) paying attention to materials used in the interior space from public health point of view; 6) designing large windows to let more natural light in (D'alessandro et al., 2020; Zarrabi et al., 2021); 7) redesigning private and common spaces such as gardens and apartment terraces as an appropriate solution for improving social interactions; 8) creating economic and social values (Quaglio et al., 2021); 9) creating more public spaces in residential areas (Stoiljković, 2022); 10) government and social support can reduce the cost of living and the possibility of experiencing income shocks (Raynor & Panza, 2021).

4.8 Land use, activity and Covid-19

The results of the studies which have dealt with the relationship between Covid-19 and land use and activity are divided into two categories including the relationship between land use types with the incidence rate and analyzing the impact of the pandemic on the citizens' activities. Lak et al. (2021) claimed that a significant relationship is observed between land use and the spread of the pandemic. Land uses located in the eastern and central areas of Tehran city exhibit the highest correlation with the number of corona patients at the neighborhood level compared to other environmental factors such as physical environment and transportation infrastructure. Pharmacies, shopping malls, retail stores, as well as cheap and crowded chain stores in low-income neighborhoods have played a critical role in the transmission of the disease. In addition, Williams (2021) and Lak et al. (2021) reported that most of the confirmed cases of Covid-19 are concentrated in the central area of the city, which is regarded as the main place of commercial activities and economic activities. The concentration of service uses in city centers has made neighborhoods face serious risks of the disease. In addition, the lack of urban and health services in other parts of the city, especially the marginal ones, has led to more vulnerability in such areas and the lack of resilience against Covid-19 (Akter et al., 2021; Majewska et al., 2022; Mouratidis, 2021; Yang et al., 2020). However, Deas et al. (2021) asserted that an increase in the use of clinics and pharmacies has increased the level of medical services, which can spread the pandemic. Some studies in this field referred to a fall in physical activity, especially among children and young people since the pandemic has closed schools, playgrounds, recreational facilities, and even large parks. The results indicate that the built environment has provided opportunities for outdoor physical activity during the pandemic (McCormack et al., 2022; Mitra et al., 2020). Further, Deas et al. (2021) and examined the spatial flexibility in urban environments and found that utilizing temporary urban uses and multi-purpose urban spaces in critical conditions has had positive social, environmental, and economic effects which promote the resilience and sustainability of cities. Hong & Choi (2021) stated that social mix and retail stores in residential areas have increased the resilience of cities against Covid-19. Similarly, Wali & Frank (2021) declared that areas with mix-used development and high street connectivity exhibit a lower mortality rate and spread of Covid-19.

4.9 Socio-economic qualities and Covid-19

The results of studies can be divided into three categories including the relationship between demographic factors and the incidence rate, the relationship between social interactions and the Covid-19 pandemic, and the association between the economic resilience of cities and Covid-19. Some studies indicated that demographic characteristics such as social status, level of education, income level, and age are among the most significant ones (Kashem et al., 2021; Liu et al., 2021). Not all settlement characteristics show consistent correlations with the spread of the infection. The transmission of the novel coronavirus is strongly associated

with specific demographic factors, such as individuals aged 65 and older, and socio-economic factors, such as GDP per capita, within urban communities (Gargiulo et al., 2020). A positive relationship is observed between race and ethnicity and the Covid-19 infection rate in the United States. Blacks, low-income workers, and people who live in shared workspaces and homeless shelters are more at risk than other citizens due to the impossibility of maintaining social distance (Kashem et al., 2021; Upshaw et al., 2021; Wali & Frank, 2021). Finucane et al. (2022) stated that the transmission of Covid-19 in black neighborhoods is more than in other areas and more importantly the behavioral reactions caused by the virus in such neighborhoods pose serious threats to public health. In addition, Kang et al. (2020) indicated that informal and temporary workers, women, youth, elderly people, refugees, and self-employed people experienced more financial pressure due to the transmission of Covid-19 than others ones.

Some other studies have focused on the relationship between social interactions and the outbreak of Covid-19. For example, Sridhar (2021) and Lak et al. (2021) argued that more social activities and interactions are reported in prosperous areas due to greater access to parks and public open spaces., These areas, like slums, exhibit a high rate during the outbreak of Covid-19 since restricting activities in wealthier areas costs extremely high. According to You et al. (2020), there is a positive relationship between social interactions and economic activities and the incidence rate. The results indicate that the spread of the virus can hardly be controlled due to socio-economic inequalities, resulting in putting the entire city at risk. Plus, the participation of citizens and the right to the city, which emphasizes the idea that urban spaces should be inclusive, democratic, and accessible to all residents has faded during the outbreak of Covid-19 (Lim et al., 2021).

Hou et al. (2021) investigated the economic resilience of cities during the pandemic and claimed that a significant association is observed between the annual growth rate of gross domestic product (GDP), the annual growth rate of total electricity consumption, and the rate of the Covid-19 pandemic. Cities with economic crises and lower GDP rates exhibit less resilience in the face of the pandemic. Moreover, Setiadi et al. (2021) reported that strategies that lead to community synergy and economic prosperity have played a critical role in the stability of *Buñol* city during the pandemic.

Based on the reviewed studies, policies such as supporting disadvantaged groups with quick and effective actions in the short term during pandemics (Kang et al., 2020), improving the socioeconomic conditions in slums and informal settlements (Sridhar, 2021), prioritizing measures to reduce social and economic inequalities in the post-pandemic era (Sen & Nagendra, 2021), increasing the density of social services such as hospitals in cities (You et al., 2020), and paying special attention to the concept of the right to the city and citizen's participation at the local scale (Lim et al., 2021) are considered as effective in this field.

4.10 Environmental qualities and Covid-19

Except for one study, investigating the impact of lockdowns on urban heat island (UHI) intensity, others have focused on the relationship between the air quality and the built environment during the pandemic since the lockdowns created a golden opportunity to investigate the hidden aspects of this relationship.

According to the reviewed literature, impacts of lockdown measures on various pollutants such as PM2.5, PM10, CO, NO_2, SO_2, and O3 have mainly been explored based on comparisons of concentration levels of air particles during the lockdown period with either pre-lockdown or post-lockdown (Cai et al., 2021; Fardani & Aji, 2021; Han et al., 2021; Nakada & Urban, 2020; Sannigrahi et al., 2021). As Addas and Maghrabi (2021) proclaimed significant improvements in air quality during lockdowns globally, more than 50% of reviewed studies in the present paper announced the same result on the city scale.

Over 60% of the studies focused on NO_2, followed by PM2.5 about 50%, and about a third of the works reported the O3 trends. By comparing the statistics, as opposed to the Ozone, which generally increased during the lockdown period, other pollutants reported a fall by different intensities after lockdown restrictions were introduced. For instance, in Xi'an, China, the concentration of O_3 rose by 100.61 %, and those of PM2.5

and PM10 dropped by 22.4 % and 20.7 %, respectively (Han et al., 2021). In a study by Nakada and Urban (2020) in Sao Paulo, a relatively same trend was observed in NO_2 and O_3. While NO, NO_2, and CO were reduced in urban areas, ozone concentrations saw an opposite trend. Results shed light on the impact of human activities in the form of vehicular movement on the urban air quality, as a consequence of the restrictions on vehicle traffic (Fardani & Aji, 2021).

A common area in about a third of studies was the existence of human activities as an effective principle for the environmental quality of cities during the pandemic. Wu et al. (2021) concluded that road traffic dominated the reduction in air pollutants in Wuhan, China. The NO_2 concentration was reduced by about 73.3 % caused by human mobility during the lockdown period, only 10.0% by meteorological conditions, and 16.7% by emissions from industry and households. Another study that reveals the impacts of human anthropogenic emissions in Jakarta, Indonesia, is done by Fardani & Aji (2021). The notable point of this research is not the reduction of NO_2 levels but the existence of different trends of decreasing inside and outside Jakarta. There has been a decrease in NO_2 in both regions, but the change that occurred in outer urban areas is not considerable. A such difference indicates that human transportation plays an obvious role in the environmental quality of the inside cities. Sannigrahi et al. (2021) investigated economically the impact of reduced anthropogenic activities on a resident lifetime by assuming that premature deaths (caused by air pollution) can be avoided with the reduction of NO_2, PM2.5, and PM10. This study put to light the relationship between urban air quality and public health during lockdown restrictions.

Wai et al. (2021) worked on a study focusing on understanding the relationship between human activity and the urban heat island (UHI) intensity. A direct correlation between Covid-19 lockdown timelines and the UHI intensity was reported, which means that a reduction in human activity can decline the UHI intensity; however, other factors such as global climate and geographic features can dominate the overall temperature of the built environment. Although this research could not identify which human activities influenced the UHI most, the link is clear. Besides, the UHI intensity figure in cities with higher population density and urban built-up areas was more affected by the pandemic events. High-density cities such as New York City, Tokyo, and Melbourne experienced higher UHI intensity patterns. When compared to Dublin and Oslo after lockdown restrictions were introduced (Wai et al., 2021). It could be concluded that these results not only challenge experts' hypotheses about the way of connection between density, built environment and its environmental quality but also reveal some hidden aspects of this relationship.

Finally introducing new public policies for promoting adaptive socio-ecological models is recommended in studies to understand the relationship between the reduced human interventions and the environmental health of cities systematically (Sannigrahi et al., 2021), Immediate controls of decreasing emission sources, like limiting vehicles, prohibiting raising dust, and reforming production equipment is recommended to achieve the urban environment's sustainability (Han et al., 2021). Also, Wai et al. (2021) believe that there are new opportunities in the areas of energy consumption, transportation, and building materials to mitigate the UHI (Urban Heat Island) effect. They recommend: 1) installing solar panel systems in houses to provide cheaper and cleaner off-grid electricity; 2) developing renewable energy projects to replace fossil fuel power plants to reduce GHG emissions in the future and, ultimately, the UHI effect; 3) limiting car parking space for non-essential vehicles in the inner city to reduce traffic volume into the city and the risks of community spread of the virus in the future; 4) Encouraging people to use digital tools or apps to monitor and analyze their modes of transportation; 5) improving bike lanes and road infrastructures to provide safer and user-friendly road conditions for people to commute by bike; 6) reducing building materials with good solar heat absorption, such as concrete, glass, stainless steel, and ceramic gravel; 7) avoid using dark colors on buildings and road surfaces to reduce radiation absorption; 8) increase the green areas and green infrastructures in the urban area to improve the cooling effect.

In these studies, a few limitations are identified which include: 1) studies have been conducted only from 2020 to April 2021. Thus, further research should be performed on the literature published after April 2021 to have a better understanding of the impact of lockdown on air quality; 2) focusing on only some specific countries or cities, thus future studies could consider other cities or regions worldwide, to further explore the interruption-recovery patterns of urban air pollution and elucidate inherent mechanisms of the variation in urban air quality during the Covid-19 pandemic (Cai et al., 2021).

4.11 Tourism and Covid-19

The studies conducted in this field have discussed the impact of the Covid-19 outbreak on the tourism industry and provided some recommendations. The peak time of disease outbreaks, quarantine policies, and reduced movement of people were among the factors affecting the tourism industry (Bugalski, 2020; Liang et al., 2021). Liang et al. (2021) assessed 12 international cities during the mandatory quarantine and asserted that the pandemic has led to a decrease in the demand for accommodation in the city center, a sharp decrease in foreign tourists, and a decline in people's tourism activities. In addition, Cai et al. (2020) found that Covid-19 negatively affected foreign travelers in Japan more than domestic ones during the early months. Further, Bugalski (2020) indicated a fall in the reservation rate in countries (such as Japan with a 96% decrease in Beijing and European countries with a 41% decrease) and a short-term rental market's stagnation. Moreover, Goh (2021) argued that the tourism crisis created by the Covid-19 pandemic proved the over-dependence of the Malaysian economy on the tourism industry, which creates an opportunity to reflect on cultural and environmental policies supporting tourism. Gao et al. (2021) also reported some changes in the tourism industry of Nanjing, China during the pandemic, including changing the attention of tourists from urban architectural attractions to urban natural ones, increasing the number of tourists visiting the city center (Nanjing Old Town), attracting to large-scale natural landscapes and green open spaces in the post-pandemic era.

A number of studies in this field have examined the method of adapting tourism to the pandemic and consider the current crisis as a golden opportunity to reflect and redefine tourism development strategies. Kowalczyk-Anioł et al. (2021) categorized the measures taken in the city of Krakow, Poland, into three levels national, regional, and city. National measures to financially support the tourism economy in Krakow were taken to stop the loss of businesses that could not operate due to pandemic restrictions. Regional measures in Krakow focused on financial support for promotional activities and urban measures were taken to create a new image of the city during and after the Covid-19 pandemic. Campaigns such as being an internal tourist and providing free tours to sightseeing places, museums, and the like were implemented to help the tourism industry in the city. The policies adopted in Krakow include supporting the development of tailor-made products; dealing with the effects of tourism hypertrophy; controlling the sharing economy; supporting the development of the MICE industry (meetings, incentives, conferences, and exhibitions); integrating cultural and creative industries with tourism; promoting nightlife; and utilizing new technologies to improve the tourism industry. In addition, Andrade et al. (2021) recommended five strategies for tourism development during the pandemic, which are locally adapted to the specific characteristics of each port city. Such strategies include understanding the behavior and movement of cruise passengers, strengthening the local identity, regionalizing the cruise business, dispersing visitors in different areas of the city, and increasing the value of the industrial heritage of the port. Additionally, Urban areas should designate certain sensitive zones as "protected areas" where restrictions can be implemented to minimize the impact of tourism. These measures should focus on reducing the overall use of these sensitive areas, adjusting the timing and distribution of visitors, and implementing strategies to encourage more responsible behavior among tourists (Corbisiero & La Rocca, 2020).

The most significant limitations and recommendations of studies in this field include reviewing the main reasons for the difference in tourism demand in coastal cities (S. Li et al., 2021), spatial limitations (Cai et al.,

2020; S. Li et al., 2021; Liang et al., 2021), discussing the concept of poverty-tourism-environment for sustainable development (Goh, 2021), drafting proposals to reduce greenhouse gas emissions created by mass tourism movements (Andrade et al., 2021), and assessing the traditional hotel industry (Liang et al., 2021).

4.12 Smartness and Covid-19

The crisis of Covid-19 had important consequences on the development of smart technology concepts. As opposed to the pace of globalization, the pandemic will speed up the digitalization of life and work (Mohamed et al., 2021). Smart city technologies previously have improved city efficacy like managing traffic congestion, assuring electricity supply, and sanitation, including solid waste management; However, neither of these had been an issue during the pandemic since cities were concentrating on enforcing lockdowns, social distancing, and ensuring basic supplies of food and medicines (Webb & Toh, 2020). Generally, smart infrastructure has been discussed in studies in the fields of smart logistics, surveillance, healthcare, and the newfound technologies and the strategy of implementation. They have shown that the smartness of cities could not only mitigate urban dysfunctionalities but also it can enhance the well-being of communities and public health in crisis.

By summarizing the smart logistic practices implemented in the six Chinese cities against Covid-19, Zhang et al. (2020) reviewed smart cities' functional efficiency and potential in distributing supplies, managing personnel running public transport and services, and delivering medical and education services. Regarding the difficulty of maintaining the supply of vital food and medicine in the face of unusual behaviors such as panic buying, it is argued that smart city technologies could be used to monitor buying behavior and limit it in case of abnormal patterns. Furthermore, the capability to optimize supply chains accompanied with surveillance, name-and-shame, or otherwise prosecute individuals engaged in anti-social activities such as hoarding is another mentioned advantage of smart cities during the pandemic (Webb & Toh, 2020). Increasing the participation of residents, urban functionality in education and employment systems, the transparency of governmental processes, and social connectedness are other cited advantages of smart logistics in a city health crisis (Hassankhani et al., 2021).

Coronavirus has impacted trends concerning urban mobility (Kunzmann, 2020). Wang (2020) claim that the spatial layout and transportation system of a city require better intelligent approaches, especially after the impact of the epidemic. Detailed information on individual locations, personal health records, and abnormal changes in mobility and activity patterns does provide possibilities for data-driven decisions in a city during the pandemic (Webb & Toh, 2020). Taking the Urban Observatory program in Newcastle, UK as an example, a real-time data capture infrastructure monitoring program has been used for several years to store data on various metrics, including vehicular traffic, pedestrian movement, and air quality. In response to the Covid-19 crisis, the live data feeds of the platform were re-purposed to develop a data dashboard that allowed local authorities to make evidence-based adaptive decisions. (James et al., 2020).

The implications of the Covid-19 pandemic have raised many questions about how the pandemic will cause cities to continue densification strategies, or make cities more compact. In the belief of authors, the answer lies in the hands of the smartness and digital development of cities. The more the smart city infrastructure is developed, the more the city will expand to the suburb instead of becoming more compact. Based on the impacts of Covid-19, a new suburbanization strategy may be the case when access to 5G digital infrastructures in the wider city region is made available. Urban densification very much depends on smart technologies that require smart management of urban complexity (Kunzmann, 2020).

In terms of smart healthcare, it is mentioned that tracking patient numbers, hospital capacity, and balancing loads across hospitals in the city are the possible capabilities of the smart city approach in the Covid-19 crisis. Furthermore, tracking key logistical items such as protective clothing, masks, gloves, medicines, and intensive care equipment is achievable if the infrastructures of the smart city become deployed. Prioritizing medical

personnel across the city to ensure that they have access to food, transportation, etc., and better screening techniques to prioritize the severity of patients during admissions are other advantages of smart healthcare (Webb & Toh, 2020). In another study, telemedicine has been mentioned as a sustainable approach for urban planning to facilitate the continuity of everyday situations (Hassankhani et al., 2021).

Reviewing the theoretical and practical aspects of technology in smart cities, provides a scoping critique of the prospects, issues, and discussions related to the implementation of technology. Theoretically, applying 6G technology, IoT devices, Digital twins, Big Data, AI-enabled development, robots, and the like in public spaces can improve public health and well-being at the urban level (Allam & Jones, 2021; Chen & Narasimhan, 2021; Dignan, 2020). However, investigating obstacles in technical, socioeconomic, and environmental categories is essential before the technology is introduced, like the case study of the 10th of Ramadan in Egypt (Mohamed et al., 2021). Further, Cavada (2022) demonstrated that implementing truly smart gamification strategies can promote recovery for the urban setting during the pandemic. In fact, gamification technologies can provide location data, ensure open sharing of these datasets, provide educational instruments, improve social interactions which were severely damaged during the pandemic, and provide support while living and working during lockdowns.

However, technology deployment in crisis management is not without obstacles. The most cited challenges which could be mentioned are privacy, confidentiality and trust issues, social inclusiveness, political bias and misinformation dissemination, technical issues, and urban functions in education and employment. These all could be considered limitations of the development of smart city policies. It is suggested that to mitigate these side effects, policymakers should liberate the process of digitalization, increase the accessibility to digital services, and enhance digital literacy (Hassankhani et al., 2021).

5. Summery and conclusions

With the outbreak of Covid-19 around the globe, our cities faced severe changes in a wide range of issues. The pandemic once again reminds us of analyzing cities through the lens of public health as it was one of the main concerns of urban planners over the last centuries when people were struggling with some health issues and poor hygiene conditions. Coronavirus now is the reason for rethinking and revaluing the policies, values, and theories of urban design and planning to make post-pandemic cities healthier. The present study examined the effects of each element of the built environment including mobility, density, soundscape, public spaces, urban green spaces, housing, land use, socioeconomic qualities, environmental qualities, smartness as well as tourism on the spread of Covid-19. Needless to say, the following results and recommendations are not the final words as the topics are context-based and the findings may vary from one context to another. So, it should bear in mind that this study aimed to give just an overview of how cities have changed during the pandemic, and more rigorous studies are required to find solid results (see Tab.3).

With regard to mobility, the results indicated that the demand for public transportation saw a significant decline while traveling by private cars increased. This is mostly because of the possibility of increased Covid-19 confirmed cases for those who choose this mode of transport, poor transportation systems, online shopping, online learning, and remote working. The pandemic also revealed that socioeconomic inequality is one of the reasons for the virus transmission as low-income people had to use public transport to get to their work. Unlike public transportation, the number of cyclists has risen in a large number of countries as the most resilient mode of transportation in the face of any disruptive events. Plus, some papers confirmed that there is no significant relationship between walking and the Covid-19 infection rate as long as people maintain social distancing and behave responsibly. According to the impacts, some recommendations are outlined to make cities resilient in the face of unexpected pandemics: designing 15-min cities, developing mixed-use neighborhoods, using IT for the better management of transport systems, and developing active transportation infrastructures.

The studies conducted on the relationship between urban density and Covid-19 exhibit conflicting results. In some studies, urban density does not play a critical role in the spread of disease, and the overcrowding of urban environments (be it high-density areas or low-density ones), network connectivity, and socioeconomic factors are considered the driving factors for the virus spread. On the contrary, some other studies regard population density to be one of the main factors in the transmission of the pandemic due to the impossibility of maintaining social distancing and report a negative impact on residents' mental health and happiness in densely populated areas. However, it is noteworthy that we should distinguish between crowdedness and density.

Regarding soundscape, the results show that the amount of noise in urban spaces has declined during the pandemic, while indices such as eventfulness, as well as acoustic complexity and richness have risen. The main reason for such trends is because of reduced human activities in urban environments. In addition, a number of studies realized the change in the perception of soundscapes during the pandemic and indicated that natural sounds to what extent became predominant in the environment.

With respect to urban public spaces, the activity in virtual spaces has increased dramatically due to the restrictions and demarcations applied in urban spaces to control Covid-19 transmission. During the pandemic, citizens exhibit less desire to spend time in public spaces and socialize with each other. Studies indicated that the continuation of the current trend may lead to the isolation of the young population and a decrease in their sense of belonging to the place. Plus, it seems that public spaces shaped by natural forms have positive impacts on citizens' happiness and their sense of belonging, and during pandemics and similar situations urban spaces can be transformed into temporary hospitals and other needed uses due to their multi-functionality of such places.

Some studies have assessed the role of green spaces on the citizens' health, the results of which emphasized that more and better access to nature reduces the incidence and mortality rate, stress and anxiety of people during the pandemic, as well as increases physical activities and happiness. These results provide a wake-up call for policymakers to make green spaces accessible for everyone and develop such spaces everywhere, especially in neighborhoods with more disadvantaged people. Some other studies have evaluated the change in the quality of citizens' presence in natural spaces and highlighted that although there is a decline in the presence of minority groups, more people welcome green spaces on different scales and perform various activities. According to these impacts, some identical recommendations are provided, including designing pocket parks, diversifying green spaces, making workplaces and housing buildings greener, and transforming abandoned urban spaces into green spaces, among many others.

Relating to housing, the results indicated that those who are living in informal settlements, shared houses, crowded places, and even small apartments are more likely to be at higher risk of catching Covid-19. Further, the parameters related to the interior design of housing help the mental and physical health of the residents during the pandemic, while their absence can lead to depression. Plus, it seems that the instability in housing prices is among the factors which threaten the citizens' health against the pandemic, especially low-income people. Covid-19 shows how much the flexibility of housing buildings, the materials used for interior design, thermal comforts, greenery, and natural light matter.

A significant relationship was observed between the type of land use and the incidence rate, and a higher concentration of commercial activities in a specific area, like city centers, can aggravate the Covid-19 pandemic. It also seems that the lack of infrastructure and facilities in marginal areas makes people more vulnerable to the virus. Moreover, human activities have reduced due to the quarantine and closure of some uses. According to suggestions, making urban environments multi-functional and flexible to do a wide range of activities and developing mixed-use neighborhoods can result in resilient cities.

The transmission of Covid-19 also depends on various demographic factors such as social status, level of education, income level, and age of people. In addition, disadvantaged groups, minorities, and low-income

people are at higher risk of infection than other people as there is a significant relationship between socioeconomic inequalities and disease outbreaks. Cities with low economic resistance, and lower GDP growth rates exhibited less resilience. The findings also show a downward trend in the participation of citizens and social interactions. There are some recommendations in this field, including supporting deprived people and prioritizing them in the face of disruptive disease events, improving the quality of slums and similar places, and bridging the widening gap between people in terms of accessibility to healthcare and other social services. With regard to environmental qualities, the results are mainly based on the relationship between air quality and the built environment during the pandemic, indicating that pollutants such as NO, NO2, PM2.5, and PM10 decreased with variable amounts in different cities after the imposition of quarantine restrictions due to the decrease of human activities and unprecedented reduction of road traffic. The pandemic reveals that while transportation is the main culprit behind the reduction of NO2, air pollution, and the death rate caused by it, industries and metrological conditions have a small share compared to human mobility. Furthermore, the reduction of human activities has helped reduce heat islands during the Covid-19 pandemic, as well. In fact, thermal islands in densely populated cities were more affected by the pandemic.

Themes	Effects	Implications
Mobility	- The use of public transportation decreased significantly - There has been a notable increase in private car travel - The number of cyclists in many nations increased	- Designing 15-min cities - Developing mixed-use neighborhoods - Using IT for the better management of transport systems - Developing active transportation infrastructures
Density	- The level of population density in urban areas is not a significant factor in the transmission of diseases - Population density is considered a key factor in the spread of the pandemic because it makes it difficult to practice social distancing	- Supporting or opposing urban development initiatives such as compact cities can be seen as premature given the conflicting data and results available
Soundscape	- The noise levels in urban areas have decreased - Measures such as eventfulness, acoustic complexity and richness, have increased - Natural sounds become more dominant in the environment	- Enhancing the infrastructure for walking and cycling in cities can contribute to lowering urban noise levels.
Public Spaces	- People are showing less interest in public areas, potentially isolating the younger generation - The use of virtual platforms has significantly surged - Public spaces designed with natural elements can boost the happiness of citizens	- Implementing a unidirectional flow within the area during pandemics - Establishing restricted entry points to enhance the management of public spaces - Restricting specific activities in public areas during health crises - Utilizing advanced technologies to enhance the overall quality of urban public spaces - Urban spaces can be transformed into temporary hospitals and other needed uses
Green Spaces	- Having access to nature lowers the occurrence and death rate, as well as reduces stress and anxiety - It also boosts physical activity levels and overall happiness	- Ensure that green areas are easily accessible to all, particularly in neighborhoods with higher levels of disadvantage - Create pocket parks within communities - Introduce a variety of green spaces - Incorporate green features into workplaces and residential buildings - Convert unused urban areas into green spaces
Housing	- People in informal settlements, shared houses, crowded places, and even small apartments face a greater risk of Covid-19	- Adapting interior spaces to new needs - Increasing green spaces in residential areas

Themes	Effects	Implications
	- Home design can impact residents' mental and physical health during the pandemic - Fluctuating housing costs can jeopardize public health during the pandemic	- Applying traditional methods for thermal comfort and air quality - Efficient water and sewage management - Considering health-friendly materials in interiors - Incorporating large windows for natural light - Enhancing public spaces in neighborhoods - Government and social aid can lower living costs and income instability
Land Use	- Mix-used development show a lower mortality rate and spread of Covid-19 - A higher concentration of commercial activities in certain regions, such as city centers, can exacerbate the spread of Covid-19 - Insufficient infrastructure and amenities in marginalized areas increase the susceptibility of residents to the virus	- Creating urban environments that are versatile and adaptable for a variety of activities - Building diverse communities with a mix of residential and commercial spaces can lead to resilient cities
Socio-Economic Qualities	- Disadvantaged groups, minorities, and low-income people incomes are at a higher risk of being impacted by the pandemic - Cities with weak economic stability and slower GDP growth rates showed lower resilience - a decline in citizen engagement and social interactions	- Assisting marginalized individuals and giving them priority during times of disease outbreaks - Enhancing the living conditions in informal settlements and comparable areas - Addressing the increasing disparity in access to healthcare and other social services among the population
Environmental Qualities	- Levels of pollutants like NO, NO_2, PM2.5, and PM10 saw a decline due to reduced traffic - A reduction in heat islands amid the Covid-19 pandemic	- Human transportation plays an obvious role in the environmental quality of the inside cities
Tourism	- Tourism activities reduced - Tourists' focus shifted towards urban and larger natural attractions - The need for lodging in city centers declined	- Distributing visitors throughout the entire city through the development of diverse attractions in various locations - Supporting tailor-made products, - Linking the tourism sector with the creative industry - Celebrating indigenous culture and heritage
Smartness	- Emphasize the pivotal role of smartness in monitoring citizens' behavior	- Smartness should be considered in controlling disease, educating citizens, increasing public participation, providing healthcare services, managing public transport, facilitating social interactions, ensuring transparent governance, and making data-driven decisions

Tab.3 Major effects of urban design and planning on the pandemic and implications for future post-pandemic cities

The findings of studies in the field of tourism represent the effects of the pandemic on both foreign and domestic tourists, indicating that the mandatory quarantine in a larger number of countries results in decreasing tourism activities, changing the attention of tourists to urban and large-scale natural attractions, increasing the significance of open spaces during the pandemic, decreasing the demand for accommodation in city centers, and the stagnation in the short-term rental market. In addition, the findings consider the pandemic as an opportunity to review tourism development plans and introduce policies in sync with the development of the economy and the resilience of the tourism industry during the pandemic and post-pandemic era. Supporting tailor-made products, integrating the tourism industry with the creative industry, promoting local culture and identity, and dispersing tourists across the whole city by creating various attractions in different areas are among such policies.

As for smartness, the findings emphasize the pivotal role of smartness in monitoring citizens' behavior, controlling disease and tracking patients, educating citizens, increasing the participation of the public,

providing medical services and healthcare, managing public transport systems, facilitating social interactions, making governance procedures transparent, gaining real-time data and big data, making evidence-based decisions, among many others. However, there are still some concerns about technology and digitalization such as privacy, trust issues, social inclusiveness, political bias, and misinformation dissemination.

References

AbouKorin, S. A. A., Han, H. & Mahran, M. G. N. (2021). Role of urban planning characteristics in forming pandemic resilient cities–Case study of Covid-19 impacts on European cities within England, Germany and Italy. *Cities, 118*, https://doi.org/10.1016/j.cities.2021.103324

Addas, A. & Maghrabi, A. (2021). The Impact of COVID-19 Lockdowns on Air Quality—A Global Review. Sustainability, 13 (18)., https://doi.org/10.3390/su131810212

Ahmadpoor, N. & Shahab, S. (2021). Urban form: Realising the value of green space: A planners' perspective on the COVID-19 pandemic. *Town Planning Review, 92* (1), 49-55.Ahmadpoor, N. & Shahab, S. (2021). Realising the value of greenspace: A planners' perspective on the COVID-19 pandemic. *Town Plan. Rev, 92*, 49-56. https://doi.org/ 10.3828/tpr.2020.37

Akter, S., Hakim, S. S. & Rahman, M. S. (2021). Planning for pandemic resilience: COVID-19 experience from urban slums in Khulna, Bangladesh. J*ournal of Urban Management, 10* (4), 325-34., https://doi.org/10.1016/j.jum.2021.08.003

Aletta, F. & Van Renterghem, T. (2021). Associations between Personal Attitudes towards COVID-19 and Public Space Soundscape Assessment: An Example from Antwerp, Belgium. International journal of environmental research and public health, 18 (22)., https://doi.org/10.3390/ijerph182211774

Alidadi, M. & Sharifi, A. (2022). Effects of the built environment and human factors on the spread of COVID-19: A systematic literature review. Science of the total environment, 850., https://doi.org/10.1016/j.scitotenv.2022.158056

Alizadeh, H., Sharifi, A., Damanbagh, S., Nazarnia, H. & Nazarnia, M. (2023). Impacts of the COVID-19 pandemic on the social sphere and lessons for crisis management: a literature review. Natural Hazards, 117 (3), 2139-2164. . https://doi.org/ 10.1007/s11069-023-05959-2

Allam, Z. & Jones, D. S. (2021). Future (post-COVID) digital, smart and sustainable cities in the wake of 6G: Digital twins, immersive realities and new urban economies. *Land use policy, 101*, 105201., http://.doi.org/10.1016/j.land usepol.2020.105201

Amerio, A., Brambilla, A., Morganti, A., Aguglia, A., Bianchi, D., Santi, F., Costantini, L., Odone, A., Costanza, A., Signorelli, C., Serafini, G., Amore, M. & Capolongo, S. (2020). Covid-19 lockdown: Housing built environment's effects on mental health. *International Journal of Environmental Research and Public Health, 17* (16), 1-10, Article 5973., https://doi.org/ 10.3390/ijerph17165973

Andrade-Marqués, M. J., Costa, J. P. & Jiménez-Morales, E. (2021). Challenges for European Tourist-City-Ports: Strategies for a Sustainable Coexistence in the Cruise Post-COVID Context.Andrade, M. J., Costa, J. P. & Jiménez-Morales, E. J. L. (2021). *Challenges for European Tourist-City-Ports: Strategies for a Sustainable Coexistence in the Cruise Post-COVID Context. 10* (11), 1269. http://.doi.org/10.3390/land10111269

Askarizad, R., Jinliao, H. & Jafari, S. (2021). The influence of COVID-19 on the societal mobility of urban spaces. *Cities, 119*, 103388., http://doi.org/10.1016/j.cities.2021.103388

Babalık, E. (2021). Urban mobility after COVID-19: a developing-country perspective. *Town Planning Review, 92* (2), 165-170., http://doi.org/10.3828/tpr.2020.33

Bamwesigye, D., Fialová, J., Kupec, P., Łukaszkiewicz, J. & Fortuna-Antoszkiewicz, B. (2021). Forest Recreational Services in the Face of COVID-19 Pandemic Stress. *Land, 10* (12), 1347., https://doi.org/10.3390/land10121347

Basbas, S., Campisi, T., Georgiadis, G., Al-Rashid, M. A. & Tesoriere, G. (2021). COVID-19 and public transport demand trends in Sicily: Analyzing external factors and governmental recommendations. *European Transport - Trasporti Europei* (83). https://doi.org/10.48295/ET.2021.83.9

Basu, B., Murphy, E., Molter, A., Basu, A. S., Sannigrahi, S., Belmonte, M. & Pilla, F. (2021). Investigating changes in noise pollution due to the COVID-19 lockdown: The case of Dublin, Ireland. *Sustainable Cities and Society, 65*, 102597., http://dx.doi.org/10.1016/j.scs.2020.102597

Basu, R. & Ferreira, J. (2021). Sustainable mobility in auto-dominated Metro Boston: Challenges and opportunities post-COVID-19. *Transport Policy, 103*, 197-210 . https://doi.org/10.1016/j.tranpol.2021.01.006

Bentley, R. & Baker, E. (2020). Housing at the frontline of the COVID-19 challenge: A commentary on "Rising home values and Covid-19 case rates in Massachusetts". *Social Science and Medicine, 265*, Article 113534. https://doi.org/10.1016 /j.socscimed.2020.113534

Bohman, H., Ryan, J., Stjernborg, V. & Nilsson, D. (2021). A study of changes in everyday mobility during the Covid-19 pandemic: As perceived by people living in Malmö, *Sweden. Transport Policy, 106*, 109-119. https://doi.org/10.1016 /j.tranpol.2021.03.013

Bonomi Bezzo, F., Silva, L. & Van Ham, M. (2021). The combined effect of Covid-19 and neighbourhood deprivation on two dimensions of subjective well-being: Empirical evidence from England. *PLoS ONE, 16* (7), e02551566. . https://doi.org/10.1371/journal.pone.0255156

Boujari, P., Vahabi, S., Mahdi, F., Rezaeisalim, M. & Shahmiri, M. S. (2023). The COVID-19 pandemic and urban density: a systematic literature review. *Proceedings of the Institution of Civil Engineers-Urban Design and Planning, 176* (2), 77-91. 1. http://dx.doi.org/10.1680/jurdp.22.00059

Buehler, R. & Pucher, J. (2021). COVID-19 impacts on cycling, 2019–2020. *Transport Reviews, 41* (4), 393-400. https://doi.org/10.1080/01441647.2021.1914900

Bugalski, Ł. (2020). The undisrupted growth of the Airbnb phenomenon between 2014–2020. The touristification of European cities before the COVID-19 outbreak. *Sustainability, 12* (23), 984141. https://doi.org/10.3390/su12239841

Cai, G., Hong, Y., Xu, L., Gao, W., Wang, K. & Chi, X. J. S. (2020). An evaluation of green ryokans through a tourism accommodation survey and customer-satisfaction-related CASBEE–IPA after COVID-19 pandemic. *13* (1), 145.5. https://doi.org/10.3390/su13010145

Cai, W.-J., Wang, H.-W., Wu, C.-L., Lu, K.-F., Peng, Z.-R. & He, H.-D. (2021). Characterizing the interruption-recovery patterns of urban air pollution under the COVID-19 lockdown in China. *Building and Environment, 205*, 108231. https://doi.org/10.1016/j.buildenv.2021.108231

Campisi, T., Basbas, S., Skoufas, A., Akgün, N., Ticali, D. & Tesoriere, G. (2020). The impact of COVID-19 pandemic on the resilience of sustainable mobility in Sicily. *Sustainability, 12* (21), 8829. 9. https://doi.org/10.3390/su12218829

Carozzi, F. (2020). *Urban density and COVID-19*. https://doi.org/10.1007/s00168-022-01193-z

Cavada, M. (2022). Evaluate Space after Covid-19: Smart City Strategies for Gamification. *International Journal of Human–Computer Interaction*, 1-12. https://doi.org/10.1080/10447318.2021.2012383

Chai, X., Guo, X., Xiao, J. & Jiang, J. (2021). Analysis of spatiotemporal mobility of shared-bike usage during COVID-19 pandemic in Beijing. *Transactions in GIS, 25* (6), 2866-2887. https://doi.org/10.1111/tgis.12784

Chen, Q. C. & Narasimhan, L. (2021). The potential of IoT-based smart environment in reaction to COVID-19 pandemic. http://doi.org/10.52842/conf.caadria.2021.2.709

Cheng, Y., Zhang, J., Wei, W. & Zhao, B. (2021). Effects of urban parks on residents' expressed happiness before and during the COVID-19 pandemic. *Landscape and Urban Planning, 212*, 104118. https://doi.org/10.1016/j.landurbplan .2021.104118

Cheshmehzangi, A. (2020). 10 adaptive measures for public places to face the COVID 19 pandemic outbreak. *City & Society, 32* (2). https://doi.org/10.1111%2Fciso.12282

Cheshmehzangi, A. (2021). Housing and health evaluation related to general comfort and indoor thermal comfort satisfaction during the COVID-19 lockdown. *Journal of Human Behavior in the Social Environment, 31* (1-4), 184-209. https://doi.org/10.1080/10911359.2020.1817225

Choerunnisa, D. N., Maula, F. K. & Iman, H. K. (2020). *The vulnerability of COVID-19 pandemic based on urban density (a case study of the core urban area in Cirebon City, West Java)*. https://doi.org/10.1088/1755-1315/592/1/012036

Cirianni, F.M.M., Comi, A. & Luongo, A.S. (2022). A sustainable approach for planning of urban pedestrian routes and footpaths in a pandemic scenario. Evidence from Italian cities. *TeMA - Journal of Land Use, Mobility and Environment, 15* (1), 125-140. http://dx.doi.org/10.6092/1970-9870/8629

Corbisiero, F. & La Rocca, R. A. (2020). Tourism on demand. New form of urban and social demand of use after the pandemic event. *TeMA - Journal of Land Use, Mobility and Environment*, 91-104. https://doi.org/10.6092/1970-9870/6916

Corburn, J., Vlahov, D., Mberu, B., Riley, L., Caiaffa, W. T., Rashid, S. F., Ko, A., Patel, S., Jukur, S., Martínez-Herrera, E., Jayasinghe, S., Agarwal, S., Nguendo-Yongsi, B., Weru, J., Ouma, S., Edmundo, K., Oni, T. & Ayad, H. (2020). Slum Health: Arresting COVID-19 and Improving Well-Being in Urban Informal Settlements. *Journal of Urban Health, 97* (3), 348-357. https://doi.org/10.1007/s11524-020-00438-6

D'alessandro, D., Gola, M., Appolloni, L., Dettori, M., Fara, G. M., Rebecchi, A., Settimo, G. & Capolongo, S. (2020). COVID-19 and living space challenge. Well-being and public health recommendations for a healthy, safe, and sustainable housing. *Acta Biomedica, 91*, 61-75. https://doi.org/10.23750/abm.v91i9-S.10115

do Val da Fonseca, M. & de Carvalho Borges Kistmann, V. S. (2021). Design and Covid-19: Monitoring Urban Data. *Strategic Design Research Journal, 14* (1), 289-298. http://dx.doi.org/10.4013/sdrj.2021.141.24

Dawwas, E. B. & Dyson, K. (2021). COVID-19 Changed Human-Nature Interactions across Green Space Types: Evidence of Change in Multiple Types of Activities from the West Bank, Palestine. *Sustainability, 13* (24), 13831. https://doi.org/ 10.3390/su132413831

Deas, I., Martin, M. & Hincks, S. (2021). Temporary urban uses in response to COVID-19: bolstering resilience via short-term experimental solutions. *Town Planning Review, 92* (1), 81-88. http://dx.doi.org/10.3828/tpr.2020.45

Dempsey, N., Brown, C., Raman, S., Porta, S., Jenks, M., Jones, C. & Bramley, G. (2010). *Elements of urban form. Dimensions of the sustainable city,* 21-51. http://dx.doi.org/10.1007/978-1-4020-8647-2_2

Dempsey, N. & Dobson, J. (2021). Planning for sociable green spaces after COVID-19. *Town Planning Review*, 1-9. https://doi.org/10.3828/tpr.2020.84

Deponte, D., Fossa, G. & Gorrini, A. (2020). Shaping space for ever-changing mobility. Covid-19 lesson learned from Milan and its region. *TeMA - Journal of Land Use, Mobility and Environment*, 133-149. https://doi.org/10.6092/1970-9870/6857

Dignan, J. (2020). Smart cities in the time of climate change and Covid-19 need digital twins. *Wiley Online Library, 2*, 109-110): http://dx.doi.org/10.1049/iet-smc.2020.0071

Dueñas, M., Campi, M. & Olmos, L. E. (2021). Changes in mobility and socioeconomic conditions during the COVID-19 outbreak. *Humanities and Social Sciences Communications, 8* (1), 1-10.0. https://ui.adsabs.harvard.edu/link_gateway/ 2020arXiv200811850D

Eltarabily, S. & Elghezanwy, D. (2020). Post-pandemic cities-the impact of COVID-19 on cities and urban design. *Architecture research, 10* (3), 75-84.4. https://doi.org/ 10.5923/j.arch.20201003.02

Enoch, M., Monsuur, F., Palaiologou, G., Quddus, M. A., Ellis-Chadwick, F., Morton, C. & Rayner, R. (2022). When COVID-19 came to town: Measuring the impact of the coronavirus pandemic on footfall on six high streets in England. *Environment and Planning B: Urban Analytics and City Science, 49* (3), 1091-1111. https://doi.org/10.1177/23998083211048497

Fardani, I. & Aji, R. R. (2021). Analysis of Changes in Air Quality in Major Cities Indonesia During COVID 19 Using Remote Sensing Data. IOP Conference Series: Earth and Environmental Science.,

Fenu, N. (2021). Bicycle and urban design. A lesson from Covid-19. *TeMA - Journal of Land Use, Mobility and Environment, 14* (1), 69-92. http://dx.doi.org/10.6092/1970-9870/7716

Finucane, M. L., Beckman, R., Ghosh-Dastidar, M., Dubowitz, T., Collins, R. L. & Troxel, W. (2022). Do social isolation and neighborhood walkability influence relationships between COVID-19 experiences and wellbeing in predominantly Black urban areas? *Landscape and Urban Planning*, 217, 104264. 4. https://doi.org/ 10.1088/1755-1315/830/1/012085.

Gao, Y., Sun, D. & Zhang, J. J. I. I. J. o. G.-I. (2021). Study on the Impact of the COVID-19 Pandemic on the Spatial Behavior of Urban Tourists Based on Commentary Big Data: A Case Study of Nanjing, *China. 10* (10), 678.8. https://doi.org/10.3390/ijgi10100678.

GargiuloC., GaglioneF., GuidaC., PapaR., ZucaroF. & CarpentieriG. (2020). The role of the urban settlement system in the spread of Covid-19 pandemic. The Italian case. *TeMA - Journal of Land Use, Mobility and Environment*, 189-212. https://doi.org/10.6092/1970-9870/6864

Goh, H. C. (2021). Strategies for post-Covid-19 prospects of Sabah's tourist market–Reactions to shocks caused by pandemic or reflection for sustainable tourism?. *Research in Globalization, 3*, 100056. https://doi.org/10.1016/j.resglo.2021.100056.

Guzman, L. A., Arellana, J., Oviedo, D. & Moncada Aristizábal, C. A. (2021). COVID-19, activity and mobility patterns in Bogotá. Are we ready for a '15-minute city'? *Travel Behaviour and Society, 24*, 245-256. https://doi.org/10.1016/ j.tbs.2021.04.008

Habib, M. A. & Anik, M. A. H. (2021). Examining the long term impacts of COVID-19 using an integrated transport and land-use modelling system. *International Journal of Urban Sciences, 25* (3), 323-3466. https://doi.org/10.1080/ 12265934.2021.1951821.

Hamidi, S., Ewing, R. & Sabouri, S. (2020a). Longitudinal analyses of the relationship between development density and the COVID-19 morbidity and mortality rates: Early evidence from 1,165 metropolitan counties in the United States. *Health Place, 64*. https://doi.org/10.1016/j.healthplace.2020.102378

Hamidi, S., Sabouri, S. & Ewing, R. (2020b). Does Density Aggravate the COVID-19 Pandemic?: Early Findings and Lessons for Planners. *J. Am. Plann. Assoc., 86* (4), 495-509. https://doi.org/10.1080/01944363.2020.1777891

Han, L., Zhao, J. & Gu, Z. (2021). Assessing air quality changes in heavily polluted cities during the COVID-19 pandemic: A case study in Xi'an, China. *Sustainable Cities and Society, 70*, 102934. https://doi.org/10.1016/j.scs.2021.102934

Hassankhani, M., Alidadi, M., Sharifi, A. & Azhdari, A. (2021). Smart city and crisis management: Lessons for the COVID-19 pandemic. *International Journal of Environmental Research and Public Health, 18* (15), 7736. https://doi.org/10.3390/ ijerph18157736

Heckert, M. & Bristowe, A. (2021). Parks and the Pandemic: A Scoping Review of Research on Green Infrastructure Use and Health Outcomes during COVID-19. *International Journal of Environmental Research and Public Health, 18* (24), 13096. 6. https://doi.org/10.3390%2Fijerph182413096

Hernández, J. R. E., Moghadam, S. T., Sharifi, A. & Lombardi, P. (2023). Cities in the times of COVID-19: Trends, impacts, and challenges for urban sustainability and resilience. *Journal of Cleaner Production*, 139735. https://doi.org/10.1016/ j.jclepro.2023.139735

Heydari, S., Konstantinoudis, G. & Behsoodi, A. W. (2021). Effect of the COVID-19 pandemic on bikesharing demand and hire time: Evidence from Santander Cycles in London. *PLoS ONE, 16* (12), Article e0260969. https://doi.org/10.1371/ journal.pone.0260969

Hizra, F. & Dewi, C. (2021). Houses amid COVID-19: Environmental challenges and design adaptation. *IOP Conference Series: Earth and Environmental Science*. https://doi.org/10.1088/1755-1315/881/1/012033

Honey-Rosés, J., Anguelovski, I., Chireh, V. K., Daher, C., Konijnendijk van den Bosch, C., Litt, J. S., Mawani, V., McCall, M. K., Orellana, AA.. & Oscilowicz, E. (2020). The impact of COVID-19 on public space: an early review of the emerging questions–design, perceptions and inequities. *Cities & health*, 1-17. https://doi.org/10.1080/23748834.2020.1780074

Hong, S. & Choi, S.-H. (2021). The urban characteristics of high economic resilient neighborhoods during the COVID-19 pandemic: A case of Suwon, South Korea. *Sustainability, 13* (9), 4679. https://doi.org/10.3390/su13094679

Hornberg, J., Haselhoff, T., Lawrence, B. T., Fischer, J. L., Ahmed, S., Gruehn, D. & Moebus, S. (2021). Impact of the COVID-19 lockdown measures on noise levels in urban areas—A pre/during comparison of long-term sound pressure measurements in the Ruhr Area, Germany. *International journal of environmental research and public health, 18* (9), 4653. https://doi.org/10.3390/ijerph18094653.

Horne, R., Willand, N., Dorignon, L. & Middha, B. (2021).). Housing inequalities and resilience: the lived experience of COVID-19. *International Journal of Housing Policy*, 1-25. https://doi.org/10.1080/19491247.2021.2002659

Hou, X., Ma, Q. & Wang, X. (2021). Spatial differentiation and elements influencing urban resilience in the middle reaches of the Yangtze River under the COVID-19 pandemic. *Discrete Dynamics in Nature and Society,* 2021. https://doi.org/10.1155/2021/6687869

Hunter, R. F., Garcia, L., de Sa, T. H., Zapata-Diomedi, B., Millett, C., Woodcock, J., Pentland, A. S. & Moro, E. (2021). Effect of COVID-19 response policies on walking behavior in US cities. *Nature Communications, 12* (1), Article 3652. https://doi.org/10.1038/s41467-021-23937-9

Jabareen, Y. & Eizenberg, E. (2021). The failure of urban forms under the COVID-19 epidemic: towards a more just urbanism. *The Town Planning Review, 92* (1), 57-63. http://doi.org/10.3828/tpr.2020.42

James, P., Das, R., Jalosinska, A. & Smith, L. (2020). Smart cities and a data-driven response to COVID-19. *Dialogues in Human Geography, 10* (2), 255-259. https://doi.org/10.1177/2043820620934211

Jasiński, A. (2022). COVID-19 pandemic is challenging some dogmas of modern urbanism. *Cities, 121,* 103498. https://doi.org/10.1016/j.cities.2021.103498

Jo, Y., Hong, A. & Sung, H. (2021). Density or connectivity: What are the main causes of the spatial proliferation of covid-19 in Korea? *Int. J. Environ. Res. Public Health, 18* (10). https://doi.org/10.3390/ijerph18105084

Kang, B., Won, J. & Kim, E. J. (2021). COVID-19 impact on residential preferences in the early-stage outbreak in South Korea. *International Journal of Environmental Research and Public Health, 18* (21), Article 11207. https://doi.org/10.3390/ijerph182111207

Kang, M., Choi, Y., Kim, J., Lee, K. O., Lee, S., Park, I. K., Park, J. & Seo, I. (2020). COVID-19 impact on city and region: what's next after lockdown? *International Journal of Urban Sciences, 24* (3), 297-315. https://doi.org/10.1080/12265934.2020.1803107

Kashem, S. B., Baker, D. M., González, S. R. & Lee, C. A. (2021). Exploring the nexus between social vulnerability, built environment, and the prevalence of COVID-19: A case study of Chicago. *Sustainable cities and society, 75*, 103261. https://doi.org/10.1016/j.scs.2021.103261

Kazemzadeh, K. & Koglin, T. (2021). Electric bike ((non) users' health and comfort concerns pre and peri a world pandemic (COVID-19): A qualitative study. *Journal of Transport & Health, 20*, 101014. https://doi.org/10.1016/j.jth.2021.101014

Keenan, J. M. (2020). COVID, resilience, and the built environment. *Environment Systems and Decisions, 40* (2), 216-221. , 216221. https://doi.org/10.1007%2Fs10669-020-09773-0

Khavarian-Garmsir, A. R., Sharifi, A. & Moradpour, N. (2021). Are high-density districts more vulnerable to the COVID-19 pandemic? S*ustainable Cities and Society, 70*, 102911. https://doi.org/https://doi.org/10.1016/j.scs.2021.102911

Kowalczyk-Anioł, J., Grochowicz, M. & Pawlusiński, R. J. S. (2021). How a Tourism City Responds to COVID-19: A CEE perspective (Kraków case study). *Sustainability, 13* (14), 7914. A CEE Perspective (Kraków Case Study). https://doi.org/10.3390/su13147914

Kunzmann, K. R. (2020). Smart cities after COVID-19: Ten narratives. *disP-The Planning Review, 56* (2), 20–31. https://doi.org/10.1080/02513625.2020.1794120

Lak, A., Sharifi, A., Badr, S., Zali, A., Maher, A., Mostafavi, E. & Khalili, D. (2021). Spatio-temporal patterns of the COVID-19 pandemic, and place-based influential factors at the neighborhood scale in Tehran. *Sustainable cities and society, 72*, 103034. https://doi.org/10.1016/j.scs.2021.103034

Larson, L. R., Mullenbach, L. E., Browning, M. H., Rigolon, A., Thomsen, J., Metcalf, E. C., Reigner, N. P., Sharaievska, I., McAnirlin, O. & D'Antonio, A. (2022). Greenspace and park use associated with less emotional distress among college students in the United States during the COVID-19 pandemic. *Environmental Research, 204*, 112367. https://doi.org/10.1016/j.envres.2021.112367

Lenzi, S., Sádaba, J. & Lindborg, P. (2021). Soundscape in Times of Change: case Study of a City Neighbourhood during the COVID-19 Lockdown. *Frontiers in Psychology, 12*, 412. https://doi.org/10.3389%2Ffpsyg.2021.570741

Li, H., Luo, W., Hou, Y., Xia, Y., Yao, J., Kang, N., Deng, C., Sun, H. & Chen, C. (2021). Factors Affecting Perceived Health Benefits and Use Behaviors in Urban Green Spaces During the COVID-19 Pandemic in Southern China Megacities. *Frontiers in Public Health, 9*. https://doi.org/10.3389/fpubh.2021.759444

Li, L., Wan, W. X. & He, S. (2021). The heightened 'security zone' function of gated communities during the covid-19 pandemic and the changing housing market dynamic: Evidence from beijing, china. *Land, 10* (9), Article 983. https://doi.org/10.3390/land10090983

Li, S., Ding, J., Zheng, X., Sui, Y. J. O. & Management, C. (2021). Beach tourists behavior and beach management strategy under the ongoing prevention and control of the COVID-19 pandemic: A case study of Qingdao, *China. Ocean & Coastal Management, 215*. https://doi.org/10.1016/j.ocecoaman.2021.105974

Li, Y. & Xu, L. (2021). The impact of covid-19 on pedestrian flow patterns in urban pois—an example from Beijing. ISPRS *International Journal of Geo-Information, 10* (7), Article 479. https://doi.org/10.3390/ijgi10070479

Liang, S., Leng, H., Yuan, Q. & Yuan, C. (2021). Impact of the COVID-19 pandemic: Insights from vacation rentals in twelve mega cities. *Sustainable cities and society, 74*, 103121. https://doi.org/10.1016/j.scs.2021.103121

Lim, S. B., Mazhar, M. U., Malek, J. A. & Yigitcanlar, T. (2021). The Right or Wrong to the City? Understanding Citizen Participation in the Pre-and Post-COVID-19 Eras in Malaysia. *Journal of Open Innovation: Technology, Market, and Complexity, 7* (4), 238. . https://doi.org/10.3390/joitmc7040238

Lima, F. T., Brown, N. C. & Duarte, J. P. (2021). Understanding the impact of walkability, population density, and population size on covid-19 spread: A pilot study of the early contagion in the united states. *Entropy, 23* (11). https://doi.org/10.3390/e23111512

Liu, C., Liu, Z. & Guan, C. (2021). The impacts of the built environment on the incidence rate of COVID-19: A case study of King County, Washington. *Sustainable Cities and Society, 74*, 103144. https://doi.org/10.1016%2Fj.scs.2021.103144

Liu, J., Peng, Z., Cai, X., Peng, Y., Li, J. & Feng, T. (2021). Students' Intention of Visiting Urban Green Spaces after the COVID-19 Lockdown in China. *International Journal of Environmental Research and Public Health, 18* (16), 8601. https://doi.org/10.3390/ijerph18168601

Liu, L., Miller, H. J. & Scheff, J. (2020). The impacts of COVID-19 pandemic on public transit demand in the United States. *PLoS ONE, 15* (11), e0242476. https://doi.org/10.1371%2Fjournal.pone.0242476

Liu, Q., Liu, Y., Zhang, C., An, Z. & Zhao, P. (2021). Elderly mobility during the COVID-19 pandemic: A qualitative exploration in Kunming, China. *Journal of Transport Geography, 96*, Article 103176. https://doi.org/10.1016/j.jtrangeo.2021.103176

Liu, S. & Wang, X. (2021). Reexamine the value of urban pocket parks under the impact of the COVID-19. *Urban Forestry & Urban Greening, 64*, 127294. https://doi.org/10.1016/j.ufug.2021.127294

Liu, Z., Lin, S., Shen, Y. & Lu, T. (2021). Collaborative neighborhood governance and its effectiveness in community mitigation to COVID-19 pandemic: From the perspective of community workers in six Chinese cities. *Cities, 116,* Article 103274. https://doi.org/10.1016/j.cities.2021.103274

Luo, S., Xie, J. & Furuya, K. (2021). "We Need such a Space": Residents' Motives for Visiting Urban Green Spaces during the COVID-19 Pandemic. *Sustainability, 13* (12), 6806. https://doi.org/10.3390/su13126806

Majewska, A., Denis, M., Jarecka-Bidzińska, E., Jaroszewicz, J. & Krupowicz, W. (2022). Pandemic resilient cities: Possibilities of repairing Polish towns and cities during COVID-19 pandemic. Land Use Policy, 113, 105904. . https://doi.org/10.1016/j.landusepol.2021.105904

McCormack, G. R., Petersen, J., Naish, C., Ghoneim, D., Doyle-Baker, P. K. J. C. & Health. (2022). Neighbourhood environment facilitators and barriers to outdoor activity during the first wave of the COVID-19 pandemic in Canada: a qualitative study. *Cities & health, 7* (4), 643-655.1-13. https://doi.org/10.1080/23748834.2021.2016218

McFarlane, C. (2021). Repopulating density: COVID-19 and the politics of urban value. Urban Stud. https://doi.org/10.1177/00420980211014810

Mitchell, A., Oberman, T., Aletta, F., Kachlicka, M., Lionello, M., Erfanian, M. & Kang, J. (2021). Investigating urban soundscapes of the COVID-19 lockdown: A predictive soundscape modeling approach. *The Journal of the Acoustical Society of America, 150* (6), 4474-4488. https://doi.org/10.1121/10.0008928

Mitra, R., Moore, S. A., Gillespie, M., Faulkner, G., Vanderloo, L. M., Chulak-Bozzer, T., Rhodes, R. E., Brussoni, M. & Tremblay, M. S. J. H. & place. (2020). Healthy movement behaviours in children and youth during the COVID-19 pandemic: Exploring the role of the neighbourhood environment. *Health & Place, 65*, 102418. https://doi.org/10.1016/j.healthplace.2020.102418

Mohamed, S. M., Moati, D. & Elsayed, M. (2021). Implementing Smart City Strategies as AN Innovative Practice for COVID-19 Pandemic in Egyptian Context. *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences, 46*, 361-368. https://ui.adsabs.harvard.edu/link_gateway/2021ISPAr46W5..361M

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G. & The, P. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLOS Medicine, 6* (7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Monahan, T. & Lamb, C. G. (2022). Transit's downward spiral: Assessing the social-justice implications of ride-hailing platforms and COVID-19 for public transportation in the US. *Cities, 120*, Article 103438. https://doi.org/10.1016/j.cities.2021.103438

Mouratidis, K. (2021). How COVID-19 reshaped quality of life in cities: A synthesis and implications for urban planning. *Land Use Policy, 111*, 105772. https://doi.org/10.1016/j.landusepol.2021.105772

Mouratidis, K. (2022). COVID-19 and the compact city: Implications for well-being and sustainable urban planning. *Science of the Total Environment, 811*, 152332. https://doi.org/10.1016/j.scitotenv.2021.152332

Mouratidis, K. & Papagiannakis, A. (2021). COVID-19, internet, and mobility: The rise of telework, telehealth, e-learning, and e-shopping. S*ustainable Cities and Society, 74*, Article 103182. https://doi.org/10.1016/j.scs.2021.103182

Mouratidis, K. & Yiannakou, A. (2022). COVID-19 and urban planning: Built environment, health, and well-being in Greek cities before and during the pandemic. *Cities, 121*. https://doi.org/10.1016/j.cities.2021.103491

Munawar, H. S., Khan, S. I., Qadir, Z., Kiani, Y. S., Kouzani, A. Z. & Parvez Mahmud, M. A. (2021). Insights into the mobility pattern of australians during covid-19. *Sustainability, 13* (17), Article 9611. https://doi.org/10.3390/su13179611

Nakada, L. Y. K. & Urban, R. C. (2020). COVID-19 pandemic: Impacts on the air quality during the partial lockdown in São Paulo state, Brazil. *Science of the Total Environment, 730*, 139087. https://doi.org/10.1016%2Fj.scitotenv.2020.139087

Nian, G., Peng, B., Sun, D. J., Ma, W., Peng, B. & Huang, T. (2020). Impact of COVID-19 on urban mobility during post-epidemic period in megacities: from the perspectives of taxi travel and social vitality. *Sustainability, 12* (19), 7954. . https://doi.org/10.3390/su12197954

Noszczyk, T., Gorzelany, J., Kukulska-Kozieł, A. & Hernik, J. (2022). The impact of the COVID-19 pandemic on the importance of urban green spaces to the public. *Land Use Policy, 113*, 105925. https://doi.org/10.1016/j.landusepol.2021.105925

Nurse, A. & Dunning, R. (2020). Is COVID-19 a turning point for active travel in cities? *Cities & Health,* 1-3. https://doi.org/10.1080/23748834.2020.1788769

Pan, J., Bardhan, R. & Jin, Y. (2021). Spatial distributive effects of public green space and COVID-19 infection in London. *Urban Forestry & Urban Greening, 62*, 127182. https://doi.org/10.1016%2Fj.ufug.2021.127182

Paydar, M. & Fard, A. K. (2021). The contribution of mobile apps to the improvement of walking/cycling behavior considering the impacts of COVID-19 pandemic. *Sustainability, 13* (19), Article 580. https://doi.org/10.3390/su131910580

Pinheiro, M. D. & Luís, N. C. (2020). COVID-19 Could Leverage a Sustainable Built Environment. *Sustainability, 12* (14). https://doi.org/10.3390/su12145863

Poortinga, W., Bird, N., Hallingberg, B., Phillips, R. & Williams, D. (2021). The role of perceived public and private green space in subjective health and wellbeing during and after the first peak of the COVID-19 outbreak. *Landscape and Urban Planning, 211*, 104092. https://doi.org/10.1016/j.landurbplan.2021.104092

Quaglio, C., Todella, E. & Lami, I. M. (2021). Adequate housing and covid-19: Assessing the potential for value creation through the project. *Sustainability, 13* (19), Article 10563. https://doi.org/10.3390/su131910563

Rakhmatulloh, A. R., Kusumodewi, D. I. & Suwandono, D. (2020). COVID-19: The Questions Ahead for Future Pedestrian Ways in Transit Area. E3S Web of Conferences. https://doi.org/10.1051/e3sconf/202020203021

Ravagnan, C., Cerasoli, M. & Amato, C. (2022). Post-Covid cities and mobility. *TeMA - Journal of Land Use, Mobility and Environment*, 87-100. http://dx.doi.org/10.6092/1970-9870/8652

Raynor, K. & Panza, L. (2021). Tracking the impact of COVID-19 in Victoria, Australia: Shocks, vulnerability and insurances among residents of share houses. *Cities, 117*, Article 103332. https://doi.org/10.1016/j.cities.2021.103332

Robinson, J. M., Brindley, P., Cameron, R., MacCarthy, D. & Jorgensen, A. (2021). Nature's role in supporting health during the COVID-19 pandemic: A geospatial and socioecological study. *International Journal of Environmental Research and Public Health, 18* (5), 2227. https://doi.org/10.3390/ijerph18052227

Roosta, M., Gholami, A. & Shahvaran, F. (2023). COVID-19 and cities: A systematic review of early urban studies. *Cities & Health*, 1-16. https://doi.org/10.1080/23748834.2023.2215413

Sakagami, K. (2020). A note on the acoustic environment in a usually quiet residential area after the 'state of emergency'declaration due to COVID-19 pandemic in Japan was lifted: supplementary survey results in post-emergency situations. *Noise Mapping, 7* (1), 192-198. https://doi.org/10.1515/noise-2020-0016

Sannigrahi, S., Kumar, P., Molter, A., Zhang, Q., Basu, B., Basu, A. S. & Pilla, F. (2021). Examining the status of improved air quality in world cities due to COVID-19 led temporary reduction in anthropogenic emissions. *Environmental Research, 196*, 110927. https://doi.org/10.1016/j.envres.2021.110927

Sen, A. & Nagendra, H. (2021). The differentiated impacts of urbanisation on lake communities in Bengaluru, India [Article]. *International Journal of Urban Sustainable Development, 13* (1), 17-31. https://doi.org/10.1080/19463138.2020.1770260

Setiadi, A., Rudwiarti, L. A., Priscilia, F. & Wardhani, M. K. (2021). City tourism branding resilience during the Covid-19 pandemic in Yogyakarta, Indonesia. Spatium, 1-8. https://doi.org/10.2298/SPAT2145001S

Shaer, A., Rezaei, M., Rahimi, B. M. & Shaer, F. (2021). Examining the associations between perceived built environment and active travel, before and after the COVID-19 outbreak in Shiraz city, Iran. *Cities, 115*, 103255. https://doi.org/10.1016/j.cities.2021.103255

Sharifi, A. (2022). An overview and thematic analysis of research on cities and the COVID-19 pandemic: Toward just, resilient, and sustainable urban planning and design. *Iscience, 25* (11). https://doi.org/10.1016/j.isci.2022.105297

Sharifi, A. & Khavarian-Garmsir, A. R. (2020). The COVID-19 pandemic: Impacts on cities and major lessons for urban planning, design, and management. *Science of the Total Environment, 749,* 142391. https://doi.org/10.1016%2Fj.scitotenv.2020.142391

Shawket, I. M. (2020). Redefining urban public space's characters after COVID-19;: empirical study on Egyptian residential spaces. 2020 24th International Conference Information Visualisation (IV), https://doi.org/10.1109/IV51561.2020.00107

Spotswood, E. N., Benjamin, M., Stoneburner, L., Wheeler, M. M., Beller, E. E., Balk, D., McPhearson, T., Kuo, M. & McDonald, R. I. (2021). Nature inequity and higher COVID-19 case rates in less-green neighbourhoods in the United States. *Nature Sustainability, 4* (12), 1092-1098. https://doi.org/ 10.1038/s41893-021-00781-9

Sridhar, K. S. (2021). Urbanization and COVID-19 Prevalence in India. *Regional Science Policy & Practice.* https://doi.org/10.1111/rsp3.12503

Stoiljković, B. (2022). Social Cohesion and Neighbor Interactions within Multifamily Apartment Buildings: Challenges of COVID-19 and Directions of Action. *Sustainability, 14* (2), Article 738. https://doi.org/10.3390/su14020738

Tajani, F., Di Liddo, F., Guarini, M. R., Ranieri, R. & Anelli, D. (2021). . (2021). An assessment methodology for the evaluation of the impacts of the covid-19 pandemic on the italian housing market demand. *Buildings, 11* (12), Article 592. https://doi.org/10.3390/buildings11120592

Tully, M. A., McMaw, L., Adlakha, D., Blair, N., McAneney, J., McAneney, H., Carmichael, C., Cunningham, C., Armstrong, N. C. & Smith, L. (2021). The effect of different COVID-19 public health restrictions on mobility: A systematic review. *PLoS ONE, 16*, Article e0260919. https://doi.org/10.1371/journal.pone.0260919

Upshaw, T. L., Brown, C., Smith, R., Perri, M., Ziegler, C. & Pinto, A. D. (2021). Social determinants of COVID-19 incidence and outcomes: a rapid review. *PloS one, 16* (3), e0248336. https://doi.org/10.1371/journal.pone.0248336

Wai, C. Y., Muttil, N., Tariq, M. A. U. R., Paresi, P., Nnachi, R. C. & Ng, A. W. (2021). Investigating the Relationship between Human Activity and the Urban Heat Island Effect in Melbourne and Four Other International Cities Impacted by COVID-19. *Sustainability, 14* (1), 378. https://doi.org/10.3390/su14010378

Wali, B. & Frank, L. D. (2021). Neighborhood-level COVID-19 hospitalizations and mortality relationships with built environment, active and sedentary travel. *Health & Place, 71*, 102659. https://doi.org/10.1016/j.healthplace.2021.102659

Webb, W. & Toh, C. K. (2020). The smart city and COVID-19. *The Institution of Engineering and Technology, 2*, 6-57. https://doi.org/10.1108/978-1-80262-049-820231005

Williams, J. (2021). Circular cities: A revolution in Urban sustainability. https://doi.org/10.4324/9780429490613

Wu, J., Qian, Y., Wang, Y. & Wang, N. (2021). Analyzing the Contribution of Human Mobility to Changes in Air Pollutants: Insights from the COVID-19 Lockdown in Wuhan. *ISPRS International Journal of Geo-Information, 10* (12), 836. https://doi.org/10.3390/ijgi10120836

Xie, J., Luo, S., Furuya, K. & Sun, D. (2020). Urban parks as green buffers during the COVID-19 pandemic. *Sustainability, 12* (17), 6751. https://doi.org/10.3390/su12176751

Yang, W., Wang, X., Zhang, K. & Ke, Z. (2020). COVID-19, urbanization pattern and economic recovery: An analysis of Hubei, China. *International Journal of Environmental Research and Public Health, 17* (24), 9577. https://doi.org/10.3390%2Fijerph17249577

Yong, S. D., Rachmawati, M. & Defiana, I. (2021). Rethinking territoriality concept on public space after pandemic COVID-19. *International Journal of Public Health Science (IJPHS), 10* (4), 856-864. http://doi.org/10.11591/ijphs.v10i4.20825

You, H., Wu, X. & Guo, X. (2020). Distribution of COVID-19 morbidity rate in association with social and economic factors in Wuhan, China: implications for urban development. *International Journal of Environmental Research and Public Health, 17* (10), 3417. https://doi.org/10.3390%2Fijerph17103417

Zarrabi, M., Yazdanfar, S. A. & Hosseini, S. B. (2021). COVID-19 and healthy home preferences: The case of apartment residents in Tehran. *Journal of Building Engineering, 35*, Article 102021. https://doi.org/10.1016/j.jobe.2020.102021

Zhang, C. H. & Schwartz, G. G. (2020). Spatial Disparities in Coronavirus Incidence and Mortality in the United States: An Ecological Analysis as of May 2020. *Journal of Rural Health, 36* (3), 433-445. https://doi.org/10.1111/jrh.12476

Zhang, J., Zhang, R., Ding, H., Li, S., Liu, R., Ma, S., Zhai, B., Kashima, S. & Hayashi, Y. (2021). Effects of transport-related COVID-19 policy measures: A case study of six developed countries. *Transport Policy, 110*, 37-57. https://doi.org/10.1016/j.tranpol.2021.05.013

Zhang, X., Hou, H., Fu, Q. & Zhang, Y. (2020). Current Problems and Restructuring Suggestions for Smart City Construction: A Case Study on Fight against COVID-19 in Several Chinese Cites. *The 11th International Conference on E-business, Management and Economics.* https://doi.org/10.1145/3414752.3414803

Image Sources

Fig.1. PRISMA flow diagram

Author's profile

Pouria Boujari

e-mail: boujaripouria@modares.ac.ir
ORCID: https://orcid.org/0000-0002-9550-7052
As a post-graduate student, he specializes in studing how public health is connected to the built environment.

Sarah Ghamar

e-mail: sarah_ghamar@modares.ac.ir
ORCID: https://orcid.org/0009-0005-1816-2221
Master in urban design (2023) from Tarbiat Modares University (TMU) in Iran. Her research focuses on analyzing the evolution and history of public spaces in urban environments, exploring how they shape the fabric of cities and influence the daily lives of their inhabitants. Also she strives in identifying the factors affecting urban public spaces transformation.

Mahid Nasirian

e-mail: mahdi.nasirian@modares.ac.ir
ORCID: https://orcid.org/0000-0002-5457-7783
PhD student and Master (2023) in landscape architecture from Tarbiat Modares University (TMU), Comprehensive Postgraduate Education university in Iran. He is Interested in urban landscape and public spaces studies, related to sustainability and human-space interactions.

Fateme Ghapanchian

e-mail: fateme.ghapanchian@modares.ac.ir
ORCID: https://orcid.org/0009-0006-9922-9789
Architect (2017) and Master in urban design (2021) at Tarbiat Modares university in Tehran. Her research focuses on the Climate change and Thermal comfort in public spaces.

Mahtab Khajavi

e-mail: mahtab.khajavi@modares.ac.ir
ORCID: https://orcid.org/0009-0002-5003-8253
Architect (2018) and Master in Urban design (2021) at the Art & architecture department of the Tarbiat modares University in Tehran. Her research areas focuses on Healthy cities, sustainability of public spaces and mental health.

Atieh Qasemi

e-mail: atiehqasemi7698@gmail.com
ORCID: https://orcid.org/0009-0008-7902-5062
Master in urban design (2023) at Tarbiat Modares University of Tehran. Since 2022, she is a member of the research group of the detailed plan of the middle west of Mashhad, Iran. Also, her research area is on the effect of mega projects on urban transformation.

Mohsen Bahari

e-mail: 7mohsenbahari7@gmail.com
He is an architect who graduated from Shahid Chamran University of Ahvaz. He focused on designing sustainable housing buildings.

Yasin Delavar

e-mail: yasin.delavar@ufl.edu
ORCID: https://orcid.org/0009-0002-1447-1527
He is a Ph.D student in college of Design, Construction and Planning at the University of Florida. His research areas focuses on Digital Twins, Visualization, BIM, Computational Design.

Hamideh Garrousi

e-mail: hamideh_garrousi@arch.iust.ac.ir
ORCID: https://orcid.org/0009-0004-0188-1150
She is interested in urban design and did a master degree in urban design at Iran University of Science and Technology, Tehran.

The identification of rurality at Nuts-3 level in Turkey

Seda Özlü ᵃ*, Sinem Dedeoğlu Özkan ᵇ, Dilek Beyazli ᶜ

ᵃ Architecture/Urban and Regional Planning,
Karadeniz Technical University, Trabzon, Turkey
e-mail: sedaaozlu@gmail.com
ORCID: https://orcid.org/0000-0002-2568-7043
* Corresponding author

ᵇ Architecture/Urban and Regional Planning,
Karadeniz Technical University, Trabzon, Turkey
e-mail: snmdedeoglu@gmail.com
ORCID: https://orcid.org/ 0000-0002-1610-2242

ᶜ Architecture/Urban and Regional Planning,
Karadeniz Technical University, Trabzon, Turkey
e-mail: dilekbeyazli@gmail.com
ORCID: https://orcid.org/0000-0002-8182-5420

Abstract

Rural-urban interactions have become an even more important issue with global changes and developments. These areas, where population density and agricultural production are low, have a complex social, economic and natural structure that cannot be handled from a single perspective. This situation necessitates a multidimensional approach to rural areas and rurality. The study aims to address the socio-demographic and economic structure of Turkey's provinces with a multidimensional approach and to analyze them comparatively. The data set of the study consists of 14 socio-demographic and 15 economic variables used in defining rural-urban areas. Three different clustering analysis methods (K-means, Ward, Two Step) were used in the study in which SPSS program was applied. As a result of the analyzes made with three clustering methods, the spatial distribution of the ruralness levels of the provinces was mapped and the variables that lead to cluster formation were determined. The results of these cluster analyses conducted with different methods at the NUTS-3 level in Turkey include a methodological discussion and a comparative determination. Although there are spatial differences as a result of the analysis of rurality with both socio-demographic and economic variables, the general similarity of the clusters formed by the three methods is significant. As a result, these processes, which are carried out comparatively with alternative clustering methods, are important in determining rural and urban areas and guide the production of healthy decisions and policies for the problems and potentials of settlements.

Keywords

Rurality; Cluster analyzes; Turkey; NUTs-3.

1. Theoretical framework

The distinction and relationship between city and countryside is one of the important issues of regional integration in Europe (Öğdül, 2010). Regional development requires interactions and influences between urban and rural development, two non-homogeneous geographical economic entities. Urban-rural synchronized development reflects the attempts of two types of socio-economic units and human settlements with different characteristics to integrate their development and coexist in an interdependent region and smoothly balance the urban-rural economy (Gao, 2012; Chen et al., 2016). Innovations in agricultural-industrial production, climate change and developments in transportation-communication technologies affect urban and rural areas in different ways. These developments have a strong impact on urban-rural interactions (Van Leeuwen, 2015). Due to these developments, it has been understood that the distinction between urban and rural areas is not as clear as it was in the past and it is no longer easy to make a distinction (Copus, 2010; Coombes & Raybold, 2004; Gulumser et al., 2011).

Rurality is important from a cultural, social, political or economic perspective, and especially for the future and sustainability of rural areas (ESDP, 1999). Early definitions of rurality were based on sociological theories that emphasized inherent differences between urban and rural communities (Van Leeuwen, 2015). According to Wirth (1938), urban lifestyle differs from rural life according to three variables: size, density and heterogeneity. Cities are traditionally defined as centers of services and employment, including administrative, commercial, educational and entertainment functions, and are connected to their surroundings through roads and other modes of transportation (Öğdül, 2010).

The built environment of rural areas differs significantly from urban areas in terms of the existence and regulation of land uses (Morrill et al., 1999). As a general definition, rural areas are defined as non-urban areas that are the location of agricultural activities (Gülümser et al. 2010). However, defining rural areas as non-urban areas or areas where agriculture and physical landscape are important is inadequate to describe today's complex reality (Labrianidis, 2006). Sociologically, the concept of rural defines a social structure whose dominant source of income is agriculture, where reproduction and production relations are determined through the ownership of agricultural production tools, and spatially refers to an area where population density is very low (Urry, 1999; in Tübitak, 2015). However, technological, economic and social developments, network relations that emerged as a result of these developments, natural structure differences, and the diversity of indicators that will define rural areas show that rural cannot be combined in a single definition.

Although urban-rural interactions are nowadays considered to be less important, this is not the case. In recent years in particular, the relationship between urban areas and their countryside has become a recurrent theme in European rural policy debates (Copus, 2010). The urban-rural dichotomy has led to two opposing ideas for many years in the past. One was the anti-urban view, which idealized and regretted the disappearance of rural life, and the other was the urban view, which saw urbanization as the engine of progress, innovation and modernization. This situation has also left its mark on spatial planning policies (Davoudi & Stead, 2002). It soon became clear that the idea of a bipolar rural-urban dichotomy was unrepresentative of the real world (Cloke, 1977). Subsequently, rural indices have sought to measure the diversity of rural environments by identifying specific localities along a spectrum between rural and local extremes, rather than looking for an area that is uniquely urban or rural (Harrington & O'Donoghue, 1998).

The publication of the European Spatial Development Perspective (ESDP) in the late 1990s marked a revival of interest in urban-rural relations (Copus, 2010). In the new EU discourse, rurality is defined in relation to the city and in a way that distributes the countryside into a new European regional economy (Hadjimichalis, 2003). This focus on the urban-rural continuum is confirmed by the visible and invisible flows of people, capital, goods, knowledge and technology between urban and rural areas (Davoudi & Stead, 2002).

Due to social, economic and technological developments and the interaction of various non-quantitative factors that affect rural development in particular, rural areas are experiencing significant temporal change (Li et al.,

2015). Recognizing the diversity of rural areas is an important element of rural development policy. In order to develop and implement effective rural strategies and policies in rural areas, it is necessary to recognize these differences, identify their strengths and weaknesses, and develop strategies that combine them. In addition, social and economic problems arising from the abandonment of land, agriculture and livestock activities in rural areas (Pirlone et al., 2017). These problems in rural areas need to be solved. This requires accurate identification on the one hand and specific tools for ad hoc policy interventions on the other. It is therefore necessary to identify the differences between the various local realities through appropriate methods of analysis (Balestrieri, 2014). Therefore, a better understanding of the needs of both urban and rural populations, the magnitude of interactions between them and the identification of vulnerable groups are important for the future (Van Leeuwen, 2015).

Classifying rural areas and distinguishing between rural and urban areas is not an easy task. Although "agricultural and rural development" is among the main policy areas, there is no universally accepted method for classifying urban and rural regions. (Gülümser et al., 2010). However, effective rural development policies should be based on an accurate classification of the main characteristics of territorial types (Bogdanov et al., 2008). The first step beyond the simple urban-rural dichotomy involves the introduction of a category of transitional space that recognizes a gradual series of states between the most urban and the most rural locations (Hugo et al., 2003). At this point, rural typology studies are carried out to understand rural areas in depth, to define/limit rural areas or to form the basis for rural planning/policies (Cloke, 1977; OECD, 1994; Boscacci et al., 1999; Schmidt-Thomé, 2005; Öğdül et al., 2007; Scholz, 2009).

Indicator development is a necessary but difficult step in defining and delimiting rural areas (Bryden, 2002). The widest diversity in typology studies is seen in the indicators and variables used and the measurement of these variables (Beyazlı et al., 2017). Although quantitative criteria have limited reliability, international organizations (such as the OECD and EUROSTAT) have often used these criteria to define rural areas because of their practicality in interregional or interstate comparisons (Labrianidis, 2006). Population density has traditionally been used to describe rural areas in Europe (Ballas et al., 2003). The NUTS -3[1] and NUTS-5 level definitions published by the OECD are based on the variables "rural population" and "population density" (OECD, 1994; Pizzoli & Gong, 2007) while EUROSTAT's studies are based on "population density". The 2005 ESPON project and RUFUS typology also used "population density" and "land use" variables to typologize urban and rural areas (Scholz, 2010).

Due to the statistical and political inadequacy of the OECD's univariate definition of rural areas based solely on the indicator "population density", many variables have been adopted with different typologies (OECD, 1994). In general, various ways of classification and definition have been derived in the literature to measure differences in the degree of rurality, including population density, rate of population loss or increase, settlement size, local economic structure, accessibility, infrastructure and landscape (Ballas et al., 2003; Baum et al., 2004; Bryden, 2002; Labrianidis, 2006; Plessis, 2001; Albrecht, 2006).

Urban-rural classifications have evolved over time from simple density approaches based on functional relationships between rural and urban areas to more complex classifications (Bryden, 2002). Due to recent developments, the degree of urbanity and rurality based on multiple classifications has begun to be discussed in the development of policies on urban and rural areas, instead of the strictness/clarity of the distinction between rural and urban areas (Cloke, 1977; OECD, 1993; ESPON, 2004; EUROSTAT, 2005).

An increasing number of multivariate statistical analyzes have been conducted in rural contexts (Cloke, 1977; Ibery, 1981; Kostowicki, 1989; Openshaw, 1985; Errington, 1990). The first steps towards multiple definitions were taken at the European Statistical Conference in 1964 (UN, 1969). The rurality index was developed in a

---

[1]   The Nomenclature of Territorial Units for Statistics (NUTS) is a statistical classification method developed by the European Union Statistical Office (Eurostat) since the 1970s to ensure that regional statistics are produced according to a single spatial classification in the European Union. In Turkey, NUTS has started to be used as the implementation basis of regional development policies.

1971 study in Wales to improve the rating and definition of rural areas (Cloke, 1977). In a multiple classification attempt in Indonesia, rurality was defined according to population, the proportion of households engaged in agriculture and the urban facility (Hugo et al., 2003). In addition, Malinen et al. (1994) presented a classification for rural Finland, while Cromartie and Swanson (1996) provided a classification for the United States (Hugo et al., 2003). Leavy et al. (1999) classified rural areas of Ireland using census data. Additionally, based on 1991 population data, the "Rurality Index for Small Areas" was created for rural Spain (Ocana-Riola & Sanchez-Cantalejo, 2005). Long et al. (2009) also established the evaluation indicator system of rurality degree index to distinguish the rurality degree of different species in China. Despite Turkey's rural potential, the government has started some initiatives to solve the rurality problem as part of its efforts to harmonize with the EU.

Based on the above-mentioned theoretical analysis, the study aims to address and comparatively analyze the socio-demographic and economic structure of the rural areas of Turkey with a multidimensional approach. In the study, firstly, the theoretical framework of rural areas and rurality is explained. Following the theoretical definitions, the method of the study (different cluster analyzes in accordance with the comparability purpose of the study), variable selection process and data set are included in the methodology section. Finally, a comparison of the rurality levels of the provinces revealed by socio-demographic and economic variables and different clustering methods is included.

2. Methodological framework

2.1 The dataset

Rural areas are characterized by their social, economic and environmental diversity. Rural areas suffer socially from migration and population aging, economically from high poverty and dependence on agriculture, naturally from environmental risks (Francini, 2020). Therefore, in the development of spatial typologies to characterize rural areas, multivariate analysis is most widely used, given that various social, economic and demographic dimensions must be taken into account (Bogdanov et al., 2008).

− *Socio-demographic Variables: Human intervention in land use is shown* by population size and density, growth rate and migration variables (Leavy, 1999). Population density is an indicator of the relative importance of built land and human interference with the natural landscape (Bengs & Schmidt-Thome, 2005). Although population density has traditionally been used to define rural areas in Europe, low population density is not always associated with rural populations (Ballas et al., 2003). Age structure is an important indicator of rurality and population aging is a common phenomenon (Cloke, 1977; OECD, 1993). Cloke (1977) stated that the aging population is more pronounced in rural areas and the elderly dependency ratio is higher. On the other hand, an age structure leaning towards the 15-45 age group indicates non-rural tendencies. Moreover, variables indicating the share of dependent persons in the total population of a region are to understand the importance of demographic composition, which differs significantly between urban and rural areas (Van Leeuwen, 2015). Finally, education level is a significant measure in determination of human resources and human capital skill levels. In rural areas, workers have lower skills, education and specialization levels when compared to urban areas (Pizzoli & Gong 2007).

− *Economic Variables*: To define the economic profile of the area, employment, production, value added and land use by sectors are taken into account (Bryden, 2002; FAO, 1986, 1993, 2005). Primarily, the correlation between land cover and GDP is an adequate indicator of land use efficiency/productivity, hence, of sustainability (Gløersen et al., 2006). It was reported that predominantly rural regions have low per capita GDP (Zheliazkov et al., 2015). Also, industrial specialization or diversity is an indicator of the level of economic development. And concentration in agriculture reflects a rural structure, while the diverse industrial distribution denotes an urban structure (Bryden, 2002). The internal structure of industries (i.e., business size, workforce type, changes, etc.) also provides clues about development potential, economic development, and

susceptibility to change. The self-employment rate is higher in rural areas (Zheliazkov et al., 2015). Finally, combination of new rural economy industries (tourism and services, recreation, specialized commerce, etc.) could be observed in modern rural areas (Bryden, 2002). Many applied studies have been examined in the process of establishing the theoretical framework for the definition/classification of rural areas and determining variables. However, due to space constraints, the most frequently mentioned studies in the national and international multiple classifications of rurality are included in Tab.1.

Variables	Cloke, 1977	Ballas et al., 2003	Baum et al., 2004	Bogdanov et al., 2006	Ocaña & Sánchez, 2005	Gülümser et al., 2010	Ögdül, 2010	Scholz & Herrmann, 2010	Vincze & Mezei, 2011	Li et al., 2015	Van Leuween, 2015	Pizzolli, 2017
Population		X					X					X
Population density	X	X		X	X		X	X	X	X	X	X
Population change	X			X		X		X	X			
Rate of urbanization/Share of rural population							X			X	X	
Population by age groups and gender	X			X					X			
Size of household										X		
Crude birth/death rate		X				X				X		
Dependency ratio					X			X	X	X		
Demographic vitality				X								
Share of young people			X	X	X					X		
Share of aged people	X			X	X					X		
Gross domestic product		X						X				
GDP per capita		X	X								X	
% primary- secondary- tertiary sector				X								
Total employment							X				X	X
Share of employment in agriculture		X	X	X	X	X	X	X		X	X	X
Share of employment in manufacturing		X			X	X	X					
Share of employment in services		X	X		X	X	X	X		X		
Total gross value added by sector								X				
Share of agriculture in total gross value added		X										
Patent applications		X										
Firm density			X									
Number of hotels/ beds per person		X									X	
Number of branch banks							X					
Job	X											
Education level			X	X		X				X		
Illiteracy rate							X			X		
Average income and income inequality						X	X		X			
Total or long-term unemployment rate		X	X	X				X				
% Households/persons with social payments				X								
% Self employees			X									
Retirement index					X							
In or out migration rate	X			X						X		
Share of ethnic minorities			X									

Tab.1 Variables used in the classification of rurality

Turkey's NUTS-3 level socio-demographic and economic data availability, theoretical context and methodological requirements were evaluated together and a data set was created. Considering the aim of comparative classification of rurality with socio-demographic and economic data depending on the heterogeneous structure of rural areas, a multivariate process was followed at the NUTS-3 level.

Considering the diversity and uniqueness of rural areas, it can be said that the variables used in different typologies are numerous. (Gülümser et al., 2010). However, one of the most important factors affecting variable

selection is the availability of data. In this study, which was conducted based on two contexts at the provincial level, 14 socio-demographic variables and 15 economic variables were used for 2018. Variables were obtained from the data sets of the Turkish Statistical Institute (TUIK) including regional and provincial levels. In this context, the data obtained or produced within the scope of the study is as follows (Tab.2).

Socio-demographic variables	Economic variables
Population	Gross domestic product per capita
Rural population	Rate of agricultural GDP *
Annual population growth rate	Rate of industry GDP *
Population density	Rate of service sector GDP *
Rate of rurality*	Rate of imports per capita
Rate of youth dependency	Rate of exports per capita
Rate of elderly dependency	Rate of domestic import *
Rate of active population* (22-44 age)	Rate of exports export *
Rate of population over 65	Rate of agricultural production in the country *
Average household size	Agricultural production per agricultural population *
Gross birth rate	The number of animals per hectare *
Gross death rate	Rate of organic production *
Infant mortality rate	Rate of organic farmer *
Rate of literacy	Rate of entrepreneurs in agriculture sector by province*
	Rate of agricultural entrepreneurs in the total *

Tab.2 Variables describing the rurality and used in the study and data sources (Turkey Statistics Institute, 2018) [2]

The determinants of rurality may vary between countries with different social backgrounds. Therefore, the choice of variables used to construct the index should be based on the context and social structure of the areas under study. And it should be reviewed and updated periodically over time (Prieto-Lara & Ocan˜a-Riola, 2010).

2.2 Methodology

In rural areas, a variety of problems need to be addressed, thus requiring on one side specific tools for a correct identification and on the other side ad hoc policy interventions. It is therefore necessary to identify the differences within the various local realities through appropriate analysis methods (Balestrieri, 2014).

In response to growing interest in the issue of regional differences, geo-statistical techniques of identifying, classifying and grouping different types of rural areas are increasingly incorporated into rural development policy design processes (Coombes, 1996; DoELG, 2002). These analyzes often focus on producing a classification or typology of rural areas based on the assessment of demographic, economic and other factors in order to facilitate policy development. In this context, cluster analysis was used in this study, which comparatively reveals rurality with various methods with the help of socio-demographic and economic data. Reasons such as "being an exploratory method", "being able to produce meaningful results from multivariate data sets", "enabling comparative analysis" and "monitoring spatial reflections" were effective in the use of cluster analysis within the scope of the study. K-means method (non-hierarchical clustering), ward method (hierarchical clustering) and two-step clustering (hybrid method) were used in the study. Thus, as a result of different clustering methods, settlements with similar rural characteristics will be identified.

Cluster analysis is a statistical method to "partition a set of observations into a distinct number of unknown groups or clusters in such a manner that all observations within a group are similar, while observations in different groups are not similar" (Timm, 2002). Copus (1996) identified one of the advantages of the methodologie as their capacity to tackle large numbers of variables easily and their adequacy for explorative data analysis. The degree of similarity in one group is defined by the distance between the observations within a multidimensional co-ordinate system where each axis represents one feature. According to its characteristics,

---

[2]   It was created by the author using the data obtained from Turkey Statistics Institute system.

each region is definitely positioned in this multidimensional space. The closer to each other regions are, the more likely they are to be grouped into the same cluster (Baum et al., 2004). Furthermore, aggregative approaches to cluster analysis lead to useful and sometimes unexpected information about data patterns (Copus, 1996). The following could be suggested when hierarchical and non-hierarchical methods are detailed:

— *Nonhierarchical or non-agglomerative methods:* These start with an a priori decision to form groups and are based on seed points equal to the desired group count (Rogerson, 2001). To obtain valid and significant results in the analysis, two conditions should be met. These are selection of significant variables and accurate determination of the cluster size (Punj & Stewart, 1983). After the variables are determined, one of the main criteria developed to determine the cluster size (Tatlıdil, 1992; Çakmak et al., 2005) is calculated with the formula $k = (N/2)1/2$ where N is the number of observations.

— *Agglomerative or hierarchical methods:* In these methods, the number of clusters is equal to the number of observations, which are then merged into larger clusters. The method aims to combine the observations into increasing sizes of clusters, using a measure of similar distances (Ballas et. al, 2003). The main approach is that the number of clusters is reduced one by one by merging two existing clusters. In the first step, each region represents a single cluster. After the last step, all regions are included in one cluster. A dendrogram visualises the steps in a hierarchical clustering procedure (Hair et al. 1998). According to Baum et al., 2004 the elbow criterion that creates a sudden jump upwards in the agglomeration coefficients, the dendrogram, various statistical values of the clusters, and the plausibility of the grouping are means of deciding on the number of clusters.

— *Two Step Cluster analysis:* This method was developed to cope with the problems in K-means algorithm. This algorithm produces solutions with a mixture of continuous and categorical variables. The SPSS algorithm leads to an optimal number of automatically determined clusters; however, since cluster analysis does not test the hypothesis, the researcher needs to check the accuracy of the solution. Cluster quality bar represents the silhouette coefficient, which is a measure of both cohesion (i.e., the similarity of the elements in a cluster), separation (i.e., the difference of the clusters) and ranges between −1 and 1 (Raggi et.al, 2013; Bacher et al., 2004). As a result, revealing so far unknown regional structures and coherences and, thus, contributing to new insights it can motivate argumentations of regional policy and contribute to initiate political effects (Baum et al., 2004).

3.   Description of rural clusters

At this stage of the study, three different clustering methods, the results of the method and the spatial distribution of the clusters are included. In the study where standardized socio-demographic and economic data were used, K-Means, Ward and Two-Step cluster analyzes were performed with the help of SPSS 25.0 software. As a result of the first analyses, the socio-demographic variables "infant mortality rate" and the economic variables "number of animals per hectare" and "rate of agricultural entrepreneurs in the total" are not significant. For this reason, these variables were removed from the data set and not used in cluster analyses. In the study, the rural structures of the settlements are summarized based on different cluster analyzes and socio-demographic and economic dimensions. These analyzes provide comparative and spatial analyzes of the rurality of the settlements.

3.1 K-Means method (non-hierarchical clustering)

Socio-demographic Clustering: It was aimed to determine the rurality levels of the settlements with 13 primarily selected socio-demographic variables using the K-means method. The number of clusters required for analysis was obtained from the formula $k = (N/2)^{1/2}$. The number of clusters for Türkiye, which has 81 provinces (k), has been determined as 6. Clusters were formed as a result of the analysis conducted in 5

iterations. According to the ANOVA table f values (sig.), the most effective variable in determining the clusters was "population density" (Fig.1 and Tab.3). "Annual population growth rate" in Cluster 4, "population density", "total population" and "active population rate" in Cluster 6, "youth dependency", "average household size" and "crude birth rates" in Cluster 2 attract attention. Finally, it is seen that the variables of "rural population", "rurality rate" and "elderly dependency ratio" are high in Cluster-1. Finally, in order to make comparisons between clusters and variables, the cluster value of each variable is given in Tab.3.
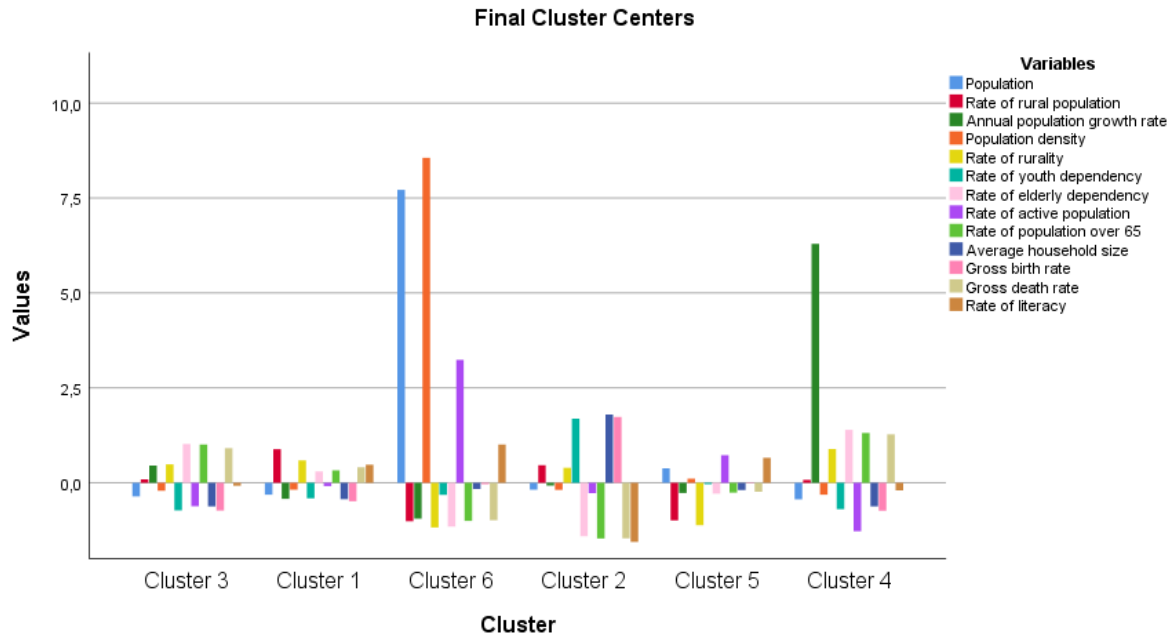

Fig.1 Socio-demographic clustering (K-means cluster analysis)

Variables	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
1.Population	-0.31537	-0.18424	-0.36026	-0.43700	0.37863	7.71591
2. Rate of rural population	0.88324	0.46240	0.08906	0.07548	-0.99397	-1.01367
3. Annual population growth rate	-0.42480	-0.07575	0.45100	6.29448	-0.27021	-0.94864
4. Population density	-0.18536	-0.18973	-0.20971	-0.31312	0.10625	8.55924
5. Rate of rurality	0.59066	0.39202	0.48397	0.88897	-1.11967	-1.17636
6. Rate of youth dependency	-0.40848	1.68925	-0.72834	-0.69586	-0.03944	-0.32015
7. Rate of elderly dependency	0.29796	-1.40749	1.01793	1.39290	-0.28676	-1.15618
8. Rate of active population	-0.08768	-0.27649	-0.62062	-1.27693	0.72586	3.23554
9. Rate of population over 65	0.32301	-1.46881	1.00612	1.30912	-0.25924	-1.00402
10. Average household size	-0.43400	1.79725	-0.62350	-0.62558	-0.19321	-0.16735
11. Gross birth rate	-0.48578	1.73370	-0.73267	-0.73812	-0.01528	-0.03780
12. Gross death rate	0.40860	-1.46216	0.91092	1.27609	-0.23966	-0.98693
13. Rate of literacy	0.47318	-1.55985	-0.07887	-0.20022	0.65866	1.00793
variable value	lowest					highest

Tab. 3. Final cluster centers values of socio-demographic variables (K-Means)

Economic Clustering: After socio-demographic clustering, economic clustering analysis was conducted with 13 economic variables defining rurality and belonging to 2018. In the analysis carried out with 6 iterations, all variables were significant. As a result of the cluster analysis, 6 economic structure clusters were formed. The most effective variable in determining the clusters was "gross domestic product per capita". As seen in Figure 2, Cluster-6 has the highest values in many variables, especially "domestic imports and exports per capita", "total GDP", "service sector GDP". Moreover, it is seen that the variables "rate of agricultural GDP" and "agricultural production", which reflect the economic structure of the rural areas, are high in Cluster-1, while "organic production" rates are high in Cluster-3. (Fig.2 and Tab.4).
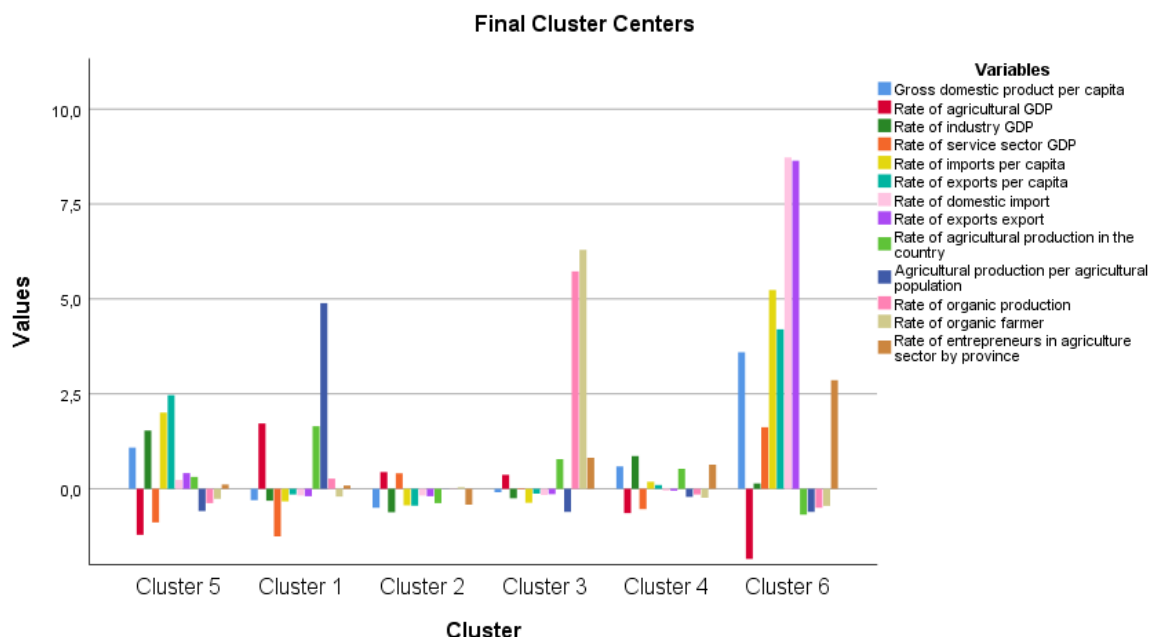
Final Cluster Centers

Fig.2 Economic clustering (K-means cluster analysis)

|	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
1. Gross domestic product per capita	-0.30089	-0.50146	-0.09172	0.59065	1.08178	3.59600
2. Rate of agricultural GDP	1.71831	0.44091	0.36582	-0.64111	-1.21459	-1.85092
3. Rate of industry GDP	-0.31328	-0.61931	-0.25040	0.86021	1.53333	0.13952
4. Rate of service sector GDP	-1.25573	0.40714	-0.01873	-0.53746	-0.88783	1.62053
5. Rate of imports per capita	-0.33210	-0.43963	-0.37131	0.18518	2.00340	5.23346
6. Rate of exports per capita	-0.15166	-0.44494	-0.12956	0.09881	2.46245	4.19905
7. Rate of domestic import	-0.17833	-0.17831	-0.16506	-0.04986	0.22880	8.72612
8. Rate of exports export	-0.19910	-0.19911	-0.14082	-0.04999	0.40950	8.63993
9. Rate of agricultural production in the country	1.64583	-0.37886	0.77765	0.52350	0.30955	-0.68449
10. Agricultural production per agricultural population	4.88745	0.00228	-0.60876	-0.21460	-0.58571	-0.60876
11. Rate of organic production	0.26787	0.00332	5.72656	-0.15209	-0.37807	-0.49971
12. Rate of organic farmer	-0.20528	0.04111	6.29366	-0.24018	-0.26671	-0.45082
13. Rate of entrepreneurs in agriculture sector by province	0.08609	-0.42022	0.81552	0.63477	0.11177	2.85742
variable value	lowest					highest

Tab.4 Final cluster centers values of economic variables (K-Means)

3.2 Ward Method (Hierarchical Clustering)

After revealing the socio-demographic and economic structures of rurality with the K-means clustering method, rurality was also discussed with the hierarchical clustering method. Secondly, Ward cluster analysis was used in the study where rurality and rural classification were discussed with different clustering methods. At this stage, standardized socio-demographic and economic data from 2018 were used. Dendrograms were created using squared Euclidean distance as distance measurement. Dendrograms obtained in the analysis reveal socio-demographic variables, distances and relationships between provinces.

Socio-demographic and economic clustering: According to the socio-demographic dendrogram, 17 clusters emerged at 1 unit distance, 8 clusters at 2 units distance, 6 clusters at 3 units distance, and 3 clusters at 4 units distance. As a result of the cluster analysis made with economic data, there are 18 at 1 unit distance, 10 at 2 unit distance, 8 at 3 unit distance, 4 at 4 unit distance. Considering the "Agglomeration Schedule" of the

analysis and the number of settlements in the clusters, the most accurate number of clusters for the analysis is 6 for the socio-demographic structure and 8 for the economic structure (Fig.3).

(a)   (b)

Fig.3 (a) Socio-demographic and (b)economic clustering according to Ward cluster analysis
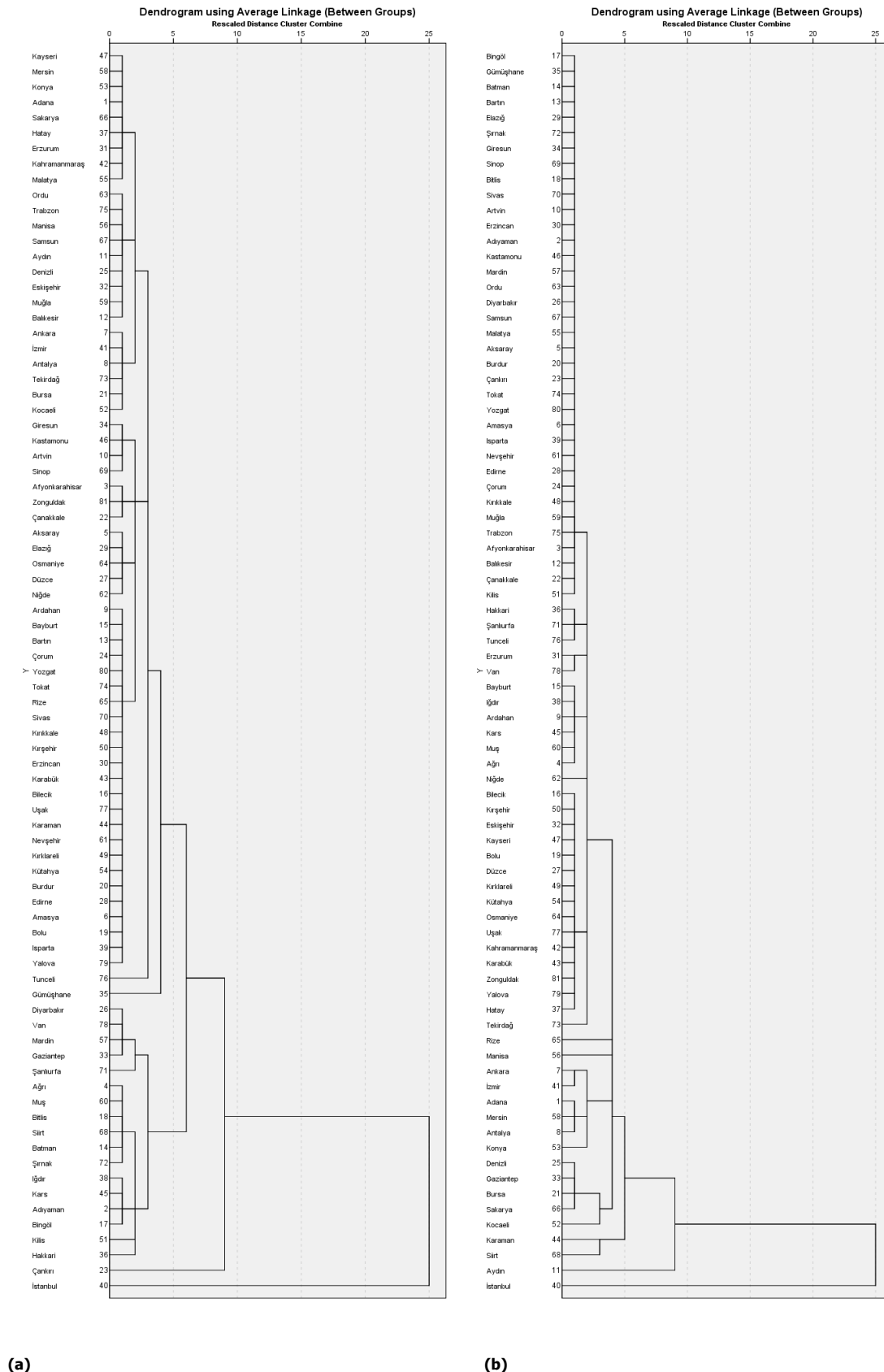
3.3 Two-Step clustering (Hybrid method)

In this step, which was carried out with standardized 2018 data, the number of clusters was first determined by the program. The number of clusters (2) created for both variable groups is insufficient to reflect the rural diversity in the country. In the next stage, cluster analysis was performed by the author by determining different cluster numbers. As a result of the analyzes and the highest cluster quality values, 4 clusters emerged for the socio-demographic structure of rurality and 5 clusters for the economic structure of rurality.

According to the two-step cluster analysis conducted with the socio-demographic variables of rurality, the most important variable in determining the cluster was "population density". The least significant variable is "Annual population growth rate". When the clusters are examined, it is seen that 43.2% of the provinces are in Cluster 1, 19.8% are in Cluster 3, 35.8% are in Cluster 3 and 1.2% are in Cluster 4. The table-4 also includes the mean values of the variables that are effective in the differentiation of the clusters. According to these values, Cluster 2 has the highest "average household size", "gross birth rate" and "rate of youth dependency" values. Cluster-4 has the highest values in terms of "population density", "total population" and "active population". Finally, "gross death rate", "rate of elderly dependency" and "rate of rurality", which are the most basic indicators of rurality, are highest in Cluster-1 (Tab.4).

Variables (importance)	Cluster 1	Cluster 2	Cluster 3	Cluster 4
1.Population density (1.00)	-0.21	-0.15	0.04	8.56
2.Population (0.67)	-0.34	-0.14	0.22	7.72
3.Gross birth rate (0.45)	-0.71	1.72	-0.09	-0.04
4.Rate of population 65 over	0.87	-1.46	-0.20	-1.00
5.Averege household size (0.48)	-0.60	1.74	-0.23	-0.17
6.Rate of youth dependency (0.40)	-0.67	1.69	-0.10	-0.32
7.Rate of elderly dependency (0.35)	0.87	-1.40	-0.23	-1.16
8.Gross death rate (0.37)	0.84	-1.44	-0.19	-0.99
9.Rate of literacy (0.32)	0.13	-1.45	0.60	1.01
10.Rate of rurality (0.30)	0.59	0.29	-0.83	-1.18
11.Rate of active population (0.17)	0.52	-0.24	0.65	3.24
12.Rural population (0.19)	0.44	0.37	-0.70	-1.01
13. Annual population growth rate (0.02)	0.27	-0.10	-0.24	-0.95
variable value	lowest			highest

Tab.4 Socio-demographic clustering according to Two Step clustering

Variables (importance)	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
1.Rate of domestic import	-0.14	-0.18	-0.03	0.16	8.73
2. Rate of exports export	-0.16	-0.20	-0.00	0.21	8.64
3. Rate of entrepreneurs in agriculture sector by province	0.08	-0.41	-0.02	2.62	2.86
4. Rate of industry GDP	0.09	-0.65	1.24	-0.00	0.14
5. Rate of agricultural production in the country	0.97	-0.41	-0.09	2.51	-0.68
6. Rate of imports per capita	-0.43	-0.44	0.66	0.30	5.23
7. Rate of service sector GDP	-1.05	0.46	-0.88	0.68	1.62
8. Gross domestic product per capita	-0.02	-0.52	0.65	0.85	3.60
9. Rate of exports per capita	-0.11	-0.45	0.64	0.31	4.20
10. Rate of agricultural GDP	0.94	0.42	-0.81	-0.69	-1.85
11. Rate of organic production	2.00	-0.05	-0.43	0.09	-0.50
12. Rate of organic farmer	1.82	-0.05	-0.34	-0.05	-0.45
13. Agricultural production per agricultural population	1.73	-0.04	-0.19	-0.61	-0.61
variable value	lowest				highest

Tab.5 Economic clustering according to Two Step clustering

Similarly, in the cluster analysis conducted with 13 economic variables, the most important variable in determining the cluster was "rate of domestic import" and the least important variable was "agricultural production per agricultural population". 55.6 % of the provinces were in cluster 2, 28.4% of the provinces were in cluster-3, 7.4% of the provinces were in clusters 1-4, and 1.2% of the provinces were in cluster-5. The "import and export rates" of the provinces in Cluster-5 are higher than those in other clusters. "Organic

production" and "rate of agricultural GDP", which are variables reflecting the economic structure of rural areas, are in Cluster-1, while "rate of agricultural production in the country" is highest in Cluster-4 (Tab.5).

3.4 The Definition of Rural Spatial Distribution

The spatial and comparative classifications obtained with clustering conducted with three methods based on the socio-demographic and economic variables are presented in Fig.4 and Fig.5. Based on the comparative socio-demographic analysis (Fig.4),

- 6 significant clusters were formed with the K-means and Ward clustering method, and 4 significant clusters were formed with the Two-step method;

- In Ward and Two-step analyses, more homogeneous clusters due to spatial proximity are observed.

- As expected, Istanbul province forms a cluster on its own in all three analyses. It is also described as the most urban area depending on the variables;

- It is one of the regions with high urbanization in Cluster-5, which includes many provinces with metropolitan status. It is continuous in the southern and western parts of the country and partly in the inner regions;

- Apart from Istanbul, Çankırı province also shows a single cluster feature in socio-demographic terms according to K-means analysis, while Gümüşhane, Tunceli and Çankırı show a single cluster feature according to Ward analysis;

- The region on the Kars-Şanlurfa line in the southeast of the country shows a similar structure in terms of socio-demography in all three methods. The region can be defined as a region with high rurality that shows continuity and homogeneity within the country.

As a result, in this step where rurality is addressed with socio-demographic variables and three different methods, clusters and continuities are observed in similar settlements.

Similarly, when comparative evaluations were made with the economic variables of rurality, the following findings emerged (Fig.5):

- 6 significant clusters were formed with the K-means clustering method, 8 with the Ward clustering method and 5 with the Two step method;

- In three different clustering analyses conducted with economic variables, more homogeneous clusters are observed in terms of spatial proximity. In these analyses based on economic structure, it is seen that the country is divided by a diagonal axis. Almost half of the country is in a single cluster in all three analyses and shows similar economic characteristics;

- As in the socio-demographic structure, Istanbul forms a separate cluster in the economic context. It is defined as the most urban region depending on economic variables;

- In addition, Karaman-Siirt provinces, where the "Rate of agricultural GDP" is high, show a cluster characteristic with high rurality in both kmenas and ward analyses;

- Similar to Karaman and Siirt provinces, Aydın, where "organic product" variables are high, also shows a separate cluster feature;

- In addition, Manisa and Rize provinces also show single cluster characteristics according to Ward analysis;

- Karaman, Siirt, Manisa, Manisa, Niğde, Rize and Siirt provinces, which have high rurality due to agricultural value and potential, show similar economic characteristics in Two step analysis. In addition, these settlements can also be defined as settlements with high rurality;

- Cluster 4-5 according to Kmeans analysis, Cluster 4-5 according to Ward analysis and Cluster 4 according to Two step analysis show urban economic structure characteristics.

As a result, similarities and continuities are observed in similar settlements in this step where the economic variables of rurality are handled with three different methods.

K-Means Cluster Analysis
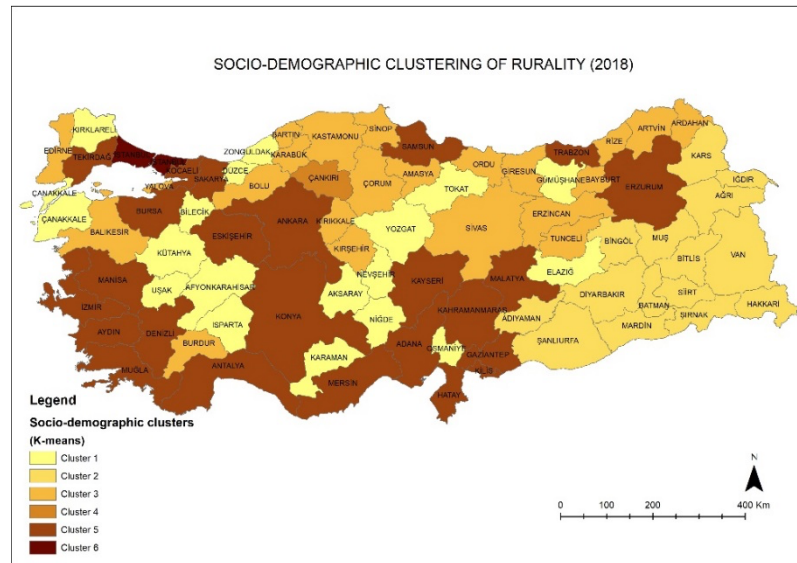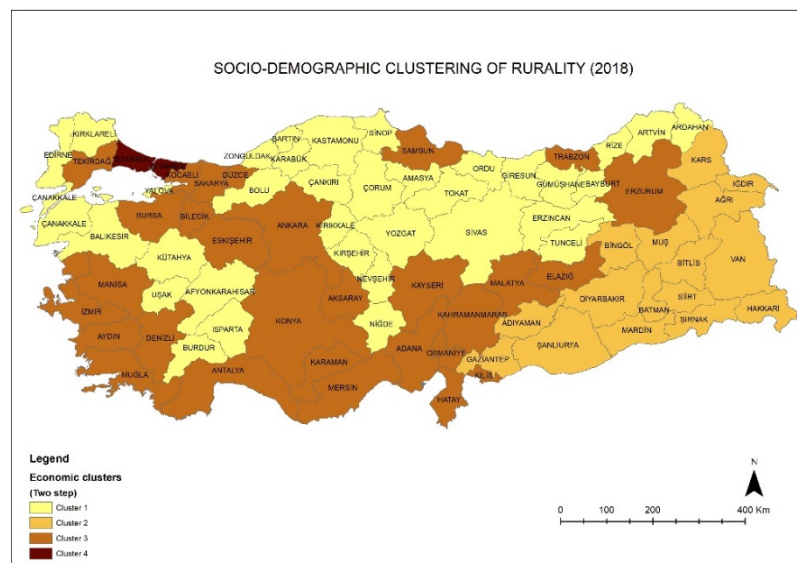
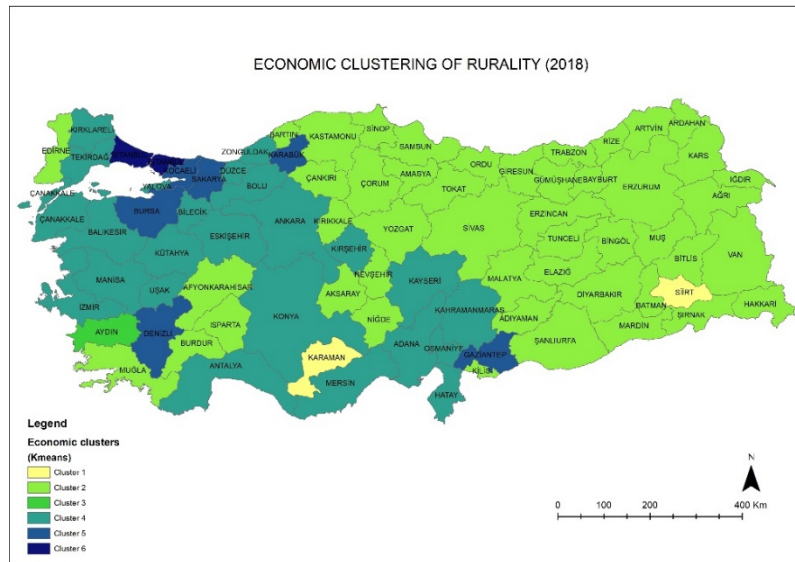Ward Cluster Analysis
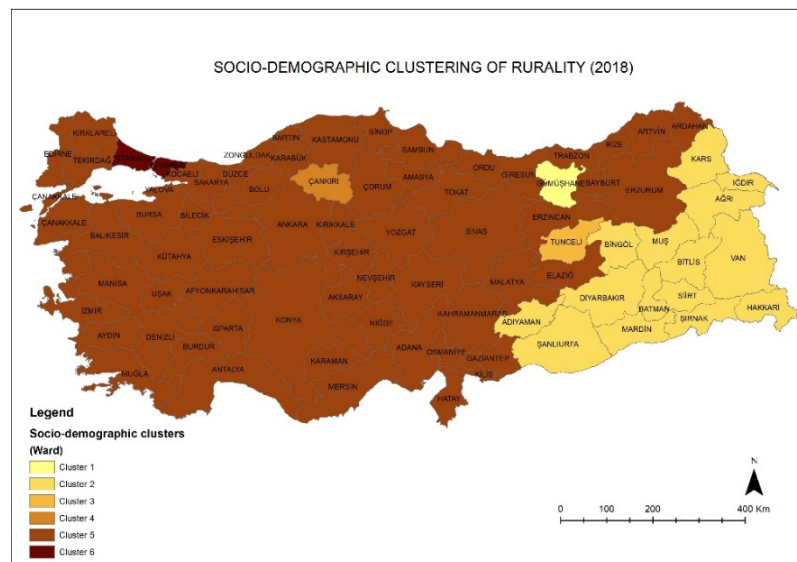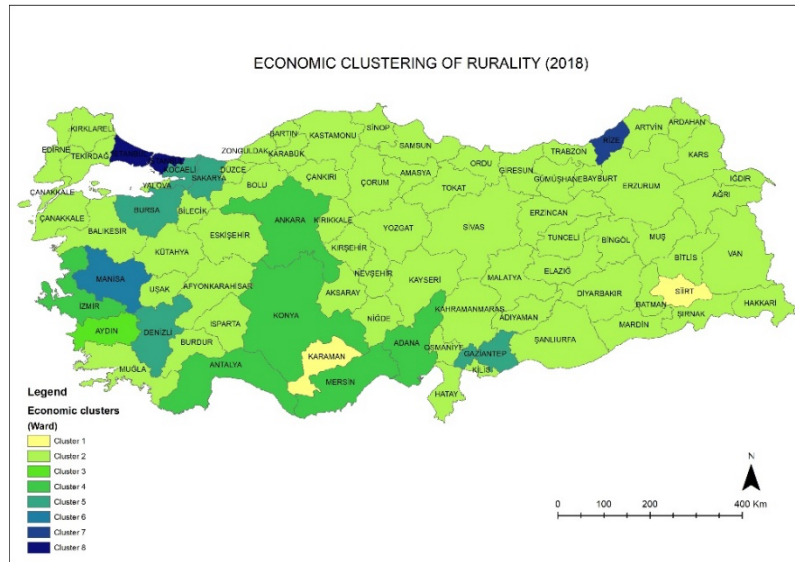
Two-Step Cluster Analysis

Fig.4 Spatial distribution of socio-demographic clusters

K-Means Cluster Analysis

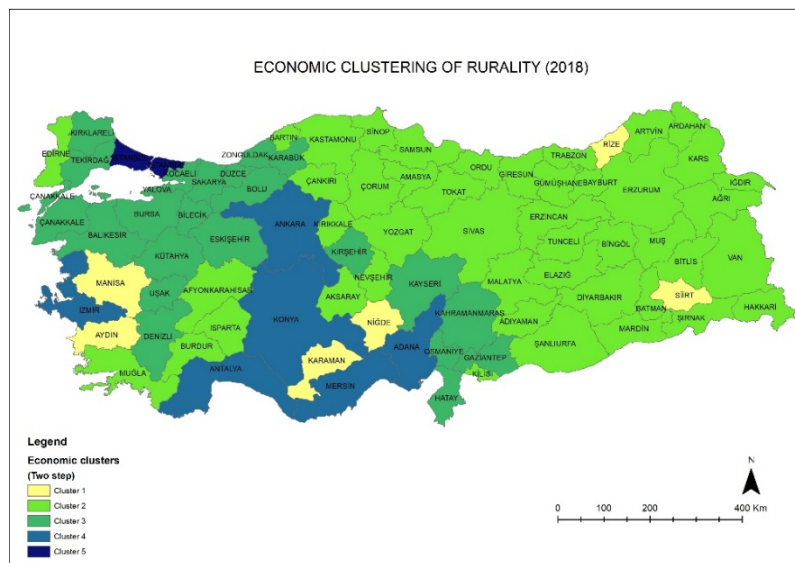Ward Cluster Analysis

Two-Step Cluster Analysis

Fig.5 Spatial distribution of economic clusters

4. Conclusion

The levels of rurality in rural areas and settlements exhibited differences in Turkey. Based on the variables used to define rurality in the study, the rurality of the provinces in Turkey was clustered sociodemographic and economic similarities. The analyses conducted with three clustering methods revealed that the spatial distribution of the rurality levels of the provinces were mapped and the variables that led to cluster formation were determined. The present study did not claim to develop a new typology but aimed to compare the current state of the rurality in the country by analyzing the existing data. The conclusions of the present study where rurality was analyzed based on two dimensions.

In all three cluster analyzes conducted with sociodemographic variables, it was observed that the homogeneity and continuity of homogeneity increased as the analysis moved from northeast towards south and especially towards southeast and the latter region was not affected by the changes in cluster count. In the Two-Step cluster analysis and Ward method, the country was economically clustered based on an imaginary diagonal axis and it was observed that the most heterogeneous clusters were formed with the K-Means method. Although the rurality levels varied spatially with both the socio-demographic and economic variables between the clusters, the general similarity of the clusters formed with the three methods was significant.

Although urban-rural interactions are currently considered less important, the reality contradicts with this perception. Furthermore, it is predicted that the relationships and interactions between the settlements will increase even further due to technological advances and the increase in mobility. This requires a good understanding of the problems and potential of urban and rural areas, determination of rurality levels, and a multi-directional approach to settlements. The present study is considered beneficial for the discussion of rural variables, to reveal spatial distribution of rural clusters, and to understand the potential use of the results obtained with alternative methods in future planning.

References

Albrecht, W. (2006). Experiences with Grids at Eurostat. Paper presented at *Nordic Forum for Geo-statistics*. Kongsvinger, Norway 12th - 14th September.

Ann, T.W., Wu, Y., Zheng, B., Zhang, X. & Shen, L. (2014). Identifying risk factors of urban-rural conflict in urbanization: A case of China. *Habitat International, 44*, 177-185. https://doi.org/10.1016/j.habitatint.2014.06.007

Bacher J., Wenzig K. & Vogler M. (2004). SPSS TwoStep Clustering – A First Evaluation. In C. Dijkum, J. Blasius, C. Durand (Eds.), *Recent Developments and Applications in Social Research Methodology. Proceedings of the RC33 Sixth International Conference on Social Science Methodology*, Amsterdam.

Balestrieri, M. (2014). Rurality and competitiveness. Some observations on the local area: The case of the Sardinian Region. *International Journal of Rural Management, 10* (2), 173-197. https://doi.org/10.1177/0973005214546599

Ballas, D., Kalogeresis, T. & Labrianidis, L. (2003). A comparative study of typologies for rural areas in Europe, *43rd Congress of the European Regional Science Association: "Peripheries, Centres, and Spatial Development in the New Europe"*. 27th - 30th August, Jyväskylä, Finland.

Baum, S., Trapp, C. & Weingarten, P. (2004). *Typology of rural areas in the CEE new Member States. Assessing rural development of the CAP*. ECON Stor, Discussion Paper, 72.

Bengs, C. & Schmidt-Thomé, K. (2005). *Urban-rural relations in Europe: ESPON 1.1*. 2. Final report.

Beyazli, D., Aydemir, S., Öksüz, A.M. & Özlu, S. (2017). Rural typology with and inductive approach. *International Journal of Environmental Research, 11* (2), 225-241. https://doi.org/10.1007/s41742-017-0022-6

Bryden, J. (2002). Rural development indicators and diversity in the European Union. *Conference on "Measuring rural diversity"*. Washington, DC. Retrieved from: http://citeseerx. ist. psu. edu/viewdoc/download

Blunden, J.R., Pryce, W.T.R. & Dreyer, P. (1998). The classification of Rural Areas in the European Context: An Exploration of a Typology Using Neural Network Applications. *Regional Studies, 32*, 149-160. https://doi.org/10.1080/00343409850123035

Bogdanov, N.L. & Stojanovic, Z. (2006). *The methodology of rural determination and identification of rural Serbia*.

Bogdanov, N., Meredith, D. & Efstratoglou, S. (2008). A typology of rural areas in Serbia. *Economic annals, 53* (177), 7-29. https://doi.org/10.2298/EKA0877007B

Boscacci, F., Arcaini, E., Camagni, R., Capello, R. & Porro, G. (1999). *A typology of rural areas in Europe. Study Programme on European Spatial Planning of the European Commission*. Milan: Milan Polytechnic.

Bryden, J. (2002). Rural development indicators and diversity in the European Union. *Conference on "Measuring rural diversity"*. Washington, DC. Retrieved from: http://citeseerx. ist. psu. edu/viewdoc/download.

Chen, D., Wang, Y., Ren, F. & Du, Q. (2016). Spatio-temporal differentiation of urban-rural equalized development at the county level in Chengdu. *Sustainability, 8* (5), 422. https://doi.org/10.3390/su8050422

Cloke, P.J. (1977). An index of rurality for England and Wales. *Regional Studies, 11* (1), 31-46. https://doi.org/10.1080/09595237700185041

Coombes, M. & Raybould, S. (2004). Finding work in 2001: urban-rural contrasts across England in employment rates and local job availability. *Area, 36* (2), 202-222. https://www.jstor.org/stable/20004382

Coombes, M. (1996). Defining Boundaries from Synthetic Data. *Environment and Planning, A, 32* (8), 1499-1518. https://doi.org/ 10.1068/a29165

Copus A. (1996). *A rural development typology of European NUTS III regions*. Working Paper 14, Agricultural and Rural Economics Department, Scottish Agricultural College, Aberdeen

Copus, A. (2010). New relationships between rural and urban areas in EU countries. Invited paper presented at the conference '*The territorial approach in agricultural and rural policies: An international review*'. Roma, Italy, 4-5.

Cromartie, J. & Swanson, L. (1996). *Defining metropolitan areas and the rural-urban continuum: a comparison of statistical areas based on county and sub-county geography* (No. 1486-2018-6794). Staff Reports 278801, United States Department of Agriculture, Economic Research Service. https://doi.org/10.22004/ag.econ.278801

Çakmak, Z., Uzgören, N. & Keçek, G. (2005). *Kümeleme analizi teknikleri ile illerin kültürel yapılarına göre sınıflandırılması ve değişimlerin incelenmesi*. Dumlupınar Üniversitesi Sosyal Bilimler Dergisi, 12, 15-36

Davoudi, S. & Stead, D. (2002). Urban-rural relationships: an introduction and brief history. *Built Environment, 28* (4), 269-277.

DoELG (2002). National Spatial Strategy for Ireland 2002-2020. In DoEaL (Ed.) *People, Places and Potential*, Dublin: Government, Stationery Office.

Errington, A.J. (1990). Rural employment in England: some data sources and their use. *Journal of Agricultural Economics, 41*, 47-61. https://doi.org/10.1111/j.1477-9552.1990.tb00618.x

European Commission. Committee on Spatial Development (1999). *ESDP-European Spatial Development Perspective: Towards Balanced and Sustainable Development of the Territory of the European Union: Agreed at the Informal Council of Ministers Responsible for Spatial Planning in Potsdam*. May. Office for Official Publications of the European Communities.

ESPON (2004). *Potentials for polycentric development in Europe*. Retrieved from: https://www.espon.eu/sites/default/files/attachments/fr-1.1.1_revised-full_0.pdf

EUROSTAT (2005). *Nomenclature of territorial units for statistics – NUTS*. Luxemburg: Eurostat.

Francini, M., Chieffallo, L. & Gaudio, S. (2021). Climate change as stressor in rural areas. *TeMA - Journal of Land Use, Mobility and Environment*, 53-71. https://doi.org/10.6093/1970-9870/7422

Gallego (2004). *Mapping rural/urban areas from population density grids, Institute for environment and sustainability*. JRC-EC, Roma: ISPRA. Retrieved form: http://81.47.175.201/urban_rural/documents/docs_others/Gallego_urban_rural.pdf.

Gao, Z. (2012). Development path of urban-rural integration. *Asian Agricultural Research, 4* (1812-2016-143392), 53-63.

Gløersen, E., Dubois, A., Copus, A. & Schurmann, C. (2006). Northern peripheral, sparsely populated regions in the European Union and in Norway. *Nordregio Report, 2006* (2).

Gulumser, A.A., Baycan Levent, T. & Nijkamp, P. (2011). Türkiye'nin kırsal yapısı: AB düzeyinde bir karşılaştırma. *İTÜDERGİSİ/a, 9* (2).

Haır, J.F., Anderson, R.E., Tatham, R.L. & Black W.C. (1998). *Multivariate Data Analysis*. Fifth Edition. New Jersey: Upper Saddle River.

Hadjimichalis, C. (2003). Imagining rurality in the new Europe and dilemmas for spatial policy. *European Planning Studies, 11* (2), 103-113. https://doi.org/10.1080/0965431032000072828

Harrington, V. & O'Donoghue, D. (1998). Rurality in England and Wales 1991: a replication and extension of the 1981 rurality index. *Sociologia Ruralis, 38* (2), 178-203. https://doi.org/10.1111/1467-9523.00071

Hodge, D.J. & Monk S. (1996) Redefining the rural development areas: the limits of spatial targeting. *Regional Studies, 30* (2), 207-214.

Hugo, G., Champion, A. & Lattes, A. (2003). Toward a new conceptualization of settlements for demography. *Population and Development Review, 29* (2), 277-297. https://www.jstor.org/stable/3115228

Ibery, B. (1981). Dorset agriculture. A classification of regional types. *Transactions of the Institute of British geographers*, 6, 214-227

Kostowicki, J. (1989). Types of agriculture in Britain in the light of types of agriculture map of Europe. *Geographia Polonica*, 56, 133-154.

Kunitsa, M.N. (2012) Typology of rural settlements in central Russia: demoecological aspect. *Reg Res Russia, 24*, 307-312

Labrianidis, L. (2006). Human capital as the critical factor for the development of Europe's rural peripheral areas. In T. de Noronha Vaz (Ed.), *The New European Rurality: Strategies for Small Firms*, 41-59.

Leavy A (1999) Urban morphology and the problem of the modern urban fabric: some questions for research. *Urban Morphology, 3* (2), 79-85

Li, Y., Long, H. & Liu, Y. (2015). Spatio-temporal pattern of China's rural development: A rurality index perspective. *Journal of Rural Studies*, 38, 12-26. https://doi.org/10.1016/j.jrurstud.2015.01.004

Long, H., Zou, J. & Liu, Y. (2009). Differentiation of rural development driven by industrialization and urbanization in eastern coastal China. *Habitat international, 33* (4), 454-462. https://doi.org/10.1016/j.habitatint.2009.03.003

Malinen, P., Keranen, R. & Keranen, H. (1994). *Rural area typology in Finland*. Oulu (WP 14) No:2014/3

Morrill, R., Cromartie, J. & Hart, G. (1999). Metropolitan, urban, and rural commuting areas: toward a better depiction of the United States settlement system. *Urban Geography, 20* (8), 727-748. https://doi.org/10.2747/0272-3638.20.8.727

Ocaña-Riola, R. & Sánchez-Cantalejo, C. (2005). Rurality index for small areas in Spain. *Social Indicators Research*, 73(2), 247-266. https://doi.org/10.1007/s11205-004-0987-3

Organisation for Economic Co-operation and Development (OECD) - Group of the Council on Rural Development (1993). *What future for our countryside? A rural development policy*. Paris: OECD.

Organisation for Economic Co-operation and Development (OECD) (1994). *Creating rural indicators for shaping territorial policy*. Paris: OECD.

Openshaw, S. (1985). Rural area classification using census data. *Geographia Polonica, 51*, 285–299

Öğdül H, Ulucay, H, Öngel S (2007). *Kent Çevresindeki Kırsal Alanlarda Değişim Biçimleri*, SOBAG-105K076, İstanbul.

Öğdül, H.G. (2010). Urban and rural definitions in regional context: A case study on Turkey. *European Planning Studies, 18* (9), 1519-1541. https://doi.org/10.1080/09654313.2010.492589

Pettersson, Ö. (2001). Microregional fragmentation in a Swedish county, *Papers in Regional Science, 80*, 389-409. https://doi.org/10.1007/PL00013630

Pinto-Correia T., Guerra C., Guimoar, N.G. & Ribeiro, S. (2014). Towards a new typology of rural Europe: integrating countryside consumption and protection in new modes of rural Occupance. *IALEEurope thematic workshop 2014: advances in spatial typologies: how to move from concepts to practice?* 4-5 July, Instituto Superior Tecnico, Lisbon.

Prieto-Lara, E. & Ocaña-Riola, R. (2010). Updating rurality index for small areas in Spain. *Social Indicators Research, 95* (2), 267-280. https://doi.org/10.1007/s11205-009-9459-0

Pirlone, F., Spadaro, I. & Candia, S. (2017). Metropolitan governance for territorial cohesion. *TeMA - Journal of Land Use, Mobility and Environment, 10* (2), 213-228. https://doi.org/10.6092/1970-9870/4956

Pızzolı, E. (2017). *Rural Development Indıcators for Regıons wıth Dıfferent Degrees of «Ruralıty»: A Statıstıcal Study*. Draft.

Pizzoli, E. & Gong, X. (2007). How to best classify rural and urban. In ponencia presentada en la *Fourth International Conference on Agriculture Statistics*, 22-24.

Plessis, V., Beshiri, R. & Bollman, R. (2001). *Definitions of "Rural"*. Ottawa: Statistics Canada.

Punj, G. & Stewart, D.W. (1983). Cluster analysis in marketing research: Review and suggestions for application. *Journal of Marketing Research*, 20 (2), 134-148. https://doi.org/10.2307/3151680

Raggi, M., Mary, S., Santini, F. & Paloma, S.G.Y. (2013). *A classification of European NUTS3 regions*. JRC85163. Luxembourg: Publications Office of the European Union.

Rogerson, P.A. (2001). *Statistical Methods for Geography*. London: Sage.

Scholz, J. & Herrmann, S. (2010). *Rural Regions in Europe. A new typology showing the diversity of European rural regions*. RUFUS Discussion Paper.

Scholz J. (2009). Rural regions in Europe - a new typology based on regional development potentials. *Conference ESEE*, 29 June-2 July, Ljubljana.

Tatlıdil, H. (1992). *Çok değişkenli istatistiksel analiz*. Ankara: Hacettepe Üniversitesi Yayınları. Ankara.

Timm, N.H. (2002). *Applied Multivariate Analysis*. New York: Springer.

Uchida, H. & Nelson, A. (2008). *Agglomeratıon index: towards a new measure of urban concentration, World Development Report, Reshaping economic geography*, Background paper. https://doi.org/10.1093/acprof:oso/9780199590148.003.0003

United Nations (1952). *Demographic Yerbook 1952*. New York. United Nations.

United Nations (1967). *Principles and Recommendations for the 1970 Population Census.* Statistical Papers Series, 44. New York: United Nations, Department of Economic and Social Affairs.

United Nations (1969). *Growth of the World's Urban and Rural Population, 1920-2000*. Population Studies, 44. New York: United Nations, Department of Economic and Social Affairs.

Vincze, M. & Mezei, E. (2011). The increase of rural development measures efficiency at the micro-regions level by cluster analysis. A Romanian case study. *Eastern Journal of European Studies*, *2* (1), 13.

Van Leeuwen, E. (2015). Urban-rural synergies: An explorative study at the NUTS3 Level. *Applied Spatial Analysis and Policy*, *8* (3), 273-289. https://doi.org/10.1007/s12061-015-9167-x.

Vidal, C., Eiden, G. & Hay, K. (2001). *Agriculture as a Key Issue for Rural Development in the European Union*. Rome: CAESAR.

Zheliazkov, G., Zaimova, D., Genchev, E. & Toneva, K. (2015). Cluster development in rural areas. *Economics of Agriculture*, 73-93. https://doi.org/10.5937/ekoPolj1501073Z

Image Sources

All figures are original produced by the authors for this paper.

Author's profile

Seda Özlü

Born in 1988 in Trabzon. She graduated from Karadeniz Technical University (Turkey), Department of Urban and Regional Planning in 2010. She completed her master's degree in 2014 and doctorate in 2022. She completed her master thesis titled "Rural Settlement Action Plan Creation Process: Trabzon/Salacik Village Experience" in 2014. The doctoral thesis of the author, is about the residential mobility. Her research interests are focused participatory planning, rural area planning, development of urban geography, housing and residential mobility. She continues her academic life in KTÜ Faculty of Architecture, Department of City and Regional Planning.

Sinem Dedeoğlu Özkan

She received her MA in Urban and Regional Planning from Karadeniz Technical University in 2015. She completed her doctorate in 2023. Her master's thesis is titled "A new method for determination of regional development level" and her doctare thesis is titled "Territorial- and network-based region dialectics in regional planning practice: A model proposal for the determination of the relational regions within the scope of 'the plan region". Her research interests include urban and regional planning, regional development, economic and social demography, networking. She continues her academic life in KTÜ Faculty of Architecture, Department of City and Regional Planning.

Dilek Beyazli

Born in 1977 in Istanbul. She graduated from Karadeniz Technical University, Department of Architecture in 1997. She completed his master's degree in 2000 and doctorate in 2005. In 2006, Dr. was appointed to the positions of Assistant Professor and in 2008 to Assistant Professors. She received the title of Associate Professor in 2012 and Professor in 2017. She continues her academic life in KTÜ Faculty of Architecture, Department of City and Regional Planning. She has completed a doctorate and 9 graduate studies under her consultancy and teaches undergraduate and graduate programs. She has urban design projects, architectural implementation projects, master plan experiences for public institutions and organizations. She has been appointed as Environmental Problems Application and Research Center, KTÜ Zero Waste Coordinator and KTÜ Master Plan Academic Coordinator and is currently the Vice Dean of the Faculty of Architecture and Head of the City and Regional Planning Department.

REVIEW NOTES – International Regulation and Legislation for the Energy Transition
Energy transition and renewable energy policies in Italy

Valerio Martinelli

Department of Civil, Architectural and Environmental
Engineering
University of Naples Federico II, Naples, Italy
e-mail: valerio.martinelli@unina.it
ORCID: https://orcid.org/0009-0007-8703-6573

Abstract
Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. This section of the Journal, Review Notes, is the expression of continuously updating emerging topics concerning relationships between urban planning, mobility and environment, through a collection of short scientific papers written by young researchers. The Review Notes are made of four parts. Each section examines a specific aspect of the broader information storage within the main interests of TeMA Journal. In particular, this section, International Regulations and Legislation for the Energy Transition, explores the challenges and opportunities in the urban context to understand the evolving landscape of the global energy transition. In this direction, the contribution of this review note examines contribution examines the role of cities in the energy transition, focusing on Italian and European policies and regulations, with particular attention to Renewable Energy Communities (RECs). It analyzes the Renewable Energy Directive II and its transposition in Italy, highlighting challenges and the need for coordination between urban and energy planning.

How to cite an item in APA format
Martinelli, V. (2024). Energy transition and renewable energy policies in Italy. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 357-362. http://dx.doi.org/10.6093/1970-9870/10941

1. Introduction

The energy transition is a crucial and complex process involving the transformation of traditional fossil fuel-based energy systems to sustainable and renewable systems. This change is closely linked to urban life, as cities are major centres of energy consumption. The interplay between cities, energy consumption and energy transition is essential to understanding the dynamics of this process. Cities play a crucial role in this transition: currently, more than half of the world's population lives in urban areas, and by 2030 nearly 60 per cent of the global population is expected to reside in cities (Staricco et al., 2020).

These occupy only 3 % of the earth's surface but are responsible for 60 to 80 % of global energy consumption and 75 % of carbon emissions (UN - United Nations Regional Center, 2022). This concentration of energy consumption and emissions makes cities a focal point for energy transition policies. With more than half of the global population living in urban areas, cities represent both a challenge and an opportunity for energy transition. The importance of the issue lies in the need to reduce CO_2 emissions, improve air quality and ensure a sustainable future for future generations (Lai et al., 2021). Cities, being large consumers of energy, can significantly influence energy supply and demand. Therefore, effective urban policies and spatial governance tools are crucial to drive this transition. This transition involves not only a technological transformation, but also an economic and social one, involving all sectors of society, especially cities that are at the centre of global energy consumption (Fasolino et al., 2020).

The energy transition is one of the main global goals that address challenges related to climate change, energy security, and sustainable development.

Energy transition in cities requires an integrated approach that considers not only the adoption of renewable energy sources, but also energy efficiency, sustainable mobility, smart resource management and active citizen participation (Magnani & Carrosio, 2021). Urban and spatial planning policies play a key role. Spatial government tools are essential to facilitate this transition. Urban planning must integrate sustainable energy policies, promoting energy efficiency in buildings, the use of renewable sources and the implementation of sustainable mobility infrastructure. Governance involving national, regional and local actors is crucial to coordinate efforts and overcome administrative barriers that often hinder renewable energy development (Mazzeo & Polverino, 2023).

In addition, active citizen participation and collaboration between public and private entities are essential to the success of energy transition initiatives (Carra et al., 2022). Efficient energy management, adoption of renewable sources, and implementation of smart technologies are essential tools for reducing the ecological footprint of urban areas. The current crisis requires the construction of a new model of social organization based on the production and consumption of energy from renewable sources, inspiring a more sustainable lifestyle and protecting the most disadvantaged users (Szulecki & Overland, 2020). In this context, Renewable Energy Communities (RECs), play a key role by promoting renewable energy production and consumption at the local level.

Cities, with their population density and economic activities, offer unique opportunities to implement innovative energy solutions such as RECs, which promote self-production and shared consumption of clean energy (Grignani et al., 2021). These initiatives not only contribute to emissions reduction, but also promote social cohesion and economic inclusion, transforming citizens from mere consumers to active players in energy production. Therefore, cities not only contribute to the problem but can also be part of the solution, becoming laboratories of innovation for energy sustainability (Gargiulo & Papa, 2021).

2. Transposition of the Renewable Energy Directive II in Italy

The energy transition is a key pillar of European Union (EU) environmental and climate policy, aimed at reducing greenhouse gas emissions, improving energy efficiency and increasing the use of renewable energy (D'Amico, 2024). In 2018, the EU adopted the Clean Energy for All Europeans Package (CEP), a set of measures

aimed at facilitating the transition from fossil fuels to renewable energy, setting ambitious targets such as achieving 32 percent of energy from renewable sources by 2030. One of the key instruments in this package is Directive (EU) 2018/2001, known as Renewable Energy Directive II (RED II). This directive not only sets binding targets for renewable energy at the European level, but also introduces Renewable Energy Communities (RECs) and requires member states to create regulatory frameworks that support their implementation (Candalise & Ruggieri, 2020). The transposition of RED II varies among member states due to different geographic, cultural, economic, and political conditions. Energy communities are defined as legal entities based on open and voluntary participation, independently managed by shareholders or members (Felice et al., 2022). These members, which can be individuals, small and medium-sized enterprises or local authorities, including municipal governments, must be located in the vicinity of renewable energy production facilities owned by the entity itself. The main objective of energy communities is to provide environmental, economic and social benefits to their members and the local areas in which they operate, rather than to generate financial profits (Martinelli, 2024). The concept of "Energy Communities" was introduced in Italy in 2017 with the Strategia Energetica Nazionale (SEN), adopted by the Ministry of Economic Development and the Ministry of the Environment. The SEN, influenced by the European Commission's Clean Energy for All Europeans Package, redefined the role of the consumer from passive to active, able to respond to price changes and provide grid services. The strategy identified the deployment of renewables, distributed generation, and the application of information technology to energy as key elements to foster self-consumption and active consumer participation in energy markets. In Italy, the energy transition is being driven by several regulations and initiatives aimed at promoting the use of renewable energy sources and improving energy efficiency (Errichiello & Demarco, 2020). Among these, the Piano Nazionale Integrato per l'Energia e il Clima (PNIEC) is a key tool, outlining the country's goals and strategies for 2021-2030. The PNIEC recognizes energy communities as a crucial element in Italy's energy transition, promoting policies and incentives that encourage their deployment and sustainable development (MASE, 2023). It was only with Decree Law No. 162/2019 (Decreto Milleproroghe), converted into Law No. 8/2020, that there was a first transitional transposition of the RED II Directive, introducing the concept of Renewable Energy Communities in Italy. Initially, Italian law strictly applied the RED II proximity concept, limiting the power of plants to 200 kW and requiring plants and members of RECs to be connected to the same secondary transformer substation (medium/low voltage). With Legislative Decree No. 199/2021, Italy took a further step toward full transposition of RED II, expanding the scope and size of renewable energy plants associated with RECs. The area of association was extended to the high/medium voltage cabin and the maximum power of plants was increased to 1 MW. The decree provided an incentive of 22 billion from the Piano Nazionale di Ripresa e Resilienza (PNRR) for municipalities with a population of less than 5,000, but implementation of the provisions had to wait until the Ministero dell'Ambiente e della Sicurezza Energetica (MASE) approved Decree Law 414/2023 (CER Decree) in November 2023 and published in January 2024. The decree provides total incentives of 5.7 billion euros, including a national feed-in tariff and a grant for small municipalities. Italy quickly transposed RED II, as the absence of a specific regulatory framework for collective initiatives to support Renewable Energy Communities and off-grid energy production and self-consumption modes made it advantageous for the Italian government to promptly implement Directive (EU) 2018/2001. However, the delay in the approval of the implementing decree has limited the large-scale deployment of RECs in Italy. In our country, the lack of a single and clear regulatory framework, slow permitting, and discrepancies between regional regulations are significant obstacles to achieving the EU energy transition goals set by the European Union. Specifically, the lack of coordination between spatial government and energy planning continues to hinder the achievement of the energy transition goals defined by the European Union. In addition, the need for technical and managerial skills for RECs management is a barrier for many small municipalities. However, with updated incentive mechanisms and

simplifications in the issuance of permits for renewable energy installations, significant growth in CERs is expected in the coming years (Legambiente, 2023).

3. Energy transition and governance of urban and territorial transformation

The European Union has outlined ambitious energy transition goals aimed at reducing carbon emissions and promoting the use of renewable energy. To achieve these goals, it is crucial to integrate the management of urban and spatial transformation with energy planning. Such integration not only improves energy efficiency but also facilitates the implementation of Renewable Energy Communities (RECs), which are essential for promoting sustainability and social equity. Urban and energy planning must be conceived as interconnected aspects. Cities, responsible for 65 % of global energy consumption and 70 % of CO_2 emissions, represent key areas for implementing the transformations needed to address the climate crisis (La Rocca & Fistola, 2014). Effective integration of these aspects enables the creation of resilient, efficient and sustainable cities, reducing carbon emissions and improving citizens' quality of life. In Italy, this integrated approach is crucial to reduce carbon emissions, improve energy efficiency, and promote collective self-consumption through RECs. These communities not only reduce emissions, but also incentivize active community participation, mitigating energy poverty and improving social equity. Concrete examples in Italy demonstrate how RECs can be tools for local development, bringing significant economic and social benefits. At the national level, there are specific challenges, such as the need for an appropriate regulatory framework and the lack of necessary infrastructure, that hinder the implementation of RECs. However, local governments also need to improve policies to promote energy efficiency and mitigate energy poverty. The decentralization process has stimulated an activism of regional and local governments, which has been crucial in promoting positive local energy strategies. Energy planning in Italy has undergone a significant evolution, characterized by a shift from centralization to decentralization of powers. With Law No. 10/1991, Italian regions acquired a key role in planning and managing energy policies, promoting the rational use of energy, energy conservation and the development of renewable sources at the local level. This decentralization has allowed energy policies to be better tailored to local needs, while creating tensions between different levels of government. In recent decades, the Italian government has introduced several reforms to incentivize renewable energy, including the Bersani Decree in 1999 and incentives for photovoltaics and other renewables in the 2000s. However, institutional fragmentation and complex permitting procedures have slowed the growth of renewable energy. Today, Italian energy policy is characterized by a complex system of interactions among various institutional actors at different levels of government. Although coordination mechanisms such as the State-Regions Conference exist, significant challenges remain, including slow permitting procedures and the lack of a uniform regulatory framework. RECs can take a leading role in accelerating the energy transition by supporting bottom-up practices and increasing the social acceptability of new installations. To achieve energy transition goals, obstacles such as restrictive building codes and lengthy permitting procedures must be overcome. In addition, greater coordination between energy and land-use planning policies is essential for integrating RECs into urban development projects. Despite the difficulties, significant opportunities exist. European directives such as the Clean Energy for All Europeans Package provide a favorable legislative framework and incentives for the development of RECs. The Piano Nazionale di Ripresa e Resilienza (PNRR) and other European programs provide funds to support the deployment of RECs. Collaboration between public and private entities, supported by a stable regulatory framework, is key to overcoming regulatory and technical barriers, fostering stakeholder mobilization and active citizen involvement. Integration of urban planning with energy planning is essential to promote sustainable urban development and achieve energy transition goals. In Italy, despite regulatory and operational challenges, there are opportunities offered by European support policies and funds that can foster the deployment of RECs. A coordinated approach that involves all local stakeholders and promotes the active participation of communities is essential. This integrated approach not only facilitates the implementation of

RECs, but also promotes sustainable urban development, improving architectural and landscape quality and contributing to urban regeneration. In sum, overcoming existing barriers through regulatory simplification, financial support, and cross-sector collaboration can enable Italy to move more rapidly toward a sustainable energy future, in line with European Union goals.

References

Candelise C, Ruggieri G. (2020). Status and Evolution of the Community Energy Sector in Italy. *Energies, 13* (8):1888. https://doi.org/10.3390/en13081888 Blazquez, J., Fuentes, R., & Manzano, B. (2020). On some economic principles of the energy transition. *Energy Policy, 147*, 111807. https://doi.org/10.1016/j.enpol.2020.111807

Carra, M., Rossetti, S., Tiboni, M., & Vetturi, D. (2022). Urban regeneration effects on walkability scenarios. *TeMA - Journal of Land Use, Mobility and Environment,* 101-114. https://doi.org/10.6093/1970-9870/8644

Colasante, A., D'Adamo, I., & Morone, P. (2022). What drives the solar energy transition? The effect of policies, incentives and behavior in a cross-country comparison. *Energy Research & Social Science, 85,* 102405. https://doi.org/10.1016/j.erss.2021.102405

D'Amico, A. (2024). Strategies and instruments for active mobility: comparison of international experiences. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 155-167. https://doi.org/10.6093/1970-9870/10771

Di Nucci, M.R., Prontera, A. (2023). The Italian energy transition in a multilevel system: between reinforcing dynamics and institutional constraints. Z *Politikwiss 33,* 181–204. https://doi.org/10.1007/s41358-021-00306-y European Commission.

Errichiello, L., & Demarco, D. (2020). From social distancing to virtual connections. *TeMA - Journal of Land Use, Mobility and Environment*, 151-164. https://doi.org/10.6092/1970-9870/6902

European Commission Directorate General for Energy. Clean Energy for All Europeans Package; European Commission Directorate General for Energy; Publications Office of the European Union: Luxembourg, 2019.

Fasolino, I., Grimaldi, M., & Coppola, F. (2020). The paradigms of urban planning to emergency-proof. *TeMA - Journal of Land Use, Mobility and Environment,* 165-178. https://doi.org/10.6092/1970-9870/6912

Felice, A.; Rakocevic, L.; Peeters, L.; Messagie, M.; Coosemans, T.; Ramirez Camargo, L. (2022). Renewable energy communities: Do they have a business case in Flanders? *Appl. Energy,* 322, 119419.

Gargiulo, C., & Papa, R. (2021). Chaos and chaos: the city as a complex phenomenon. *TeMA - Journal of Land Use, Mobility and Environment, 14* (2), 261-270. https://doi.org/10.6093/1970-9870/8273

Grignani A, Gozzellino M, Sciullo A, Padovan D. (2021). Community Cooperative: A New Legal Form for Enhancing Social Capital for the Development of Renewable Energy Communities in Italy. *Energies 14* (21):7029. https://doi.org/10.3390/en14217029

Fistola, R., & La Rocca, R. A. (2014). New technologies for sustainable energy in the smart city: the WET theory. *TeMA - Journal of Land Use, Mobility and Environment, 7* (1), 29-42. https://doi.org/10.6092/1970-9870/2267

Lai, S., Isola, F., Leone, F., & Zoppi, C. (2021). Assessing the potential of green infrastructure to mitigate hydro-geological hazard. *TeMA - Journal of Land Use, Mobility and Environment*, 109-133. https://doi.org/10.6093/1970-9870/7411

Legambiente. (2023). Comuni Rinnovabili, available at: https://www.legambiente.it/wp-content/uploads/2023/06/Comuni-Rinnovabili-2023.pdf

Mazzeo, G., & Polverino, S. (2023). Nature-based solution for climate change adaptation and mitigation in urban areas with high natural risk. *TeMA - Journal of Land Use, Mobility and Environment, 16* (1), 47-65. https://doi.org/10.6093/1970-9870/9736

Ministero dell'Ambiente e della Sicurezza Energetica. (2023). Piano Nazionale Integrato per l'Energia e il Clima, available at: https://www.mase.gov.it/sites/default/files/PNIEC_2023.pdf

Magnani, N., & Carrosio, G. (2021). Understanding the energy transition. In Springer eBooks. https://doi.org/10.1007/978-3-030-83481-4

Martinelli, V. (2024). New trends in energy transition policies: citizens' involvement in the European energy market. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 147-153. https://doi.org/10.6093/1970-9870/10772

United Nations (2022). World Economic and Social Survey 2022: Frontier Technologies for Sustainable Development. New York.

Sarrica, Mauro, Fulvio Biddau, Sonia Brondi, Paolo F. Cottone, and Bruno M. Mazzara. (2018). A multi-scale examination of public discourse on energy sustainability in Italy: empirical evidence and policy implications. *Energy Policy 114*:444–454. https://doi.org/10.1016/j.enpol.2017.12.021.

Staricco, L., Brovarone, E. V., & Scudellari, J. (2020). Back from the future. A backcasting on autonomous vehicles in the real city. *TeMA - Journal of Land Use, Mobility and Environment, 13* (2), 209-228. https://doi.org/10.6092/1970-9870/6974

Szulecki, K., & Overland, I. (2020). Energy democracy as a process, an outcome and a goal: A conceptual review. *Energy Research & Social Science, 69*, 101768.

Author's profile

Valerio Martinelli

He is an engineer, with a master's degree in building Engineering-Architecture at the Department of Civil, Architectural and Environmental Engineering of the University of Naples Federico II. He is currently a first year Ph.D. student in Civil Systems Engineering at the same department. His research activity focuses on the study of Renewable Energy Communities.

TeMA
Journal of
Land Use, Mobility and Environment

REVIEW NOTES – Urban strategies, programmes and tools

Strategies and instruments for active mobility: European overview

Annunziata D'Amico

Department of Civil, Architectural and Environmental
Engineering
University of Naples Federico II, Naples, Italy
e-mail: annunziata.damico@unina.it
ORCID: https://orcid.org/0009-0005-5481-8064

Abstract

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. This section of the Journal, Review Notes, is the expression of continuously updating emerging topics concerning relationships between urban planning, mobility and environment, through a collection of short scientific papers written by young researchers. The Review Notes are made of four parts. Each section examines a specific aspect of the broader information storage within the main interests of TeMA Journal. In particular, the Urban strategies, programmes and tools section presents the different strategies and tools for active mobility implemented internationally.

The purpose of this review is to provide an overview of the instruments and strategies implemented in Europe to encourage active mobility. In addition, some solutions to promote active transport implemented in several European cities have been reported. These initiatives represent an opportunity for European communities to act in a necessary, indispensable and continuous process of improving urban mobility in the direction of environmental sustainability.

These measures, enhanced by dedicated tools such as SUMPs, promote behavioral change and support mobility planning, setting active mobility as a winning strategy to improve city life and urban efficiency.

Keywords

Walking; Cycling; Europe; Urban strategies; Urban tool.

1.   The European commitment to sustainable mobility

The cities of the future must be designed for people, with modern and sustainable transport infrastructure that can meet the needs of an increasing urban population, which must connect to places and people, and access services and opportunities.

Although at a more measured pace than in the past, urbanization is inexorably advancing throughout the world, including Europe. In 2021, almost 75% of EU inhabitants lived in urban settings, including cities, towns and suburbs, and this share is set to increase (Eurostat, 2022), and the increase in urbanization also involves changes in the way people move and thus new paradigms of mobility.

Thanks to the European Green Deal (EGD) and the Sustainable and Smart Mobility Strategy (SSMS), the EU is at the forefront of the fight against climate change, with the ambitious goal of reducing greenhouse gas emissions in the transport sector by 90% by 2050, compared to 1990 levels (EC, 2022).

The SSMS, presented by European Commission (EC) in 2021, putting European transport on track for the future, pursuing three main objectives: 1) *Sustainable Mobility;* 2) *Smart Mobility;* 3) *Resilient Mobility* (Fig.1).
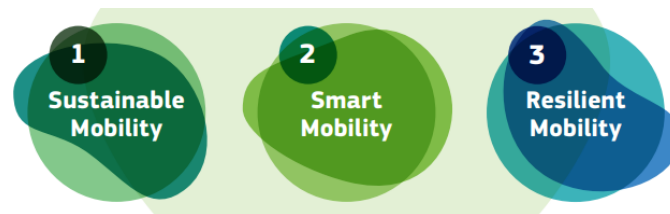

Fig.1 Objectives of the European "Sustainable and Smart Mobility Strategy"

These strategies outline the path for a more robust and sustainable European transport system that can overcome future crises. In addition, new technologies and innovations can help shape and create the conditions for profound changes in mobility policies and models.

"As set out in the 2030 climate target plan, increasing the modal shares of collective transport, walking and cycling, as well as automated, connected and multimodal mobility will significantly lower pollution and congestion from transport, especially in cities and improve the health and well-being of people" (EC, 2020).

The seamless multimodality made possible by digital solutions is crucial in urban and suburban areas, so innovative solutions are being strengthened, such as the integration of different transport services into a service accessible on demand, known as "Mobility as a Service", MaaS (D'Amico, 2023a).

For a zero emissions future, in addition to investing in technologies, a collective commitment is required, which also requires a profound transformation of individual and social behavior (Martinelli, 2024).

Active mobility modes like walking and cycling, which are low-cost and emission-free ways to get around, can bring a variety of benefits to society, including decarbonizing transportation, reducing air and noise pollution, alleviating congestion, and improving health.

In the framework of the EU for urban mobility, a boost to the promotion of sustainable mobility and more on a human scale (rather than a car) came mainly with the introduction of the Sustainable Urban Mobility Plan (SUMP) an instrument presented within the EU's Efficient and Green Mobility Package of 2021 (D'Amico, 2024).

A particular emphasis on the promotion of active travel modes, such as walking and cycling are also specified within the updated concept of SUMP, published in March 2023 as part of Commission Recommendation on national SUMP support programmes.

An important step forward for the promotion of active mobility in Europe is also taken with the proposal for a revised trans-European transport (TEN-T) network Regulation published in December 2021. The proposal introduces the figure of cycle corridors within the TEN-T network, proposes integration with multimodal urban nodes, the promotion of charging infrastructure for electric vehicles (such as bicycles, scooters and e-scooters) and the establishment of dedicated funding for active mobility.

Active mobility is a priority for the European Union and also its road safety policy, "Vision Zero" (reducing road deaths by 2050), plays an important role in its promotion; in fact, "Vision Zero" focuses on vulnerable road users, such as pedestrians and cyclists, in all aspects of the "safe system" approach.

The EU also supports research and several funding programmes for the implementation of the European Green Deal in various sectors, from energy, transport and digital; among the funding involving active mobility, there are for example: "European Structural and Investment Funds (ESIF)", and the "Horizone Europe" and "LIFE" programmes. These funds support a wide range of interventions, to create a sustainable and healthy European economy and environment.

In addition to these general programmes, the European Commission support initiatives and campaigns to raise awareness of sustainable mobility. In February 2023, the European Parliament adopted a resolution on the development of an EU Cycling Strategy, which has been concretized in the "European declaration on cycling" (2024) which serves as a strategic compass for existing and future European policies and initiatives relating to cycling. An annual event that sees more and more participants is the "EUROPEANMOBILITYWEEK" the European Commission's awareness campaign on sustainable urban mobility; this event promotes behavioral change in favour of active mobility, public transport and other clean and intelligent transport solutions.

These initiatives represent an opportunity for European cities to act in a necessary process, indispensable and continuous improvement of urban mobility in the direction of environmental sustainability combined with local economic growth and the quality of life of cities.

The implementation of these policies, together with other Community acts, can help to create a safer, sustainable and accessible transport system for all European citizens.

2. Active mobility measures undertaken in European cities

By setting clear priorities and implementing concrete measures, European cities, including through the SUMP tool, are taking action to promote a more sustainable and resilient urban mobility, favoring the promotion of active modes.

There are several measures and initiatives put in place by different cities to plan new urban developments in order to prioritize soft mobility. Surely the most widespread investment is in dedicated infrastructure, creating networks of safe and comfortable bike paths and pavements, pedestrian areas and limited traffic areas, reducing architectural barriers; among the prerogatives of some cities there is also to promote active mobility and at the same time enhance and redevelop existing urban areas (D'Amico, 2024; D'Amico, 2023b; Pellicelli et al., 2022).

Active mobility is an important opportunity for European cities to become more sustainable, liveable and humane. In a European ranking of 2022, Helsinki established itself as the city with more space for pedestrians and cyclists, with a score of 69%. Amsterdam and Copenhagen follow closely with 64% and 63% respectively (Statista Research Department, 2023).

Amsterdam is considered one of the most bike-friendly cities in the world and thanks to the many bike paths the city has an extensive and well-connected network so most citizens usually travel by bike. The city of Copenhagen has also invested heavily in creating infrastructure for active mobility, with over 400 km of bike paths, a very efficient bike-sharing system, and also boasts one of the best multimodal public transport systems in the world (known for affordable rates and wide opening hours). Granada is another exemplary model of European city on a human scale, where pedestrian mobility is valued and promoted as a healthy and sustainable lifestyle; this is confirmed by the "Pan-European evaluation and classification of the city on urban mobility for livable cities" (2022) where it is the city with the highest percentage of pedestrian street network (57.6%).

The goal of European countries is to encourage a change in the mobility habits of citizens by making urban spaces more friendly for pedestrians and cyclists. The following are some solutions for the promotion of active

transport implemented in different European realities; the measures vary from city to city, depending on the characteristics of the territory, the context, the needs of citizens and the objectives defined in the various planning instruments.

Madrid – SPAIN

Fig.2 "BiciMAD" the electric bike sharing system in the city of Madrid

Madrid, the capital and most populous city of Spain, is promoting public transport and active mobility in a bid to reduce air pollution and heavy car traffic. The city is fighting for a more sustainable mobility and to respect the limits of polluting emissions imposed by the EU through the "*Madrid 360 Strategy*", presented in September 2019.
The main objective of the Strategy is to define a series of objectives and measures to reduce the emissions of the city of Madrid, taking into account the needs of mobility and social, economic and territorial development, maintaining "at all times a global vision (360º) and long-term" (Madrid 360, 2019).
The city aims to cut greenhouse gas emissions by 65% by 2030 and achieve climate neutrality by 2050, establishing itself as a pioneer in the ecological transition.
The city of Madrid is doing its part to locate the European Green Deal, through plans to turn the city into a low-emission zone and to promote micro mobility and shared mobility.
In 2022, the Spanish capital approved the final text of the "*Madrid 360 Sustainable Mobility Plan*", its new Sustainable Urban Mobility Plan (PUMS) that defines the framework for the development of the city's mobility policies until 2030.
More and better public transport is a key component of the PUMS which plans to expand the network of priority lanes for buses and the metro network. The city also started the first free electric bus lines in the city: the "Zero Lines" (zero emissions, zero costs for users) (Eurocities, 2021).
The Plan devotes ample space to active mobility, as 35 km of new bike lanes are planned by 2050, supported by 20,000 parking spaces for bicycles and personal mobility vehicles. Micromobility will be enhanced through the implementation of 300 micromobility hubs and, at the same time, the city's electric bike sharing system, "BiciMAD", will be expanded to 10,000 bicycles. Additionally, Madrid is implementing low-emission zones, the whole city will be declared a LEZ (Low Emission Zone) in 2025 (CIVITAS, 2024). These developments, together with other measures, bring the city closer to its climate goals, while promoting sustainable mobility and public transport.

Paris – FRANCE

Fig.3 Map of Paris "Plan Vélo 2021-2026"

The bicycle is a means of transport that Parisians have long been adopting. The pandemic allowed the City to test policies and interventions that directly address issues of transport emissions, noise pollution, and public health, all the while creating infrastructure that is more reflective of the needs of its people.

Starting in 2014 with the "Plan vélo 2015-2020", the city of Paris launched a massive and unprecedented investment plan to facilitate the use of bicycles. In fact, between 2014 and 2021, 300 km of cycle paths and 52 kilometers of temporary routes were set up ("pop-up" lanes created during the pandemic), bringing the Paris cycle network to more than 1,000 km in length.

To amplify the transformation of the city in favor of cycling, Paris committed in 2021 to a new phase that took shape with the new "*Plan Vélo 2021-2026*" which aims to make the city of Paris 100% cycle-friendly. This ambition translates into concrete actions on several fronts, including the strengthening of infrastructure dedicated to bicycles, the creation of safe parking and the modernization of the cycling system in the entire metropolitan area (Plan Vélo-Ville de Paris, 2021).

The "*Plan Vélo 2021-2026*" provides for the construction of 130 km of new slopes and 52 km of temporary tracks made permanent; it is also promoted the guarantee of a secure parking through the installation of more than 100000 racks, in private and public spaces (especially near stations and intermodal points).

The city's political commitment is aimed at reshaping streets and public spaces for the needs of people rather than cars. In fact, by 2026, the City plans to reclaim one out of every two on-street parking spaces for new trees, playgrounds, and bike and shared mobility facilities.

Paris won the 2023 Sustainable Transport Award (STA) for the city's innovative efforts to promote inclusive and active mobility, expand cycling and pedestrian infrastructure, and reclaim urban space for public use (ITDP, 2023).

Sofia – BULGARIA

Fig.4 The "Green Ring" Project of Sofia

Sofia is the capital and largest city of Bulgaria, with 1.26 million inhabitants. Being in the center of the Balkan Peninsula, it is halfway between the Black Sea and the Adriatic Sea. It is the fastest growing city in Bulgaria, attracting considerable numbers of commuters and daily tourists.

The city of Sofia continued growth and development, however, puts pressure on its transport infrastructure, as well as undermining its liveability.

To address these challenges, in 2019, the City Council adopted the *Sustainable Urban Mobility Plan* (SUMP) which aims to reduce congestion and transform the city's mobility by making it more ecological and sustainable. The strategic document for the period 2019-2035 responds to 4 main requirements:
- Eco-friendly;
- Realistic;
- Financially secured;
- Measurable.

To promote active mobility choices, the city has planned a series of investments to make walking and cycling alternatives feasible and attractive. In this regard, the PUMS has provided for better maintenance of pedestrian paths (with the priority resurfacing of pavements near schools, hospitals, markets, administrative buildings and cultural institutions), an expansion of the cycle network (which goes from the current 55.5 km to 160 km by 2025) and the activation of electric bicycle rental services (Sofia City PUMS, 2019).

Among the key projects of the PUMS is the "Green Ring", a 30 km green ring consisting of a park and a bike path that surrounds the city center. The park will be used by about 250,000 people and will connect 30 neighborhoods, helping to improve the active mobility of the entire city (EU Urban Mobility Observatory, 2023a).

In order to further improve the conditions for walking and cycling, parking rates will be further increased, public transport (bus, tram and metro) will be improved and shared mobility will be encouraged.

In addition, the city developed the "Sofia Coin mobile app" that measures the distance traveled using active modes, measure the emissions saved for each trip and reward virtuous users with free tickets for public transport and discounts for other micromobility services.
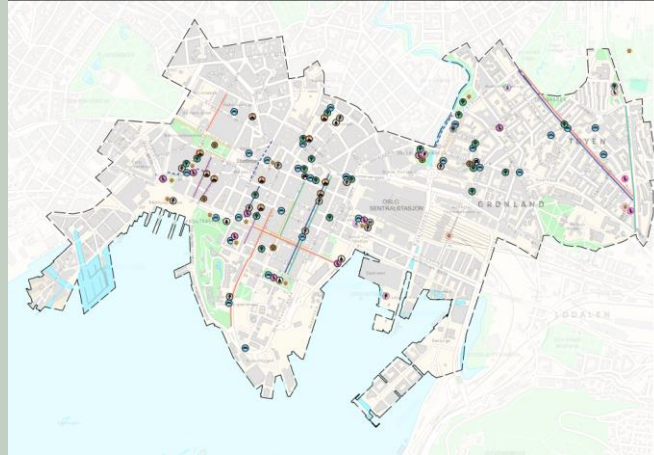
Oslo – NORWAY

Fig.5 Delimitation of the area of the "Car-free Liveability Program" of Oslo, with mapping of implemented measures in the period 2017 - April 2022

Oslo's population is one of the fastest growing in Europe, with an increase of 30% since 2000. With a current population of 680,000 and another 30% increase in population expected by 2040, the city intends to implement measures that will manage the impact of this growth on the environment and climate. Norway is not part of the European Union, but is part of the European Economic Area (EEA) and shares many rules with EU Member States.

In 2014, the survey "Public Space Public Life" (PSPL) found that, despite its compact structure, several urban areas needed improvement in terms of connectivity and usability, especially with regard to pedestrian and cycling mobility and the quality of the spaces themselves (EU Urban Mobility Observatory, 2021).

In response to these challenges, Oslo kicked off the "*Car-free Liveability Program*" to turn the city into a greener, more vibrant and inclusive place, aiming to drastically reduce traffic and private car space in the city centre.

The initial intention of the program to ban the central area of the city to most vehicles, met with opposition mainly from businesses; for this reason, the city has made its approach more gradual by aiming to have as few vehicles as possible in the city center.

In phase one of the "*Car-free Liveability Program*", on-street parking spaces were removed within the central Ring 1 and so were some parking spaces in surrounding areas, to introduce measures that encourage liveability and pedestrianism (temporary and permanent): such as playgrounds, green areas and street furniture (such as benches, water taps, public toilets). In the following phases of the programme, the changes to the traffic routes were implemented further, imposing some closures of central roads, increasing the pedestrian network and cycle paths.

Meanwhile the City Council of Oslo, in 2018, commenced the implementation of its "Action Plan for increased City Life 2018-2027", which provided the strategic orientation for the implementation of the "*Car-free Liveability Program*" and the city's zoning plan, which was adopted in 2019 (EU Urban Mobility Observatory, 2021).
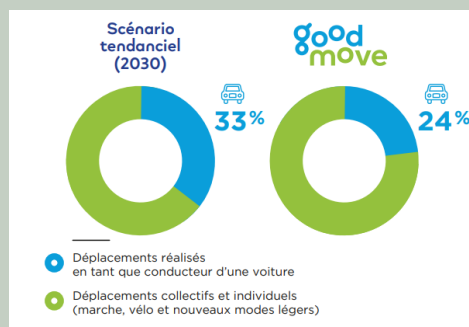
Brussels – BELGIUM

Fig.6 Ambition of the "Goog Move" Plan to reduce the movements that take place with individual motorised vehicles in Brussels

Brussels-capital region is home to 1.2 million inhabitants, residing in 19 different municipalities in the region. Centrally located in Belgium, the region attracts a significant number of daily commuters from the large metropolitan area, which includes about 2.5 million people, or 20% of Belgian inhabitants. Often labelled "the capital of Europe", Brussels is home to many EU institutions, attracting economic and political actors and an international workforce (EU Urban Mobility Observatory, 2020).

"*Good Move*" is the Regional Mobility Plan (2020-2030) for the Brussels-Capital Region (BCR), approved in 2020 by the Brussels Government. It defines the main political orientations in the field of mobility. The aim of this plan is to improve the living environment of the people of Brussels, while supporting the demographic and economic development of the Brussels-Capital Region.

"*Good Move*" won the prestigious 8th European SUMP Award (Sustainable Urban Mobility Plan) awarded in 2020 as part of the annual competition of the European Commission on the topic "Safe Walking and Cycling" (Bruxelles Mobilité, 2021).

This plan is the result of a wide-ranging four-year participatory process involving all stakeholders in Brussels: mobility and institutional partners, municipalities, the economic and associative world as well as citizens. "*Good Move*" adopts a transversal approach to mobility, with an action plan divided into six focus:

- *Good Neighbourhood:* to regulate mobility in neighbourhoods and improve the quality of life of residents;
- *Good Network:* organising transport networks and ensuring efficient service;
- *Good Service:* to offer the inhabitants and users of the Region a range of integrated services;
- *Good Choice:* guiding individual and collective choices without harming the freedom of each individual;
- *Good Partner:* ensure partnership governance of the mobility plan;
- *Good Knowledge:* update mobility data and regularly evaluate the Good Move plan.

These focuses embody the transversality of the chosen approach and involve a concomitant implementation in order to achieve the expected results. From these six "focus" have emerged 50 action sheets, a true programmatic tool for controlled mobility in the Brussels-Capital Region.

One of the first actions delivered by "*Good Move*" was to introduce a default region-wide speed limit of 30 km/h, with only a few exceptions for the main traffic arteries (EU Urban Mobility Observatory, 2023b).

The aim of the plan is to reduce the proportion of car journeys from one third to one quarter (Fig.1) and thus to encourage the majority use of active modes for short (walking) and medium-distance journeys (cycling and micro-mobility); and public transport, to ensure that they take on a larger part of the medium (5 km to 10 km) and long (more than 10 km) journeys (Bruxelles Mobilité, 2021).

3. Conclusion

In recent years, as part of a broader commitment to public health and urban liveability cities are working to take measures to reduce socio-spatial inequalities, pollution and vehicular congestion, at the same time promoting pedestrian and cycling mobility (D'Amico, 2024). At the same time, the European Union encourages and helps cities to develop policies aimed at achieving EU objectives regarding the fight against climate change and the creation of an efficient and sustainable transport system; it does so through funding and various integrated strategies and policies to address the set of environmental and urban challenges that affect cities as a whole. Action at EU level, as well as the mobilisation of European resources, can make a significant contribution to supporting local, regional and national initiatives.

Sustainable Urban Mobility Plans (SUMPs) are a driving force for European urban mobility policy, providing a framework for innovation and integration of new mobility services with low environmental impact, to accelerate the transition to zero-emission, sustainable and intelligent mobility. The shift from vehicle-based mobility to bicycle-based and walking-based mobility has many benefits for individuals and society at large, improving the health, environment, safety and liveability of cities. Many European cities, as highlighted in this study, are investing in walking and cycling, encouraging the creation of sustainable infrastructure such as cycle paths, pedestrian lanes and pedestrian areas, which in turn improve the quality of urban spaces. These measures, enhanced by dedicated tools such as SUMPs, promote behavioral change and support mobility planning, setting active mobility as a winning strategy to improve city life and urban efficiency.

References

Bruxelles Mobilité (2021). Good Move. Plan régional de mobilité 2020-2030 of the Brussels-Capital Region. Retrieved from: https://mobilite-mobiliteit.brussels/sites/default/files/2021-04/goodmove_FR_20210420.pdf

D'Amico, A. (2023a). New frontiers for sustainable mobility: MaaS (Mobility as a Service). *TeMA - Journal of Land Use, Mobility and Environment, 16* (2), 455-460. http://dx.doi.org/10.6093/1970-9870/10039

D'Amico, A. (2023b). Urban spaces and pedestrian mobility: the role of urban design for enhancing walkability. *TeMA - Journal of Land Use, Mobility and Environment, 16* (3), 639-644. Retrieved from: http://dx.doi.org/10.6093/1970-9870/10327

D'Amico, A. (2024). Strategies and instruments for active mobility: comparison of international experiences. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 155-167. http://dx.doi.org/10.6093/1970-9870/10771

EC (2020). Sustainable and Smart Mobility Strategy – putting European transport on track for the future. COM/2020/789 final. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0789

EC (2022). Study on New Mobility Patterns in European Cities. Task A: EU Wide Passenger Mobility Survey. Retrieved from: https://transport.ec.europa.eu/system/files/2022-12/2022%20New%20Mobility%20Patterns%20in%20European%20Cities%20Task%20A%20Executive%20summary.pdf

EU Urban Mobility Observatory (2020). Brussels: promoting walking and cycling as a priority in urban mobility. Retrieved from: https://urban-mobility-observatory.transport.ec.europa.eu/resources/case-studies/brussels-promoting-walking-and-cycling-priority-urban-mobility_en?prefLang=it

EU Urban Mobility Observatory (2021). Oslo – Promoting Active Transport Modes. Retrieved from: https://urban-mobility-observatory.transport.ec.europa.eu/resources/case-studies/oslo-promoting-active-transport-modes_en?prefLang=it&etrans=it

EU Urban Mobility Observatory (2023a). Sofia's SUMP 2019-2035: Addressing Urban Mobility Challenges. Retrieved from: https://urban-mobility-observatory.transport.ec.europa.eu/resources/case-studies/sofias-sump-2019-2035-addressing-urban-mobility-challenges_en?prefLang=it

EU Urban Mobility Observatory (2023b). Brussels City 30 – changing the mobility model for a calmer city with safe roads and less noise. Retrieved from: https://urban-mobility-observatory.transport.ec.europa.eu/resources/case-studies/brussels-city-30-changing-mobility-model-calmer-city-safe-roads-and-less-noise_en?prefLang=it

Eurocities (2021). Cycling and walking – Madrid on the move. Retrieved from: https://eurocities.eu/latest/cycling-and-walking-madrid-on-the-move/

Eurostat (2022). Urban-rural Europe – introduction. Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=587819

ITDP (2023). Paris, France Honored with the 2023 Sustainable Transport Awar. Retrieved from: https://itdp.org/2023/01/10/paris-2023-sustainable-transport-award/

Madrid 360 (2019). Avance de la Estrategia de Sostenibilidad Ambiental-Madrid-360. Retrieved from: https://www.madrid360.es/wp-content/uploads/2021/09/Avance-Estrategia-Sostenibilidad-Ambiental-Madrid-360_baja.pdf

Martinelli, V. (2024). New trends in energy transition policies: citizens' involvement in the European energy market. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 147-153. http://dx.doi.org/10.6093/1970-9870/10772

Pellicelli, G., Rossetti, S., Caselli, B. & Zazzi, M. (2022). Urban regeneration to enhance sustainable mobility. *TeMA - Journal of Land Use, Mobility and Environment*, 57-70. https://doi.org/10.6093/1970-9870/8646

Plan Vélo-Ville de Paris (2021). Paris 100% cyclable. Plan Vélo 2021-2026. Retrieved from: https://cdn.paris.fr/paris/2021/11/18/80f9fd1e6d5012e0a4a9820bd6adfd56.pdf

Statista Research Department (2023). Leading cities in Europe scored by the availability of space for people walking and cycling in 2022. Retrieved from: https://www.statista.com/statistics/1405935/european-cities-ranked-by-space-for-people-walking-and-cycling/#statisticContainer

Image Sources

Fig.1: https://transport.ec.europa.eu/document/download/4610b81e-452e-40c8-a7ed-5ab0c9cfe074_en?filename=mobility-strategy-factsheet.pdf;

Fig.2: https://www.bicimad.com/;

Fig.3: https://www.paris.fr/pages/un-nouveau-plan-velo-pour-une-ville-100-cyclable-19554;

Fig.4: https://sofiaplan.bg/portfolio/zelen-ring/;

Fig.5: https://www.oslo.kommune.no/byutvikling/bilfritt-byliv-2016-2023/#gref;

Fig.6: https://mobilite-mobiliteit.brussels/sites/default/files/2021-04/goodmove_FR_20210420.pdf.

Author's profile

Annunziata D'Amico

She is an engineer, Ph.D. student in Civil Systems Engineering at Department of Civil, Architectural and Environmental Engineering of University of Naples Federico II. Currently, her Ph.D. research concerns the topic of MaaS and soft mobility in urban systems for children, to encourage walkability and more sustainable and active mobility.

TeMA

REVIEW NOTES – Urban Practices

Global warming or global warning? A review of urban practices for adaptation to extreme heat

Stella Pennino

Department of Civil, Architectural and Environmental
Engineering
University of Naples Federico II, Naples, Italy
e-mail: stella.pennino@unina.it
ORCID: https://orcid.org/0009-0008-4439-0078

Abstract

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. This section of the Journal, Review Notes, is the expression of continuously updating emerging topics concerning relationships between urban planning, mobility and environment, through a collection of short scientific papers written by young researchers. The Review Notes are made of four parts. Each section examines a specific aspect of the broader information storage within the main interests of TeMA Journal. In particular, the Urban Practices section aims at presenting recent advancements on relevant topics that underline the challenges that the cities have to face. This note provides an overview of the challenges that global warming poses and the risks in terms of climate change that it generates for territories and cities, with a specific focus on the extreme heat phenomenon. The challenges that adaptation to extreme heat events commonly faces are outlined, and a brief review of international case studies is carried out. Finally, the results of the review are discussed highlighting some key threads of extreme heat events adaptation practices and three significant examples of adaptation in urban areas are reported, within a perspective of integration and sharing of know-how on the topic.

How to cite an item in APA format

Pennino, S. (2024). Global warming or global warning? A review of urban practices for climate adaptation to extreme heat. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 373-381. http://dx.doi.org/10.6093/1970-9870/10949

1. Introduction

With each passing month, in line with the IPCC predictions, global temperatures continue to rise, setting new and increasingly critical records. According to the Copernicus Climate Change Service bulletin, January 2024 was the hottest January ever recorded. The analyses carried out by the European monitoring service on global surface air and sea temperatures, sea ice cover and hydrological variables confirm the continuing upward trend, keeping global warming at the top of the list of threats to the stability of communities, ecosystems and global balances also for 2024 (Copernicus Climate Change Service, 2024). As set out in the previous review note of this series, in fact, temperature increases are determining factors in altering the climate, interfering with natural weather cycles, and in doing so exacerbating pre-existing conditions of vulnerability and inequality at a global level, leading to a real political and social crisis: the climate crisis (European Environment Agency, 2024).

The extreme climatic hazards triggered by climate change are multiple, different in nature and in the effects they produce. Each of these requires specific independent assessments, evaluations of their mutual correlation, and consequent adaptation strategies that are targeted, effective, and capable of being integrated into existing urban planning practices and adaptation to other pressing climate hazards. Building resilience to contain the risks for inhabitants, businesses and infrastructures deriving from the impact of climate change represents a challenge for local planners and public decision-makers (Palermo et al., 2024).

In the previous note of this series, a review of several European climate change adaptation case studies was conducted, the analysis of which, although limited and not exhaustive, allowed the identification of some prevailing threads of action on the basis of the climate impacts or the sector concerned. Five categories were identified: extreme temperatures, extreme rainfall and flooding, drought and alteration of ecosystems due to extreme heat, physical and psychological human health and the spread of dangerous viruses and invasive species, and finally governance measures (Pennino, 2024). In their conciseness, these five categories constitute a useful framework for schematising and unifying the analysis of adaptation strategies to complex climatic phenomena, bringing their study back to the monitoring of two naturally variable causes: water sources and temperature variations, and their respective effects on three sectors: ecosystems and biodiversity, human beings, and the governance of the aforementioned systems.

As a prosecution of this analysis, this review note aims to deepen the investigation of case studies of urban practices of adaptation to climate change, focusing however on examples related to extreme temperatures and their impacts on the different subsystems mentioned. Adaptation to climate change and the need to deal with its impacts pose in evidence how important it is to identify and implement new planning practices that integrate these profiles into land-use policymaking (Isola et al., 2024).

2. Adaptation to extreme heat

Extreme heat events or so-called "heat waves" when they persist more than two following days can be defined as periods that are much hotter than usual for the time of year and the area where they take place (Eltahir & Krol, 2022), and are characterised by stagnant warm air masses and consecutive nights with high minimum temperatures (Luber & McGeehin, 2008). Climate change models and statistics developed so far show a correlation between climate change and the frequency and intensity of extreme heat events, increasing the risk associated with the phenomenon and making the measures to be taken in this regard more urgent (U.S. Environmental Protection Agency, 2016). Indeed, these phenomena constitute a major risk to human health, being the first cause of weather-related deaths in the United States (NOAA's National Weather Service, 2023) and a prevalent cause in many other countries. In addition to this, extreme heat also poses a threat to infrastructures such as roads and power lines (Cybersecurity & Infrastructure Security Agency, n.d.), constitutes a risk factor for energy security, as increased energy consumption for air-conditioning causes an increase in demand and also affects production costs (Center for Climate Change and Health, 2016), can

damage or kill crops and livestock, and contributes to natural disasters such as droughts and wildfires (European Commission, n.d.).

Due to some compounding factors, extreme heat is a prominent risk in urban environments. There are in fact two factors that exacerbate the phenomenon in these areas:

— The first is the urbanization rate; this in fact has an impact on the so-called "urban heat island" phenomenon, a state that increases the perceived temperature and, depending on the morphology of cities, prevents the dissipation of the hot air masses that characterise periods of extreme heat.

— The second is the ageing of the population; this demographic trend, combined with the concentration of the population in urban areas, implies a greater concentration of people vulnerable to these phenomena precisely in urban areas, requiring even more effective and targeted strategies in these areas.

Urbanization has a great effect on the change in land cover and urban planning is the most relevant decision-making process affecting urban land covers (Dinç & Gül, 2021). Moreover, the multidisciplinary nature of the issue highlights how reducing the phenomenon of urban heat islands also leads to an improvement in the energy efficiency of urban settlements (Gaglione & Ania, 2021).

The less visibly evident nature of this type of climatic phenomena sometimes causes little public recognition and even underreporting of their effects, making them a silent killer (Luber & McGeehin, 2008). In recent years, however, interest in this type of phenomena has increased significantly, and several cities around the world have put in place adaptation measures such as increasing urban greenery, increasing the albedo of urban roofing and pavement surfaces, financial support programmes for low-income people, public health strategies, monitoring tools, communication campaigns, public cooling shelters, and in the most virtuous cases a combination of these strategies through the drafting of actual Heat Response Plans. A research group of the University of Oxford published in 2021 a systematic heat-specific review of implemented actions, reporting on the state of the art of implemented extreme heat adaptation actions. From their results, they found that in the more developed high-income countries extreme heat is mainly treated as a health issue and with particular reference to urban areas, while in low- and middle-income countries adaptation strategies focus more on agriculture and livelihood impacts, often including related phenomena such as drought (Turek-Hankins et al., 2021).

Strategies for adapting to extreme heat are therefore diverse and differentiated according to geographical region and national income, and there is currently a substantial body of literature on the subject and collections of case studies. From a comparative study of review papers on the topic, and of various repositories of case studies, it was possible to identify leading threads of extreme heat adaptation, and the organisations and fields that support and guide each of these.

3. A review of case studies

Climate change is a global issue, affecting all regions of the world but impacting each one in different ways, depending on pre-existing conditions. As such, at the global level, UN-sponsored organisations and programmes are at the forefront in funding and implementing adaptation strategies and actions. Through a complex bureaucracy of bodies, organisations, conventions and frameworks, the United Nations is engaged in producing reports and guidelines that can guide countries to implement locally targeted adaptation actions. In addition, they directly promote the actions carried out in lower-income countries, thus having organisations that operationally follow up on the design and implementation of adaptation actions worldwide.

Among the many outcomes of this UN-coordinated work is the Adaptation Knowledge Portal of the United Nations Framework Convention on Climate Change, an online resource of the UNFCCC Knowledge-to-Action Hub for Climate Adaptation and Resilience (also called as the Nairobi work programme (NWP)). This repository collects and makes available numerous knowledge resources on climate change adaptation such as tools, documents, methodologies and an extensive collection of case studies. This portal brings together many of

the projects carried out by large organisations (Wetlands International, International Union for Conservation of Nature, etc.), NGOs (WWF, Conservation International, etc.) and international organisations (UNDP, UNESCO, etc.). In terms of adaptation to extreme heat, in accordance with the results of the review by Turek-Hankins et al. (2021), this platform brings together most of the adaptation actions carried out in low-income countries. Thus, these case studies focus on adaptation in terms of agriculture and cultivation, and the maintenance of local livelihoods and livability for the inhabitants of global areas that are heavily impacted by rising temperatures and that previously showed higher levels of vulnerability.

At the opposite end of the spectrum, numerous international networks have sprung up to collect and connect the experiences of higher-income areas, focusing especially on cities that, due to their concentration of activities and people, are particularly relevant to the climate change issue, both on the side of causes and mitigation, and on the side of consequences and adaptation. One of the most famous and influential networks is C40, which brings together the experiences of the world's largest cities engaged in climate action. In 2021, C40 published a report on Urban Heat & Equity, reporting on the experiences of the 12 cities in the C40 Cool Cities Network. This report brings together case studies of cities with very different social and geographic characteristics and stands out because it links the issue of adaptation to extreme heat with that of spatial justice or climate justice. In fact, the case studies in this report are a remarkable resource for analysing the relationship between the socio-demographic characteristics of a city and its geographical and ecosystemic characteristics, for the development of plans and strategies for adapting to extreme heat that are integrated, multifaceted, just and inclusive.

A third specialist source of case studies, halfway between the two previous examples, is the repository of Case Studies and Heat Action Plans of the Global Heat Health Information Network, an independent international forum of scientists, practitioners and policy makers focused on improving the capacity to protect populations from the avoidable health risks of extreme heat in the context of climate change. This network of practitioners, funded by the WHO and WMO among other institutions, has a clearly defined strategy of action organised in 5 pillars, ranging from capacity building to monitoring services up to communication and outreach. In fact, the case studies reported by this organisation stand out for the integrated approach they present, being characterised as multi-focus interventions that integrate principles and good practices of climate change adaptation, comprehensively improving the health of the people they address.

In order to provide a multi-faceted overview of case studies, one has been extrapolated from each of the cited repositories.

2.1 Coping with drought and climate change (CwDCC) in Mozambique
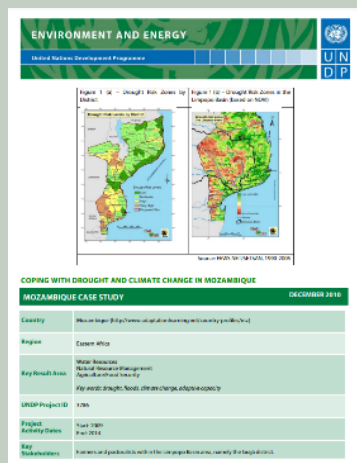
Mozambique is one of the poorest countries in the world and it is also frequently affected by natural disasters. Recent natural disasters have included droughts over consecutive years, alternated with severe flooding. The current coping strategies the communities use during the droughts are not adapted to the environmental changes, but often lead to further environmental degradation. To address vulnerability in the agriculture sector, the project is developing and piloting a range of coping mechanisms to enhance food security and the capacity to adapt to climate change in agricultural and pastoral systems. The aim of the project is to reduce vulnerability to drought in farming and pastoral communities by diversifying agricultural production to cope with changed climatic conditions. More specifically, the Mozambique CwDCC project will reduce drought vulnerability in farming and pastoral communities by guaranteeing water supply and through training the local communities to grow drought-resistant crops, like sweet potato, cassava or sorghum. The project will also help improve the communication lines to make weather forecast and climate information available to communities. Moreover, the project will address water supply issues through construction of water harvesting cisterns.

Organization: UNDP – United Nations Development Programme

Source: UNDP Climate Change Adaptation Portal, UNFCCC Adaptation Knowledge Portal; 2024

Retrieved from:
https://www4.unfccc.int/sites/NWPStaging/Pages/item.aspx?ListItemId=23200&ListUrl=/sites/NWPStaging/Lists/Main
DB&SearchId=86801ab1-b396-d2f8-2c74-f76687b61550, https://www.adaptation-undp.org/projects/coping-drought-and-climate-change-cwdcc-mozambique

2.2 How does your city integrate inclusivity and equity in planning and delivering heat actions? The Mexico City case study

The Government of Mexico City has developed the "Green Infrastructure Master Plan" whose goal is to reconnect the Conservation Land and Natural Protected Areas, with the urban land; to provide the city and its inhabitants with green spaces for multiple environmental, social and cultural purposes, and to contribute to the mitigation and adaptation to climate change. This plan includes four main programmes:
1) Designing of Parks;
2) Socio-Environmental Restoration of Conservation Areas;
3) River Sanitation;
4) Green Challenge.
Its aim is to protect, conserve, and build new green areas around the city, focusing on the city's marginalised zones.
Designing of parks is an effort between SEDEMA, the Water System (SACMEX, in Spanish) and the Public Works and Services Ministry (SOBSE, in Spanish). Its aim is to protect, conserve, and build new green areas around the city, focusing in the city's marginalised zones.
To select those areas a regionalisation (mapping) of Mexico City was done. The criteria to do it were the type of climate, type of soil, type of vegetation, land use, habitability index. The habitability index measures the population's access to health, transportation, job, education, services. Areas with a less habitability index are those where it is needed to pay more attention to provide services. Then these criteria were crossed with geological, hydro-meteorological, and chemical-technological risks. The final criterion crossed was the accessibility to green areas. With this information the areas to build green areas were selected, taking into account free space to do it.
The goals of the programme included:
- Expanding and improving green areas per citizen;
- Revegetation of the city;
- Building green spaces for recreation and enjoyment of citizens;
The selection of vegetation to be used in each park was made considering its potential and contribution to environmental services such as soil conservation and improvement, humidity regulation, heat island mitigation, rainwater infiltration, carbon capture, pollinator attraction, biodiversity, among other aspects, which also considers comfort parameters and the application of new technologies to improve the environment. Until now, the city has rehabilitated 11 parks of 16 for example Xochimilco Ecological Park, National Canal Linear Park or Grand Canal Linear Park.

The local community is involved to be part of those changes in their area in order to appropriate, enjoy and take care of the green spaces.
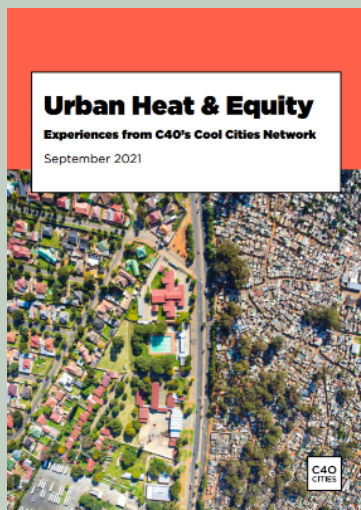
Organization: The Government of Mexico through its Ministry of Environment (SEDEMA) with the Water System (SACMEX) and the Public Works and Services Ministry (SOBSE)

Source: Urban Heat & Equity, Experiences from C40's Cool Cities Network; September 2021

Retrieved from: https://www.c40knowledgehub.org/s/article/Urban-Heat-and-Equity-Experiences-from-C40s-Cool-Cities-Network?language=en_US

2.3 AI for Resilient Cities: bringing together technology and community outreach for heat-health interventions in India

Figure 7 Empowering Women in Understanding Heatwaves and Climate Change

This intervention deals with using AI to provide early warning of heatwaves and developing and disseminating early warnings to vulnerable populations. In India, most vulnerable communities do not have access to either information about the occurrence of these events, or the understanding of risk from current warnings. This lack of useful information inhibits pre-emptive and potentially life-saving action.

SEEDS, in partnership with Microsoft, has developed the AI for Resilient Cities model. The AI for Good Lab research program has been funded primarily by Microsoft. The model leverages weather datasets (e.g., temperature patterns, built-up roof type classification, vegetation cover, water bodies) and high-resolution satellite imagery to identify areas at high risk of heatwaves. SEEDS uses the AI generated maps to find high risk homes, prioritize outreach for early warning and preparation, and demonstrate the significance of heat risks to locals (since many residents underestimate the danger that they face). Furthermore, early heatwave warning allows healthcare providers to take proactive measures to protect public health, reducing the overall burden of heatwaves on the healthcare system and leading to more climate-resilient cities. Evidence based outreach also allows SEEDS to implement long term heat mitigation interventions such as: monitoring temperature and humidity through Automatic Weather Stations (AWS), infrastructure interventions such as cool roofing strategies and water supply point repair, heatwave preparedness and response, including the establishment of cooling centers and the distribution of heat-health advisories.

Once the AI tool has identified the households at risk, SEEDS begins outreach to prepare for the upcoming heatwave and implement solutions. Approximately 2,500 volunteers from the local community have been engaged by SEEDS thus far. The outreach program has included the following activities: mobilizing some 40 women as community leaders to lead door to door awareness campaigns, training frontline workers, including 13 traffic police officers, 247 civil defense officers, 154 Anganwadi workers, and 32 ASHA workers, training of some 60 community volunteers in communication skills to effectively educate and engage the community, educating over 6,100 students about climate change and heatwaves, creating posters for the beat the heat campaign to ensure widespread awareness of heatwave risks and precautions. Besides the community, SEEDS partnerships also extend to government organizations and agencies who focus on climate resilience, heat and health.

The existing framework for the AI for Resilient Cities program exhibits high scalability potential because of its community centric design, so the program can easily be tailored to suit diverse cultural, social, and geographical contexts. By combining data driven modelling with community engagement and low cost, sustainable interventions, it offers a holistic approach to climate adaptation.

Organization: Sustainable Environment and Ecological Development Society (SEEDS)

Source: Global Heat Health Information Network; 2023

Retrieved from: https://ghhin.org/resources/ai-for-resilient-cities-bringing-together-technology-and-community-outreach-for-heat-health-interventions-in-india/, https://climahealth.info/resource-library/ai-for-resilient-cities-bringing-together-technology-and-community-outreach-for-heat-health-interventions-in-india/

4. Considerations from case studies

Extreme heat is an inevitable climatic hazard that will occur more and more frequently and intensely due to climate change. The assessment of the intensity of the occurrence though, and the development of the coping

strategies, are not easy due to the complexity of the phenomenon. It is indeed strictly tied to the level of urbanization of the area, to the locally pre-existing conditions of vulnerability, and among this occurrence the socio-demographic situation of the specific community affected.

A wide range of targeted measures are now well established as effective solutions to extreme heat assessment, prevention or coping mechanisms like monitoring systems, increase of urban surfaces albedo or urban greening, and heat wave support procedures for the elderly. Due to the intrinsic complexity of climate change itself though, single specific and targeted actions can sometimes risk to not effectively integrate in the broader pre-existing context, lowering the level of success of the whole strategy.

The three case studies reported from the different repositories have been specifically selected for the broader vision that characterises them.

The first case study integrates a strategy aimed at reducing the vulnerability of the agri-pastoral system of the region together with reducing the vulnerability of the community affected by the natural threat and having to actively deal with it. This example offers a good practice of capacity building, and it manages to jointly deal with the environmental and the social aspect of the phenomenon, and by doing so it also strengthens the economic system both on the side of the products and of the producers. This intervention is also an example of ecosystem-based adaptation. In order to be effective and long-lasting, adaptation interventions must be developed accordingly to the natural, social and historical characteristics of the target area, in order to well integrate into it, last during time, and obtain the maximum possible outcome in terms of ecosystem services provided. Ecosystem Services are crucial elements for human well-being, and despite their inclusion in urban plans, there are still issues to address requiring innovative research approaches and trajectories to explore for planning the ecological and digital transition of cities (Moraci et al., 2024).

The second case study integrates planning of parks and greenery with the provision of services to the population. It particularly stresses on two key concepts of effective adaptation: to be local-based, in fact it is accurately designed on the technical side to take advantage of the particular characteristics of the soil and the area identified; and to engage the community, developing a sense of attachment and cure which will also encourage further preservation of the area. This second example also represents a sustainable intervention, as it is designed to concurrently cope with environmental and social needs, also optimizing the use of economic resources while dealing with extreme heat and other extreme climate events at the same time.

The third case study is a comprehensive good practice. It involves the use of the most recent technologies, therefore implementing the now well-established extreme heat monitoring systems with AI, with the community engagement and capacity building. This practice stresses the great helpfulness, but insufficiency, of technologies and ICT systems, that must always be integrated with appropriated training of the operators, engagement and sensibilisation of the citizens, all with a great care towards inclusivity and the empowerment of less regarded social categories, in this case women.

This brief overview on the state of the art of adaptation to extreme heat and the presentation of three different case studies collects the main actual trends and underlines some key concepts that will be central in the effective implementation of climate change adaptation interventions. Raising awareness in the civil population is a first common need to increase effectiveness, sharing, and support given to the implemented action. The targeted training of all the operators involved, the volunteers, the community leaders is also a key factor as it increases the positive outcomes of the actions implemented and becomes a key element of the capacity building, strengthening the skills of the locals and reducing their vulnerability to the climatic threat. Pertinent communication is also a clue element, it is needed to inform the citizens, to further raise awareness, and it needs to be differentiated depending on the population target of the communication. Finally, a strong reliance on the characteristics of the single area, both in terms of environment, culture, people and economy is always the base for an effective climate change adaptation intervention.

References

AI for Resilient Cities: bringing together technology and community outreach for heat-health interventions in India - ClimaHealth. (2023). ClimaHealth. https://climahealth.info/resource-library/ai-for-resilient-cities-bringing-together-technology-and-community-outreach-for-heat-health-interventions-in-india/

Vetter, R., Heneghan, Y., Campbell, K. & Miranda Morel, L. (2021). *Urban Heat and Equity: Experiences from C40's Cool Cities Network.* C40 Cities Climate Leadership Group https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q0000001m0C/UH.Uwdodmkuhirqzhb_8WDS1m0vbUjFllIC7jpvRaJk

Copernicus: In 2024, the world experienced the warmest January on record. (2024, February 8th). Copernicus Climate Change Service. https://climate.copernicus.eu/copernicus-2024-world-experienced-warmest-january-record

Center for Climate Change ad Health. (2016). *Extreme Heat, Climate Change and Health*. https://climatehealthconnect.org/wp-content/uploads/2016/09/ExtremeHeat.pdf

Cybersecurity & Infrastructure Security Agency (CISA). *Extreme Heat.* CISA. https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/extreme-weather-and-climate-change/extreme-heat

Dinç, G. & Gül, A. (2021). Estimation of the future land cover using Corine Land Cover data. *TeMA - Journal of Land Use, Mobility and Environment, 14* (2), 177-188. http://dx.doi.org/10.6092/1970-9870/7671

European Commission. *Consequences of climate change*. Climate Action. https://climate.ec.europa.eu/climate-change/consequences-climate-change_en

Eltahir, E. & Krol, A. (2022). Extreme Heat. *MIT Climate Portal.* https://climate.mit.edu/explainers/extreme-heat

European Environment Agency (2024). European Climate Risk Assessment: Executive Summary. In *eea.europa.eu*. Publications Office of the European Union. https://doi.org/10.2800/204249

Gaglione, F. & Ania, A. E. D. (2021). Resilience as an urban strategy: The role of green interventions in recovery plans. *TeMA - Journal of Land Use, Mobility and Environment, 14* (2), 279-284. http://dx.doi.org/10.6092/1970-9870/8054

Global Heat Health Information Network. (2024). *AI for Resilient Cities: bringing together technology and community outreach for heat-health interventions in India | Global Heat Health Information Network*. Global Heat Health Information Network. https://ghhin.org/resources/ai-for-resilient-cities-bringing-together-technology-and-community-outr each-for-heat-health-interventions-in-india/

Isola, F., Lai, S., Leone, F. & Zoppi, C. (2024). Integrating climate change adaptation into municipal masterplans through Strategic Environmental Assessment. A case study concerning Sardinia. *TeMA - Journal of Land Use, Mobility and Environment*, (1), 61-78. http://dx.doi.org/10.6093/1970- 9870/10438

Luber, G. & McGeehin, M. (2008). Climate change and extreme heat events. *American Journal of Preventive Medicine*, *35*(5), 429–435. https://doi.org/10.1016/j.amepre.2008.08.021

Moraci, F., Bevilacqua, C. & Pizzimenti, P. (2024). Planning the Transition of Cities. Innovative research approaches and trajectories. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 109-127. http://dx.doi.org/10.6092/1970-9870/10430tema

NOAA's National Weather Service. *Weather related fatality and injury statistics*. https://www.weather.gov/hazstat/

Palermo, A., Chieffallo, L. & Virgilio, S. (2024). Re-generate resilience to deal with climate change. A data driven pathway for a liveable, efficient and safe city. TeMA - Journal of Land Use, Mobility and Environment, Special Issue 1(2024) 11-28. http://dx.doi.org/10.6093/1970-9870/9969

Pennino, S. (2024). Global warming or global warning? A review of urban practices for climate change adaptation in Europe. *TeMA - Journal of Land Use, Mobility and Environment*, 17 (1), 169-177. http://dx.doi.org/10.6093/1970-9870/10784

Turek-Hankins, L. L., De Perez, E. C., Scarpa, G., Ruiz-Diaz, R., Shwerdtle, P. N., Joe, E. T., Galappaththi, E. K., French, E. M., Austin, S. E., Singh, C., Siña, M., Siders, A. R., Van Aalst, M. K., Templeman, S., Nunbogu, A. M., Berrang-Ford, L., Agrawal, T. & Mach, K. J. (2021). Climate change adaptation to extreme heat: A global systematic review of implemented action. *Oxford Open Climate Change*. https://doi.org/10.1093/oxfclm/kgab005

UNDP. (n.d.). *Coping with Drought and Climate Change (CwDCC) in Mozambique*. UNDP Climate Change Adaptation Portal. https://www.adaptation-undp.org/projects/coping-drought-and-climate-change-cwdcc-mozambique

UNFCCC. *Coping with Drought and Climate Change, Mozambique*. UNFCCC Adaptation Knowledge Portal. https://www4.unfccc.int/sites/NWPStaging/Pages/item.aspx?ListItemId=23200&ListUrl=/sites/NWPStaging/Lists/MainDB& SearchId=86801ab1-b396-d2f8-2c74-f76687b61550

UNFCCC. Adaption Knowledge Portal. https://www4.unfccc.int/sites/nwpstaging/Pages/Home.aspx

C40 Knowledge Hub. *Urban Heat and Equity: Experiences from C40's Cool Cities Network.* (2021). https://www.c40 knowledgehub.org/s/article/Urban-Heat-and-Equity-Experiences-from-C40s-Cool-Cities-Network?language=en_US

U.S. Environmental Protection Agency (EPA) & Centers for Disease Control and Prevention (CDC) (2016). *Climate Change and Extreme Heat: What You Can Do to Prepare*. EPA & CDC. https://www.epa.gov/sites/default/files/2016-10/documents/extreme-heat-guidebook.pdf

Author's profile

Stella Pennino

She is an engineer and Ph.D. student in Civil Systems Engineering at the Department of Civil, Architectural and Environmental Engineering of the University of Naples Federico II. Her research activities concern adaptation of the urban environment to climate change-related hazards and vulnerability measures, with the aim of mainstreaming sustainability in urban planning decision-making.

REVIEW NOTES – Urban planning literature review

Exploring approaches and solutions for urban safety: a focus on childhood

Tonia Stiuso

Department of Civil, Architectural and
Environmental Engineering
University of Naples Federico II, Naples, Italy
e-mail: tonia.stiuso@unina.it
ORCID: https://orcid.org/0009-0006-2474-8138

Abstract

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. This section of the Journal, Review Notes, is the expression of continuously updating emerging topics concerning relationships between urban planning, mobility, and environment, through a collection of short scientific papers written by young researchers. The Review Notes are made of five parts. Each section examines a specific aspect of the broader information storage within the main interests of TeMA Journal. In particular, the Urban planning literature review section presents recent books and journals on selected topics and issues within the global scientific panorama.

For the second issue of TeMA Journal volume no. 17, this section provides a comprehensive overview of the challenges and solutions related to child-friendly safe cities, using a variety of scientific sources and practical resources to illustrate effective approaches and innovative strategies. This contribution aims to examine these challenges and the solutions proposed in the scientific literature, specifically in books, journals, and reports.

How to cite an item in APA format

Stiuso, T. (2024). Exploring approaches and solutions for urban safety: a focus on childhood. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (2), 383-389. http://dx.doi.org/10.6093/1970-9870/10939

1. Introduction

The safety and well-being of vulnerable people, like children, women and elders, in the urban environment is a complex challenge that requires a holistic and multidimensional approach (Stiuso, 2024), as it is influenced by multiple factors, including community violence, road safety and the condition of urban parks. Children's perceived vulnerability to the danger posed by strangers and concerns about the misbehaviour of some adolescents have contributed to the consolidation of the idea that public spaces are meant for adults. Policies that restrict children's participation in public spaces reinforce and reflect the common belief that such spaces belong to adults (Valentine, 1996). Community violence is a widespread problem, especially in urban areas, and children and adolescents are the most affected. For example, one survey found that 36% of high school students in New York City had experienced threats of physical harm in the last school year (O'Donnell et al., 2002). Children living in urban environments marked by community violence develop resilience mechanisms through family support, community resources and social relationships, demonstrating a remarkable capacity to adapt despite adversity. Road safety for children is crucial and requires safe infrastructure, educational campaigns and traffic policies that protect young pedestrians, considering that the design of safe urban spaces, where children can move freely, is fundamental to their development and well-being. However, public policies and parental concerns often limit children's autonomous mobility and independence, reflecting growing anxiety about safety, even though risks have decreased compared to the past. A paradigm shift is therefore needed to integrate children's perspectives into more balanced and inclusive safety policies, highlighting the importance of listening to their voices to develop safer communities and more effective policies (Bessell, 2015). In recent years, studies have proposed a methodological analysis that takes into account all urban characteristics, and to assess safety in urban public parks, several factors such as infrastructure, surveillance and accessibility are analysed (Gargiulo & Papa, 2021). This approach allows us to identify areas for intervention in parks and all public spaces, providing precise indications for making them safer and more welcoming (Abdelfattah, 2022). Moreover, children's perception of safety and subjective well-being varies significantly in different contexts and on different scales (home, school, neighbourhood, country). Therefore, cultural and socio-economic factors that influence perceived safety and, consequently, the way children live in the urban context should also be examined, as this is a crucial factor for the well-being of citizens. Fear of traffic is the main reason for restrictions on children's independent mobility, leading to a reduction in their play space and time spent unsupervised (Hillman et al., 1990). Freedom of movement, considered a fundamental human right (Pellicelli, 2022), is rarely recognised in national policies concerning children; it is therefore essential to listen to and value children's experiences in order to develop safe environments and allow them to grow independently, contributing to their overall development. Only in this way will it be possible to create public spaces that not only protect children, but also foster their growth and well-being (González-Carrasco et al., 2018). It should also be added that policies restricting the movement of children reflect public concerns about child safety that emerged at the beginning of the 20th century and have become increasingly widespread. As public perceptions of risk increased, local policymakers were forced to take preventive and precautionary measures to ensure the well-being and safety of their citizens (Beck, 2009).

Urban safety for children mainly concerns the physical characteristics of public environments, playgrounds and schools, rather than a subjective perception of safety, which belongs more to parents or legal guardians. Indeed, children perceive an environment as unsafe not so much because of the possibility of acts of violence, but rather because of its conformation and state of decay (Carra, 2022; Mischo, 2024). It is essential to consider children's perspectives when designing spaces, not only to ensure their physical safety, but also to understand which aspects influence their perception of safety. Furthermore, creating spaces that are perceived as safe even for parents or legal guardians allows children to live with greater independence and freedom, as their movements depend largely on adult decisions.

2. Agreements and strategies developed at international level

The relevance of children's freedom of movement is a topic of growing international interest. While Article 12 of the International Covenant on Civil and Political Rights (ICCPR) recognises the right to freedom of movement as fundamental, the United Nations Convention on the Rights of the Child (UNCRC) gives children the right to freedom of expression and information (Articles 12 and 13), freedom of thought, conscience and religion (Article 14) and freedom of association (Article 15), freedom of movement is not addressed. At the national level, in a number of countries, policies regarding the movement of children are generally restrictive rather than facilitative. (Boetti, 2021). The lack of recognition of children's freedom of movement in international conventions is a significant gap that requires urgent attention from international organisations and governments worldwide. It is essential to adopt appropriate policies and measures to ensure adequate global well-being and development for all children, enabling them to realise their full potential and contribute meaningfully to society (Honorati & Ferraris, 2021). Some countries have adopted policies that facilitate children's freedom of movement, such as Finland, where the idea that children have the right to play freely outdoors and explore their environment is actively promoted. This perspective promotes children's cognitive and social development. In Japan, the culture of walking to school alone is widespread, which enables children to acquire autonomy and responsibility from a young age (Ruşitoru, 2023). In contrast, in countries such as the United States and Australia, restrictive policies have restricted children's freedom of movement, with negative consequences on their well-being and development. These different experiences highlight the importance of facilitative policies that allow children to explore and interact with their environment, contributing to their physical, emotional and cognitive development (Rams et al., 2022).

2.1 Sustainable Development Goals (2015)

The Agenda 2030 through its Sustainable Development Goals, highlights the vulnerability of children and the need to invest in their lives, survival and development. It commits to ensuring an educational environment that enables children to fully realise their rights and capacities (Agenda 2030). The Agenda also recognises children as agents of change, offering them a platform to fulfil their potential (Agenda 2030). The Goals call on cities to consider the interests of vulnerable groups, including children. For example, Target 11 promotes public and green spaces that foster interactions between generations and social cohesion, encouraging a sense of belonging. Specifically, Target 7 states that by 2030, governments should ensure "universal access to safe, inclusive and accessible green and public spaces, particularly for women, children, older people and people with disabilities".

2.2 New Urban Agenda (2016)

The New Urban Agenda promotes a safe, healthy and inclusive urban environment by improving road safety and involving children in dialogue with local stakeholders (The New Urban Agenda - Habitat III, 2016). The New Urban Agenda is a document that encapsulates the shared vision for a better and more sustainable urban future. It was adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in Quito, Ecuador, on 20 October 2016 and was endorsed by the United Nations General Assembly during the sixty-eighth plenary meeting of its seventy-first session on 23 December 2016 (Child-responsive Urban Policies, Laws and Standards: A Guidance | UN-Habitat).

2.3 Habitat III Children's Charter (2016)

The New Urban Agenda is supported by the Habitat III Children's Charter, which calls for the inclusion of children in urban affairs for their well-being. This document fills a gap in urban development, providing tools for legislators, politicians, urban planners and academics to create child-sensitive urban policies and standards.

It focuses on methodologies, data collection, participation and involvement of children. The document is structured as follows: Chapter I introduces the context, purpose and child rights-based approach. Chapter II discusses regulatory standards and policies, emphasising children's participation as a human right. It presents the legal obligations of authorities to facilitate children's participation in urban decision-making processes. Chapter III focuses on urban planning and social services. Chapter IV provides examples of national and sub-national urban policies, demonstrating how to integrate children's rights into legislation. Finally, the paper concludes with recommendations for child-friendly urban policies, laws and standards (Children's Assembly and Charter - Historic First at United Nations Habitat III Conference, 2016).

2.4 The United Nations Convention on the Rights of the Child (1989)

The right of children to express opinions, be heard and have their needs considered is fundamental, not a privilege. This right, along with non-discrimination, survival, development and the best interests of the child, is enshrined in the UN Convention on the Rights of the Child.

Article 12 establishes two rights: to express a point of view and to have it taken into account. Children have the right to influence decision-making and their views must be considered in policies. Age and maturity guide the weight of their opinions but should not limit them. The involvement of children in decision-making processes is a key outcome of the Convention.

2.5 Child-Centred Urban Resilience Framework: a tool for inclusive city planning (2020)

The CCURF adopts an urban systems vision, aligning human and children's rights and gender-sensitive approaches with urban development, and promoting children as agents of resilience. It is divided into four strategic areas:

- Improving the lives of children by ensuring access to basic services, decent work and protection for their survival and development.
- Involve the community in the protection and promotion of human and children's rights, with emphasis on safety and security, especially for girls.
- Create safe spaces for children, providing accessible and gender-sensitive infrastructure and information.
- Promoting the integration of children in urban management and planning.

The CCURF combines research and expertise, including Plan International's work with IIED and Arup's work supported by the Rockefeller Foundation on the Cities Resilience Index.

Tools such as the Cities Resilience Index, UNISDR's 'The TEN Essentials for Making Cities Resilient' and UN Habitat's 'City Resilience Profiling Tool' provide guidelines for urban resilience, but a solution was needed for organisations working with the poor and vulnerable. Each community is unique, so the CCURF helps understand urban dynamics, stakeholders and areas of intervention to maximise impact (Communications & Communications, 2020).

3. Best practices and strategies

This study collects strategies, international agreements, guides and best practices for integrating children's rights into urban policies relating to their safety. By putting children's needs at the center and listening to them, we demonstrate that the services designed for them become more effective, promoting safe and inclusive urban environments.

It is of great importance to integrate children's rights into urban policies and legislation, improving access to quality infrastructure and healthy living spaces for all. However, the lack of disaggregated data on children in urban areas, together with the scarcity of resources to collect child-focused data, limits the ability to monitor

policies and budgets, and to hold governments accountable for respecting children's rights. It is therefore necessary to analyse current urban policies and strategies adopted at the international level to address the issue more thoroughly and to reduce urban inequalities and improve urban safety for children.

Child-Responsive Urban Policies, Laws and Standards: A Guidance
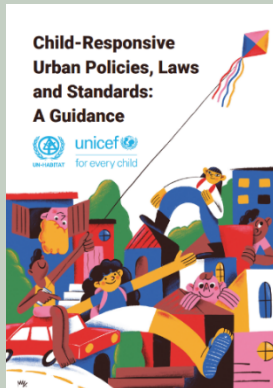
Principal author: Anna Kvashuk
Contributors: Anne Amin, Rongedzayi Fambasayi, Samuel Njuguna, John Omwamba, Remy Sietchiping
Publisher: UN-Habitat and the United Nations Children's Fund (UNICEF)
Retrieved from: https://unhabitat.org/child-responsive-urban-policies-laws-and-standards-a-guidance

This guide, jointly developed by UN-Habitat and UNICEF, addresses the challenge of poor integration of children's rights into urban policies and legislation, hindering the development of sustainable and inclusive urban spaces. Currently, more than half of the world's two billion children are between 10 and 18 years old and can participate in decision-making processes. However, current urban laws, policies and practices do not allow children to influence the issues that affect them (growing up, learning and playing). The guide demonstrates that by putting children's issues at the centre and listening to them, services designed to meet their needs become more effective and efficient. It also provides lessons learned from UN-Habitat and UNICEF, recommending the direct participation of children in urban planning processes, not just as observers. The guide also addresses child-responsive standards in areas such as housing, road safety and public spaces, with examples of good practice from different countries to include and consider children and their needs in national urban policies.

Ghent: a child and youth-friendly city (Most Child and Youth-friendly City in Flanders, 2015)

Authors/Editors: Moïra Phuöng Van de Poël
Internally proofread by Aditi Partha
Last updated on 23 February 2023
Retrieved from: https://stad.gent/en/city-governance-organisation/city-policy/ghent-child-and-youth-friendly-city/most-child-and-youth-friendly-city-flanders

The vision and action plan for 'Ghent: a Child and Youth Friendly City' aims to create a comprehensive and inclusive urban environment where young people can thrive. All aspects of city life, such as education, mobility, urban planning, health, environment and sports, must take into account the needs of children, including those from vulnerable families. The active participation of children is essential to stimulate their creativity and sense of responsibility. The plan recognises the ongoing challenges and promotes continuous collaboration between sectors and stakeholders, with new approaches to ensure a sustainable and just future for the young citizens of Ghent.

Children in urban areas

Authors/Editors: Moïra Phuöng Van de Poël
Internally proofread by Aditi Partha
Last updated on 23 February 2023
Retrieved from:
https://stad.gent/en/city-governance-organisation/city-policy/ghent-child-and-youth-friendly-city/most-child-and-youth-friendly-city-flanders

This article discusses the challenges children face in urban environments, including malnutrition, health inequities, unbalanced educational opportunities, air pollution and vehicular traffic, and violent and abusive environments. It explores inequalities in access to health and education services and the risk of violence. It proposes actions to improve the living conditions of urban children, such as improving employment opportunities, addressing malnutrition, improving air quality and mobilising the community against violence. The article emphasises the importance of targeted policies and global cooperation to ensure a safe and healthy environment for urban children.

Child-friendly Integrated Public Spaces in Jakarta, Indonesia (Aji et al., 2016)

Authors/Editors: Moïra Phuöng Van de Poël
Internally proofread by Aditi Partha
Last updated on 23 February 2023
Retrieved from: https://cities4children.org/blog/safe-area-based-facilities-for-urban-children-in-disadvantaged-settings/

This research focuses on the study child-friendly integrated public spaces (RPTRA) in Kembangan district, West Jakarta. The method used combines qualitative data from interviews and observations with quantitative data from questionnaires. The study shows that RPTRAs, like parks, are mainly used by residents of densely populated areas. The availability of facilities, facilitated accessibility and the role of parents are crucial for children's attendance at RPTRAs. Despite meeting the general needs of children well, RPTRAs fail to develop adequately in relation to the evolving needs of their users, due to the diversity of functions and limited land availability. This study aims to evaluate the location, role and functions of RPTRAs in residential areas and propose ideal criteria for these spaces in the urban context.

Establishing Geographies of Children and Young People (Skelton & Aitken, 2019)
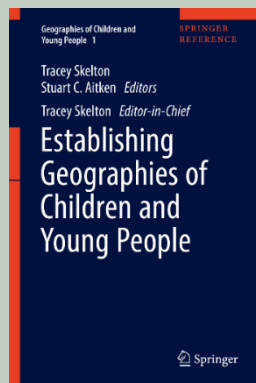
Editor: Tracey SkeltonStuart C. Aitken
Publisher: Springer Singapore
Pubblication year: 2019
Book series: Geographies of Children and Young People
ISBN code: 978-981-287-040-7
Retrieved from: https://link.springer.com/referenceworkentry/10.1007/978-981-4585-88-0_27-1?fromPaywallRec=false

The chapter 'Establishing Geographies of Children and Young People' opens the first volume of Springer's 'Geographies of Children and Young People' collection. It explores the philosophical and theoretical debates that have shaped the geography of children and young people, citing theorists such as Bourdieu, Darwin and Spinoza. Key concepts such as 'development' and 'participation' and themes such as child, childhood, youth and intergenerationality are analysed. Disciplinary approaches examine political, educational, emotional, affective and spatial geographies, as well as religiosity. The book establishes a basis for understanding the intersections between traditional disciplinary approaches, showing the diversity of young people's lives around the world.

References

Abdelfattah, L., Deponte, D. & Fossa, G. (2022). The 15-minute city as a hybrid model for Milan. *TeMA - Journal of Land Use, Mobility and Environment*, 71-86. https://doi.org/10.6093/1970-9870/8653

Aji, H. S., Budiyanti, R. B. & Djaja K. (2016). The development of child-friendly integrated public spaces in settlement areas as an infrastructure of Jakarta. *WIT Transactions on Ecology and the Environment*. https://doi.org/10.2495/sdp160021

Bessell, S. (2015). Perceptions of risk and safety in public spaces: towards a child standpoint. In Springer eBooks, 1–18. https://doi.org/10.1007/978-981-4585-99-6_12-1

Boetti, M. (2021). La sottrazione internazionale di minori: trasferimento o trattenimento illecito secondo la normativa internazionale ed europea. https://hdl.handle.net/20.500.12608/39542

Caggiano, G. (2020). COVID-19. Competenze dell'Unione, libertà di circolazione e diritti umani in materia di controlli delle frontiere, misure restrittive della mobilità e protezione internazionale. I Post di AISDUE. https://www.aisdue.eu/wp-content/uploads/2020/05/Post-Giandonato-Caggiano-2-covid-19.pdf

Carra, M., Rossetti, S., Tiboni, M. & Vetturi, D. (2022). Urban regeneration effects on walkability scenarios. *TeMA - Journal of Land Use, Mobility and Environment*, 101-114. https://doi.org/10.6093/1970-9870/8644

Urban Work | World Vision International (2016). *Children's Assembly and Charter - historic first at United Nations Habitat III Conference*. https://test.wvi.org/urban-programmes/article/childrens-assembly-and-charter-historic-first-united-nations-habitat-iii

UN-Habitat (2023). *Child-responsive urban policies, laws and standards: a guidance*. Retrieved form: https://unhabitat.org/child-responsive-urban-policies-laws-and-standards-a-guidance

Communications, M. & Communications, M. (2020). *Child-Centred Urban Resilience Framework: a tool for inclusive city planning*. Plan International Australia. https://www.plan.org.au/publications/child-centred-urban-resilience-framework-a-tool-for-inclusive-city-planning/

Farina, C. & Calandra, G. (2022). Canzoni/corpi in movimento: un laboratorio itastra in tempi di pandemia. Italiano Lingua Due. Retrieved form: https://riviste.unimi.it/index.php/promoitals/article/download/18154/16118

Gargiulo, C. & Papa, R. (2021). Chaos and chaos: the city as a complex phenomenon. *TeMA - Journal of Land Use, Mobility and Environment*, *14* (2), 261-270. https://doi.org/10.6093/1970-9870/8273

González-Carrasco, M., Casas, F., Ben-Arieh, A., Savahl, S. & Tiliouine, H. (2018). Children's Perspectives and Evaluations of Safety in Diverse Settings and Their Subjective Well-Being: A Multi-National Approach. Applied Research in Quality of *Life, 14* (2), 309-334. https://doi.org/10.1007/s11482-018-9594-3

Honorati, C. & Ferraris, F. (2021). Italia-Guida alle buone prassi per il riconoscimento e l'esecuzione nell'Unione europea di accordi in materia familiare che coinvolgono minori. Retrieved form: https://hdl.handle.net/10281/333020

Gent (2015). *Most child and youth-friendly city in Flanders*. Retrieved form: https://stad.gent/en/city-governance-organisation/city-policy/ghent-child-and-youth-friendly-city/most-child-and-youth-friendly-city-flanders

Mischo, F. (2024). *Safer cities for children*. Urbanet. https://www.urbanet.info/safer-cities-for-children/

O'Donnell, D. A., Schwab–Stone, M. E. & Muyeed, A. Z. (2002). Multidimensional resilience in urban children exposed to community violence. *Child Development, 73* (4), 1265-1282. https://doi.org/10.1111/1467-8624.00471

Pellicelli, G., Rossetti, S., Caselli, B. & Zazzi, M. (2022). Urban regeneration to enhance sustainable mobility. *TeMA - Journal of Land Use, Mobility and Environment*, 57-70. https://doi.org/10.6093/1970-9870/8646

Petch, R. & Henson, R. (2000). Child road safety in the urban environment. *Journal of Transport Geography, 8* (3), 197-211. https://doi.org/10.1016/s0966-6923(00)00006-5

Rams, D., Villanger, G. D., Quattrini, N., Huijts, T., Balaj, M. & Eikemo, T. (2022). Il Centro di Ricerca UNICEF Innocenti. Retrieved form: https://www.torrossa.com/gs/resourceProxy?an=5328367&publisher=FZP755

Ruşitoru, M. V. (2023). *Eccellenza educativa in Finlandia come mi si è rivelata*. Retrieved form: https://books.google.com/books?hl=en&lr=&id=Pr-xEAAAQBAJ&oi=fnd&pg=PA7&dq=In+Finlandia+si+promuove+attivamente+il+diritto+dei+bambini+di+giocare+all%27aperto.&ots=tD1BF_--bi&sig=kKqE2T4_qrWFyYizJr5cu4bRu8E

Stiuso, T. (2024). Exploring approaches and solutions for urban safety: a focus on women. *TeMA - Journal of Land Use, Mobility and Environment*, *17* (1), 179-186. https://doi.org/10.6093/1970-9870/10778

The New Urban Agenda - Habitat III. (2016). Habitat III. https://habitat3.org/the-new-urban-agenda/

Valentine, G. (1996). Children should be seen and not heard: the production and transgression of adults' public space. *Urban Geography, 17* (3), 205-220. https://doi.org/10.2747/0272-3638.17.3.205

Author's profile

Tonia Stiuso

She is an engineer and research fellow at the Department of Civil, Architectural and Environmental Engineering at the University of Naples Federico II. Her research currently focuses on the theme of urban sustainability, in particular the study of gender inequalities and adaptation to climate change.