
GAZİ ÜNİVERSİTESİ
Gazi
1926

USING PRE-DEFINED TRAVEL TIME CONSTRAINTS TO REVITALIZE URBAN SPACES

Ayşe Reyyan LALE

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF SCIENCE
IN CITY AND REGIONAL PLANNING DEPARTMENT

GAZİ UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

FEBRUARY 2025

ETHICAL STATEMENT

I at this moment declare that in this thesis study, I prepared the thesis writing rules of Gazi University Graduate School of Natural and Applied Sciences;

- All data, information, and documents presented in this thesis have been obtained within the scope of academic rules and ethical conduct,
- All information, documents, assessments, and results have been presented by scientific ethical conduct and moral rules,
- All material used in this thesis that is not original to this work has been exhaustively cited and referenced,
- No change has been made in the data used,
- The work presented in this thesis is original,

or else, I admit all loss of rights to be incurred against me.

Ayşe Reyyan LALE
26/02/2025

USING PRE-DEFINED TRAVEL TIME CONSTRAINTS TO REVITALIZE URBAN SPACES

(M. Sc. Thesis)

Ayşe Reyyan LALE

GAZİ UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

February 2025

ABSTRACT

15-minute city theory defines a highly flexible urban area where all people live in there can access daily needs within a 15-minute distance by walking or cycling. The main idea is to fit all of the needed functions in a compact urban area and so it has to be multifunctional. To establish the methodology to answer research questions, a bibliometric analysis was performed on Web of Science. With the help of VOSviewer, the keywords found were organized into 4 clusters, which are (1) pedestrian accessibility, (2) mobility, (3) chrono-urbanism and (4) sustainable development, and searched again on Web of Science. The methodologies that can analyze the field most effectively for these 4 clusters were determined by examining the methodology of articles. Neighborhoods around Anıtkabir are selected for the field study and the determined analyses were applied. According to the results, the neighborhoods of Emek, Yukarı Bahçelievler, and Bahçelievler are where the majority of the business sector is located. The commercial units can be reached in a very short time from anywhere in the area, even within a walking distance of 400 meters/ 5 minutes. Accessibility between streets and urban texture are balanced. Educational institutions are situated within easy reach and close to residential areas. The majority of the government buildings are situated on İnönü Boulevard in the southern part of the region. Hospitals and family health centers make up health regions, and it has been found that the accessibility and distribution of these facilities are not fairly equal. The parks and open green spaces shown as recreational areas are extremely accessible for people living in the area, within a 5-minute walking distance. The majority of the neighborhoods under investigation are included in the greatest isochrone of 15-minute "liveable areas," indicating that they have the fundamental spatial quality required for a 15-minute neighborhood where inhabitants may easily access essential services. Although it has not been named, it has been identified through the analyses that the case study area has been designed in accordance with the 15-minute city design concept in many respects. Since it was designed in this manner from the beginning, it has a hopeful future for people who wish to adopt the 15-minute city concept today, despite being in the center of a metropolis that has developed significantly over time.

Science Code	:	80208
Key Words	:	15-minute city, urban accessibility, urban non-motorized mobility
Page Number	:	143
Supervisor	:	Prof. Dr. Ebru V. ÖCALIR

KENTSEL ALANLARIN YENİDEN CANLANDIRILMASI İÇİN YOLCULUK SÜRESİ SINIRLAMALARININ KULLANILMASI

(Yüksek Lisans Tezi)

Ayşe Reyyan LALE

GAZİ ÜNİVERSİTESİ

FEN BİLİMLERİ ENSTİTÜSÜ

Şubat 2025

ÖZET

15 dakikalık şehir teorisi, içinde yaşayan tüm insanların günlük ihtiyaçlarına yürüyerek veya bisikletle 15 dakikalık bir mesafe içinde erişebildiği son derece esnek kentsel alanları tanımlar. Ana fikir tüm ihtiyaç duyulan işlevleri kompakt bir kentsel alana sığdırmak olduğu için bu alanın çok işlevli olması gerekmektedir. Araştırma sorularını yanıtlayacak metodolojiyi oluşturmak için Web of Science üzerinde bir bibliyometrik analiz yapılmıştır. VOSviewer yardımıyla erişilen anahtar kelimeler (1) yaya erişilebilirliği, (2) hareketlilik, (3) krono-şehircilik ve (4) sürdürülebilir kalkınma olmak üzere 4 küme halinde organize edilmiş ve Web of Science'ta tekrar aranmıştır. Saha çalışması için Anıtkabir çevresindeki mahalleler seçilmiş ve belirlenen analizler uygulanmıştır. Sonuçlara göre, Emek, Yukarı Bahçelievler ve Bahçelievler mahalleleri ticaret sektörünün çoğunluğunun bulunduğu yerlerdir. Ticari birimlere alanın herhangi bir yerinden çok kısa bir sürede, hatta 400 metre/5 dakikalık yürüme mesafesiyle ulaşılabilmektedir. Sokaklar arasındaki erişilebilirlik ve kentsel doku dengelidir. Eğitim kurumları yerleşim alanlarına yakın ve kolay ulaşılabilir bir konumdadır. Kamu binalarının büyük çoğunluğu bölgenin güney kesiminde İnönü Bulvarı üzerinde yer almaktadır. Hastaneler ve aile sağlığı merkezleri sağlık birimlerini oluşturmakta olup bu tesislerin erişilebilirliğinin ve dağılımının adil olmadığı görülmüştür. Rekreasyon alanı olarak belirlenen parklar ve açık yeşil alanlar, bölgede yaşayan insanlar için 5 dakikalık yürüme mesafesinde son derece erişilebilirdir. İncelenen mahallelerin çoğunluğu 15 dakikalık "yaşanabilir alanların" en büyük izokronunda yer almaktadır; bu da mahalle sakinlerinin temel hizmetlere kolayca erişebildiği 15 dakikalık bir mahalle için gereken temel mekansal kaliteye sahip olduklarını göstermektedir. Her ne kadar adı konulmamış olsa da, yapılan analizler sonucunda çalışma alanının birçok açıdan 15 dakikalık şehir tasarımı konseptine uygun olarak tasarlandığı tespit edilmiştir. Başından beri bu doğrultuda tasarlandığı için, zaman içinde önemli ölçüde gelişen bir metropolün merkezinde olmasına rağmen, bugün 15 dakikalık şehir konseptini benimsemek isteyenler için umut verici bir geleceğe sahiptir.

Bilim Kodu	:	80208
Anahtar Kelimeler	:	15 dakikalık şehir, kentsel erişilebilirlik, kentsel motorsuz hareketlilik
Sayfa Adedi	:	143
Danışman	:	Prof. Dr. Ebru V. ÖCALIR

ACKNOWLEDGEMENTS

I am deeply thankful to my advisor Prof. Dr. Ebru V. ÖCALIR, for her consistent support and guidance throughout all stages of the research presented in this thesis. I express appreciation to all the teaching staff at Gazi University, who have consistently inspired me for my pursuit of knowledge. I would also like to express my gratitude to my husband Buğra LALE, thank you for all your support, without you it would be much harder to finish this research and my dear son Yiğit Ali, my mother and father for their continious support and understanding through the writing process. My sincere thanks also go to rest of my dear family who was always there for me whenever I needed. My thanks and appreciations also go to my colleagues and people who have willingly helped me with their abilities. I was not going to finish this thesis without support of all the people mentioned, thank you for being always there for me…

CONTENTS

Page

ABSTRACT iv

ÖZET v

ACKNOWLEDGEMENTS vi

CONTENTS vii

LIST OF TABLES ix

LIST OF FIGURES xi

LIST OF IMAGES xiv

LIST OF MAPS xv

SYMBOLS AND ABBREVIATIONS xvi

1.INTRODUCTION 1

2. 15-MINUTE CITY IDEA IN LITERATURE 5

2.1. Bibliometric Analysis 7

2.2. The Most Cited 5 Articles in Web of Science 16

2.3. The Literature on Cluster Analysis 26

2.3.1. The literature of cluster 1: pedestrian accessibility 27

2.3.2. The literature of cluster 2: mobility 38

2.3.3. The literature of cluster 3: chrono-urbanism 55

2.3.4. The literature of cluster 4: sustainable development 58

2.4. 15-Minute City Idea 71

2.4.1. Similar theories 76

2.4.2. Concept and key attributes 80

3. METHODOLOGY 85

4. CASE STUDY: ANKARA-ANITKABİR AND SURROUNDING NEIGHBORHOODS 91

Page

4.1. Cluster 1: Pedestrian Accessibility 99

4.2. Cluster 2: Mobility 104

4.3. Cluster 3: Chrono-Urbanism 108

4.4. Cluster 4: Sustainable Development 111

4.5. Concluding Remarks 126

5. CONCLUSION 129

REFERENCES 137

RESUME 143

LIST OF TABLES

Table **Page**

Table 2.1. Author citation analysis sorted through number of citations 9

Table 2.2. Author citation analysis sorted through number of documents 9

Table 2.3. Keyword list for “15-minute city” number of occurences as 5..... 12

Table 2.4. Country citation analysis for top-10 cities with most citations..... 15

Table 2.5. First 5 most cited articles 16

Table 2.6. Findings and methodologies of first 5 most cited articles 24

Table 2.7. Articles found with keywords “15-minute city” and “accessibility” and “GIS” and “pedestrian accessibility” and “walking” 27

Table 2.8. Articles found with keywords “15-minute city” and “accessibility” and “GIS” 31

Table 2.9. Articles found with keywords “mobility” and “proximity” and “public space” and “sustainable mobility” and “urban planning”..... 39

Table 2.10. Articles found on Web of Science with keywords “mobility” and “15-minute city” 41

Table 2.11. Articles found with keywords “chrono-urbanism” and “smart cities” 56

Table 2.12. Description grouping of resources..... 57

Table 2.13. Articles found with keywords “sustainability” and “sustainable development” 59

Table 2.14. Article found with keywords “15-minute city” and “sustainability” 69

Table 4.1. Urban amenities..... 97

Table 4.2. Description grouping of resources for the calculation of indicators 109

Table 4.3. Value ranges of indicators 109

Table 4.4. Number of road motor vehicles..... 113

Table 4.5. Number of workday travels in Ankara according to transportation types..... 114

Table 4.6. Number of workday travels according to transportation types in total 115

Table **Page**

Table 4.7. Comparison of the rate of increase in the number of motor vehicles with population growth in Ankara 117

LIST OF FIGURES

Figure **Page**

Figure 2.1. Structure of the thesis 7

Figure 2.2. The graphic of the distribution of publications and citations by year 8

Figure 2.3. “15-minute city” search areas 8

Figure 2.4. Author citation analysis 10

Figure 2.5. Keyword analysis for “15-minute city” with number of occurences as 1 11

Figure 2.6. Keyword analysis for “15-minute city” number of occurences as 5 13

Figure 2.7. Country citation analysis for “15-minute city” 15

Figure 2.8. Spatial accessibility analysis 29

Figure 2.9. Functional accessibility analysis 29

Figure 2.10. Web of Science categories for search rule 3 30

Figure 2.11. Spatial distribution of facilities based on the KDE analysis in Oslo 33

Figure 2.12. Access to different types of facilities within a 15-minute walk 33

Figure 2.13. Evolution of Coimbra’s urban perimeter and population 35

Figure 2.14. Origins, destinations, and road network 36

Figure 2.15. Accesibility to urban facilities plus jobs 36

Figure 2.16. The four layers of an equitable sustainable mobility model 43

Figure 2.17. Changes in urban income inequality and residential segregation 44

Figure 2.18. Number of accessible POIs within 15-minute by multiple travel modes 48

Figure 2.19. The six types of POIs in selected districts 50

Figure 2.20. Liveable areas and coverage percentage within each selected district 51

Figure 2.21. Change in average travel distance between 2019–2022 53

Figure 2.22. Average distance of commuting travel. 53

Figure 2.23. Average distance of non-commuting travel. 54

Figure **Page**

Figure 2.24. Indicators of education dimension 57

Figure 2.25. Indicators of health and social welfare dimension. 57

Figure 2.26. Indicators of supply dimension. 58

Figure 2.27. The components of Smart Sustainable Cities. 61

Figure 2.28. Characteristics of smart city 65

Figure 2.29. Urban forms as interconnected urban ecosystems 70

Figure 2.30. Timeline of related planning concepts that preceded 15-minute city 71

Figure 2.31. The evolution of neighborhood unit concept 73

Figure 2.32. The Superblock Barcelona 78

Figure 2.33. The low-traffic neighborhoods 79

Figure 2.34. The concept of 15-minute city 81

Figure 3.1. Determination the methodology for cluster 1 86

Figure 3.2. Determination the methodology for cluster 2 87

Figure 3.3. Determination the methodology for cluster 3 88

Figure 3.4. Determination the methodology for cluster 4 89

Figure 3.5. Scope of study 90

Figure 4.1. Bahçelievler Siedlung / Bahçelievler Building Cooperative 93

Figure 4.2. Anıtkabir and surrounding in 1945 95

Figure 4.3. Anıtkabir and surrounding in 1952 95

Figure 4.4. Anıtkabir and surrounding in 1976 96

Figure 4.5. Anıtkabir and surrounding in 2024 96

Figure 4.6. Boundaries of the neighborhoods included in the zoning plan 97

Figure 4.7. Modal-split analysis-ratio of workday travels in Ankara 114

Figure 4.8. Modal-split analysis-ratio of workday travels in Ankara in total 115

Figure **Page**

Figure 4.9. Redesigned streets by applying sustainable transportation methods 125

LIST OF IMAGES

Image **Page**

Image 4.1. Dögol Street in weekdays at 18:00 119

Image 4.2. Aşkabat St. commercial use photos with motorized transportation 119

Image 4.3. Narrowed pedestrian sidewalks 121

Image 4.4. Sidewalks occupied by vehicles 121

Image 4.5. Sidewalks occupied by vehicles 121

Image 4.6. Bicycle road next to Anıtkabir 124

LIST OF MAPS

Map **Page**

Map 4.1. Old city and new city boundaries in the Jansen Plan 92

Map 4.2. 1/1000 scale Implementation Zoning Plan in force 98

Map 4.3. Case study area 99

Map 4.4. Land-use mix analysis 102

Map 4.5. Amenity analysis 102

Map 4.6. Spatial distribution of facilities based on the Kernel density estimation value analysis in case study area 103

Map 4.7. Accessible areas 400 meter/5-minutes walk 105

Map 4.8. Accessible areas 800 meter/10-minutes walk 106

Map 4.9. Accessible areas 1200 meter/15-minutes walk 107

Map 4.10. Liveable and accessible areas 5-10-15 minute walk 108

Map 4.11. Indicators of K1 (supply/commercial), K2 (primary school/education) and K3 (secondary school/education) and its local spatial autocorrelation 110

Map 4.12. Indicators of K4 (high school/education), K5 (library/education) and K6 (family health services/health) and its local spatial autocorrelation 110

Map 4.13. Indicators of K7 (hospitals/health), K8 (green areas/recreation) and K9 (sport activities/recreation) and its local spatial autocorrelation 111

Map 4.14. Traffic volume analysis on weekdays and weekend 118

Map 4.15. Bicycle roads in Amsterdam, Copenhagen, Munich and Paris 122

Map 4.16. Bicycle roads in Ankara 124

Map 4.17. Bicycle route 125

SYMBOLS AND ABBREVIATIONS

The symbols and abbreviations used in this study are presented below, along with their explanations.

Symbols	**Explanations**
km	Kilometer
km/hr	Kilometer per hour
m²	Square meters
km²	Square kilometers
CO_2	Carbon Dioxide

Abbreviaitons	**Explanations**
C40	C40 Cities Climate Leadership Group
GDP	Gross Domestic Product
GIS	Geographic Information Systems
OECD	Organisation Economic Co-operation and Development
POI	Points of Interest
VOSviewer	Bibliometric analysis and network visualization software

1. INTRODUCTION

The twenty-first century is an era where urbanization is the dominant motif and more and more people settle in urban areas. According to the United Nations, the urban population will reach 700 million in every year to reaching 5.2 billion by 2030, in other words 60% of people will live in cities by the year 2030.

While the invention of cars had brought many easiness in people's lives in terms of mobility, trade and socialization, it has also several negative effects as well. For instance, cars changed the city plan in a very aggressive way, which our cities started to be planned according to the car routes and roads. It ended up with car dependent urban planning that creates inequalities, especially in terms of social and economic perspectives (Moreno, 2021).

As it is known, the traffic problem is growing in cities day by day. There are many reasons behind that problem, such as irregular urbanization or insufficient public transportation infrastructure to meet the needs of every citizen who whether lives in the center or periphery of the city. In addition to that, according to OECD report, air pollution could cause to 6-9 million premature deaths and cost 1% GDP by 2060 because of sick days, medical bills and decreased agricultural output. The biggest rises in mortality rates include India, China, Central Asian countries, where rising populations live together in dense big cities mean more people will be exposed to bad air conditions caused traffic congestion (The Economic Consequences of Outdoor Air Pollution, 2016).

With the increasing population and better economic standards, today everyone can buy a car especially in developed and developing countries. Consequently, the number of cars in traffic increases day by day and the roads will not be enough. To increase road capacity, municipalities increase the number of lanes but soon they will not be enough as well. Most large cities have similar problems; during rush hours it takes hours to reach home, work or the destination point, finding an appropriate parking space would be very hard most of the times or short-trips can easily turn into long-hours.

In addition to that, Toprak (2019) mentions transportation sector contributes significantly to CO_2 emissions and accordingly climate change. Especially car-oriented urban planning leads

individual car usage in high rates and consequently will contribute CO_2 emissions, traffic jam and air pollution. Many hopeful, sustainable transportation modes are planned in cities. However, to reach success, they should be integrated into a comprehensive sustainable urban mobility to decrease CO_2 emissions caused by individual car usage.

Problem / description of the topic

Planners have frequently disagreed on the topic of neighborhood planning. It has been in practice since the industrial revolution, especially in the 20th century when it became clear that large cities were ineffective at providing for the basic necessities of their residents. It can be identified that first proximity-centric plans and secondly mobility-centric plans were popular. While the latter concentrates on the centralization of urban functions and primarily stresses motorized mobility, the former aims to improve the functionality of cities through greater distribution of urban services and amenities among cities.

In 1898, Ebenezer Howard proposed the garden city approach, which was the first effort to use physical architecture to address social and health issues. In 1923, the neighborhood unit concept was first presented by Clarence Perry as an urban planning strategy that employed the neighborhood as the fundamental planning unit. Drawing inspiration from Howard, Perry envisioned communities where residents live close to parks, elementary schools, community centers, houses of worship, and shopping places.

At the beginning of the century, issues including air pollution, traffic, poverty, and inequality were not sufficiently addressed. In the meantime, new challenges like resource scarcity and climate change emerged, emphasizing the necessity to reconsider urban planning and design models and conceptions. In the late 2010s, the COVID-19 outbreak led to an unexpected global crisis. The COVID-19 pandemic demonstrated the value of entire neighborhoods in times of health emergency, demonstrating the fragility of car-dependent neighborhoods and modernist-inspired cities in the face of unfavorable disasters like pandemics.

As a post-COVID plan to enable a more sustainable recovery from the pandemic and to construct comprehensive, climate-sensitive, and resilient communities, the 15-minute city idea was presented and the importance of proximity-based design is understood clearly.

Purpose of the research and research questions

As it was mentioned, 15-minute city design is not a new concept, but it has come to the agenda again after the pandemic. When looking at the issues on the transformation of existing city parts into 15-minute cities, we ask the question of can this theme be applied to an existing city structure in Ankara?

In this research, the following questions will be answered:

1. What is the 15-minute city theory and how much attention has it received in literature?
2. Can we find the characteristics of 15-minute city in an existing urban structure?
3. Is there a potential to create 15-minute cities in the city center with some interventions?

The anticipated results of this research will lay the groundwork for evaluating selected neighborhoods of Ankara viability as a 15-minute city idea. These findings will also provide information and data that may be used to inform strategic initiatives that support resilient, sustainable, and healthy urban environments. The goal of this research is to identify can existing urban textures have the characteristics of 15-minute city and determine whether the 15-minute city concept can be implemented in existing urban centers with some interventions or not. The sections where the answers to the mentioned questions are found and analyzed will be stated in the thesis.

2. 15-MINUTE CITY IDEA IN LITERATURE

The application of quantitative methods (bibliometric analysis, such as citation analysis) to bibliometric data (such as publication and citation units) is known as the bibliometric methodology. The fact that bibliometrics was first discussed in the 1950s indicates that the methodology is not new. The development, accessibility, and availability of bibliometric software like VOSviewer, as well as scientific databases like Scopus and Web of Science, have all contributed to the bibliometric analysis's an increase in popularity in business research in recent years. Additionally, the bibliometric methodology has been cross-disciplinaryly applied from information science to business research. More crucially, bibliometric analysis's appeal in research is a result of its usefulness in managing substantial amounts of scientific data and generating highly impactful research, not a passing trend (Donthu, 2021).

Researchers use bibliometric analysis for several purposes, including identifying new trends in the performance of articles and journals, patterns of collaboration, and the components of research, as well as investigating the intellectual framework of a particular field in the body of existing literature. Bibliometric analysis provides rigorous sense of vast amounts of unstructured data, which is helpful for mapping and interpreting the evolutionary details of well-established areas as well as the cumulative body of scientific knowledge.

Bibliometric analysis has emerged as a valuable method for examining the concept of the 15-minute city, a model promoting urban planning that prioritizes accessibility and livability by ensuring that residents can meet most of their daily needs within a short walk or bike ride. One illustrative example is found in the exploration of case studies in cities that have implemented the 15-minute city principles. A study by Allam (2024) conducted a bibliometric analysis on 15-minute city framework. This study demonstrates the increasing interest in the 15-Minute City concept and its variations around the world. The concept's flexibility and applicability in tackling the opportunities and problems posed by various urban settings is demonstrated by the wide range of terminology, administrative levels of implementation, and time-based urban planning methodologies. Urban planners, legislators, and people have responded favorably to the 15-Minute City's emphasis on accessibility,

closeness, and sustainability as it works to improve quality of life and advance more resilient, inclusive, and sustainable urban settings.

In another research conducted by Yang (2024), they discovered that despite being created in 2016, the idea of the 15-minute city did not gain significant popularity until 2020, when the global pandemic started. Global crises, such as the pandemic's effects on public health, the ecological and climatic emergency, and socioeconomic inequalities, have accelerated the shift in urban planning toward a new paradigm. The pandemic is expected to enhance sustainability in urban areas by fundamentally challenging current urban systems, necessitating new approaches to address similar scenarios. Accessibility-based planning, where urban possibilities are available for all people regardless of their transport modalities and social positions, is one beneficial strategy, as promoted by those who support the 15-minute city.

Using a bibliometric review of the 15-minute city literature, this study identified four major themes - urban sustainability, resilient thinking, utopian city model, and technology - that represent the main research priorities. Based on the results, the similarities and differences between the two ideas were investigated. Despite coming from rather different backgrounds, the two ideas are based on the general idea of human-centric planning, which questions many facets of the current planning system (Yang, 2024)

This section includes both qualitative and quantitative research. Written works, maps, and images constitute the produced and compiled content. This study's goal is to evaluate the chosen area by using the right methodologies. After an extensive review of the data collected for this study, a number of significant findings were discovered, providing light on the distinctive features that characterize the research issue. These findings in turn call attention to the essential elements that foster a dynamic and sustainable mobility environment, precisely in line with the forward-thinking notion of the "15-minute city". With the results, answers to the research questions were obtained. At all stages and structure of the thesis is depicted in figure 2.1, the relevant places were searched and the answers to the questions were explained.

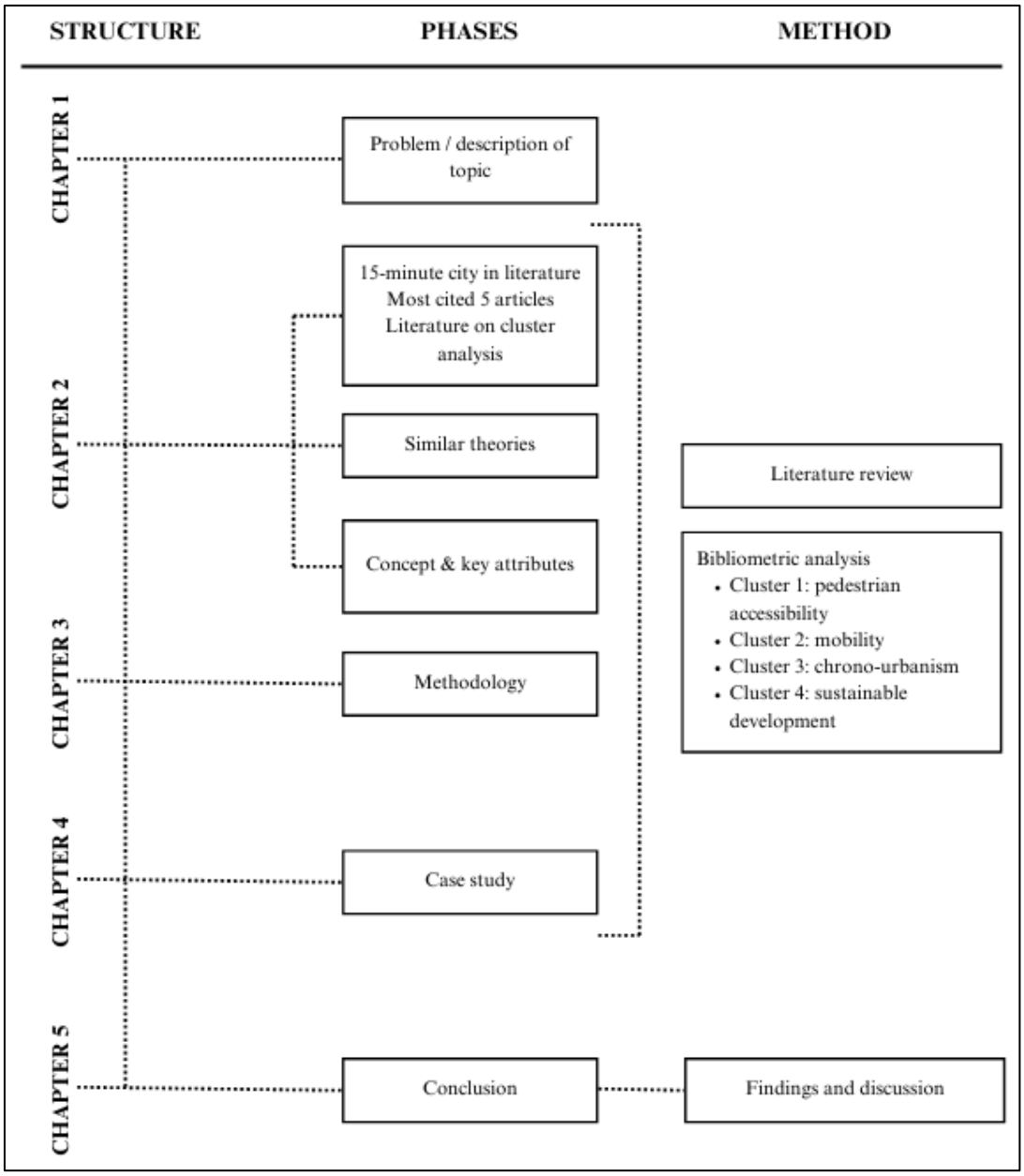


Figure 2.1. Structure of the thesis (Prepared by the author)

2.1. Bibliometric Analysis

A keyword search was carried out on Web of Science, before the study to help answering research questions. Different from a systematic literature review, bibliometric analysis is an analytical method that facilitates the monitoring of academic trends through visualization software used to obtain formal and quantitative data on the current state of a subject area. Researchers use bibliometric analysis for a variety of purposes, including to study the intellectual framework of an existing field and to identify developing trends in article and journal performance, collaboration patterns, and research components.

A literature search was performed in 05.11.2024 on "Web of Science Core Collection" by choosing all fields. The search rule in this analysis is “15-minute city” or “15-minute cities” or “15 minute city” or “15 minute cities” and 176 publications,146 article, 9 review article, 8 early access, 6 editorial material, 1 book review, 1 correction and 1 letter, reached.

In terms of year range, depicted on figure 2.2., the oldest of the publications was published in 2011 and the newest was published in 2024. It can be inferred that it is a subject that has been widely researched in the last 13 years, especially during the pandemic period. The list of publications reached was analyzed via VOSviewer.

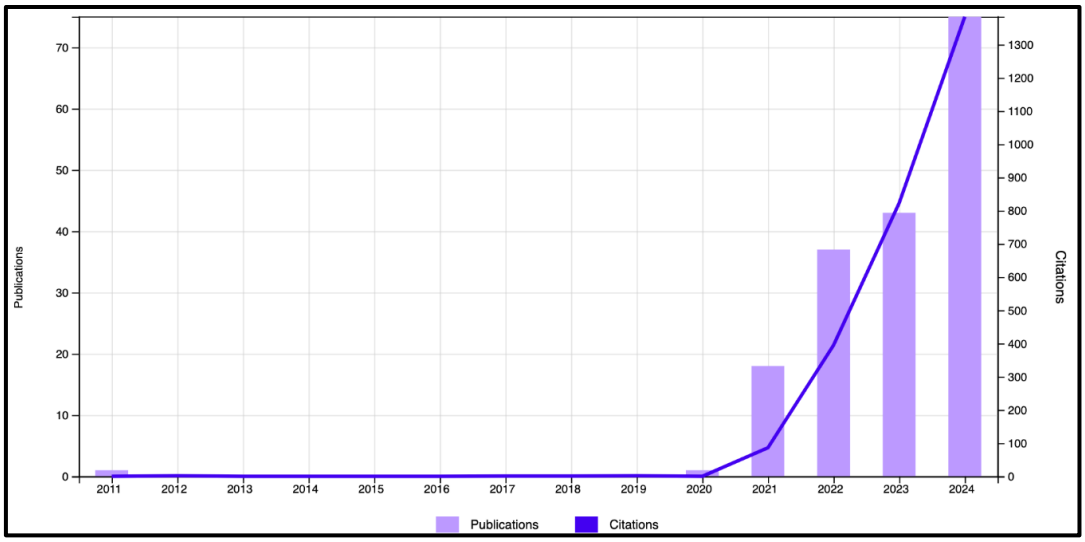


Figure 2.2. The graphic of the distribution of publications and citations by year (Web of Science)

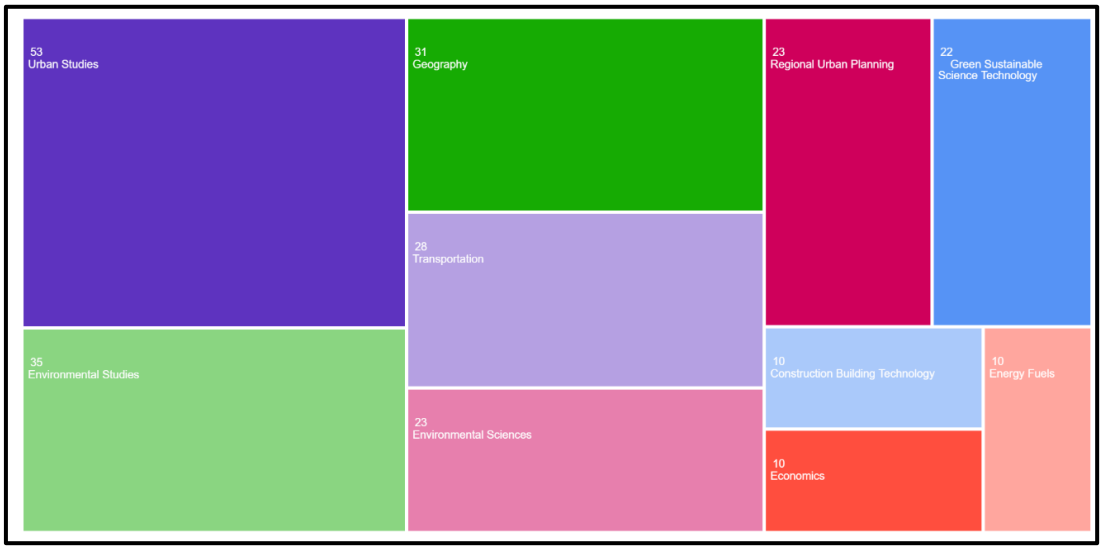


Figure 2.3. “15-minute city” search areas (Web of Science)

As it is depicted in figure 2.3., 53 of them are in the area of "Urban Studies", 35 of them are in "Environmental Studies", 31 of them are "Geography",28 of them are in the area of "Transportation" and 23 of them are "Regional Urban Planning" field.

Author citation analysis for "15-minute city"

533 authors were identified among the publications and these were reduced to those with at least 1 publication and 1 citation, and 388 authors meet the threshold. The list of 5 mostly cited authors are listed on table 2.1. and the table 2.2. lists the authors who produced the most documents.

Table 2.1. Author citation analysis sorted through number of citations
(Prepared by author)

	Author	Documents	Citations	Total Link Strength
1	Allam, Zaheer	9	820	22
2	Moreno, Carlos	7	806	20
3	Chabaud, Didier	6	722	18
4	Gall, Catherine	1	573	4
5	Pratlong, Florent	1	573	4

Table 2.2. Author citation analysis sorted through number of documents
(Prepared by author)

	Author	Documents	Citations	Total Link Strength
1	Allam, Zaheer	9	820	22
2	Moreno, Carlos	7	806	20
3	Chabaud, Didier	6	722	18
4	Murgante, Beniamino	6	20	7
5	Annunziata, Alfonso	4	20	7

Carlos Moreno is the inventor of 15-minute city term, so it is not surprising to see him in the list of mostly cited author. Additionally, Zaheer Allam and Didier Chabaud are the other most important researchers about 15-minute city term. Their articles will be analyzed in the thesis.

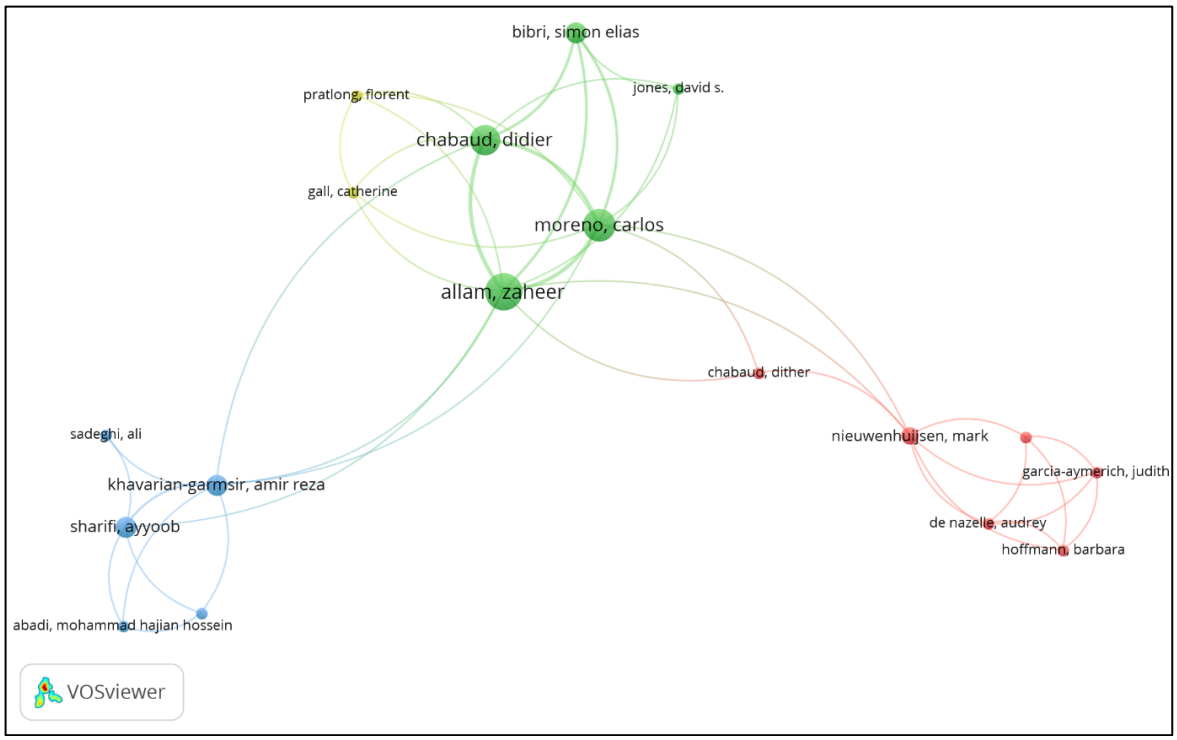


Figure 2.4. Author citation analysis (Prepared by author)

Keyword analysis for “15-minute city”

In the publications, by choosing co-occurrence and author analysis, that are found from the research 590 keywords were identified with the minimum number of occurrences as 1. After that, keywords are downloaded and scanned, there are 15 keywords that is found similar with “15-minute city”, which are “15-min city, “15-minute cities”, “15 minute city”, “15-minute-city”, “15 -minute city”, “15 min city”, “15-minute city index”, “15-minute city model”, “15-minute city paradigm”, “15-minute city: urban planning”, “15-minute neighborhood” and “15minute index”. All these keywords are replaced by “15-minute city” and the keywords have decreased to 575 with the thesaurus file.

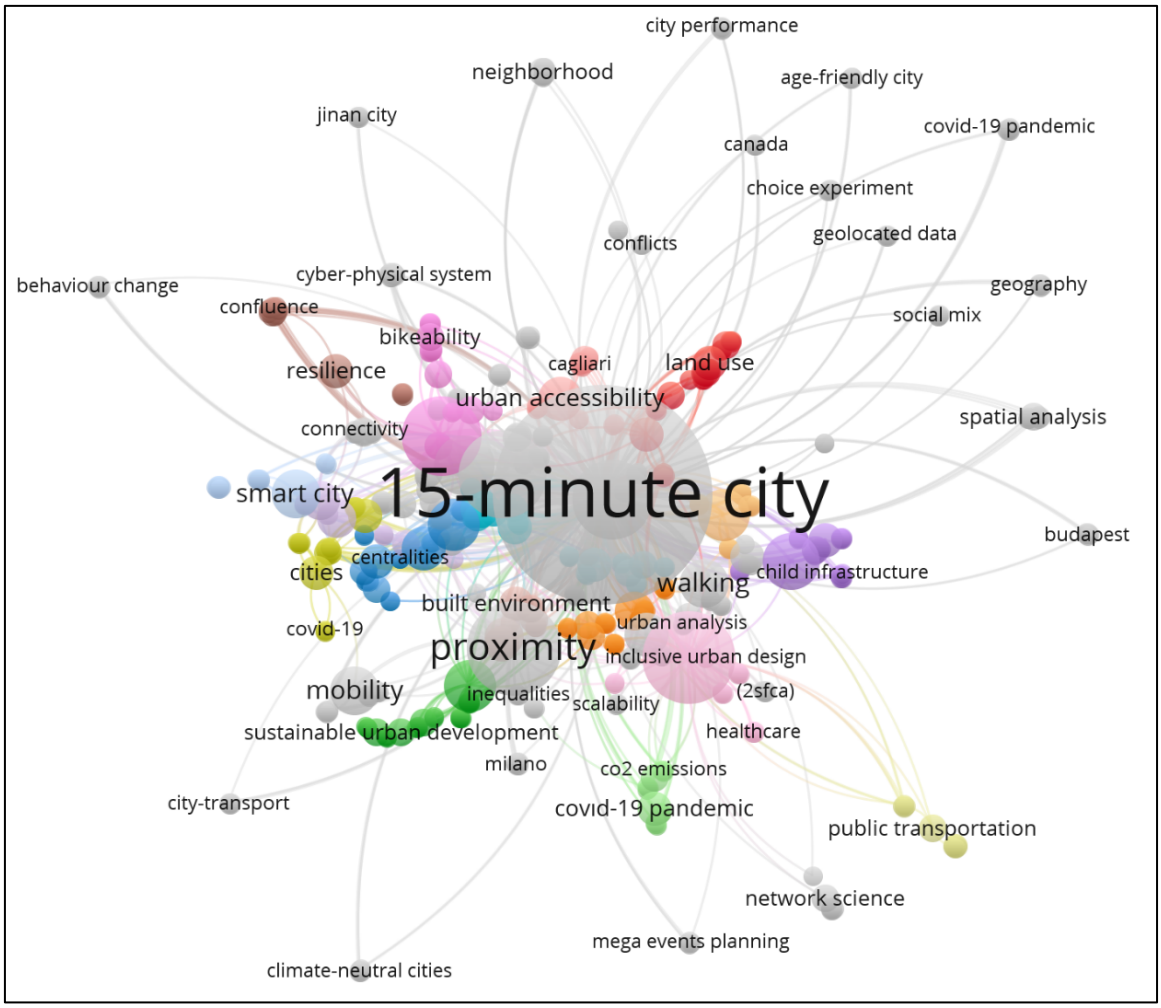


Figure 2.5. Keyword analysis for "15-minute city" with the minimum number of occurences as 1 (Prepared by author)

Analyzing and interpreting the results of a clustering technique typically does not present any major challenges when the number of objects to be clustered is relatively small. However, it is far from simple to analyze and interpret a clustering solution when working with a large number of objects. This could be an issue, particularly if clustering methods are used at the publication level. After that, we might have clustering solutions with thousands or even millions of publications included. It can be very difficult to make sense of these clustering solutions (Van Eck and Waltman, 2017). Therefore, the keywords repeated at least 5 times in the group of findings were narrowed and 16 keywords were identified. These 16 keywords are listed on the Table 2.3. The relationship figure is depicted on the figure 2.6.

Table 2.3. Keyword list for “15-minute city” with the minimum number of occurences as 5 (Prepared by author)

	Keyword	Occurrences	Total Link Strength
1	15-minute city	118	116
2	proximity	22	42
3	accessibility	21	36
4	urban planning	19	29
5	sustainability	16	25
6	walkability	16	32
7	smart cities	9	14
8	pedestrian accessibility	8	13
9	chrono-urbanism	7	7
10	GIS	7	11
11	sustainable mobility	7	10
12	mobility	6	7
13	walking	6	11
14	public space	5	9
15	sustainable development	5	6
16	urban accessibility	5	8

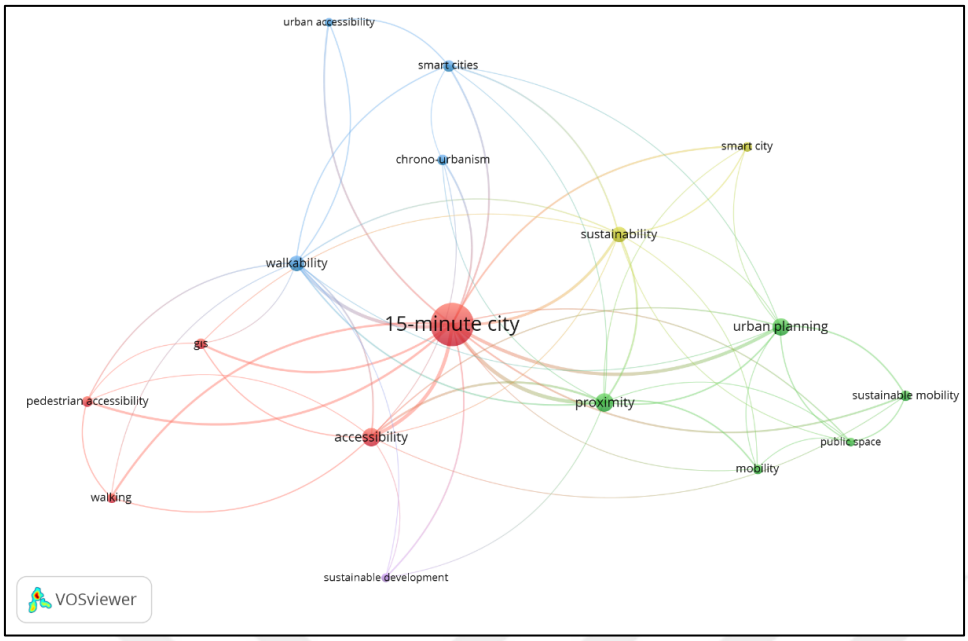


Figure 2.6. Keyword analysis for "15-minute city" with the minimum number of occurences as 5 (Prepared by author)

Bibliometric research largely depends on clustering techniques. For example, groups of related publications, authors, or journals can be identified using them. Clustering techniques were developed primarily in computer science, network science, and statistics. Bibliometricians typically use pre-existing clustering techniques created in other fields rather than creating their own. They sometimes modify these methods to fit the unique features of bibliometric data before applying them to bibliometric data sets (Van Eck and Waltman, 2017).

The larger the circle, the more frequently a keyword appears, and the color of an item corresponds to the cluster to which that keyword belongs. The lines between the circles show which keywords were mentioned together in a paper. Keywords can be joined into "clusters" using the VOSviewer software according to proximity and/or affinity. For the 16 items, the VOSviewer program displayed 4 clusters;

- Cluster 1: "15-minute city", "accessibility", "GIS", "pedestrian accessibility", "walking"
- Cluster 2: "mobility", "proximity", "public space", "sustainable mobility", "urban planning"
- Cluster 3: "chrono-urbanism", "urban accessibility", "walkability"
- Cluster 4: "sustainability", "sustainable development"

For the cluster 1, these keywords that have been provided focus on urban planning concepts related to accessibility, walkability and geographic information system (GIS). An ideal name for this group will be “Pedestrian accessibility”.

For the cluster 2, the group of keywords focus on creating sustainable, accessible, and well-planned urban environments that prioritize efficient mobility and public space utilization. “Mobility” theme will reflect the interconnectedness of urban mobility, sustainable transportation, and the use of public spaces in urban planning.

For the cluster 3, the group of keywords focus on how time, technology, and accessibility intersect to shape the future of cities. “Chrono-urbanism” theme blend the concepts of time (chrono-urbanism), technological advancement (smart cities), and urban experiences (accessibility and walkability).

For the cluster 4 and 5, the keywords focus on creating cities that are not only technologically advanced but also environmentally, socially, and economically sustainable. “Sustainable development” theme emphasize the environmental or societal responsibility (sustainability) and sustainable development.

Country citation analysis for “15-minute city”

The 48 countries where the researches were carried out have been identified and these were reduced to those with at least 1 document and 1 citation of a country, and it was concluded that there were 44 countries that meet the threshold. Their relationships in terms of bibliographic linkage are illustrated in figure 2.7.

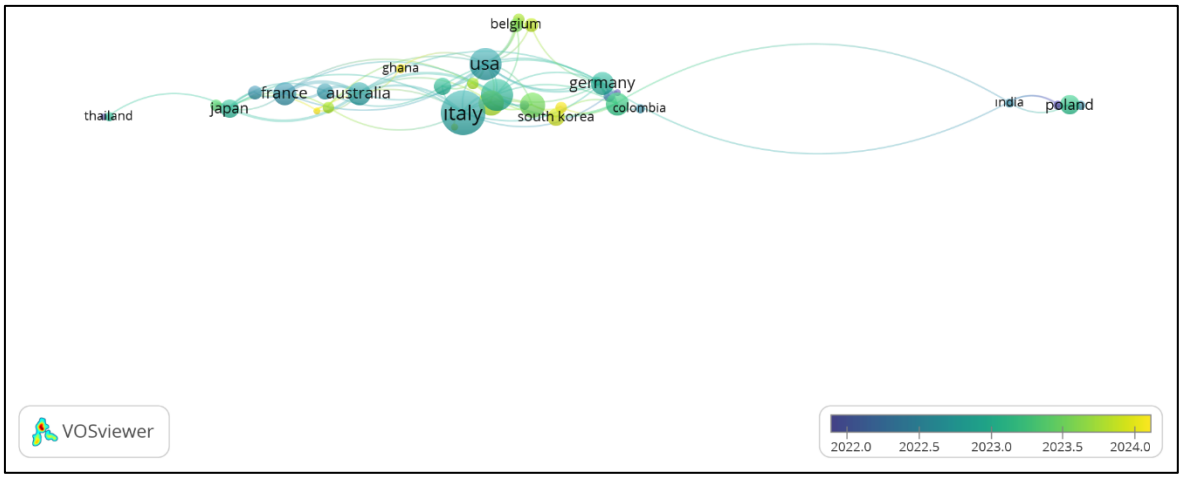


Figure 2.7. Country citation analysis for “15-minute city” (Prepared by author)

It is a current issue as it can be understood from the time-line under the analysis. France, Spain, Australia and Italy are the countries that have discussed this issue the most and get most citations compared to other countries.

Table 2.4. Country citation analysis for top-10 cities with most citations (Prepared by author)

	Country	Documents	Citations	Total Link Strength
1	France	11	820	15
2	Spain	20	410	13
3	Australia	11	399	22
4	Italy	38	347	15
5	Greece	6	261	0
6	Norway	5	193	8
7	Japan	7	154	12
8	Peoples R China	13	132	5
9	USA	20	114	21
10	Iran	3	107	3

In conclusion, this analysis has outlined several intriguing facets of the "15-minute city" idea and suggested some new research directions that may be explored further in the future. Utilizing a two-pronged approach, the technique included bibliometric analysis within the

VOSviewer tool in addition to a qualitative examination of present contributions on the issue and associated roadmaps.

Additionally, it was concluded that it would be useful to examine the articles mentioned above. As mentioned, we see that the importance of the issue has gained momentum with the pandemic and its importance has increased with the increase in the number of studies conducted. The most frequently used word groups will be the guiding criteria in the research.

2.2. The Most Cited 5 Articles in Web of Science

In table 2.5. the most cited 5 analysis is given with their informations. The articles mentioned in the table 2.5. will be analyzed respectively and finally their methodologies and results will be presented and compared with in table 2.6. Additionally, their theoretical background will be utilized in the literature review section "2.5. 15-Minute City Idea".

Table 2.5. First 5 most cited articles (Prepared by author)

	Authors	Article Title	Author Keywords	Citation	Publication Year	WoS Categories
1	Moreno, C; Allam, Z; Chabaud, D; Gall, C; Pratlong, F	Introducing the 15-Minute City: Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities	15-minute city; urbanism; sustainability; collective intelligence; proximity; smart cities; Carlos Moreno; walkability; humane cities	573	2021	Engineering, Electrical & Electronic; Urban Studies
2	Pozoukidou, G; Chatziyiannaki, Z	15-Minute City: Decomposing the New Urban Planning Eutopia	15-min cities; proximity; inclusive planning; COVID-19 pandemic; spatial planning; land use planning; bottom-up wellbeing	191	2021	Green & Sustainable Science & Technology; Environmental Sciences; Environmental Studies

Table 2.5. (continued) First 5 most cited articles (Prepared by author)

3	Nieuwenhuijsen, MJ	New urban models for more sustainable, liveable and healthier cities post covid19; reducing air pollution, noise and heat island effects and increasing green space and physical activity	Cities; Traffic; Urban planning; Transport; COVID19; Air pollution; Noise; Green space; Heat; Physical activity; Superblocks; 15-minute city; Low traffic neighbourhoods; Car free city	135	2021	Environmental Sciences
4	Logan, TM; Hobbs, MH; Conrow, LC; Reid, NL; Young, RA; Anderson, MJ	The x-minute city: Measuring the 10, 15, 20-minute city and an evaluation of its use for sustainable urban design	10-minute city; 15-minute city; 20-minute city; Transport planning; Urban planning; spatial accessibility; Active transport	102	2022	Urban Studies
5	Guzman, LA; Arellana, J; Oviedo, D; Aristizábal, CAM	COVID-19, activity and mobility patterns in Bogota. Are we ready for a '15-minute city'?	COVID-19; Travel patterns; Activity location; 15-Minute city; Bogota	94	2021	Transportation

- Moreno, C., Allam, Z., Chabaud, D., Gall, C., Pratlong, F. (2021).
  Introducing the “15-Minute City”: Sustainability, resilience and place identity in future post-pandemic cities.

The article explores the concept of the 15-minute city, a model for urban living where residents can access all essential services-such as work, healthcare, education, and recreation-within a 15-minute walk or bike ride from their homes. This urban planning concept gained attention during the COVID-19 pandemic as cities looked for ways to enhance sustainability, reduce carbon footprints, and increase resilience to future global crises.

Key points from the article:

- Sustainability and Resilience: The 15-minute city model promotes reduced reliance on cars, thereby lowering pollution and enhancing air quality. It also emphasizes decentralized infrastructure, which can help cities become more resilient in the face of disruptions such as pandemics or climate change.
- Place Identity: This model fosters a stronger sense of community and place identity, as people become more connected to their neighborhoods. The idea is that local services and public spaces create opportunities for greater social cohesion, enhancing residents' attachment to their environments.
- Post-Pandemic Relevance: The article highlights how the pandemic reshaped perceptions of urban space and transportation, underscoring the need for cities to adapt to new social and economic realities. The 15-minute city responds to these shifts by offering a more flexible, accessible urban layout.
- Challenges and Criticisms: The model also faces challenges, including the risk of exacerbating social inequalities if certain neighborhoods are underdeveloped or lack sufficient infrastructure. There's also concern that it may be difficult to retrofit existing urban spaces to meet these standards.

Overall, the article presents the 15-minute city as a forward-thinking approach to urban planning that balances sustainability, resilience, and community-building, while also addressing the challenges posed by the post-pandemic world. It is noted that the 15-minute city aligns with ideas that emphasize proximity, walkability, and social interaction within urban environments. However, while the concept has quickly been embraced by cities worldwide, they argue that fully implementing the 15-minute city will require further research to examine the roles and interconnections of factors like density, proximity, diversity, and digitalization. Achieving this will necessitate the use of modern research methods and a discussion on how this model can complement traditional urban planning approaches. Therefore, it is important to recognize that, in addition to appealing to mayors and organizations like C40, the 15-minute city is paving the way for a new research agenda.

- Pozoukidou, G., Chatziyiannaki, Z. (2021).
  15-minute city: Decomposing the new urban planning eutopia.

The article critically examines the concept of the 15-minute city. It breaks down the key components and promises of this model, including its potential to enhance sustainability,

reduce car dependency, and improve the quality of life by promoting walkability and local living. It also considers how this model might improve urban resilience by fostering more self-sufficient neighborhoods, especially in the face of crises like the COVID-19 pandemic. However, the article also discusses the challenges and limitations of implementing the 15-minute city. These include the risks of gentrification, social exclusion, and the difficulty of retrofitting existing urban structures to meet these ideals. It argues that while the concept is appealing, it is important to critically assess its feasibility and to ensure that it does not inadvertently deepen urban inequalities.

Key points from the article:

- Core Benefits: Promotes sustainability by reducing car dependency and lowering carbon emissions. Enhances walkability and local living, improving residents' quality of life. Strengthens urban resilience by encouraging self-sufficient neighborhoods, especially in crises like the COVID-19 pandemic.
- Challenges and Criticism:
  - Gentrification: Risk of displacing low-income residents due to rising property values and increased demand for certain areas.
  - Social Exclusion: The model might reinforce inequalities if some neighborhoods lack adequate infrastructure or services.
  - Urban Retrofit Difficulty: Existing cities may face challenges in adapting to this model, especially in densely built environments.
- Need for Further Research: The model requires careful study to assess the roles of density, proximity, diversity, and digitalization in making it successful. Research methods need to be updated to evaluate the feasibility of the 15-minute city. Discussion is needed on how this model can complement or challenge traditional urban planning approaches.

Ultimately, the article suggests that the 15-minute city, while offering a potentially transformative vision for the future of urban living, requires more nuanced discussion and thorough research to ensure its successful implementation and to avoid reinforcing social disparities.

- Nieuwenhuijsen, M.J. (2021)

New urban models for more sustainable, liveable and healthier cities post covid19; reducing air pollution, noise and heat island effects and increasing green space and physical activity.

The article explores the shift in urban planning towards models that prioritize sustainability, health, and livability in the aftermath of the COVID-19 pandemic. It discusses how cities can evolve to address challenges like air pollution, noise, heat island effects, and inadequate green spaces while promoting physical activity. The paper is a narrative meta-review, rather than a systematic one, examining several innovative and forward-thinking urban models that could impact public health. It highlights models reported in recent years, particularly in relation to COVID-19 during the past year, with a focus on urban developments aimed at enhancing citizens' health.

Key points from the article:

- Post-Pandemic Urban Transformation: The pandemic highlighted the need for cities to adapt in ways that improve public health, environmental quality, and resilience to future crises. Urban spaces are reimagined to support these goals through innovative design and planning.
- Addressing Environmental Issues:
  - Air Pollution: The article emphasizes the importance of reducing air pollution by promoting cleaner transportation (e.g., electric vehicles, cycling) and more sustainable infrastructure.
  - Noise Pollution: Strategies like limiting traffic and promoting quieter public spaces are discussed to reduce urban noise levels.
  - Heat Island Effect: The article highlights how urban areas can reduce the heat island effect through increased green spaces, tree planting, and reflective materials in buildings and roads.
- Promoting Green Spaces: Increasing urban green spaces, parks, and tree canopies is seen as essential for improving air quality, providing recreational areas, and promoting physical and mental health. Green spaces help mitigate the impacts of heat and pollution.
- Encouraging Physical Activity: New urban models include pedestrian-friendly streets, dedicated cycling lanes, and public parks that encourage walking and physical activity, which have significant health benefits.

- Holistic Approach: The article advocates for integrating environmental, social, and health-related goals in urban planning to create cities that are not only more sustainable but also more livable and resilient for future generations.

Several new urban concepts or models are being implemented in various cities to address the issues mentioned above, including Superblocks, low-traffic neighborhoods, the 15-minute city, car-free cities, or combinations of these. These models share the common goal of reducing private car usage and promoting public and active transportation (walking and cycling), which helps lower air pollution, noise, and heat island effects, while also increasing physical activity and ultimately improving public health. Overall, the article argues that post-pandemic cities should prioritize health, sustainability, and accessibility to create environments that support both people and the planet, while mitigating urban environmental challenges.

- Logan T.M. (2022).
  The x-minute city: Measuring the 10, 15, 20-minute city and an evaluation of its use for sustainable urban design.

The article examines the idea of the "x-minute city," which describes urban planning models intended to create communities where important services and amenities (such as work, schools, healthcare, shopping, and recreation) are within a short 10-, 15-, or 20-minute walk or bike ride. By promoting walkability, lowering reliance on cars, and encouraging social interaction and local economic development, this idea supports sustainability aims.

Key points of the article:

- Definitions of Time-Based Accessibility: The article defines and measures the 10, 15, and 20-minute city concepts in terms of accessibility to essential services. The core idea is that these time thresholds represent a sustainable urban experience, where daily needs can be met without requiring long commutes.
- Sustainable Urban Design: The authors discuss how these time-based urban design models contribute to sustainability. They highlight benefits such as reduced carbon emissions, improved air quality, better physical health, and stronger community cohesion.

These outcomes arise from limiting reliance on cars and encouraging more active forms of transport.

- Challenges and Limitations: While the concept of the X-minute city is appealing, the article also acknowledges challenges. These include issues like ensuring equitable access to services across different socio-economic groups, adapting existing infrastructure to support walkability and cycling, and the risk of creating too many "self-contained" neighborhoods that might hinder broader city connectivity.
- Evaluation and Application: The article evaluates real-world applications of the 10, 15, and 20-minute city frameworks, examining how cities around the world are implementing or testing these models. The evaluation includes case studies and discusses how these models are adapted to different urban contexts, including population density, geographical features, and local policy environments.
- Implications for Future Urban Planning: The article concludes by emphasizing the potential for time-based urban design to reshape cities for the future. It advocates for a balanced approach that integrates the X-minute city with broader transportation networks, regional development plans, and policies that prioritize environmental sustainability and social equity.

This study presents an analysis of the x-minute city concept utilizing accessibility analysis techniques to assess access to a selection of critical destinations. A quantitative approach that is scalable and replicable in any other city was introduced. Urban planners and policymakers can use the methodology and results presented to assess the availability of different amenities, test scenarios for enhancing accessibility, and pinpoint areas that require interventions, whether they be network-wide (e.g., adding missing links) or service-related (e.g., improving service delivery; amenity gaps).

- Guzman, L.A. (2021)
  COVID-19, activity and mobility patterns in Bogota. Are we ready for a '15-minute city'?

The article explores the impact of the COVID-19 pandemic and lockdown measures on mobility, activity patterns, and urban inequalities in Bogotá, Colombia. It assesses whether Bogotá meets the concept of a "15-minute city," where essential services are accessible within a short walking distance. The study's conclusions serve as a reminder that land use

and urban planning are crucial in addressing social and geographic disparities in a city and that accessibility and travel behavior are not only matters of urban transport planning.

Key points of the article:

- Impact on Mobility and Activity: Lockdown measures resulted in significant changes in mobility and activity patterns, with disproportionate effects on low-income groups. Low-income residents faced greater challenges, including a higher reliance on physical mobility for work and essential activities, which increased their exposure to contagion.
- Inequalities in Access: The city exhibits marked socio-spatial segregation, with essential services (e.g., healthcare, education, banking) concentrated in wealthier areas. While local shops are relatively accessible across neighborhoods, critical services remain out of reach for many low-income residents within the "15-minute" framework.
- Survey and Findings: Data from a web-based survey highlighted that 58% of low-income respondents could not work from home, compared to 11% of high-income respondents. Online shopping and digital connectivity, crucial during lockdowns, were less accessible to low-income groups, exacerbating inequality.
- Urban Planning Insights: The findings stress the importance of integrating land-use and urban planning with transport policies to address socio-spatial inequalities. Expanding non-motorized infrastructure (e.g., cycle paths) and local service availability is recommended to support equitable access.
- 15-Minute City Readiness: Bogotá is partially aligned with the "15-minute city" concept, particularly in local retail access. However, broader implementation is hindered by the uneven distribution of critical services and socio-economic disparities.

Overall, Inequalities in the ability of people and social groups to adjust and react to the limitations imposed by the global COVID-19 pandemic are evident in the study of urban mobility and activity behavior across socioeconomic categories in the city of Bogota. The results of the survey make it clearly apparent that behavioral shifts have differentiated negative effects on the economy, society, and health of communities that begin in various disadvantageous positions and must quickly adjust to changing circumstances.

Table 2.6. Findings and methodologies of first 5 most cited articles (Prepared by author)

	Authors	Article Title	Methodology	Findings	Case City
1	Moreno, C; Allam, Z; Chabaud, D; Gall, C; Pratlong, F	Introducing the 15-Minute City: Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities	Literature review Theoretical framework Data collection and analysis	-The concept focuses on proximity-based urban planning, aiming for neighborhoods with optimal densit -The goal is to improve quality of life by reducing the need for long-distance travel -This model encourages more time for social interactions and community engagement -It addresses the lack of social functions in current urban planning models	No specific city
2	Pozoukidou, G; Chatziyiannaki, Z	15-Minute City: Decomposing the New Urban Planning Eutopia	Literature review Theoretical framework Case Study Comparative approach	-It promotes local living by improving access to essential services, potentially enhancing residents' quality of life - May lead to gentrification in wealthier areas, as they are more likely to have the infrastructure needed to support this concept - Inequality in access to resources might deepen - May not be universally applicable or feasible in all urban contexts, especially in larger cities or those with historical layouts that don't easily accommodate this model - Findings emphasize both the opportunities and limitations of the 15-minute city model, urging careful consideration of its broader impacts on urban planning, society, and sustainability.	Portland, Melbourne, Paris

Table 2.6. (continued) Findings and methodologies of first 5 most cited articles (Prepared by author)

	Authors	Article Title	Methodology	Findings	Case City
3	Nieuwenhuijsen, MJ	New urban models for more sustainable, liveable and healthier cities post covid19; reducing air pollution, noise and heat island effects and increasing green space and physical activity	Literature review Identification of urban models Theoretical framework Comparative analysis	-Implementing new urban models, such as low-traffic neighborhoods and 15-minute city, significantly reduces air pollution by limiting vehicle emissions, leading to improved air quality - Increasing green spaces and enhancing urban parks help lower the urban heat island effect by providing more shade and promoting cooling through vegetation - Urban designs that encourage walking and cycling, such as the 15-minute city and pedestrian-friendly spaces, lead to higher levels of physical activity among residents - The pandemic has accelerated the adoption of these models, with many cities seeking to create post-COVID environments that are more resilient and adaptable to future crises	Examples from Barcelona, London, Paris and Freiburg
4	Logan, TM; Hobbs, MH; Conrow, LC; Reid, NL; Young, RA; Anderson, MJ	The x-minute city: Measuring the 10, 15, 20-minute city and an evaluation of its use for sustainable urban design	Literature review Geospatial analysis Case study Quantitative data analysis	-Important portion of Seville's population has broad access to sustainable urban mobility alternatives -Public transportation and active mobility could be the core components of a linked x-minute city - Given that many of the current mobility issues can be effectively addressed at the metropolitan, applying the x-minute city concept to metropolitan areas could be an important area of future research	Seville

Table 2.6. (continued) Findings and methodologies of first 5 most cited articles (Prepared by author)

	Authors	Article Title	Methodology	Findings	Case City
5	Guzman, LA; Arellana, J; Oviedo, D; Aristizábal, CAM	COVID-19, activity and mobility patterns in Bogota. Are we ready for a '15-minute city'?	Literature review Spatial analysis Behavioral and temporal analysis	-Disproportionate impact of lockdown on low-income groups about mobility and activities - Low-income individuals reported the largest decreases in time devoted to primary activities, while high-income groups were better able to maintain or shift activities online -While local shops are relatively accessible citywide, critical services such as healthcare, education, and banking are concentrated in wealthier eastern areas, limiting access for low-income populations -Public transport use declined significantly, with increases in walking and cycling trips, particularly among medium- and low-income groups - Bogotá exhibits some readiness for the "15-minute city" concept, particularly in terms of access to local retail shops.	Bogotá

2.3. The Literature on Cluster Analysis

Under the 2.1. Bibliometric Analysis section, the keywords repeated at least 5 times in the group of findings were narrowed and 16 keywords were identified. These 16 keywords are listed on table 2.3. and in figure 2.6. The larger the circle, the more frequently a keyword appears, and the color of an item corresponds to the cluster to which that keyword belongs.The lines between the circles show which keywords were mentioned together in a paper. With Vosviewer 4 cluster groups are detected as in the following;

Cluster 1: “15-minute city”, “accessibility”, “GIS”, “pedestrian accessibility”, “walking”
Cluster 2: “mobility”, “proximity”, “public space”, “sustainable mobility”, “urban planning”
Cluster 3: “chrono-urbanism”, “smart cities”, “urban accessibility”, “walkability”
Cluster 4: “sustainability”, “sustainable development”

2.3.1. The Literature of Cluster 1: Pedestrian Accessibility

For the cluster 1, 3 different searches are conducted on Web of Science to detect methodologies for the analysis.

- Search Rule 1: “15-minute city” and “accessibility” and “GIS” and “pedestrian accessibility” and “walking”

For the cluster 1, 5 keywords are searched on “author keywords” field and 2 articles are found related with those keywords (Table 2.7.). The publication year for both of the articles are 2023 and they are published from the same authors. Their Web of Science Categories are “Geography”, “Geography Physical” and “Remote Sensing”.

Table 2.7. Articles found on Web of Science with keywords “15-minute city” and “accessibility” and “GIS” and “pedestrian accessibility” and “walking” (Prepared by author)

Authors	Article Title	Author Keywords	Times Cited, WoS Core	Publication Year	WoS Categories
Harroucha, R; Chaouni, AA	Mosques pedestrian accessibility analysis under the 15 min cities concept	Urbanization; Pedestrian accessibility; Walking; 15-minute city; GIS-based-approach	3	2023	Geography
Harroucha, R; Chaouni, AA	GIS-based approach evaluating sustainable spatio-functional accessibility to mosques	Urbanization; pedestrian accessibility; walking; 15-minute city; GIS-based-model	2	2023	Geography; Geography, Physical; Remote Sensing

Because of the themes, keywords and publication years are same and “Mosques pedestrian accessibility analysis under the 15 min cities concept” article is not open to public, only “GIS-based approach evaluating sustainable spatio-functional accessibility to mosques” article will be examined.

- Harroucha, R., Chouni A.A. (2023)
  GIS-based approach evaluating sustainable spatio-functional accessibility to mosques

The article explores the application of GIS to assess both spatial and functional accessibility of mosques, framed within the "15-minute city" concept. The study focuses on the Agdal district in Fez, Morocco. Summary of the methodology and findings;

- Rapid urbanization has increased distances, motorization, and population density, creating accessibility challenges for essential services like mosques.
- A GIS-based model was applied to evaluate pedestrian accessibility to 30 mosques in Agdal.
- Two dimensions were analyzed, first one is spatial accessibility; assessed how far worshippers can walk (200m, 400m, and 600m). Accordingly, figure 2.8. displays: (a) The mosque M's service network at a walking distance of x meters. (b) The catchment area of the mosque M, which is the convex envelope enclosing the mosque's service network at a walking distance of x meters; each walking distance of x meters corresponds to a walking time of t minutes; (c) the area whose population can walk a maximum of x meters to reach the mosque M; (d) the area that is spatially disadvantaged or whose population cannot walk that distance.

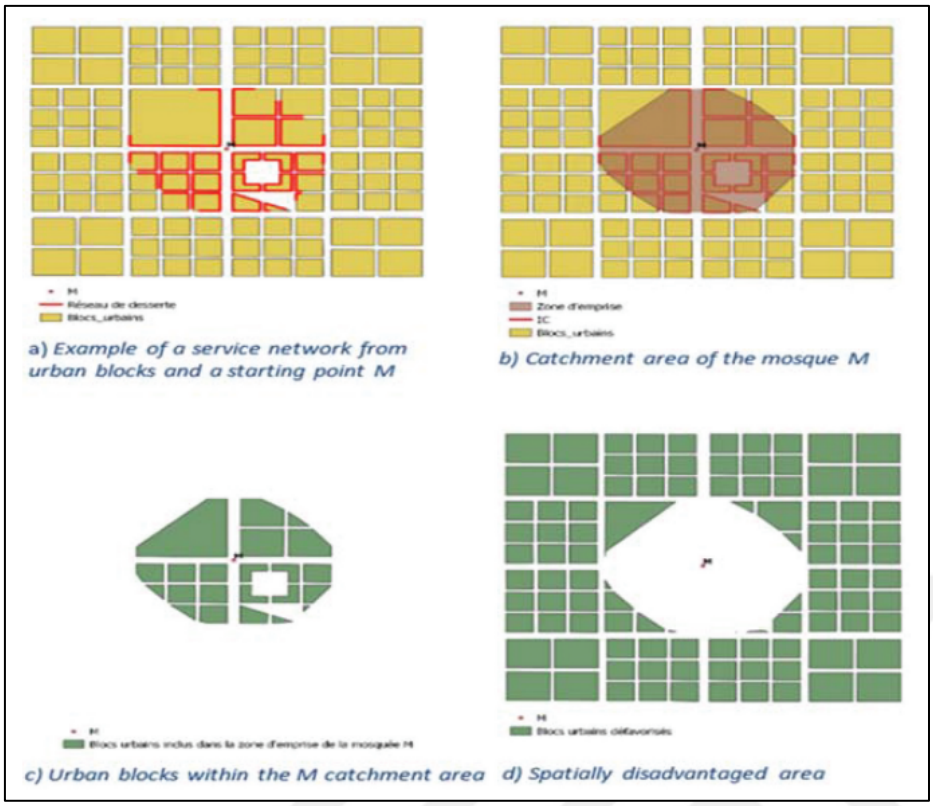


Figure 2.8. Spatial accessibility analysis (Harroucha and Chaouni, 2023)

- Second one is functional accessibility; compared mosque capacities with the number of worshippers in their catchment areas. The land use plan of the study area, the urban areas that are part of the catchment area, and the urban areas that are deprived are depicted in Figure 2.9. images a, b, and c, respectively.

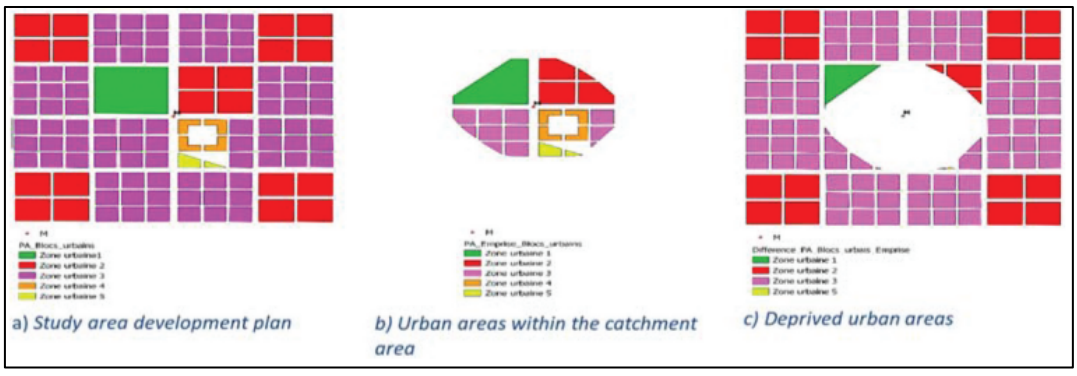


Figure 2.9. Functional accessibility analysis (Harroucha and Chaouni, 2023)

- Given that 1200 m and 600 m walking distances, respectively, correspond to 15- and 30-minute walking times, the study from Correa-Parra (2020) offers a methodology for evaluating an urban area's potential to become a 15-minute city based on its current core

urban functions. Using the same reasoning, they chose walking times of 15 minutes, 10 minutes, and 5 minutes for our study, which correspond to walking distances of 600, 400, and 200 meters, respectively.

- Many mosques were spatially accessible but functionally inadequate due to insufficient capacity to serve the populations in their areas.
- Addressing accessibility gaps by either expanding existing mosques or constructing new ones in underserved areas.
- Efforts to improve accessibility should prioritize larger catchment areas (e.g., 600m walking distance).

- Search Rule 2: "15-minute city" and "accessibility" and "GIS" and "pedestrian accessibility"

A search on Web of Science in "author keyword" field by removing "walking" from the word group gives the same results as search rule 1.

- Search Rule 3: "15-minute city" and "accessibility" and "GIS"

A search on Web of Science in "author keyword" field by removing "walking" and "pedestrian accesibility" 5 articles are reached (Table 2.8.). The publication years are 2023 and 2024. Their categories are illustrated on Figure 2.10. The 2 articles were evaluated on "Search Rule 1: "15-minute city" and "accessibility" and "GIS" and "pedestrian accessibility" and "walking"" section and the rest of the articles will be examined respectively.

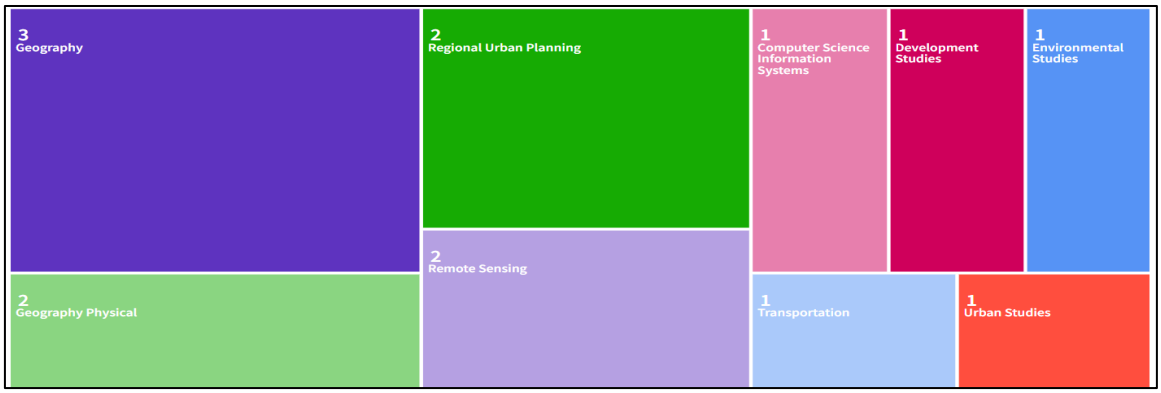


Figure 2.10. Web of Science Categories for search rule 3

Table 2.8. Articles found on Web of Science with keywords “15-minute city” and “accessibility” and “GIS” (Prepared by author)

Authors	Article Title	Author Keywords	Times Cited, WoS Core	Publication Year	WoS Categories
Akrami, M; Sliwa, MW; Rynning, MK	Walk further and access more! Exploring the 15-minute city concept in Oslo, Norway	15 -minute city; Urban planning; GIS-analysis; Accessibility; Proximity; Oslo	5	2024	Geography; Regional & Urban Planning; Transportation
Monteiro, J; Para, M; Sousa, N; Natividade-Jesus, E; Ostorero, C; Coutinho-Rodrigues, J	Filling in the Spaces: Compactifying Cities towards Accessibility and Active Transport	urban layout; urban form; urban compactification; sustainability; accessibility; transport energy; active travel; 15-Minute City; GIS	5	2023	Computer Science, Information Systems; Geography, Physical; Remote Sensing
Harroucha, R; Chaouni, AA	Mosques pedestrian accessibility analysis under the 15 min cities concept	Urbanization; Pedestrian accessibility; Walking; 15-minute city; GIS-based-approach	3	2023	Geography
Harroucha, R; Chaouni, AA	GIS-based approach evaluating sustainable spatio-functional accessibility to mosques	Urbanization; pedestrian accessibility; walking; 15-minute city; GIS-based-model	2	2023	Geography; Geography, Physical; Remote Sensing
Korah, PI; Cobbinah, PB; Adu, P	Beyond the known: Walking accessibility twist to new cities	New cities; Fragmentation; 15-Minute city; Walking accessibility; Urban amenities; GIS	0	2024	Development Studies; Environmental Studies; Regional & Urban Planning; Urban Studies

- Akrami M., Sliwa, M.W., Rynning M.K. (2024)
  Walk further and access more! Exploring the 15-minute city concept in Oslo, Norway

The article evaluates the applicability of the 15-minute city model in Oslo using a mixed-methods approach. Through GIS-based spatial analysis, document review, and interviews with urban planners, it examines the extent to which Oslo meets the principles of the 15-

minute city and explores strategies for integrating this concept into its urban planning framework.

Summary of the methodology and findings;

- The process involved mapping out locations that were within a 15-minute walk from people's homes, then calculating the number of facilities in each category that were situated there. Additionally, gathered insights from urban planners about the challenges and opportunities for adopting the model in Oslo's planning.
- -The objective is to quantify the ease of access to various services and facilities within a 15-minute walk and to find spatial trends in the distribution of facilities that take walkability and population density into account.
- The dataset consists of a grid with 250 m x 250 m cells that contain 2019 population statistics aggregated. They used demographic data for age ranges 0–5 and 6–19, respectively, to analyze access to kindergartens and schools.
- People who reside in suburban areas, more car-oriented, can walk longer than those who live closer to the city center. Given that the majority of the central regions were built before cars were a commonly available form of mobility, this is not unexpected. This demonstrates how a grid-based, interconnected street network is crucial to creating a metropolis that is 15 minutes away. In most outside regions, walkability is restricted not only by the prevalence of cars but also by the mountainous terrain, which lengthens the distances between locations.
- While kindergartens and other educational facilities are more or less uniformly dispersed throughout residential areas, unsurprisingly, commercial, entertainment, and healthcare amenities are concentrated in the city center (figure 2.11.).
- Figure 2.12. demonstrates the primary finding of research: the quantity of amenities in each category that residents in various regions of the city may reach within a 15-minute walk.

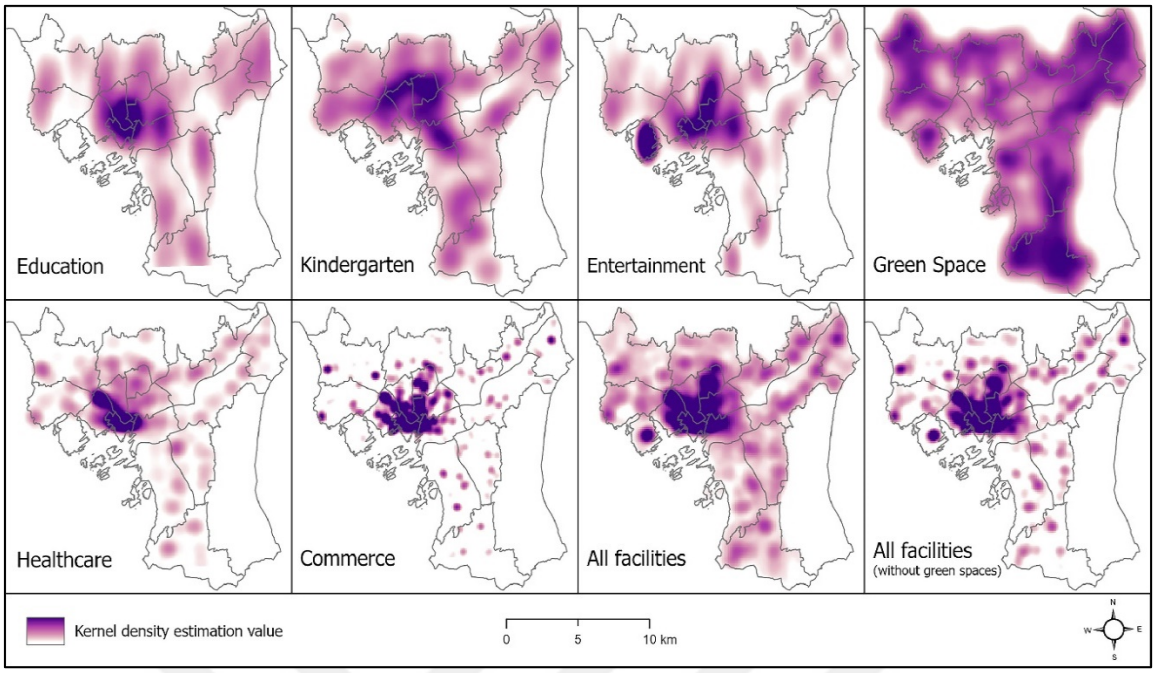


Figure 2.11. Spatial distribution of facilities based on the KDE analysis in Oslo (Akrami, 2024)

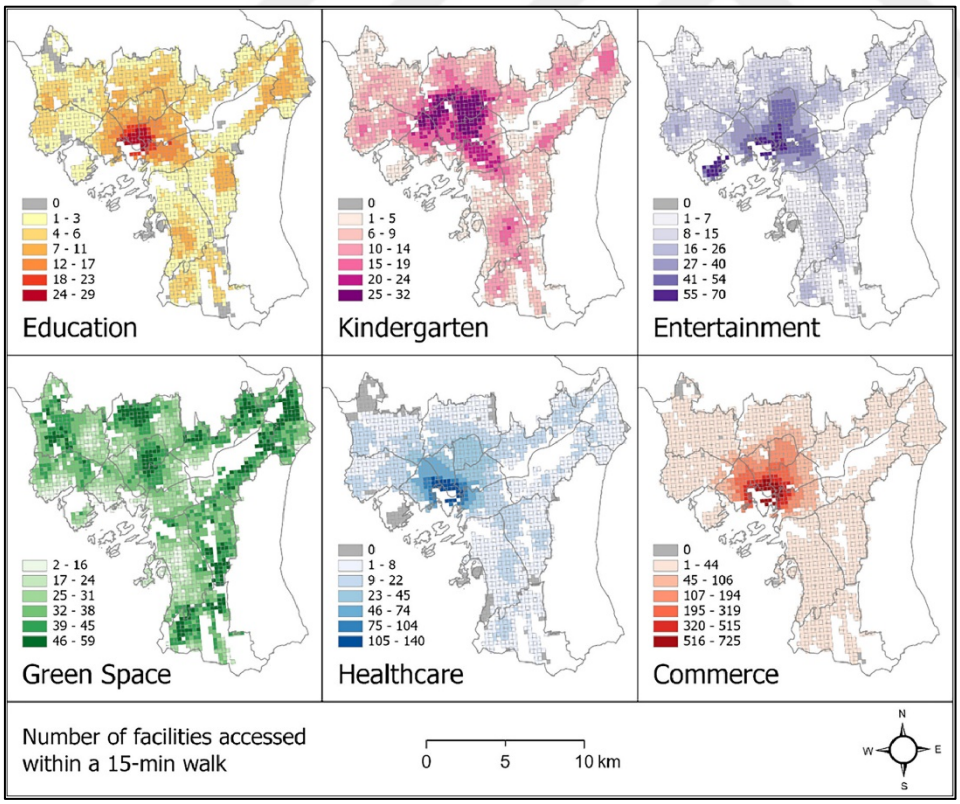


Figure 2.12. Access to different types of facilities within a 15-minute walk (Akrami, 2024)

- Inner City Success: High accessibility to diverse facilities and infrastructure aligns well with the 15-minute city concept.

- Suburban Challenges: Limited facility distribution, car dependency, and hilly topography hinder accessibility in outer-city areas.
- Strategic Alignment: Oslo's urban planning strategies, such as densification around transit hubs and green infrastructure expansion, share similarities with 15-minute city principles.
- Barriers: Existing low-density neighborhoods, socio-economic disparities, and political constraints pose challenges to city-wide implementation.

o Monteiro, J., Para, M., Sousa, N., Natividade-Jesus, E., Ostorero, C., Coutinho-Rodrigues, J. (2023)
Filling in the Spaces: Compactifying Cities towards Accessibility and Active Transport

The article focuses on urban compactification as a strategy to counter urban sprawl, improve accessibility, and promote active transport modes like walking and cycling. Using Coimbra, Portugal, as a case study, it presents a GIS-based methodology to evaluate the benefits of transforming cities by filling vacant spaces in line with municipal master plans. Summary of the methodology and findings;

- The proposed methodology centers on a comparison of the city of Coimbra as it currently exists, which will be referred to as "Coimbra" or "real Coimbra," with its smaller equivalent, "Compact Coimbra." In other words, the actual Coimbra's urban plan is contrasted with a fictitious, condensed pattern in which Coimbra is reorganized by relocating residential neighborhoods, public buildings, and employment centers from the suburbs onto empty lots in the actual city while adhering to local laws.
- Accessibility, active transportation modal share, transportation energy consumption, and the extent to which a city layout qualifies as a 15-minute city are the four quantitative factors uses GIS used in the comparison.
- Over the ages, sprawl increased with regional developments exceeding comparable population growth (Figure 2.13.).

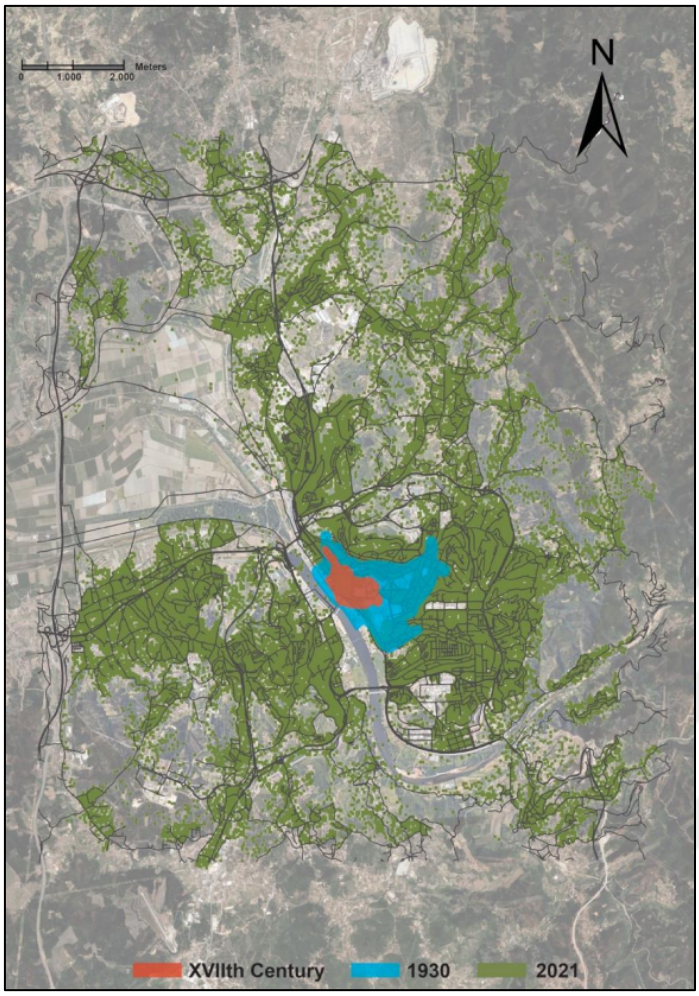


Figure 2.13. Evolution of Coimbra's urban perimeter and population (Monteiro, 2023)

- Only 0.2% of journeys use active modes, according to survey data, primarily because of high inclines and inadequate cycling network compatibility (i.e., a lack of infrastructure and general safety). Public transportation and private vehicles account for 30 and 70 percent of motorized travel, respectively. However, if the cycling network were improved and deterrents were removed, the low cycling share is expected to increase dramatically.
- As seen in Figure 2.14., the city's overall urbanized area decreased by approximately 88% after the conclusion of this compactification process, from 141,720 m^2 to 16,732 m^2.

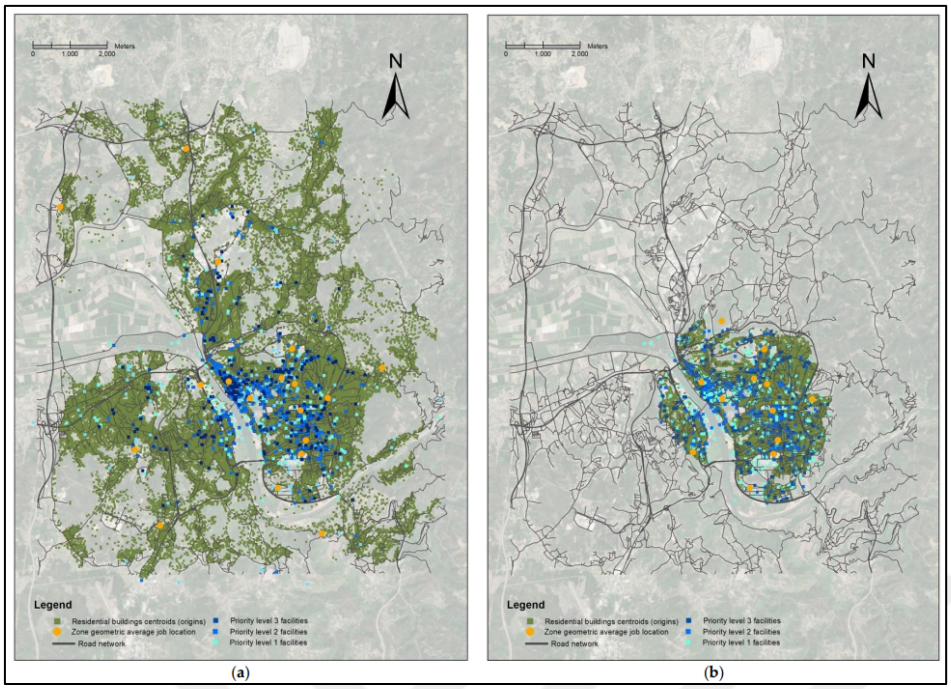


Figure 2.14. Origins, destinations, and road network. (a) Layout of Coimbra; (b) layout of compact Coimbra. (Monteiro, 2023)

- As predicted, compactification raises the accessibility scores, as shown in Figure 2.15. Even in the more central areas, which had high scores prior to compactification, there is a noticeable overall increase. As the city gets denser and more compact, accessibility rankings equally becoming more consistent.

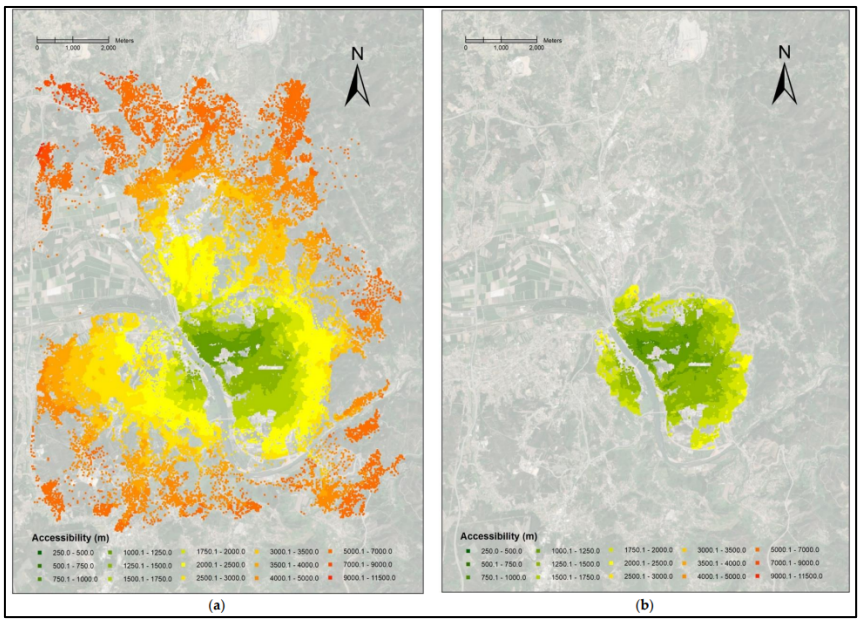


Figure 2.15. Accesibility to urban facilities plus jobs (m). (a) Coimbra; (b) compact Coimbra. (Monteiro, 2023)

- Compact Coimbra is often a walkable city when walking 700 or 800 meters, especially when facilities are the only thing taken into consideration. This stands in sharp contrast to real Coimbra, which is far from walkable with an average distance per resident to facilities of 1440 m or 2533 m if employment is included. Regarding cycling, both cities are accessible by bicycle for the average resident, assuming that the distances are between 3800 meters. Nevertheless, even though compact Coimbra is clearly bikeable for all of its residents, this ability is only present in the city's more central regions.
- According to the case study results, Coimbra's accessibility, attainability of a 15-minute city status, active mode share, and transportation energy consumption all increased as a result of compactification.
- This approach underscores the importance of thoughtful urban design in mitigating environmental and social impacts of sprawl, providing a model for sustainable city planning.

o Korah, P.; Cobbinah, P.; Adu, P. (2024)
Beyond the known: Walking accessibility twist to new cities.

- Research on new cities in African contexts has primarily focused on housing, infrastructure, and service provision, leaving walking accessibility for residents within and outside these areas largely unexplored.
- This paper uses Accra, the national capital of Ghana, as a case study to address two objectives: (a) assess walking accessibility within and outside new cities in the area, and (b) compare access to urban amenities for residents inside and outside these new urban developments.
- The study utilizes publicly available data on the locations and distribution of urban amenities in Accra, employing accumulated distance and spatial autocorrelation analysis to derive insights.
- Walking accessibility to six work and non-work activities is computed.
- Findings indicate new cities are disadvantaged in terms of walking accessibility to amenities.
- In the Greater Accra Metropolitan Area (GAMA), parks are the least accessible facilities, with an average walking time of 2.67 hours and a maximum of 8.08 hours to reach the nearest park. Conversely, health facilities are the most accessible, with residents requiring

an average of 19 minutes (0.32 hours) and a maximum of 1.67 hours to reach them on foot.

- The results reveal that less than 50% of metropolitan residents have walking access to parks, schools, and new job opportunities within a 15-minute walk. Residents in new cities are particularly disadvantaged, with significantly lower walking accessibility to parks, schools, job opportunities, and public transport stops compared to those living outside these areas.
- This highlights how the planning and location of new cities in Accra fail to prioritize walking accessibility. The findings emphasize the fragmented and uncoordinated development of new cities, contributing to unsustainable urban forms.
- As new cities continue to emerge across African urban landscapes, the study recommends a more integrated and equitable provision of urban amenities within walking distance in these areas and their peripheries to foster more sustainable urban development.

2.3.2. The Literature of Cluster 2: Mobility

For the cluster 2, 3 different searches are conducted on Web of Science to detect methodologies for the analysis.

- Search Rule 1: “mobility” and “proximity” and “public space” and “sustainable mobility” and “urban planning”

For the cluster 2, 5 keywords are searched on “author keywords” field with English language and 1 article is found related with those keywords (Table 2.9.). The publication year of the article is 2022. The Web of Science Categories are “Geography”, “Geography Physical” and “Remote Sensing”.

Table 2.9. Articles found on Web of Science with keywords ““mobility” and “proximity” and “public space” and “sustainable mobility” and “urban planning” (Prepared by author)

Authors	Article Title	Author Keywords	Times Cited, WoS Core	Publication Year	WoS Categories
Longo, D; Orlandi, S; Boeri, A; Turillazzi, B	Proximity As a Design Strategy For Sustainable, Collaborative and Inclusive Urban Public Spaces	city of proximity; urban planning; community creation; urban public space; sustainable mobility; design strategies; co-design platforms; social innovation practices; urban transformation processes; the Atelier of Urban Innovation Lab Bologna.	1	2022	Architecture; Green & Sustainable Science & Technology; Regional & Urban Planning

- Longo, D., Orlandi, S., Boeri, A., Turillazzi, B. (2022)
  Proximity As a Design Strategy For Sustainable, Collaborative and Inclusive Urban Public Spaces

- The article explores the use of proximity-based approaches in urban planning to create sustainable, inclusive, and collaborative public spaces.
- As a direct result of the forced physical separation between people, which was chosen as the first measure to slow down the spread of COVID, there have been noticeable changes in how daily spaces are used. These changes have occurred in the public and semi-public domains, where the "necessary everyday tasks" are met, as well as in the private sphere of the home, which has changed to become a setting for combining privacy, leisure, and work.
- The neighborhood spaces, which serve as the focal point of residents' life, are a network of nodes that trace the reference infrastructure of modern "proximity" based urban planning and redevelopment initiatives as a means of encouraging maintenance of the urban environment and 15-minute city concept have been introduced by Moreno.
- Bologna (Italy) is regarded as a model collaborative city based on this type of neighborhood-centric strategy. Urban transformation strategies are tested and improved at Bologna's Urban Innovation Lab (IUL). In addition to collecting citizen input and

encouraging community involvement, interactive tools and workshops make it easier to explore design scenarios.

- Furthermore, the subject is examined through a selection of 60 projects considered essential to their people-place-based approach, which is defined by urban reactivation policies that involve local communities and foster horizontal and interinstitutional cooperation while focusing on the fundamental relationships between citizens and their city and neighborhoods. The goal of the atlas of excellent practices is to serve as a helpful resource for recognizing potential tactics, fixes, procedures, and outcomes attained in various settings. A workbench designed to host and promote various types of collaboration between numerous users is the second primary component that defines the Atelier layout.
- The shared characteristics and cross-cutting elements that arose from the comparison of the case studies and design interactions offer helpful insights, lessons learned, and a practical set of practices to help in directing the shift toward a collaborative and relationship-based city model. Furthermore, the methodological approach to understanding and reading the Atelier's urban transformation processes emphasizes and notes the significance of considering and combining all the various elements that describe the complex framework of urban dynamics, in terms of the actors to be involved, the actions to be carried out, the spaces to be improved, the uses to be matched, the enabling processes, and the achievable results.

- Search Rule 2: “mobility” and “proximity” and “public space” and “sustainable mobility”

A search on Web of Science in “author keyword” field by removing “urban planning” from the word group gives the same results as search rule 1.

- Search Rule 3: “mobility” and “proximity” and “public space”

A search on Web of Science in “author keyword” field by removing “sustainable mobility” from the word group gives the same results as search rule 2. Since the word “proximity” gives similar results to the word “accessibility” in cluster 1, a research was conducted by removing that word and keeping “mobility” and adding “15-minute city” to find results as example for the analysis.

- Search Rule 4: “mobility” and “15-minute city”

As mentioned, since the terms "proximity" and "accessibility" in cluster 1 produce comparable results, a study was carried out in which the terms "mobility" and "15-minute city" were included in order to obtain results as an example for the analysis. As a result of this search, 7 results were found in Web of Science. However, one of the results “Design of a Micromobility Transportation Unit with AI” was removed because it was not relevant to the subject. In table 2.10. the results are given.

Table 2.10. Articles found on Web of Science with keywords “mobility” and “15-minute city” (Prepared by author)

Authors	Article Title	Author Keywords	Times Cited, WoS Core	Publication Year	WoS Categories
Tammaru, T; Sevtsuk, A; Witlox, F	Towards an equity-centred model of sustainable mobility: Integrating inequality and segregation challenges in the green mobility transition	Sustainable mobility; Equity; Segregation; Activity spaces; 15-Minute City; Transit-oriented development; E-mobility	5	2023	Economics; Geography; Transportation
Mouratidis, K	Time to challenge the 15-minute city: Seven pitfalls for sustainability, equity, livability, and spatial analysis	15-minute city; Sustainable cities; Livable cities; Accessibility; Sustainable mobility; Compact city	3	2024	Urban Studies
Jin, T; Wang, K; Xin, Y; Shi, J; Hong, Y; Witlox, F	Is a 15-Minute City Within Reach? Measuring Multimodal Accessibility and Carbon Footprint in 12 Major American Cities	15-minute City; CO2 Emissions; Mobility Flows; Accessibility; Spatial Planning; Net-Zero Future	3	2024	Environmental Studies
Wang, T; Li, Y; Chuang, I; Qiao, W; Jiang, J; Beattie, L	Evaluating the 15-minute city paradigm across urban districts: A mobility-based approach in Hamilton, New Zealand	15-Minute-city; Urban structure; Geolocated data; Human mobility analysis; GIS spatial analysis	2	2024	Urban Studies

Table 2.10. (continued) Articles found on Web of Science with keywords “mobility” and “15-minute city” (Prepared by author)

Kim, Y; Lee, S	Neighborhood-level determining factors of travel distance by trip purpose: Policy implications for the N-minute city	N -minute city; 15-Minute city; Travel distance; Mobile phone location-based mobility big data; COVID-19	0	2025	Urban Studies
Calafati, L; Froud, J; Haslam, C; Johal, S; Williams, K	Place and mobility in Wales: Challenges and opportunities for reducing car use in a car-dependent, low-density country	liveability; 15-minute city; 20-minute neighbourhood; Wales; car-dependence; mobility; metrophilia; small towns	0	2023	Economics

- Tammaru, T., Sevtsuk, A., Witlox, F. (2023)
  Towards an equity-centred model of sustainable mobility: Integrating inequality and segregation challenges in the green mobility transition

- To frame the conversations around the relationship between sustainable mobility and the spatial architecture of urban inequality, they propose a four-layer Equitable Sustainable Mobility model. The model's four layers are illustrated in figure 2.16: (a) the distribution of urban opportunities organized around home locations; (b) the distribution of mobility infrastructure and access to important locations for daily activities by various modes of transportation; (c) the areas where all family members engage in their daily activities in urban areas; and (d) the proportion of trips made by various social groups using sustainable modes of transportation.

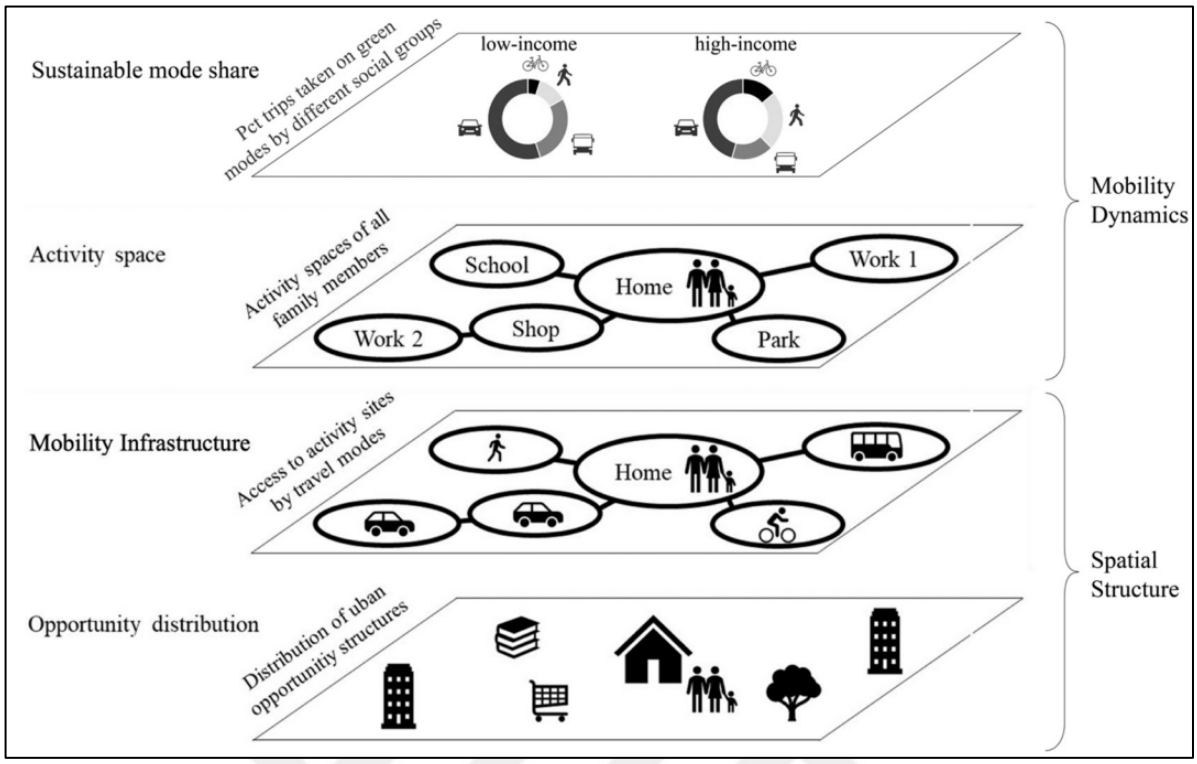


Figure 2.16. The four layers of an equitable sustainable mobility model (Tammaru, 2023)

- Opportunity Distribution: Spatial distribution of urban opportunities (e.g., jobs, services) influences travel needs and accessibility, often disadvantaging marginalized groups.
- Mobility Infrastructure: Availability and quality of mobility systems, including public transit, e-mobility, and cycling infrastructure, should be distributed equitably.
- Activity Spaces: Daily activity patterns of residents differ across socio-economic groups, affecting their interaction with urban mobility systems.
- Sustainable Mode Share: Encouraging adoption of green mobility modes while minimizing inequities between social groups.
- Cross-level interactions: According to the framework, the first two levels of the mode offer the greatest chance for balancing the shift to sustainable urban mobility. According to the opportunity distribution layer, residential segregation usually causes wealthier groups (or other groups with greater social power in a city) to live closer to opportunities than do lower income groups. This allows the wealthy to travel to these opportunities more quickly and without a car.
- While low-income groups are confined to underinvested areas with fewer chances, wealthy households frequently live-in communities with better access to amenities, employment prospects, and educational options. A self-reinforcing vicious cycle is produced by this unequal distribution: wealthy communities attract more services and

infrastructure, which raises their standard of living, while underprivileged neighborhoods continue to be neglected, which restricts their mobility and keeps them in poverty (Figure 2.17.).

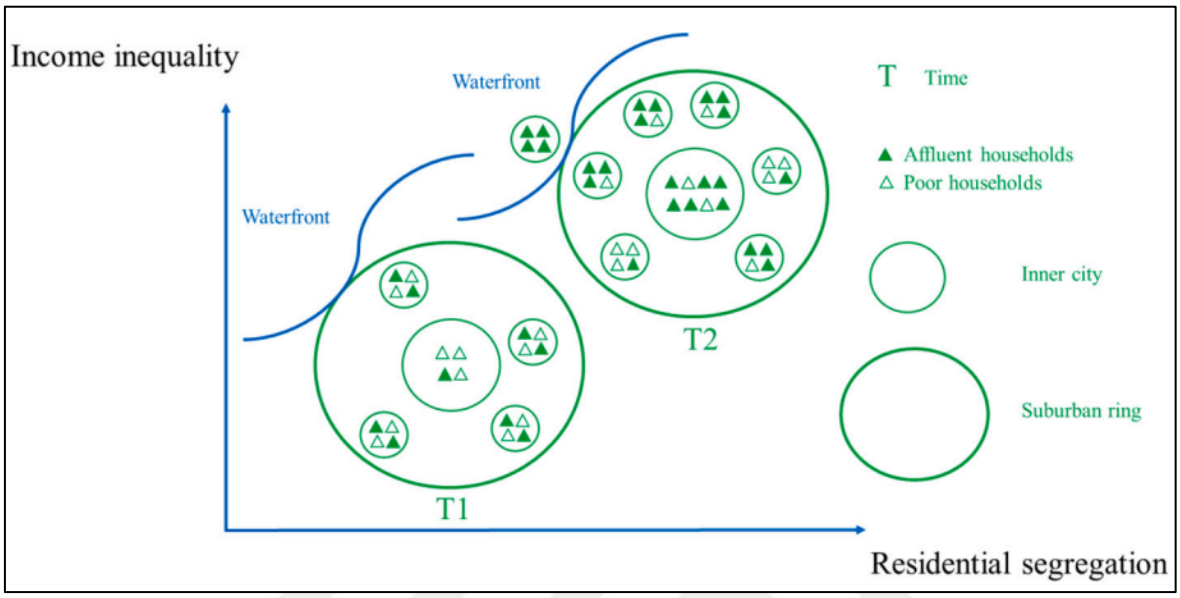


Figure 2.17. Changes in urban income inequality and residential segregation (Tammaru, 2023)

- In conclusion, in order to reduce greenhouse gas emissions and slow down global warming, cities must transition from carbon-fueled automobility to sustainable mobility. However, policies that promote active modes of transportation and reduce daily trip distances in an effort to reduce greenhouse gas emissions frequently conflict with the goals of urban equity. The approaches and tactics for attaining a quicker, more effective, and more fair adoption of green urban mobility are covered in the papers compiled into this special issue.
- Three main conclusions for an equity-centered model of sustainable mobility are drawn from the studies, which are contextualized within the larger research findings in the field; addressing severe residential segregation in order to promote a mix of residences at the neighborhood level, automobility must give way to other kinds of green mobility in metropolitan areas and accessing to opportunities requires both local and metropolitan area-wide solutions.

- Mouratidis, K. (2024)
  Time to challenge the 15-minute city: Seven pitfalls for sustainability, equity, livability, and spatial analysis

- The article has a critical point of view for “15-minute city” theory. He believes that; systematic, comprehensive evaluations of constraints and difficulties are lacking. The 15-minute city may therefore be used uncritically as a framework for analysis and policy in a number of recent empirical research projects and policy texts. He thinks, they risk greater delays in achieving environmental and socioeconomic goals if they don't recognize and address the problems with the 15-minute city.
- This study explores the drawbacks of the 15-minute city in contemporary literature from a theoretical and geographical analytical standpoint, using a sustainability, equity, and livability lens. The paper then suggests other theoretical and methodological approaches to deal with contemporary issues. Instead of rejecting or "retiring" the idea, the goal is to evaluate it critically, highlight its shortcomings, and start a fresh discussion about how to refocus the theoretical and analytical techniques of the 15-minute city on improving societal and environmental results.
- Seven identified pitfalls:

- Exaggeration of Originality: Statements of originality ignore comparable ideas that have been put out in the past, including Perry's "Neighborhood Unit" and Krier's "City within the City."
- Unrealistic Decentralization: Since not all services (such as hospitals and colleges) can be spread equitably, complete decentralization to create self-sufficient areas is not feasible from an economic and environmental standpoint.
- Prioritize Quantity Over Sufficiency: When analyzing spatial data, it is common to focus on the quantity of facilities rather than their optimal distribution or sufficiency for a range of populations.
- Inappropriate Facility Aggregation: When different facilities are grouped into general categories, it can be difficult to distinguish between their unique accessibility and quality variations.
- Neglect of Urban Nature: The emphasis is frequently restricted to parks' closeness, neglecting the larger variety of blue and natural areas (such as rivers and forests) and their qualitative characteristics.

- Public Transportation Exclusion: Theoretical focus on bicycling and walking ignores the function of public transportation for longer distances and general urban connection.
- Disregarding Individual Variations in Mobility: Accessibility focused on walking and bicycling ignores the needs of people with mobility impairments or other restrictions.

- The paper's specific goal is to draw attention to potential misunderstandings, weaknesses and ambiguities about the 15-minute city as a theory and spatial analytical tool among scholars, practitioners, and anybody else interested in urban and transportation issues. The seven pitfalls that have been identified may spark additional discussion and encourage urban theorists, scholars, practitioners, and legislators to develop solutions. In the end, the 15-minute city would realign itself toward better environmental and societal outcomes by resolving the seven pitfalls that have been identified.

  - Jin, T., Wang, K., Xin, Y., Shi, J., Hong, Y., Witlox, F. (2024)
    Is a 15-Minute City Within Reach? Measuring Multimodal Accessibility and Carbon Footprint in 12 Major American Cities

A crucial research topic is addressed in the paper: how realistic is the 15-minute city concept for American cities? This study uses Point of Interest (POI) check-in data from 12 major American cities to provide an extensive framework for evaluating the 15-minute city concept. Due to the spatial distribution of necessary activities outside convenient cycling, walking, and public transportation distances, the data indicate a prevalent reliance on cars among residents.

Given that low-emission forms of transportation can fit the majority of residents' daily activities within a 15-minute radius, there is considerable potential for achieving the 15-minute city goal. Comparatively speaking, metropolises like New York City, San Francisco, Boston, and Chicago seem to have a better chance of becoming a 15-minute walking city, but places like Atlanta, Dallas, Houston, and Phoenix seem to have a greater challenge doing so.

When examining inter-group comparisons, communities with a higher median income and a larger percentage of White people typically have more accessible points of interest (POIs), with a significant number of activities concentrated within a 15-minute radius. Compared to

African Americans, this group also has a greater tendency to complete daily tasks by walking, bicycling, or taking public transportation within a 15-minute journey time, offering a larger potential for CO2 reduction. Policymakers can learn from this study how far American cities are away from the idea of a 15-minute city. It also draws attention to the possible decreases in CO2 emissions that could be accomplished with effective implementation.

However, there are significant obstacles to implementing the 15-minute city concept in US cities, mainly since Americans often commute a median distance of 5.0–12.6 km for everyday activities. The median distances for work-related, shopping, errand-running, and social and recreational journeys are 12.6 km, 5.0 km, 6.0 km, and 6.8 km, respectively, according to the 2022 US National Household Travel Survey. The typical commute time for daily activities is 6–15 minutes by car and 1–2.5 hours by foot, depending on walking (5 km/h) and driving (50 km/h). These distances are far beyond what could be reasonably covered on foot or on bicycle in a 15-minute city.

Using extensive POI check-in data from 12 major American cities, this article offers a thorough framework for experimentally assessing the idea of the 15-minute city. First, this research goes deeper, assessing both the availability of services and the community's desire for activities within this timeframe, in contrast to previous studies that only concentrated on accessible activity places or services (i.e., POIs) within 15 minutes. It also looks at the possibility of using a 15-minute city model, which aims for cutting down on CO2 emissions and travel distances. Second, this study covers a broader range of transportation options, including walking, bicycling, public transportation, and even private automobiles. The 15-minute city's enlarged vision highlights the value of supporting local communities while cutting down on travel times and CO2 emissions.

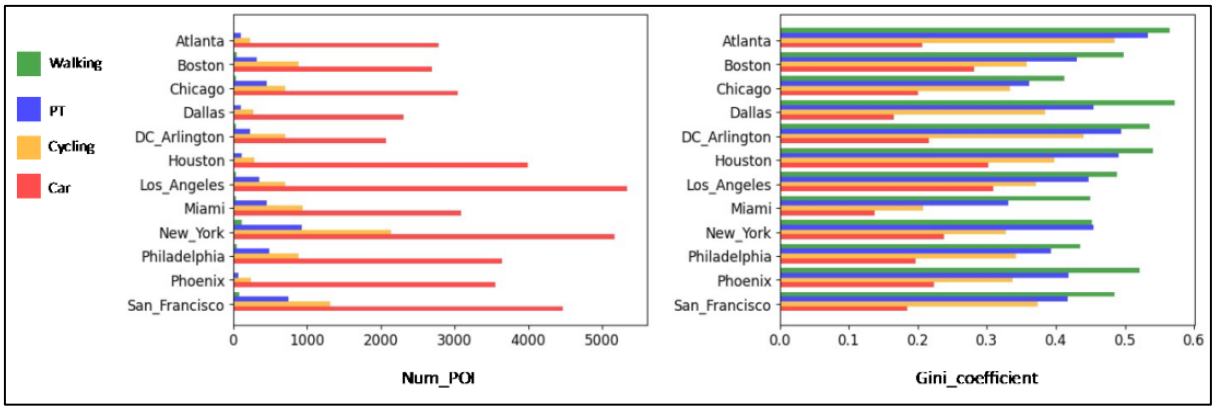


Figure 2.18. The number of accessible POIs within 15-minute by multiple travel modes and corresponding Gini coefficient across different cities-PT: public transit (Jin, 2024)

People can reach the most POIs in 15 minutes by automobile in all of the chosen cities, with cycling following in second. Only a small number of POIs are accessible by foot. Los Angeles performs best among these studies in terms of POIs that are easily accessible by automobile, followed by New York City, San Francisco, and Houston. Figure 2.18. illustrates that DC Arlington performs the worst in this area. Compared to other cities, residents of New York City have more access to points of interest when it comes to sustainable modes of transportation including walking, bicycling, and public transportation. However, cities with the worst performance on accessible points of interest by sustainable modes of transportation include Atlanta, Dallas, Houston, and Phoenix.

Because most everyday activities take place beyond than a 15-minute walk, bike ride, or public transportation ride, car dependency is more common in some areas. The majority of these tasks, whether by bicycle, public transportation, or automobile, may, in fact, be completed within 15 minutes thanks to the adoption of the 15-minute city concept. The most promising strategy for cutting journey distances and CO2 emissions for the majority of the cities examined in this research is to encourage citizens to use public transportation and bicycles to carry out their daily tasks. In certain cities, including New York City, San Francisco, Boston, and Chicago, the 15-minute walking idea is also feasible. Atlanta, Dallas, Houston, and Phoenix are outside the 15-minute walking radius because of the low proportion of activities that can be completed in that time frame. Because Americans rely so heavily on their cars, encouraging local neighborhoods that are 15 minutes away by automobile is still important and might effectively reduce journey distances and CO2 emissions by about 50%.

- Wang, T., Li, Y., Chuang, I., Qiao, W., Jiang, J., Beattie, L. (2024)
  Evaluating the 15-minute city paradigm across urban districts: A mobility based approach in Hamilton, New Zealand

The article examines the "15-minute city" concept's potential to reduce urban sprawl and car reliance while evaluating its implementation in Hamilton, New Zealand. It analyzes residents' access to necessary services within walking distances of 5, 10, and 15 minutes using a mobility-based approach that makes use of GIS and geolocated mobile data.

In order to evaluate Hamilton, New Zealand's urban and transportation frameworks, this study uses a two-step technique. In the first step, a spatial study is conducted to determine "liveable areas" in particular districts that have walkable access to basic amenities. A mobility analysis that examines people' travel habits and specifically focuses on their preference for "local living" is part of the second step. The four urban districts in Hamilton that are the focus of these analyses are business-centric, mixed residential-centric, historical-residential-centric, and industrial-centric.

The six important services categories include grocery stores and supermarkets, schools and universities, parks and natural reserves, hospitals and pharmacies, restaurants and cafés, and transit stops. The decision to exclude workplaces from this list was influenced by the evolving nature of work and commuter habits, particularly in the wake of the epidemic. Furthermore, a number of factors might impact commute distances; for example, persons' home location choices may be impacted by income levels and the transportation infrastructure close to their place of employment. In order to determine "liveable areas" in Hamilton City, this study concentrated on the six non-workplace categories. Maps of the Hamilton district design were also utilized. Each neighborhood's POIs are depicted in figure 2.19.

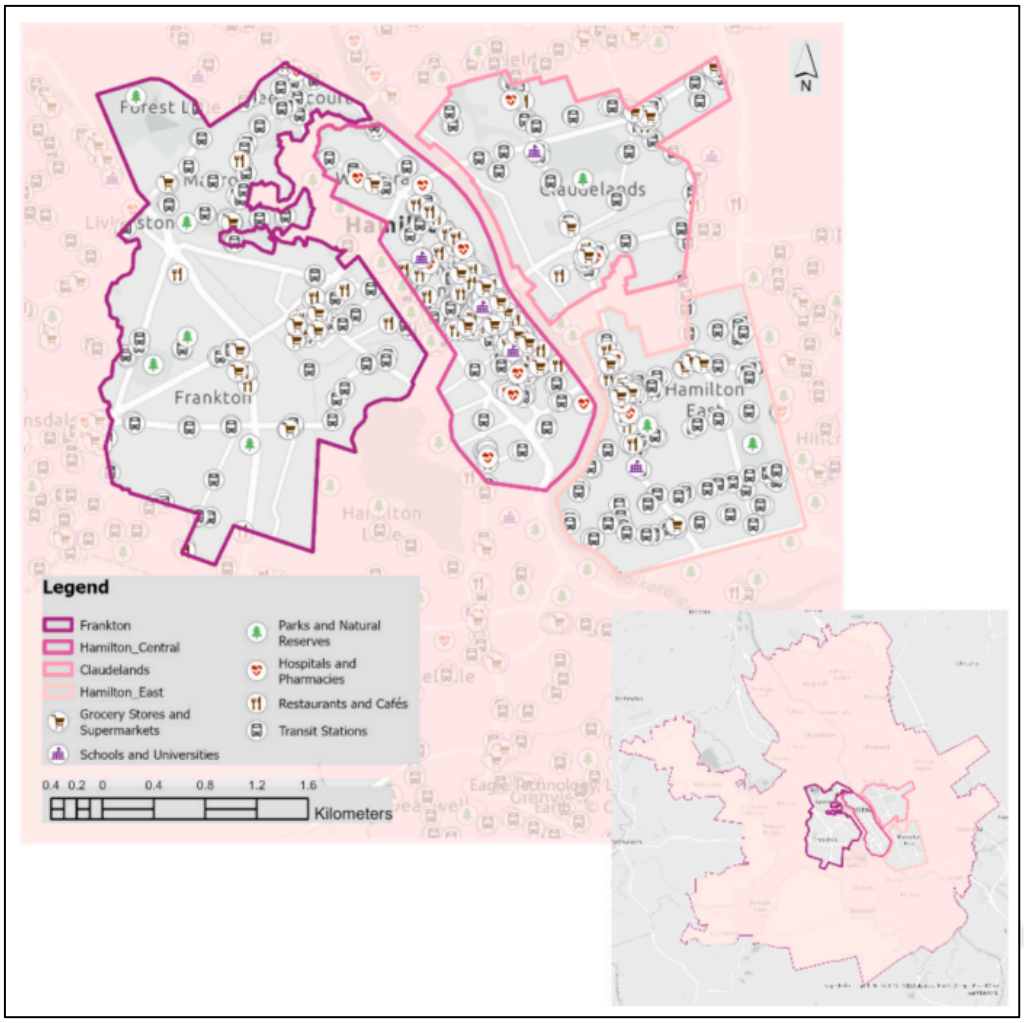


Figure 2.19. The six types of POIs in selected districts (Wang, 2024)

They marked areas accessible within various isochrones by creating buffer zones surrounding each POI. The six categories of vital services were used to classify these buffer zones. Subsequently, these distinct buffer zones for each category were combined to create a composite walking area that matched each kind of necessary service. Finding the intersections between these category-specific buffer zones is a crucial component. These intersections were operationalized to define what the study refers to as "liveable areas," which are defined as locations where people may walk to daily necessities and lessen their reliance on cars.

Three goals were achieved by this mapping: firstly, it helped in understanding the gradations of accessibility and liveability within the urban fabric to pinpoint areas that have fallen short in prioritising interventions. The second benefit was that it made it possible to assess how well Hamilton's current urban structures conform to the "15-minute city" model's spatial

principles. By creating this baseline, they were able to learn more about how Hamilton's urban fabric might be modified to fit this model. Lastly, the mapping showed inconsistencies between the idealized "15-minute city" mobility patterns and the actual mobility behavior of the population. These patterns primarily involve walking, which typically results in a significantly shorter journey distance. In this manner, particular regions that need for focused interventions for sustainable development could be found (figure 2.20.).

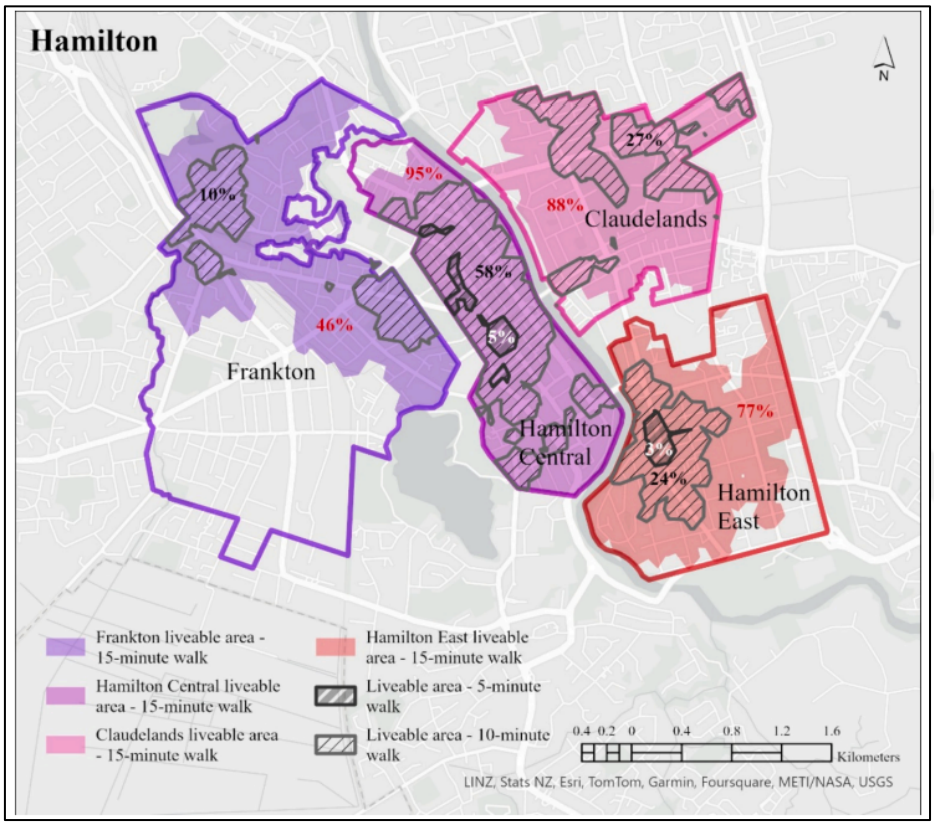


Figure 2.20. Liveable areas and coverage percentage within each selected district (Wang, 2024)

Based on three different isochrone radii of 400, 800, and 1200 meters throughout four Hamilton districts, this study provides a thorough assessment of "liveable areas" in terms of human movement. They have investigated the viability and usefulness of the widely recognized "15-minute city" concept by examining the variations in mobility patterns among inhabitants of four districts with different structures. This analysis shows that while urban structure is the main factor influencing inhabitants' mobility patterns, other factors may also have a big impact.

- Kim, Y., Lee, S. (2025)
  Neighborhood-level determining factors of travel distance by trip purpose: Policy implications for the N-minute city

In order to support the development of n-minute cities, this study aims to examine the variables that affect living radii through the use of spatial regression analysis and mobile phone location-based mobility big data.

Study favors the idea of n-minute cities by separating pre- and post-COVID-19 periods, as well as between commuting and non-commuting travel. It also finds factors influencing living radii and shows decreased average travel distances in the post-pandemic period. They will next apply traffic polygons to examine the spatial variations in average travel distance at a finer spatial scale than administrative districts. They further establish October 2019 as the pre-pandemic era and October 2022 as the post-pandemic period, respectively, and examine how the urban environmental elements of the 15-minute city idea influence trip distances based on the reasons of travel.

While neighborhood living and cultural amenities continue to have a continuous influence on commute distance, the post-COVID-19 era has seen a shift in the impact of factors including population density, commercial facilities, and the job-housing ratio. This emphasizes how crucial it is to give these factors top priority while developing a n-minute city.

Commuting trip distances were found to be consistently around 1 km longer than non-commuting trip distances, and this difference remained even after COVID-19. Second, commuting distances fluctuated, rising and falling after COVID-19 started, but then steadily declining after the fourth wave spread in 2021. Thirdly, there was a significant drop in the non-commuter travel distance, which was followed by an increase. Following the introduction of the social distancing incentive program for people who had received all recommended vaccinations, a steady pattern showed that travel distances were gradually returning to their pre-COVID-19 levels (Figure 2.21.)

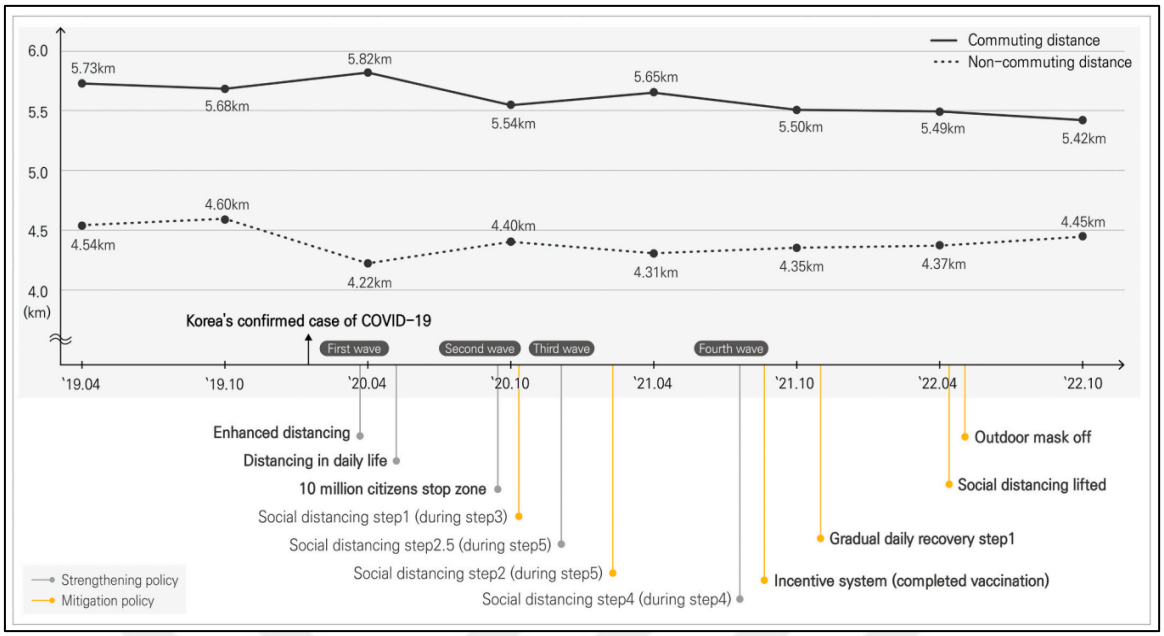


Figure 2.21. Change in average travel distance between 2019–2022 (Kim and Lee, 2025)

Figures 2.22. and figure 2.23. shed light on the spatial differences in average travel times around Seoul, taking into account the impact of COVID-19 as well as differences in journey times according to the reason for travel. In terms of commuter traffic, the Gangnam district and center Seoul had shorter trip times, but the surrounding regions had greater journey times. According to the analysis, people who live in downtown Seoul often have a smaller living radius than people who live on the outskirts of the city; this tendency is seen in both commuting and non-commuting situations.

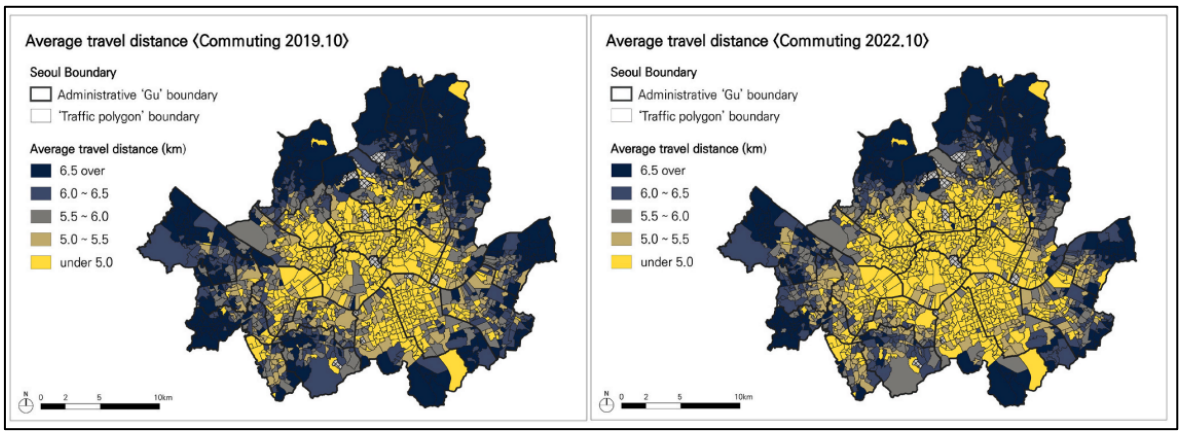


Figure 2.22. Average distance of commuting travel (Kim and Lee, 2025)

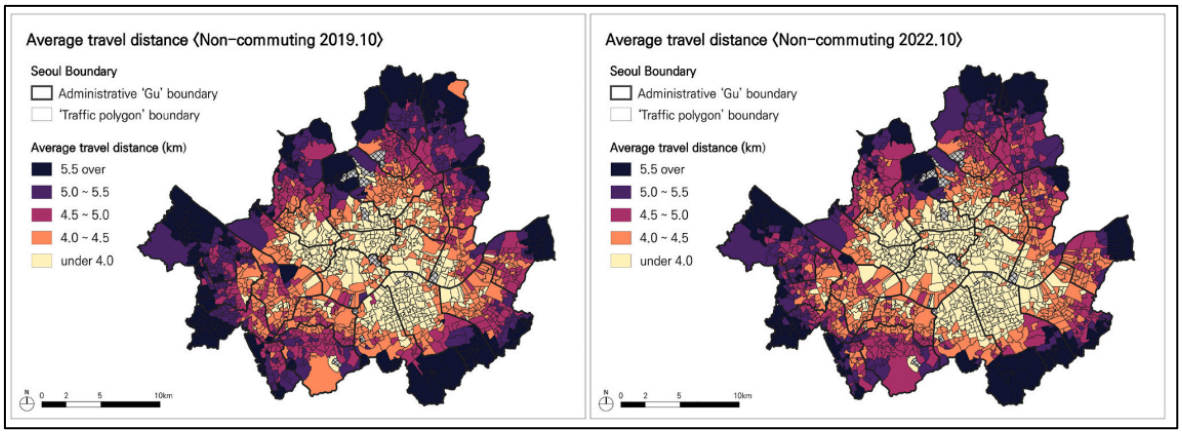


Figure 2.23. Average distance of non-commuting travel (Kim and Lee, 2025)

In 2019, it was found that a greater mix of residential and commercial facilities was linked to shorter non-commuting trip distances, while a higher mix of residential and business facilities was linked to longer non-commuting trip distances. These findings shed light on the effects of diversity variables on non-commuter travel distance. Nevertheless, none of these variables showed a substantial impact in 2022, demonstrating that the urban ambient factors influencing travel patterns have changed significantly since the COVID-19 pandemic.

- Calafati, L., Froud, J., Haslam, C., Johal, S., Williams, K. (2025)
  Place and mobility in Wales: Challenges and opportunities for reducing car use in a car-dependent, low-density country

This study uses Wales as an example to examine the potential and difficulties of implementing the revolutionary modal shift embodied in the 15/20-minute place vision. Wales, a country in the United Kingdom with 3.1 million people, is a diversified region that includes both larger and smaller settlements as well as urban, peri-urban, and rural areas.

It takes a meso-perspective on car reliance, emphasizing the connection between mobility and settlement type and structure. The following are the main research questions: What connections exist between daily movement patterns and the settlement architectures of various locations in Wales? How are the opportunities and challenges for lowering car use defined by these settlement structures? To what extent are there the preconditions for a substantial decrease in car use?

The study affirmed that car reliance is a structural characteristic of Welsh communities, whether in urban and rural periurban settings. The car is not only the most convenient but frequently the sole mode of transportation due to low density, the separation of work, live, and shop amenities, and workplaces and residential areas that are focused on cars. However, the analysis also indicates that Wales contains a variety of high-density or mixed-use urban neighborhoods, mostly town centers, city centers of large urban areas, and some mixed-use urban neighborhoods.

They believe that this research has three major policy consequences. The first is that policy must adopt a more discerning perspective on locations while concentrating on the relationship between transportation patterns and settlement structure. The necessity for Welsh policy to harmonize town planning and transport policy is the second policy implication. The third suggestion, which could seem to pose the biggest challenges, is the necessity of more overtly discouraging the use of cars. Car use may still be seen as more appealing or convenient, and modal shift may be restricted, even with improved public transportation and more active travel.

2.3.3. The Literature of Cluster 3: Chrono-urbanism

For the cluster 3, 3 different searches are conducted on Web of Science to detect methodologies for the analysis.

- Search Rule 1: “chrono-urbanism” and “smart cities” and “urban accessibility” and “walkability”

For the cluster 3 - search rule 1, 4 keywords are searched on “author keywords” field with English language and no results are found.

- Search Rule 2: “chrono-urbanism” and “smart cities” and “urban accessibility**”**

For the cluster 3 - search rule 2, 3 keywords are searched on “author keywords” field with English language and no results are found.

- Search Rule 3: “chrono-urbanism” and “smart cities”

For the cluster 3 – search rule 3, 2 keywords are searched on “author keywords” field with English language and 1 article is reached. Because of “urban accessibility” is searched on cluster 1 as “accessibility” and “pedestrian accessibility” and “walkability” is searched on cluster 1 as “walking” and “pedestrian accessibility”, they are removed to have a result.

Table 2.11. Articles found on Web of Science with keywords “chrono-urbanism” and “smart cities” (Prepared by author)

Authors	Article Title	Author Keywords	Times Cited, WoS Core	Publication Year	WoS Categories
Sierra, J.; Ortiz, A.	A Quantitative Model of the City in 15 Minutes for Decision-making	Chrono-urbanism; Smart cities; Open data; Geospatial analysis; Multivariate analysis; Composite indicators	1	2024	Environmental Sciences

- Sierra, J., Ortiz, A. (2024)
  A Quantitative Model of the City in 15 Minutes for Decision-making

In modern metropolitan settings, it is essential to address issues like pollution, heat islands, and urban sprawl. Meeting the needs of citizens requires an understanding of urban systems and a focus on sustainability and proximity. In order to assess resource accessibility, this study offers a quantitative model with 21 composite variables that correspond to the dimensions of the 15-minute city theory (education, health and social welfare, leisure and culture, and supply).

The 70 neighborhoods that make up València, Spain's Ciutat Central, which is home to 96.3% of the city's population, will be the subject of this study's examination. Valencia has 830,000 residents, making it the third most populated city in Spain. Following the definition and computation of the study's 21 KPIs (key point indicator) for each of the 70 neighborhoods in Ciutat Central de Valencia, chloroplast maps are used to analyze the behavior of the indicators (figure 2.24., 2.25. and 2.26.). To provide the spatial behavior

displayed by the 21 indicators (Table 2.12.) in the city's neighborhoods with statistical relevance.

Table 2.12. Description grouping of resources (Sierra and Ortiz, 2024)

Indicator	Description	Dimension
K1	Early Childhood Education Centres	Education (EDU)
K2	Primary Schools	
K3	Secondary Schools	
K4	Vocational Training Centres	
K5	Adult Education Centres	
K6	Health Care Centres	Health and Social Welfare (HSW)
K7	Social Resources for Young People	
K8	Social Resources for the Elderly	
K9	Social Resources for the Entire Population	
K10	Pharmacies	
K11	Municipal and Special Markets	Supply (SUP)
K12	Food Products	
K13	Supermarkets	
K14	Household Products	
K15	Cultural Products	
K16	Other Products	
K17	Food Services	Leisure and Culture (L&C)
K18	Cultural Services	
K19	Sport Activities	
K20	Museums, Libraries and Theatres	
K21	Parks and Green Areas	

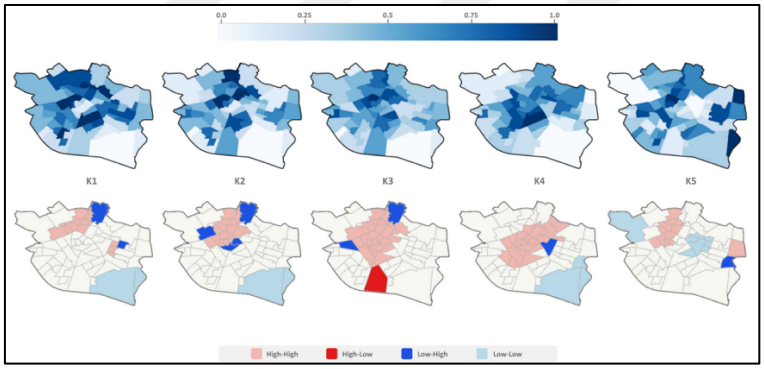


Figure 2.24. Indicators of education dimension (Sierra and Ortiz, 2024)

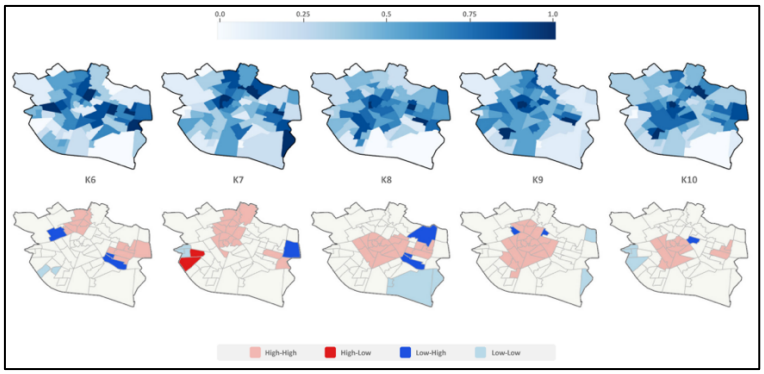


Figure 2.25. Indicators of health and social welfare dimension (Sierra and Ortiz, 2024)

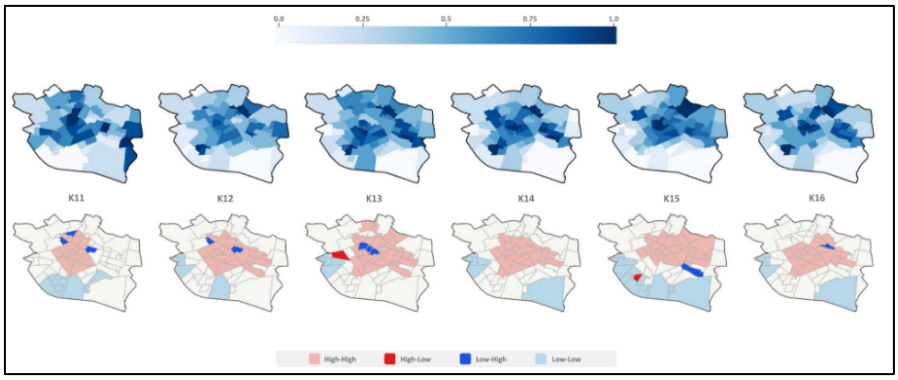


Figure 2.26. Indicators of supply dimension (Sierra and Ortiz, 2024)

Values are typically concentrated in neighborhoods in the city center and its northeastern extension, according to the KPIs' overall behavior. As the neighborhoods get farther from the city center, the indicator's value decreases radially. This pattern supports the arguments made by academicians and urban planners over the past few decades about the marginalization of cities' periphery.

Despite the progress made toward sustainability objectives, there is still an urgent need to address disparities and improve accessibility and inclusivity, especially in periperal areas. This distinction is a result of historical influences, fast urban growth, and social segregation, underscoring the difficult problems faced by urban planners. However, exceptional instances such as the Benimaclet neighborhood demonstrate how important resource access and community interaction are to achieving favorable outcomes.

In any case, the suggested indications make the model a highly beneficial instrument for organizations who track the city's development. This coordinated endeavor seeks to build more resilient and egalitarian cities, with a focus on improving accessibility and mobility, in order to promote a more sustainable and inclusive future for everybody.

2.3.4. The Literature of Cluster 4: Sustainable Development

For the cluster 4, 2 different searches are conducted on Web of Science to detect methodologies for the analysis.

- Search Rule 1: “sustainability” and “sustainable development”

For the cluster 4 - search rule 1, 2 keywords are searched on “author keywords” field with English language and 20 results are reached. As shown in table 2.13., they are listed according to their citation numbers. While the publication years vary between 2015 and 2024, it is understood that there are current topics. Of the 20 results, 15 are articles, 4 are review articles, 1 is a book chapter and 1 is a proceeding paper. The first 5 of the results are analyzed in terms of their methodology, the methods applied and the findings.

Table 2.13. Articles found on Web of Science with keywords “sustainability” and “sustainable development” (Prepared by author)

	Authors	Article Title	Author Keywords	Times Cited, WoS Core	Publication Year	WoS Categories
1	Höjer, M; Wangel, J	Smart Sustainable Cities: Definition and Challenges	Smart city; Sustainable city; Sustainable development; Definition of sustainability; ICT	252	2015	Computer Science, Hardware & Architecture; Computer Science, Information Systems
2	Corbett, J; Mellouli, S	Winning the SDG battle in cities: how an integrated information ecosystem can contribute to the achievement of the 2030 sustainable development goals	Sustainable development goals; smart city; sustainability; green IS; grounded theory; information system ecosystem	94	2017	Information Science & Library Science
3	Kutty, A; Abdella, G; Kucukvar, M; Onat, N; Bulu, M	A system thinking approach for harmonizing smart and sustainable city initiatives with United Nations sustainable development goals	Smart city initiatives; sustainable smart city; systems thinking; United Nations sustainable development goals; United Nations urban sustainability agenda	63	2020	Development Studies; Green & Sustainable Science & Technology; Regional & Urban Planning

Table 2.13. (continued) Articles found on Web of Science with keywords ““sustainability” and “sustainable development”” (Prepared by author)

4	Singh, T; Solanki, A; Sharma, S; Nayyar, A; Paul, A	A Decade Review on Smart Cities: Paradigms, Challenges and Opportunities	Smart cities; Urban areas; Government; Technological innovation; Sustainable development; Bibliometrics; Market research; Smart city; Internet of Things; big data; cloud computing; sustainability; cyber-physical system	52	2022	Computer Science, Information Systems; Engineering, Electrical & Electronic; Telecommunications
5	Tura, N; Ojanen, V	Sustainability-oriented innovations in smart cities: A systematic review and emerging themes	Smart city; Sustainability-oriented innovation; Sustainable development; Urban development; Systematic literature review	50	2022	Urban Studies

- Höjer, M., Wangel, J. (2015)
  Smart Sustainable Cities: Definition and Challenges

There are five developments that can be seen from the beginning of smart sustainable cities.

1. Globalization of environmental problems and sustainable devopment; Decades of UN conferences have emphasized the global nature of environmental problems like biodiversity loss and climate change, which call for local action and sustainable development.

2. Urbanization and urban growth; Given that most people on the planet live in cities, metropolitan areas are essential for addressing sustainability issues.

3. Sustainable urban development and sustainable cities; With an emphasis on infrastructure, governance, and resource management, cities are embracing sustainable practices at an increasing rate.

4. Information and communication technologies; Smart cities rely heavily on information and communication technologies (ICT) to facilitate creative urban solutions and effective resource usage.

5. Smart cities; The idea combines innovative ICT to enhance urban living, and its expansion is being driven by collaboration between the public and private sectors.

Development that satisfies current needs without compromising the capacity of future generations to satisfy their own needs is known as sustainable development. Two fundamental ideas are included in it: the idea of "needs," specifically the basic needs of the world's poor, which should be given top priority; and the notion that the environment's capacity to meet present and future needs is constrained by the state of technology and social organization.

The notion of Smart Sustainable Cities (SSC) should be viewed as a whole. As illustrated on figure 2.27, an entity must have all three components in order to be considered a smart sustainable city; otherwise, it is either a smart city, a sustainable city, an example of smart sustainability, or something else entirely.

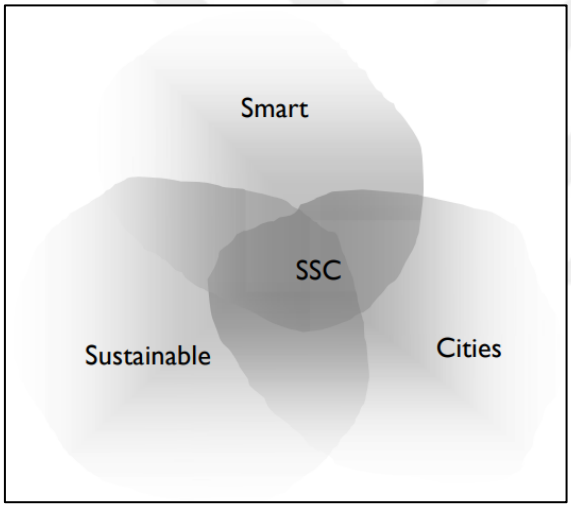


Figure 2.27. The components of Smart Sustainable Cities (Höjer and Wangel, 2014)

A Smart Sustainable City is one that uses smart technology to satisfy its current residents' demands while preserving the capacity of future generations or other people to meet their own needs, so staying within local or global environmental constraints.

Five major obstacles to smart, sustainable cities are listed in the article: Strategic Assessment: The necessity of creating procedures and techniques to analyze and appraise the solutions for intelligent, sustainable cities. Setting priorities for competing goals and resolving conflicts amongst sustainability factors are part of this.

- Mitigating Measures: Making sure advancements in smart technologies, like ICT, don't have the opposite effect of what they're supposed to. To avoid unintended outcomes, cities must implementcountermeasures.
- Top-Down and Bottom-Up Balance: striking a balance between innovative grassroots ideas and expansive corporate solutions. Large-scale projects can be funded by corporate giants, while grassroots efforts encourage invention and originality, which are frequently unscalable and improperly assessed.
- Competence Building: enhancing municipal governments' knowledge of information and communication technologies and ability to make well-informed judgments and accurately assess the solutions provided by technology suppliers.
- Governance Models: Creating governance frameworks that successfully manage technological initiatives in urban areas and incorporate a variety of stakeholders to guarantee coordinated and sustainable growth.

- Corbett, J., Mellouli, S. (2017)
  Winning the SDG battle in cities: how an integrated information ecosystem can contribute to the achievement of the 2030 sustainable development goals

The United Nations established the ambitious development agenda in 2015 that includes 17 sustainable development goals (SDGs) that must be accomplished by 2030. In addition to SDG 11, which focuses on creating sustainable cities, many other SDGs focus on issues that fall within the authority of local governments.

Cities will therefore be instrumental in accomplishing these objectives, and they argue that the information systems (IS) community needs to be a proactive partner in these endeavors. By creating a conceptual model to describe the role of IS in creating smart, sustainable cities and offering a framework of action for IS academics and city managers, this study aims to help in the accomplishment of the SDGs.

In order to achieve this, they conduct a grounded theory research on two green IS that are utilized to control green space and water quality in a globally renowned smart city. Based on these results, they present a model that explains how the creation of smart, sustainable

cities is supported by the interactions between three interconnected domains: sustainability, politics, and administration, enabled feasible in an integrated information ecosystem.

Transitioning from theory to practice, they illustrate the model's applicability using two real-life scenarios. They conclude by defining an action framework that outlines important city-related acts and offering related research questions. Beyond just a simple call to action, this work offers a crucial starting point for further study and application that will result in a sustainable future for everybody.

- Kutty, A., Abdella, G., Kucukvar, M., Onat, N., Bulu, M. (2020)
  A system thinking approach for harmonizing smart and sustainable city initiatives with United Nations sustainable development goals

The pattern of development in smart cities has changed in recent years, with smart cities utilizing ICTs and other clever solutions to try to adopt sustainable practices. According to earlier research, these smart cities have struggled to properly integrate sustainable development objectives into their smart plans, preferring to concentrate more on reaching smartness objectives than sustainability targets and goals.

In support of the UN Urban Sustainability Agenda, this document offers a comprehensive interrogative analysis of a number of ongoing smart city projects worldwide. Using a system thinking approach, this article seeks to align smart and sustainable city projects with the Sustainable Development Goals of the UN. The project creates conceptual models to help the city make the shift to a smart, sustainable city.

This article gives readers an overview of the state of numerous smart city projects worldwide and how they are helping to accomplish the UNSDGs. According to the findings, while smart city initiatives have repeated the inclusion of sustainability goals in their smart agenda, cities have not fully embraced these goals in practice. In order to uncover a number of potential causal relationships in actual situations, the authors have taken a system-thinking approach.

The following recommendations can be implemented by smart cities worldwide in order to meet the meta-aim of sustainable urban development in smart cities by 2030:

1. In order to foster high-quality education and possibilities for lifelong learning, smart cities should serve as dynamic learning hubs. This will help to develop intelligent people. Intelligent people would promote greater economic expansion and adaptability as well as serve as a catalyst for the emergence of new sectors.
2. To enable an unambiguous bureaucracy and better structure responsible governance for citizens, governance plans should be open and inclusive of all stakeholders.
3. Cities need to collaborate with research institutions, universities, nongovernmental groups, international advisory boards, and nongovernmental players in order to develop a smart plan. These collaborations enable smart cities to benefit from a number of advantages. Making the most of the small government funding set aside for the creation of smart cities is one such advantage.
4. In order to connect futuristic transformation methods of smart cities, a framework that is both socially inclusive and adaptable is required to reduce social inequities and other social difficulties that exist in cities.
5. If the smart initiatives are not supported by committed leaders who believe in the potential for smart city development, the change of the city is not complete. These leaders do not have to be in the local government, such as mayors, district attorneys, or governors; they can also be project managers, planning directors, execution community members, non-governmental organization activists, and others.

- Singh, T., Solanki, A., Sharma, S., Nayyar, A., Paul, A. (2022)
  A Decade Review on Smart Cities: Paradigms, Challenges and Opportunities

The emergence of a future city that ensures the rights and well-being of its residents from the standpoints of industrial development industry, urban planning, environment, and sustainable development has led to the rise of the smart city paradigm. The smart city has a number of subdomains for the study. Working with the many subdomains inside a smart city necessitates appropriate instruction regarding the smart city's history.

This study serves as a guide for the same. This study provides a thorough evaluation of the literature in the field of smart cities. It conducts a systematic review of research articles that were published between 2011 and 2021 in a number of reputable publications.

It will support companies, researchers, and the government in their efforts to advance the idea of smart cities. This paper first explains how this idea came to be, then goes on to provide some definitions and characteristics along with the actual plan and main pillars of the smart city. A typical architecture with several levels, including sensing, transportation, data management, and application layers, is covered in this study. There are numerous platforms and supporting technologies for smart cities; therefore, their implementation would be difficult without them. The various elements of the smart city are covered in the paper. To observe different opportunities, difficulties, and future trends in the smart city, a thorough literature review is being conducted. In the field of smart cities, it can serve as a guide and source of research direction.

A Smart City comprises several features. Smart city applications are depended on four key features, sustainability, comfort, quality of life, urbanization, and intelligence (figure 2.28.). Ecosystems, pollution, energy, and climate change are all connected to sustainability. The purpose of citizens' quality-of-life traits is to advance their welfare. The transition of technology, infrastructure, and management from rural to urban settings is one of the characteristics of urbanization and smartness.

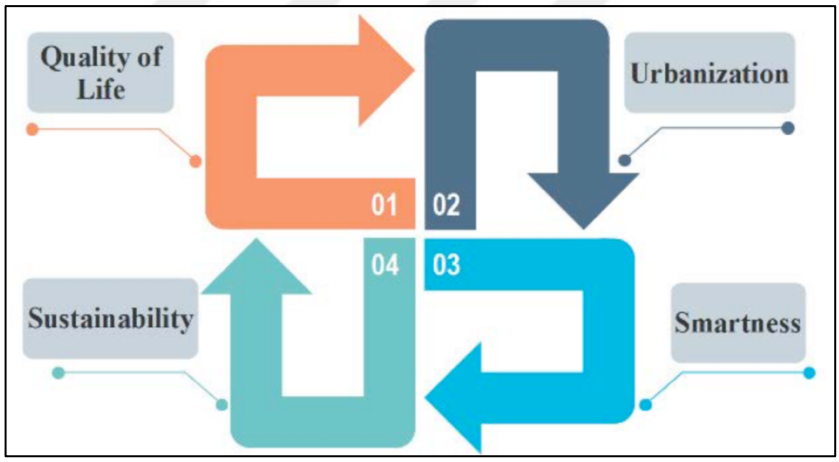


Figure 2.28. Characteristics of smart city (Singh, 2022)

After a detailed literature review, the case study of smart city is analyzed. This section presents a number of cases of smart cities that are categorized geographically and macroscopically correspond to three primary types of cities and communities, especially in relation to differing levels of technological innovation and human capital. They explain the Masdar smart city and all of its components.

Masdar Metropolis is the first completely sustainable city in the world. In 2009, the first "sustainable satellite city" was officially launched. According to the proposal, the metropolitan area would be home to a large number of training facilities, manufacturing centers, alternative energy research institutes, and marketing and finance experts. Smart energy; waste management, additional recycling and reuse routes, and energy obtained from wind and solar power plants. Smart building; buildings designed to install renewable energy classifications on their rooftops in order to provide a "near-zero energy" supply. Smart mobility; An innovative concept for the transportation sector. Municipal and remote transportation are not clearly distinguished from one another. High-speed transportation systems, however, offer rapid access to all nearby cities through a condensed and vast network of micro metropolises to semi-personal. Smart people; the city aims to become a global leader in efficiency, alternative energy, and environmental sustainability research by building the Institute of Science and Technology.

This study concludes that the rise of the idea of a "smart city" is raising the standard of living for those who live there. Additionally, protecting the limited resources of world is turning into a hard task. Then, using technology to preserve natural resources is one approach that might be used. Increasing productivity, reducing the time spent on chores, lowering costs, and promoting sustainability are the smart city's main goals. Smart healthcare, warehouses, manufacturing, grids, communities, transportation, hospitality, and other elements are some of the various components that create a smart city. To accomplish the goals, technologies are used in all of these components.

Government officials, companies, and researchers who wish to expand the development of smart cities are the target audience for this review study. Following the literature overview, this article addresses the typical difficulties developers encounter when putting smart city applications into practice. Although there are many obstacles in the way, these obstacles also present potential in this field. Following a discussion of some potential research opportunities, potential future research trends in smart cities are examined.

- Tura, N., Ojanen, V. (2022)
  Sustainability-oriented innovations in smart cities: A systematic review and emerging themes

A systematic literature review has made. This systematic literature review's goal is to examine the connections between "sustainable oriented innovations" (SOI) and smart city growth. They did this by looking at how SOIs are interpreted in the context of smart cities. The investigation concentrated on looking at the types, scope, scale, and examples of SOI innovations that were provided, as well as how they relate to sustainable development and smart cities. Examining the primary theme (focus) areas of how articles take SOIs into account in smart city contexts and identify potential areas for future research was another major subject of interest.

The study's findings demonstrate that innovations are in fact viewed as a crucial component of creating sustainable smart cities, which involve using various ICT (information and communication technology) to address sustainable urban development issues. Prior research frequently uses the classification of technological innovation, organization innovation, and policy innovation to understand smart city innovations. However, the innovation component of smart cities has expanded along with their development and comprehension, and they are now viewed as innovation ecosystems that include a variety of innovation methods, from technical solutions to process renewal and citizen participation.

They started by identifying four primary perspectives that scholars use to discuss the SOI dimensions in a smart city context, based on an in-depth examination of the literature: the technological perspective, the organizational perspective, the social innovation perspective with citizen engagement, and system-level changes with innovation ecosystems. Second, they identified a number of specific themes under each primary viewpoint. The results indicate that a large number of the review's articles include numerous aspects of SOI and fit under multiple topics. In reality, every article in the analysis was published between 2010 and 2021, making them all relatively recent. For instance, a number of themes from the perspective of technology-related solutions remain over this time, however some newly highlighted areas are also noteworthy. In relation to SOIs in smart city environments, some themes, such as developing innovation ecosystems and citizen involvement, have garnered more attention recently.

The discussion part identifies seven core components of smart cities, categorizing them into two groups, first one is enablers of sustainable smart cities:

- Technology: A foundational element supporting ICT, IoT, big data, and other advanced tools.
- Governance: Transitioning towards smart governance with a mix of top-down policies and citizen-driven approaches.
- Economic: Emphasizing business models, entrepreneurship, and smart economic growth.
- Human aspects: Addressing societal dimensions like citizen engagement and social inclusivity.

The second is targets of innovations:

- Public services: Enhancing service delivery and quality of life.
- Natural environment: Implementing eco-friendly initiatives for sustainability.
- Physical infrastructure: Creating sustainable urban infrastructure.

In conclusion, article summarizes the study's findings about SOIs in smart cities, acts as the conclusion. Technology, organizational and managerial innovation, social innovation, and system-level innovation ecosystems are the four main viewpoints that are identified as influencing SOI integration. The chapter highlights the necessity for a balanced approach that incorporates human-centered and socially inclusive methods, even though technical improvements dominate the conversation. It emphasizes how crucial it is to involve the public in decision-making procedures and to support innovation ecosystems in order to facilitate thorough urban change. The authors advise politicians and city planners to embrace interdisciplinary approaches for promoting inclusive and sustainable smart city development, and they call for future study to examine the interaction between digital and sustainable transitions, or "twin transitions."

- Search Rule 2: “15-minute city” and “sustainability”

The keyword “sustainable development was removed from the search to reach relevant sources for “sustainability”. Only 1 article is reached in Web of Science Core Collection in the author keywords field.

Table 2.14. Article found on Web of Science with keywords “15-minute city” and “sustainability” (Prepared by author)

Authors	Article Title	Author Keywords	Times Cited, WoS Core	Publication Year	WoS Categories
Allam, Z; Bibri, S; Chabaud, D; Moreno, C	The Theoretical, Practical, and Technological Foundations of the 15-Minute City Model: Proximity and Its Environmental, Social and Economic Benefits for Sustainability	15-Minute City; compact city; eco-city; smart city; proximity; mixed-land use; urban computing and intelligence; sustainability; decarbonisation; urban planning and design	33	2022	Energy and Fuels

- Allam, Z., Bibri, S., Chabaud, D., Moreno, C. (2022a)
  The Theoretical, Practical, and Technological Foundations of the 15-Minute City Model: Proximity and Its Environmental, Social and Economic Benefits for Sustainability

The theoretical, practical, and technological foundations of the 15-Minute City is examined in this paper, with an emphasis on the proximity aspect of mixed land use and the advantages of sustainability for the environment, society, and economy that smart technologies promote. The 15-Minute City's fundamental goals and dimensions are not new; in fact, they are consistent with the work of urban thinkers who are interested in creating sustainable urban forms, especially compact cities and eco-cities, and integrating them under the general heading of sustainable cities. Under their mixed land use plan, both of these models have proximity as a common denominator. This is done in order to attain the social and economic advantages of sustainability, as well as the environmental advantages. Human settlements can be self-sufficient when all the necessities are close by, allowing residents to live in their communities or neighborhoods. Figure 2.29. depicts the idea of "access by proximity," which is based on 15 interrelated variables that define urban forms as interconnected urban ecosystems.

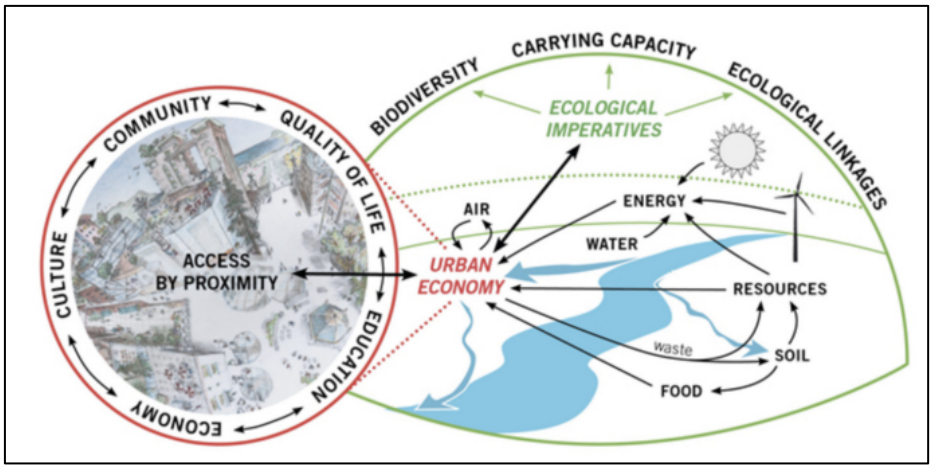


Figure 2.29. Urban forms as interconnected urban ecosystems (Allam, 2022a)

Another prevalent dominator is that, despite the fact that the advent of cars significantly improved city operations, performance, and service delivery, these advantages are outweighed by the unprecedented rise in use and population dependence. Many architects, urban thinkers, and academics have specifically questioned their impact on urban planning. Even in some of the world's top eco-districts, attempts to reduce car use by limiting parking have attracted a lot of criticism. One of the reasons put forth in this respect is that in order to change travel habits away from the usage of private vehicles, public transportation should be available within eco-districts from an early age. Otherwise, residents might become dependent on vehicles for mobility, which could have an impact on their travel habits.

The compact city enables cities to be sustainable while accommodating a wider range of social classes and cultural perspectives. This is consistent with proximity-based features, particularly when it comes to maintaining human-scale urban vibrancy. Because proximate zones are seamlessly connected, people may access various resources inside their districts or neighborhoods, preventing them from becoming excessively dependent on cars. In addition to lowering the incidence of accidents, fewer automobiles would lead to more possibilities for people to interact with one another when cycling or walking around towns. In the end, the compact city would contribute to lower energy use, which would improve environmental sustainability.

In order to increase the city's capacity and efficiency (cost and speed) for public transportation, the suggested strategies could therefore be used in combination with the implementation of other policies, such as the prohibition of large vehicles and other cars that

have the potential to cause accidents in specific areas of the urban environment. This would be especially beneficial for lowering traffic and the transportation sector's carbon footprint. The addition of bike lanes and pedestrian routes (with services at the end of the journey) would also aid in the shift to sustainable mobility.

The social alienation that urban residents had to deal with was made harder by sprawl and single-use buildings that affected cities all over the world even before the pandemic. Cities that adopted modernist designs have suffered from high energy usage and heavy traffic because of their energy-intensive architectural features and other vices that make them unlivable. Additionally, cities have lost their attraction as centers for social interaction and have instead become places of inequality and social isolation.

Different dynamics and distinctive urban morphologies that already exist in various cities must be considered while redesigning the urban environment. Urban planners can do this by using the large amount of work produced by numerous renowned urban thinkers who support human-scale urban settings. This implies that rather than functioning as separate entities, the various elements—such as residential neighborhoods, bike lanes and walkways, marketplaces, educational institutions, recreation centers, and others—should be combined to improve social connections and human relationships.

2.4. 15-Minute City Idea

Many cities are implementing innovative urban concepts or models, such as car-free cities, low-traffic neighborhoods, 15-minute cities, Superblocks, or a combination of these. These models are similar in that they seek to decrease the use of private vehicles and enhance public transit and active transportation (walking and cycling), which will lower air pollution, noise pollution, and heat island impacts. They also want to encourage physical activity, which will ultimately promote and improve health. Additionally, the 15-minute city's shorter distance between houses and other locations will promote cycling and walking and raise levels of physical exercise. The additional advantages include addressing the climate problem and its effects on health as well as reducing CO2 emissions (Nieuwenhuijsen, 2021).

The 15-minute city idea combine the ideas from the past; such as Clarence Perry’s Neighborhood Units that there should be a hierarchical system of urban amenities with

compact residential units, Ebenezer Howard's Garden City proposed the compact towns near both nature and basic services, the German concept *Stadt der kurzen Wege (city of short distances)* and Polycentric city design proposal aims to create multiple city centers that are act as growth points of the city. The other city ideals are listed and schematized in the figure 2.30. that was prepared by EIT Urban Mobility (2022).

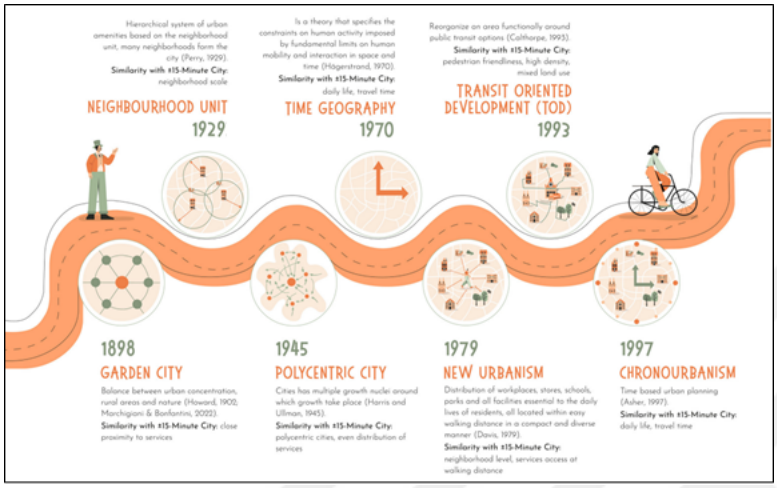


Figure 2.30. Timeline of related planning concepts that preceded 15-minute city (EIT Urban Mobility, 2022)

Many sociologists in the United States in the years after World War I had confirmed the necessity of reestablishing "primary groups," which were essentially collections of families that served as the foundation for the social structure and had a close relationship with their territory in large American cities' socially degraded neighborhoods. Reorganizing the suburbs of big cities in accordance with "neighbourhood groups" might achieve this, building the traditional sense of solidarity and social control that exist in village communities. As a result, Perry created a model of the Forest Hill Gardens neighborhood, which Frederick Law Olmsted had planned, and he created the "neighbourhood unity formula" in 1929, which summed up the neighborhood's features in six principles. The internal road system, local stores, institutional locations, open spaces, limits, and proportions were among the six guiding concepts. Based on following approximations, Perry suggested the optimal neighborhood unit size, which would mediate between the suburban residential density (80–95 people per hectare), a comfortable walking distance, and the school's users (1,000–1,600 students). He ultimately decided on a 60-hectare area of land that could accommodate roughly 6,000 people and have a 400-meter radius around it. Additionally, it established a green standard of 16 square meters per resident, which is split as follows:

Children's playgrounds use 3 square meters (19%), followed by similar equipment for kids in 5.5 square meters (34%), tennis courts in 2.25 square meters (14%), public gardens in several locations, and small green spaces and places with varying equipment in 3 square meters (19%). The collective facilities comprised an elementary school, a library, a community centre, and a church. Lastly, there was a retail establishment for every 100 inhabitants, in accordance with a standard that was well recognized at the time (Pinto and Akhavan, 2022). The links between a neighborhood's residential elements and the uses that are easily accessible on foot are illustrated in Perry's 1929 sketch, figure 2.31.

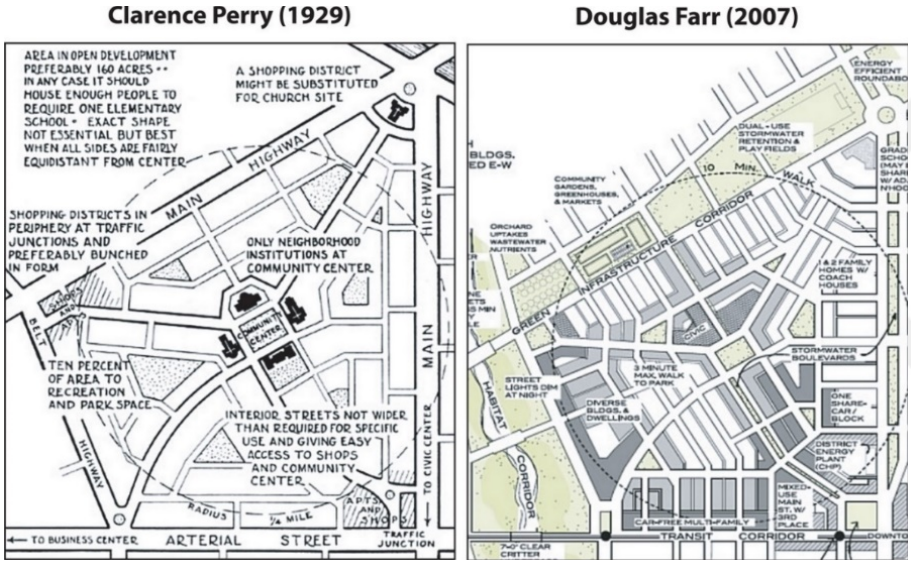


Figure 2.31. The evolution of neighborhood unit concept (Farr, 2007)

The new "15-minute city" concept, which was adapted from Howard's Garden City concept—which is less utopian now given the need for sustainable and urban green—seems to be an attempt to adapt Perry's "neighbourhood unit" ideas to the modern world. In order to create inclusive neighborhoods where a resident's fundamental requirements can be met in 15 minutes by foot, bicycle, or public transportation, the "15-minutes city" approach to urban design strives to improve quality of life. Making the city more accessible and enhancing the "walkability" of the neighborhoods is one of the main goals. Regarding the expansion of public areas, the strategy is to restructure the events that can be held in already-existing facilities (such stadiums, libraries, etc.), varying them in terms of time and location. Making greater use of the open spaces at workplaces, schools, housing complexes, and universities—especially on the weekends—increases the amount of green open spaces. Residents' social interactions are encouraged, the neighborhood's quality of life is enhanced,

traffic and pollution in the most central metropolitan districts reduce, and commuting phenomena are decreased (Pinto and Akhavan, 2022).

The focus of Moreno (2021) on abandoned cities during the lockdown resulted from a fresh perspective that enables him to emphasize the value of green areas, neighborhood relationships, and proximity trade globally. For him, the city was "connected" because of the connections among its residents, who were at last released from the metro-work-sleep routine. Therefore, time, quality of life, and proximity are the foundations of a new look. Proximity to a variety of services and activities as well as a fluid and continuous connection between the private residence and the public area. According to Moreno, the "city of the quarter of an hour" embodies the outcome of his research and has enabled him to bring together three fundamental ideas: "topophilia" (the feeling of attachment to a place), "chronotope" (the intimate connection between space and time), and "chrono-urbanism" (the study of what the city offers its residents regarding the use of their lifetimes).

According to Gaglione (2022), the 15-minute city draws its origins from the concept of neighborhood unit developed in 1923 in a competition for Chicago, to describe compact neighborhood planning. Rooted in the 1923 "neighborhood unit" concept, which emphasized compact residential areas with nearby services to foster community identity, the idea evolved through movements like New Urbanism and Transit-Oriented Development, both of which advocated for walkable urban environments. The COVID-19 pandemic accelerated interest in this model, highlighting the importance of proximity-based services, soft mobility, and safe public spaces to address health crises, climate change, and aging populations

Thus, the problem of proximity is an old idea that, unfortunately, has taken on a fresh meaning as a result of the COVID-19 pandemic. With the effect of COVID-19, some cities aim to embrace this approach and one of the well-known examples is Paris. The mayor Anne Hidalgo aimed to give Paris a new face with extensive pedestrian green areas on the large boulevards where used to be car-dominated places. According to Reid (2020), she is inspired with the ideas of Carlos Moreno and he has introduced “15-minute city” term in 2016. At an election campaign held in a bike shop on January 28, Hidalgo revealed further people-first plans for Paris, such as the creation of protected bikeways on all of the city's bridges and bike paths on every street in the French capital. The initiatives, which seek to make Paris a more livable city, expand on Hidalgo's "Plan Vélo" transportation reforms, which have

included removing parking spaces for vehicles and increasing areas for bicyclists and pedestrians during her current term in office. "You will love season 2 of Plan Vélo if you enjoyed season 1," she said in her second election. On January 29, Hidalgo disclosed that cars would mostly suffer in order to create the space needed to make Paris bike-friendly. Paris will eliminate 72% of its on-street parking spots as part of her plans. Hidalgo intends to eliminate 60,000 of Paris's 83,500 on-street parking areas (Reid, 2020).

Furthermore, the fast pace of climate change and the risk of contagion rendering it essential to alter urban mobility patterns and make long-term changes to the way urban land is distributed. It's time to think about urban transportation in all of its forms as a justice concern that extends beyond cities. People with lower incomes often have close links to their home areas. In order to significantly improve urban planning, mobility patterns—such as those involving urban-peri-urban-rural linkages, local agriculture development, and city expansion limitation—must be taken into account. Redistributing urban space should be viewed as a means of facilitating access for various modes of transportation, including more environmentally friendly ones that could help in the implementation of biosecurity and social distancing measures (Guzman, 2021).

Beyond decreasing emissions, this idea of urban design—generally referred to as the "x-minute city" or "neighborhood"—offers a host of additional advantages. Improved public health, environmental justice, and social cohesiveness are only a few of these advantages. The Parisian model, for instance, has been referred to as a "city of proximities," encompassing both people and amenities. In other words, going for a walk in one's neighborhood fosters social connections and unity. Because people tend to trust their neighbors more and because it has been demonstrated to increase the quality of life for both young and old residents, pedestrian-oriented neighborhoods—which are associated with denser cities—also better foster social capital. In turn, a key component of community resilience is the development of social networks, social cohesiveness, and social capital via accessibility (Logan, 2022).

As mentioned, the term defines a highly flexible urban area where all people live in there can access daily needs within a 15-minute distance by walking or cycling. The aim is to decentralize the local economy with putting all the necessities of urban life, such as, workplaces, green areas, markets, pharmacy, health units etc. The main idea is to fit all of

those functions in a compact area and so it has to be multifunctional (Moreno, 2021). This concept's main selling point is that it is feasible to rearrange the urban layout so that all of the main services and facilities can be reached on walking in no more than fifteen minutes. According to this paradigm, soft mobility—that is, riding a bicycle with a strong preference for walking—is the preferred form of transportation (Allam and Jones, 2020).

Urban dwellers would have adequate time for themselves as well as for building and cultivating deeper social ties if every area of the city was arranged within a 15-minute radius. This would result in more livable cities. Because people are frequently "trapped" in traffic and as essential infrastructure, such as road networks, has traditionally been positioned to favor automotive flow over human traffic, this has not been feasible in modern urban setups (Allam and Jones, 2020).

Cities were already going through a significant process of change at the time of the Covid-19 outbreak, taking into account both new opportunities and challenges like climate change, digital transformation, sustainable mobility, reclaiming degraded areas, redefining public spaces, social inclusion, and integration policies. As a result, social separation, teleworking, fear of crowd, and lockdown limits on commuting have all transformed how people live their lives and how cities are set up. (Pinto and Akhavan, 2022).

The pandemic crisis has become the major effect for re-organizing cities. Now, people are much aware that another health or other sourced crisis might happen and our cities are not ready for it. Therefore, proximity-based services or soft mobility has become an important choice while planning our cities. Relieving traffic, offering safe and pleasant spaces for walking and cycling, at the same time affordable and successfully implemented urban transportation structure will help future cities to mitigate an unexpected crisis like COVID-19 pandemic.

2.4.1. Similar theories

The 15-minute city or the 20- and 30-minute neighborhoods are examples of related notions that can be covered by the x-minute city principles, introduced by Radics (2024), which can be generalized as a concept. The concepts of the 15-minute city concept, which has a well-established theoretical framework and a wide range of literature, are used to explain the x-

minute city concept primarily, though not exclusively. Because of their diversity, these ideas are also known in the literature as the x-minute city or neighborhood concept.

The idea is an effective solution for the transition to urban sustainability since it is a responsive urban planning concept to many modern urban difficulties. Social cohesion, local community formation, engagement, and general well-being can all be enhanced by people-oriented urban design concepts, the revitalization of public spaces, participatory planning, and decision-making, and the establishment of venues for interactions. Regular physical activity, like walking and cycling, has significant health benefits as well. Active mobility adoption is projected to have positive environmental effects and reduce air and noise pollution, and the x-minute city concept has additional advantages that make it an acceptable option for developing climate-neutral communities. The x-minute city may also have economic advantages by increasing local spending and the local economy, among other things.

In addition to x-minute city concept 20-minutes city by Capasso Da Silva in 2020 introduced 20-minute city term. Capasso Da Silva (2019) she believes that it is possible to plan cities to reach the daily needs by walking, cycling or mass transportation within 20 minutes. It is believed that during the planning process, aim should be on accessibility rather than transportation. Accessibility can be incorporated into municipal sustainability strategies, as demonstrated by the 20-minute city. Enhanced accessibility serves sustainability and climate action objectives in addition to transportation-related ones (Capasso Da Silva, 2019). It recommends shifting away from land use planning strategies to one that is more vision-led and putting more of an emphasis on creating livable neighborhoods at the neighborhood level. A 20-minute city approach suggests using more environmentally friendly modes of transportation, which could result in reduced time spent stuck in traffic, decreased noise pollution, fewer greenhouse gas emissions, and better air quality (Mackness, 2021). The area is a bit longer than the Moreno’s 15-minute city as it is 20-minute city; however, they both have similar aspects to city planning like proximity or reduction of car dependence.

The 20-minute city idea was inspired by Portland's 20-minute neighborhood proposal, which called for a neighborhood where people could get to everyday activities in twenty minutes, preferably on foot but also by bicycle, public transportation, or even a car. A 20-minute city is one that enables its citizens to walk, bike, or take public transportation from their

residences to the majority of activities needed for a good quality of life in less than 20 minutes (Capasso Da Silva, 2019). Sydney's metropolitan plan, which conceptualizes the metropolitan area as three city subregions and is supported by transportation networks that allow the majority of citizens to reach a subregional center in less than 20 minutes by public transportation, has pursued polycentric growth in Australia. However, in general, 20-minute city models lack information on the dynamics of the transportation network and employment opportunities (Li, 2024).

There are some other theories similar to Moreno's; Weng promote the health dimension of the citizens. Walkable neighborhoods can help to decrease the risk of obesity and diseases related with movelessness. Academics generally agree that improved neighborhood walkability should improve physical activity (including leisure-time physical activity), active transportation, and mental health. There is a strong relationship between the chronic diseases like overweight and non-commuting. So, better neighborhood planning which force people to walk and health outcomes will be affected positively. As a result, they argue that four aspects of building walkable and healthy communities should be prioritized: (1) providing full coverage service assurance, (2) constructing a continuous and pedestrian-friendly street network, (3) forming a compact and accessible layout, and (4) developing affordable housing (Weng, 2019).

The Superblocks in Barcelona is another model which has similar features with 15-minute city design theory. Barcelona has more than 500 superblocks planned (figure 2.32.), which provide space for people, active transportation, and greenery while reducing motorized traffic for some blocks. The objective is to establish a safer, more equitable, greener, and healthier public area that fosters community ties and the local economy. They will improve green space and physical exercise while lowering noise levels, heat island impacts, and air pollution (Nieuwenhuijsen, 2021).

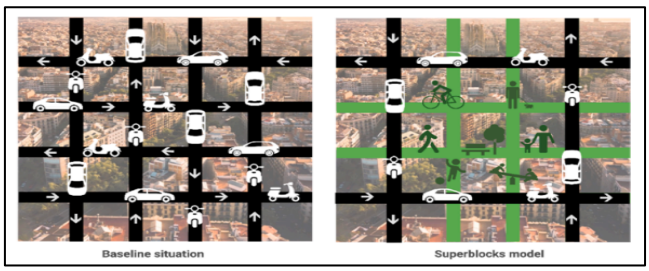


Figure 2.32. The Superblock Barcelona (Nieuwenhuijsen, 2021)

Similar measurements are being applied in low traffic neighbourhoods, London. As emergency measures to create safer walking and bicycling environments (safer from COVID-19 and from traffic injury risk), they are part of a series of relatively quick and cheap streetscape changes, shown in figure 2.33, that the government is encouraging and/or funding. In addition, they aim to deter the growth of car use given that public transportation is still operating with significant capacity restrictions. Decreased car ownership, fewer injuries and crimes on the streets, and safer residential streets for exercise, play, and socializing are all benefits of low traffic neighborhoods (Nieuwenhuijsen, 2021).



Figure 2.33. The low-traffic neighborhoods (Nieuwenhuijsen, 2021)

These new models, such as Superblocks or low-traffic neighborhoods, seem to be similar in that they shift the emphasis from automobiles to people, that is, from a city for cars to a city for people. They reverse the transport planning pyramid, making public transportation, walking, and bicycling the top priorities instead of cars. More public space is provided, and more infrastructure is built for the preferred means of transportation, like safer bike routes. Additionally, they expand the amount of green area (Nieuwenhuijsen, 2021). The idea, every amenity that a person need should be available within 15-minute walking or cycling. The detailed classifications vary but generally it is divided into certain categories; education, health-care, food-related services are the most common ones (Calafiore, 2022). Moreno (2021), emphasizes the needs for urban functions, which are; living, working, commerce, healthcare, education and entertainment. Different from Moreno, Capasso Da Silva (2020) choose faith-based services and Weng (2019) added elderly care and transport provision.

2.4.2. Concept and key attributes

15-minute city is defined as an ideal geography where most people's daily needs and necessities are located in a distance of 15 minute by walking or cycling. In other words, citizens can be able to reach a number of desirable community amenities and services with a 15-minute time. The list of amenities and services are playgrounds and parks, libraries, schools, markets, workplaces, health units etc.

In terms of physical planning, 15-minute city design principles are heavily depended on the design keystones in the past, which are accessibility, walkability, density, mix of land-use and diversity of amenities. One of the most important difference that distinguish 15-minute city design from other design approaches is the intention of bringing activities to neighborhoods but not bringing people to activities (Pozoukidou and Chatziyiannaki, 2021).

The 15-minute city concept has founded the term "chrono-urbanism", which summarizes that the quality of urban life is related with the amount of time that spend on transportation. In other words, the time that is spend on transportation is inversely proportional to the quality of urban life. The concept, originated from Carlos Moreno, who promotes for an urban life where people can reach their daily needs within 15-minute walking or cycling. Moreno advocates that, citizens will be able to enjoy a higher quality of life where they can do six essential functions, which are living, working, commerce, healthcare, education and entertainment. To achieve those functions in the neighborhood, the urban built structure needs to be redesigned with components density, proximity, diversity and digitalization (Moreno, 2021).

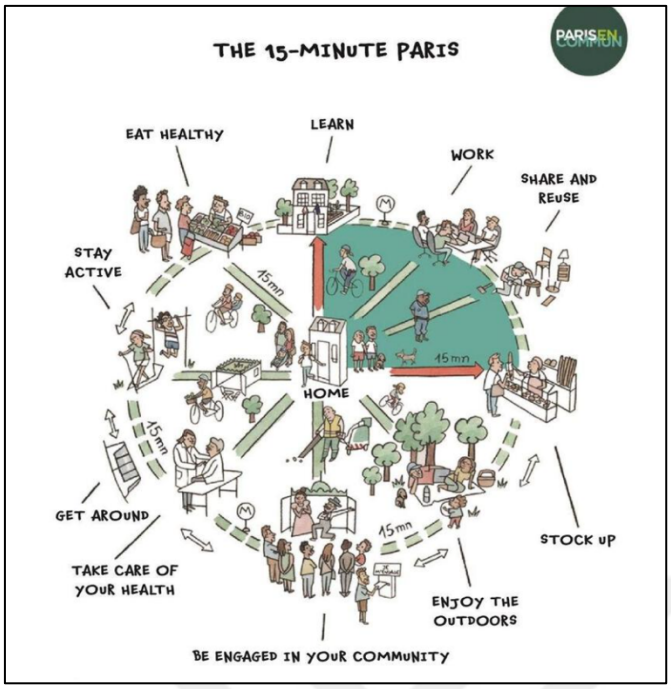


Figure 2.34. The concept of 15-minute city (Paris en Commun)

Density is a crucial component of the city and its built environment. In traditional planning, density is viewed related with the ultra-high-density buildings, but for 15-minute planning, it is evaluated as people per kilometer square. In other words, city has to be planned sustainably, the optimum number of people should be placed in order to not cause over consumption of resources (Moreno, 2021). The concept advocates the idea of a small city in which people may be comfortably sustained by the availability of resources, as opposed to the typical urban planning concept in which density is simply considered in terms of built environment quotas (Allam, 2022b).

Proximity is the keystone of the 15-minute city term that ideally wants to achieve daily needs in closer dimensions-15 minute by walking or cycling. The dimension is not only important for time lost while travelling but it also helps to reduce the environmental and economic impacts of such activity. In addition, social relationships are affected from it positively as people can be aware of other people while walking. Moreno believes that, dimension is crucial as it allows people to use same place for different activities, such as, school playgrounds can be used for public parks after school times. It will help to earn space, which should be very carefully designed and will maximize the playgrounds and green areas of neighborhood.

Diversity is considered in two ways, first the diversity of uses in neighborhood like mix of the residential, commercial and entertainment constituents and secondly, diversity of different cultured and aged people. Having a multicultural dimension of city has positive effects on both citizens can enjoy different cultural products and the area can be a destination point for tourists, as they may also want to learn different cultures.

Digitalization is another important issue to actualize the other three dimensions of 15-minute city concept. Just as in smart city concept, reaching the aims of the term is closely related with using different technologies effectively. For instance, through digital software and applications it could be possible to enhancement of bike sharing and with the sensors to ensure the safety and security of cyclists. In addition to that, measuring parameters is also an important facility, that digitalization offers us, to avoid over usage of non-renewable resources or to determine the optimal number of consumption of resources (Moreno, 2021). Furthermore, smart technology will allow the '15-Minute City' model to be tailored to the needs of different geographies in order to completely address place-relevant human factors (Allam, 2022b).

This idea of proximity is closely linked to the 15-minute city model, as neighborhoods often develop into "micro cities" where residents can meet their basic needs while also reducing pollution and using green transportation like bicycles or micro-mobility vehicles or walking. The benefits of this proximity are actually numerous and include: improving the quality of life by saving time; strengthening socioeconomic ties within the neighborhoods, improving the nearby shops; and revitalizing the district as a whole, which experiences a greater vibrancy of associations and trade. Additionally, socially active areas appear to have fewer issues with micro-criminality and insecurity (Papas, 2023).

Some important climate change-related issues, such as increased stress on the populace and the environment, are highlighted by the neighborhood city concept. Cities must ensure public safety and equitable access to housing and technology for all segments of society. In addition to improving urban liveability and repairing the socioeconomic divisions brought forth by modern urban planning concepts, the 15-minute city model provides a chance to lower emissions. Based on strong human-scale principles, the model seems to be a workable approach, and more research can assist policymakers in understanding how to implement this model in various regions (Papas, 2023).

Research question 1 is answered in section 2. The question is “What is the 15-minute city theory and how much attention has it received in literature?” and its answer is stated in section 2.1, 2.3. and 2.4. The 15-minute city concept combines ideas from the past, including Ebenezer Howard's Garden City, which suggested compact towns close to basic services and nature, Clarence Perry's Neighborhood Units, which suggested a hierarchical system of urban amenities with compact residential units and the Polycentric city design proposal, which seeks to create multiple city centers that serve as the city's growth points. Additionally, Perry's "neighbourhood unit" concepts appear to have been adapted for the present era by the new "15-minute city" model, which was based on Howard's Garden City vision, which is less utopian now given the need for sustainable and urban green. The "15-minutes city" approach to urban design aims to enhance quality of life by developing inclusive neighborhoods where a resident's basic needs can be satisfied in 15 minutes by walking, biking, or using public transportation. One of the main goals is to improve the "walkability" of the communities and make the city more accessible. The plan for increasing public spaces is to reorganize activities that may be hosted in existing spaces (such stadiums, libraries, etc.), changing their schedule and location.

In addition to that, a clustering study was conducted according to the keyword groups found and the methodology of the thesis was obtained. A literature search was performed on "Web of Science Core Collection" by choosing all fields and 176 publications, 146 article, 9 review article, 8 early access, 6 editorial material, 1 book review, 1 correction and 1 letter are reached. In terms of year range, the oldest of the publications was published in 2011 and the newest was published in 2024. It can be inferred that it is a subject that has been widely researched in the last 13 years, especially during the pandemic period. The list of publications reached was analyzed via VOSviewer. As a result, it can be concluded that in the last 14 years, it has earned a place in the academic literature together with the pandemic.

3. METHODOLOGY

Before constructing the methodology, a bibliometric analysis was carried out in section 2.1. to identify the most used keywords, the authors who have worked the most on this topic and the countries they are associated with. For this, the term “15-minute city” was searched in Web of Science and the most cited authors and researchers who produced the most documents on this topic were identified. In section 2.2., the 5 most cited articles were examined in detail to create a basis for the literature review and this data was utilized in the following section. In section 2.4, what the 15-minute city is, its history and components are examined in detail and a theoretical background is developed by comparing similarities and differences with similar theories.

As it was required to determine a study direction and methodology to examine the selected area; a keyword analysis was conducted to find keywords that were used together and the resulting group of words was narrowed down by selecting phrases that were repeated at least 5 times. As a result of this analysis, 16 keywords were found and Vosviewer software was asked to group the results in order to determine the relationships between these word groups. As a result, 16 keywords were narrowed down to 4 clusters;

- Cluster 1: “15-minute city”, “accessibility”, “GIS”, “pedestrian accessibility”, “walking”
- Cluster 2: “mobility”, “proximity”, “public space”, “sustainable mobility”, “urban planning”
- Cluster 3: “chrono-urbanism”, “smart cities”, “urban accessibility”, “walkability”
- Cluster 4: “sustainability”, “sustainable development”

When it comes to labeling these clusters, the details of which are explained in section 2.3., “pedestrian accessibility” for cluster 1, “mobility” for cluster 2, “chrono-urbanism” for cluster 3 and “sustainable development” for cluster 4 is chosen.

With the cluster searches given under the title “2.3. The Literature on Cluster Analysis”, the articles on these topics were analyzed in detail with their methods, findings and results. “GIS-based approach evaluating sustainable spatio-functional accessibility to mosques”

(Harroucha and Chouni, 2023), one of the articles found in the searches for Cluster 1 and was not considered suitable for use in the methodology because it measured the accessibility of mosques in street and block detail. In the next study, the phrases were reduced to "15-minute city", "accessibility" and "GIS" and "Walk further and access more! Exploring the 15-minute city concept in Oslo, Norway" (Akrami, 2024) is reached. The article aims to measure the density of the city of Oslo in terms of amenities using GIS. With the data obtained as a result of the analyzes, an arrangement can be made as to which amenity needs are the most, which will guide the planned city arrangement. The same methodology was applied in the case study area to calculate which amenity remains within a 15-minute walking distance and which ones need to be increased in density and accessibility. Calculations were conducted by taking the Kernel density analysis used in the article as an example and the results are shared under the heading "4.1. Cluster 1: Pedestrian Accessibility" (Figure 3.1).

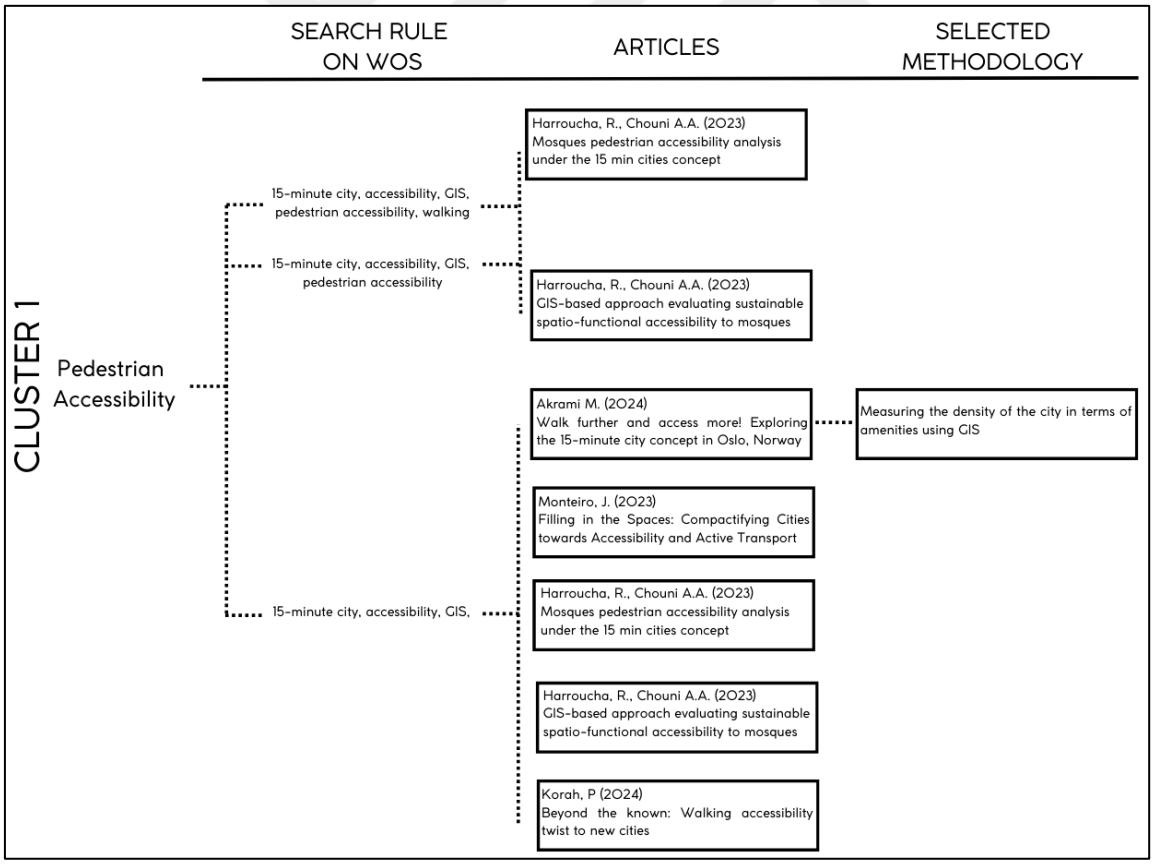


Figure 3.1. Determination the methodology for cluster 1 (Prepared by the author)

In the keyword searches for Cluster 2 (figure 3.2.), with the first search rule, "mobility" and "proximity" and "public space" and "sustainable mobility" and "urban planning", the article

“Proximity as a Design Strategy for Sustainable, Collaborative and Inclusive Urban Public Spaces” (Longo, 2022) is reached. Even though, it has a very rich content in terms of literature, the field study describes how an “Urban Innovation Lab” in Bologna served the public during and after the pandemic. Its methodology could not be taken as an example since it would not serve the analysis to be conducted. Then, when the search rule was changed and searched for “mobility” and “15-minute city”, the article “Towards an equity-centered model of sustainable mobility: Integrating inequality and segregation challenges in the green mobility transition” (Tammaru, 2024) is reached. It examines the 15-minute city model in order to reduce greenhouse gas emissions and slow down global warming by presenting an equitable sutainable mobility model rather than a site analysis

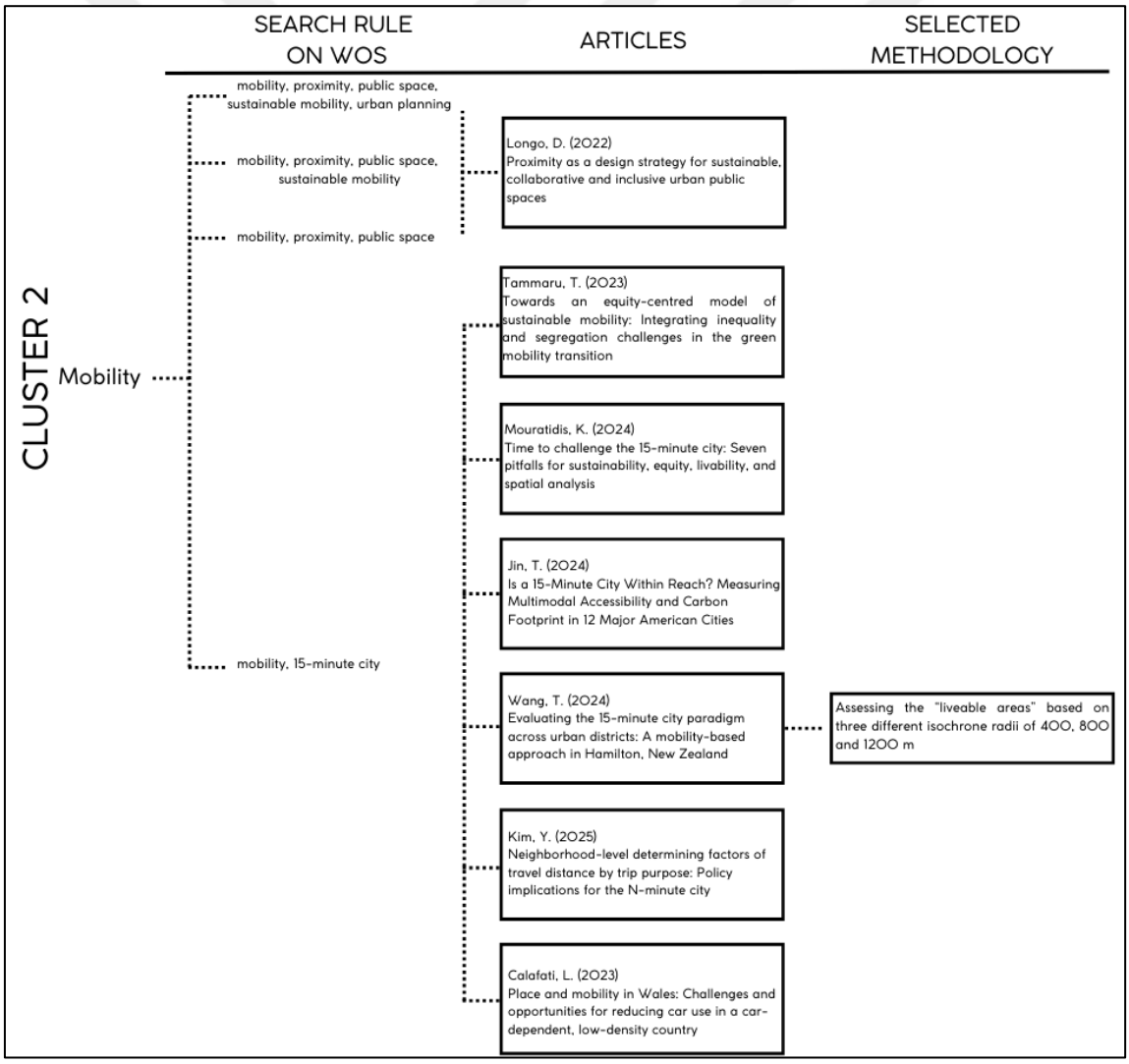


Figure 3.2. Determination the methodology for cluster 2 (Prepared by the author)

The article “Time to challenge the 15-minute city: Seven pitfalls for sustainability, equity, livability, and spatial analysis” by Mouratidis (2024) has a more critical attitude towards the 15-minute city theory. For this purpose, 7 pillars are identified and the ways in which the 15-minute city concept can be improved are discussed. This article will be cited in the 5.1. Critiques and Discussion section at the end. In the article written by Jin (2024), it is discussed whether American cities can be adapted to the 15-minute city model, and 12 cities selected for this purpose are compared with each other and it is discussed which one is more suitable and can be adapted to this model. In these 3 articles, a methodology that can be applied to the study area could not be identified. “Evaluating the 15-minute city paradigm across urban districts: A mobility-based approach in Hamilton, New Zealand” by Wang (2024) evaluated the urban sprawl and accessibility to daily needs in 5,10,15-minute time frames by reducing car dependency. 6 important amenity categories such as access to supermarkets, schools, parks, hospitals and cafes and restaurants were examined, but workplaces were excluded from this list. The reason for this is that with the pandemic, many institutions have switched to working from home and flexible working systems. With the buffer zones created around the amenities identified in the area, livable areas of 5, 10 and 15-minutes were determined. By applying this methodology to the selected analysis, liveable areas of 5, 10, 15-minutes were determined and the extent to which mobility on walking is possible was measured.

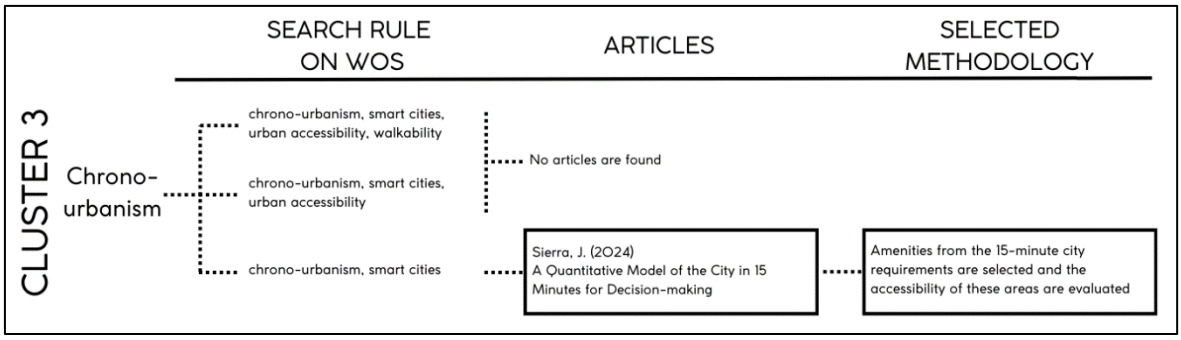


Figure 3.3. Determination the methodology for cluster 3 (Prepared by the author)

A search with the keywords “chrono-urbanism” and “smart cities” in search rule 3 (figure 3.3.) for Cluster 3 resulted in a single article “A Quantitative Model of the City in 15 Minutes for Decision-making” (Sierra and Ortiz, 2024). In the article, 4 amenities from the 15-minute city requirements were selected and the accessibility of these areas in the city Valencia was evaluated. Applying a similar methodology, the 4 amenities in the case-study area were divided into 9 indicators and the accessibility of individual neighborhoods to each amenity

was evaluated among themselves. With a model to be created in this way, the development and needs of the region can be monitored and what we need to do for a sustainable and inclusive city in the future can be determined.

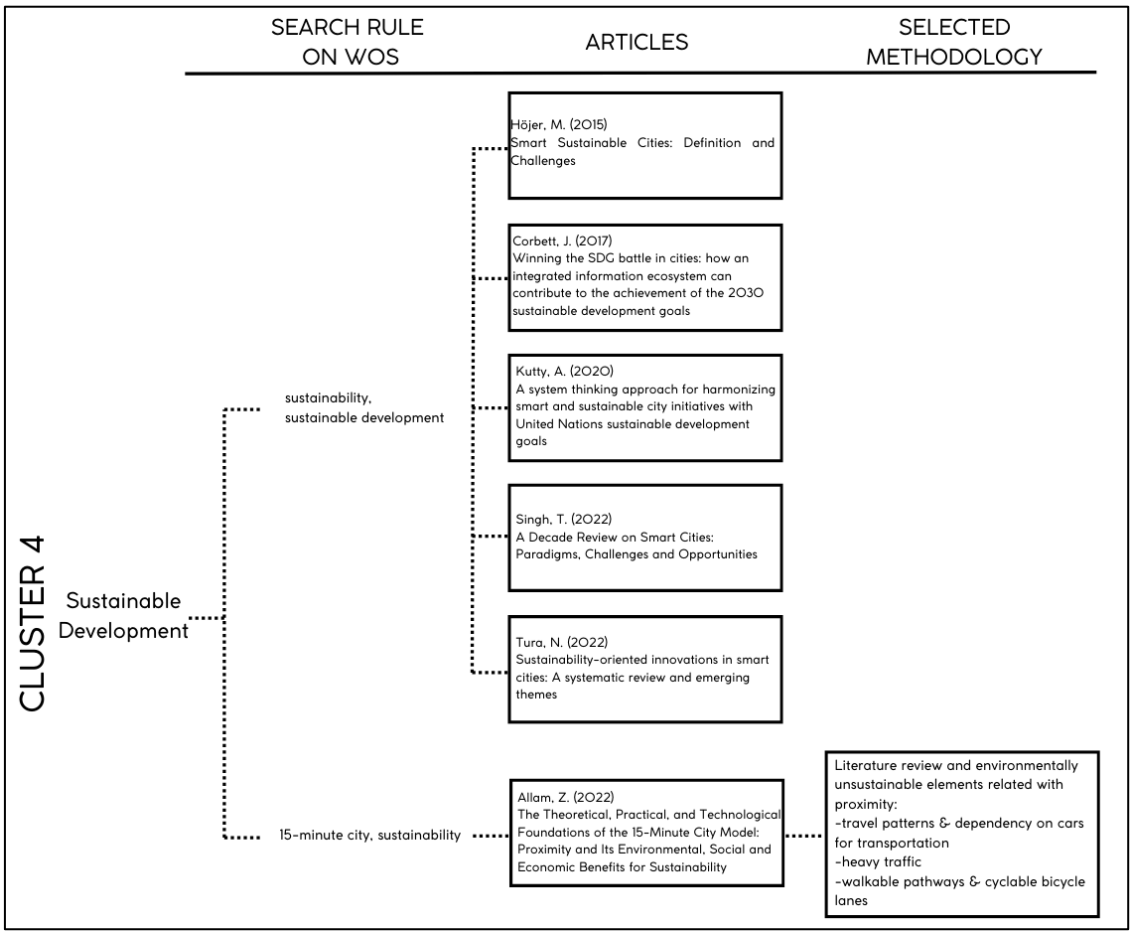


Figure 3.4. Determination the methodology for cluster 4 (Prepared by the author)

The last cluster group, cluster 4, “sustainability” is not enough by itself to reach meaningful searches about 15-minute city. For the first search rule all keywords were entered and 5 articles are selected from findings. All of their methodologies are literature review about mainly explaining the terms and their relationships in literature. Additionally, the relationship between 15-minute city and sustainability is not determined and in the second search rule “15-minute city” keyword was added and the article which was written by Allam (2022) is reached. The research explains the environmentally unsustainable elements related with proximity and the concept of “travel patterns and dependency on cars for transportation, heavy traffic and walkable pathways and cyclable bicycle lanes” are explained as the main reason for this unsustainable transportation. Therefore, the study area and Ankara in general were analyzed by briefly mentioning the literature under each heading. On the conclusion

part, the findings are summarized and the discussions are made. Limitations and future research suggestions is shared. The scope of study is given in figure 3.5. in detail.

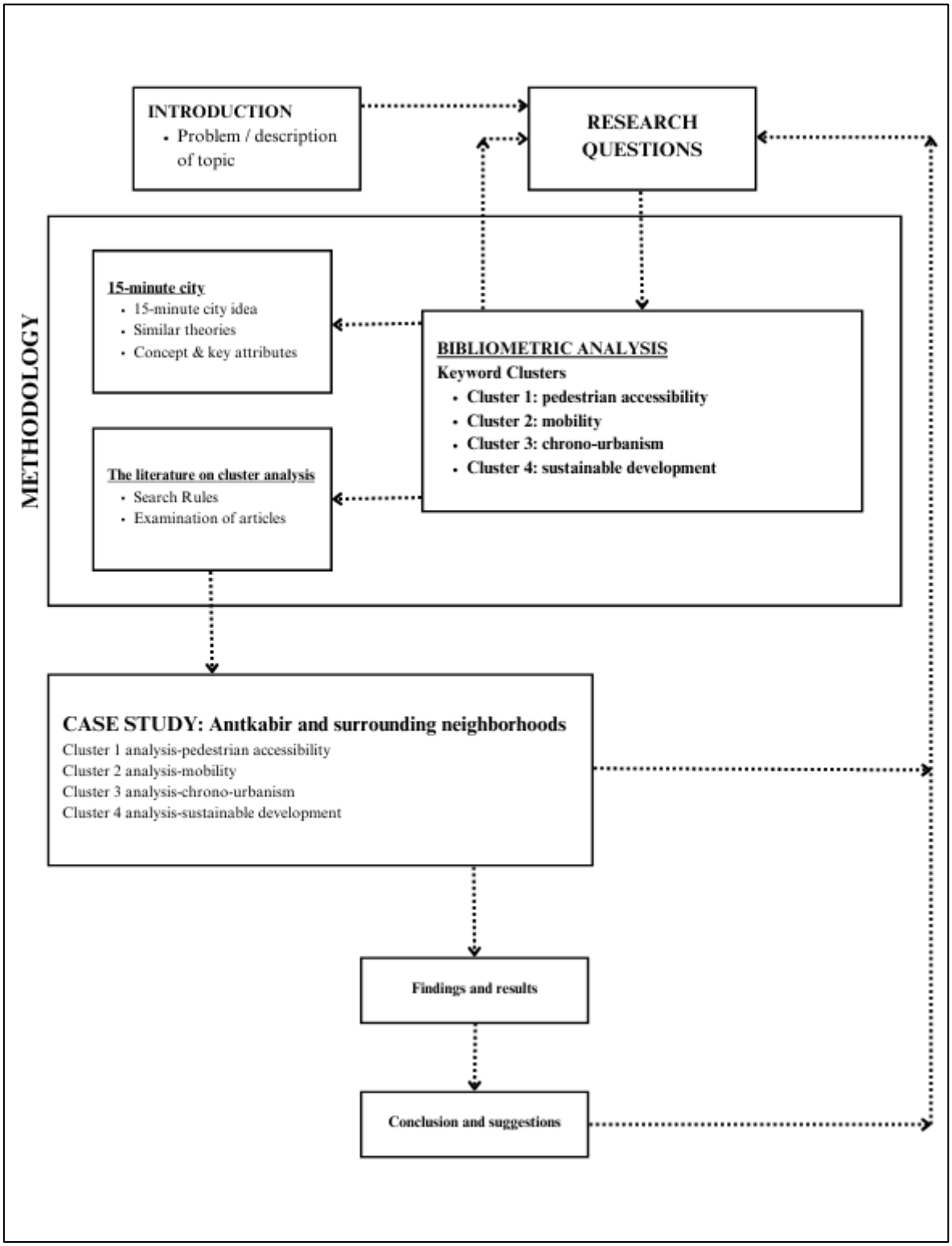


Figure 3.5. Scope of study (Prepared by author)

4. CASE STUDY: ANKARA-ANITKABİR AND SURROUNDING NEIGHBORHOODS

This section of the thesis outlines and motivates the investigation's organization and execution. It also motivates the techniques used to acquire data, as well as how the data was processed and analyzed.

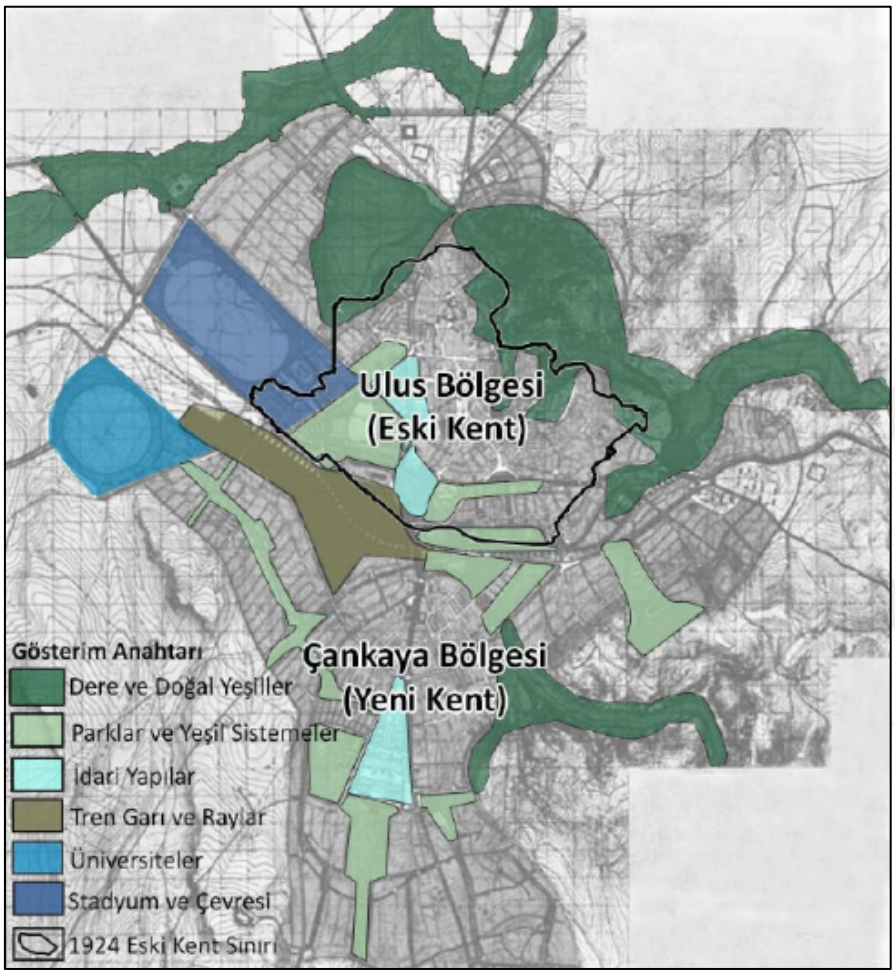
The research undertaken in this study is both qualitative and quantitative. Images, writings, and maps constitute the content that has been created and gathered. The purpose of this study is evaluating the selected area with the appropriate techniques. A case study technique is frequently required in order to understand the very complicated processes that are urban development, and it has been used in this thesis. The case study technique focuses on one or a few instances of a specific phenomena and seeks to illuminate the general by looking at the details. A spatial analysis approach was used for the case study.

Ankara is the capital of Turkey and geographically located close to the center of Turkey. The districts of Ankara are Altındağ, Çankaya, Mamak, Keçiören, Sincan, Yenimahalle, Akyurt, Beypazarı, Çamlıdere, Çubuk, Elmadağ, Etimesgut, Evren, Kazan, Gölbaşı, Bala, Ayaş, Güdül, Haymana, Kalecik, Kızılcahamam, Nallıhan, Polatlı, Pursaklar and Şereflikoçhisar.

Ankara has become rapidly crowded after becoming the capital. Private and public sector investments were concentrated in the capital and its region, and the resulting employment opportunities led to a large population influx. It is highly probable that the development of the economy, health and education infrastructure, low crime rates, high levels of public investment per capita and high levels of deposits per capita encourage migration.

The Lörcher Plan (1924-1925), was commissioned to regulate the expropriation in the south of the historical center of the city and to orient the city; Eskişehir (Old Town), which constitutes the Ankara Castle and its surroundings, was given as an urban improvement area and the expansion possibilities were to be evaluated (boundaries shown in map 4.1). However, before the plan was completed, due to the rapid population growth, Yenişehir (New Town) was planned as an administrative center under the name 'Çankaya' with a plan in accordance with the expropriation law (Güngör and Özcan, 2022). With its wide avenues,

hotels, theaters, shopping centers, and high-rises, the new sector has the characteristics of a modern town. The new area also includes international embassies and government offices (Yalçıner Ercoşkun, 2013).



Map 4.1. Old city and new city boundaries in the Jansen Plan (Söylemez, 2016)

In 1928, a competition was organized for the preparation of a city plan for the capital Ankara and Jansen's proposal was selected first. His urban plans were generally dominated by the 'Garden City' approach. The arrangement of houses with gardens, which is seen as a common feature in the plans he prepared for cities in Turkey, is considered as an interpretation of the Garden City approach. He carried the settlement model that combines the positive aspects of rural and urban life of the Garden City approach to urban plans. In addition to his works on urban planning, Hermann Jansen also worked on an architectural scale. Jansen's only architectural work is the Bahçelievler settlement (figure 4.1.). The integrity of this housing environment is a successful, aesthetically pleasing and admirable living environment both at the level of the single building and the settlement as a whole (Güngör and Özcan, 2022).

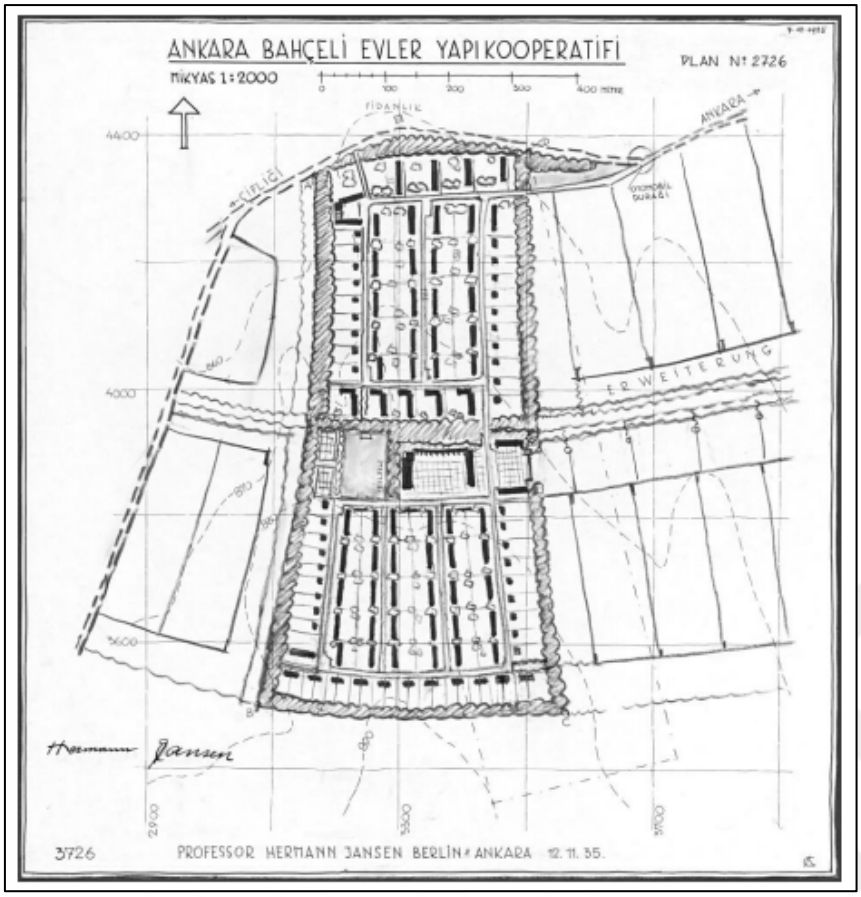


Figure 4.1. Bahçelievler Siedlung / Bahçelievler Building Cooperative (Güngör and Özcan, 2022)

In 1941, a project competition was organized with Paul Bonatz as the president of the jury (Can Bilge, 2018). In 1942, the results of the Anıtkabir Project Competition were announced in a report titled 'Jury Report on the Atatürk Anıtkabir Project Competition'. At the end of its report, the jury felt the need to make a number of warnings about the construction of Anıtkabir. The jury stated that caution should be exercised in the construction of buildings around the Anıtkabir site, as the Anıtkabir site is approximately 30 meters higher than the surrounding land. Stating that buildings should not be randomly constructed around Anıtkabir, the jury has decided that Anıtkabir should be surrounded by a residential area consisting of low-rise buildings organized with green areas. The jury recommended that since Rasattepe, where Anıtkabir was to be built, was not high enough, the height of the construction around it should be taken into consideration. The Rasattepe area, which had no buildings around it in the 1940s, has been heavily built up over the years. For many years, high-rise construction around Rasattepe was not allowed in order not to block the silhouette

of Anıtkabir. No more than four storeys were allowed in the buildings around Anıtkabir (Boran, 2011).

Looking at the debates that were widely covered in the press, it is possible to think that the recommendation of the Anıtkabir Jury Committee to pay attention to the height of the construction around the Anıtkabir was meticulously followed, except Başkent University Hospital. Indeed, construction in the immediate vicinity of Anıtkabir was not allowed to exceed four storeys. However, no attention was paid to the construction in the areas coinciding with the axis flow of Anıtkabir. Anıtkabir has two axes that cut each other perpendicularly. The axis extending in the northwest/southeast direction of the Lion Road opens to the urban void at both ends. One end of the axis points towards Çankaya and the other towards the Forest Farm. The other axis, the northeast/southwest axis, is directed towards Ankara Castle (Boran, 2011).

In 1952, a new plan was sought through a competition and the Yücel-Ubaydin Plan won the competition and was approved by the Council of Ministers in 1957. The Yücel-Ubaydin Plan, led to radical floor increase decisions on the existing order. The cooperative areas in the Yenişehir area (Kızılay, Bahçelievler, Tandoğan) are transformed from 1-2 storey garden houses to a construction pattern starting from 4 storeys up to 10 storeys (Söylemez, 2016).

In summary, Ankara Castle symbolizes the old Ankara, while the Çankaya region, including Anıtkabir, symbolizes the new Ankara. Especially Anıtkabir, which is identified with Ankara and has a very strong symbolic meaning, has been accepted as a landmark to a great extent in the researches conducted (Eraydın, 2016). It can be concluded that if a project so important as the symbol of Ankara is to be implemented, the most appropriate place for it should be an urban unit consisting of neighborhoods starting from the old city borders and forming the nearby neighborhoods of Anıtkabir including Bahçelievler as it was designed by Jansen with Garden City perspective.

In light of all these developments, historical aerial photographs of Anıtkabir taken in 1945, 1952, 1976 and 2024 published by the Ministry of National Defense on November 10, 2024. Started in 1945, the construction of Anıtkabir consisted of four parts and the last part was completed in 1953. In 1945 (figure 4.2.), there were no buildings around Anıtkabir and its surroundings, except for a few settlements, but in 1952 (figure 4.3.), it is noticeable that most of the Mebusevleri Neighborhood was built and a part of the Bahçelievler Neighborhood

was built. The 1976 aerial photograph (figure 4.4.) looks almost identical to the one taken in 2024 (figure 4.5.), except for very slight differences.



Figure 4.2. Anıtkabir and surrounding in 1945 (Ministry of National Defense, 2024)



Figure 4.3. Anıtkabir and surrounding in 1952 (Ministry of National Defense, 2024)



Figure 4.4. Anıtkabir and surrounding in 1976 (Ministry of National Defense, 2024)



Figure 4.5. Anıtkabir and surrounding in 2024 (Ministry of National Defense, 2024)

Many criteria and details were taken into consideration when selecting the case study area as mentioned. Criteria such as Anıtkabir's strategic location, its central location in terms of

transportation and diverse transportation options, its historical and cultural significance, located in a residential area in Çankaya, which was called Yenişehir after the establishment of the Republic. assisted in the site selection. When the current zoning plans for the region are investigated, it is understood that the 1/1000 Scale Implementation Zoning Plan that covers the entire neighborhoods of Emek, Bahçelievler, Yukarı Bahçelievler, Mebusevleri, Yücetepe, Anıttepe, Maltepe, Korkutreis, Kızılay, Cumhuriyet, Meşrutiyet, Kocatepe and some parts of Kültür, Kavaklıdere, Fidanlık and Sağlık neighborhoods (illustrated on Figure 4.6.), mostly within the boundaries of the regional floor layout plan and central business area is in force (Map 4.2.).

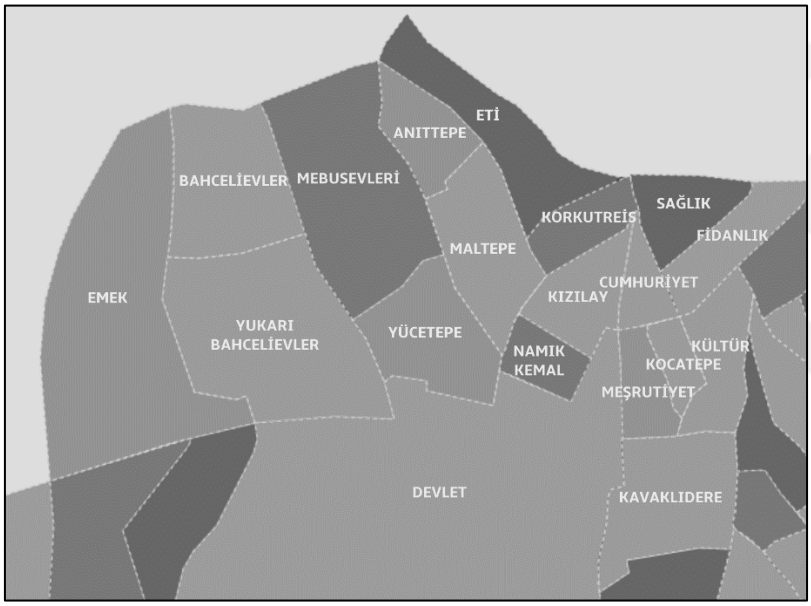
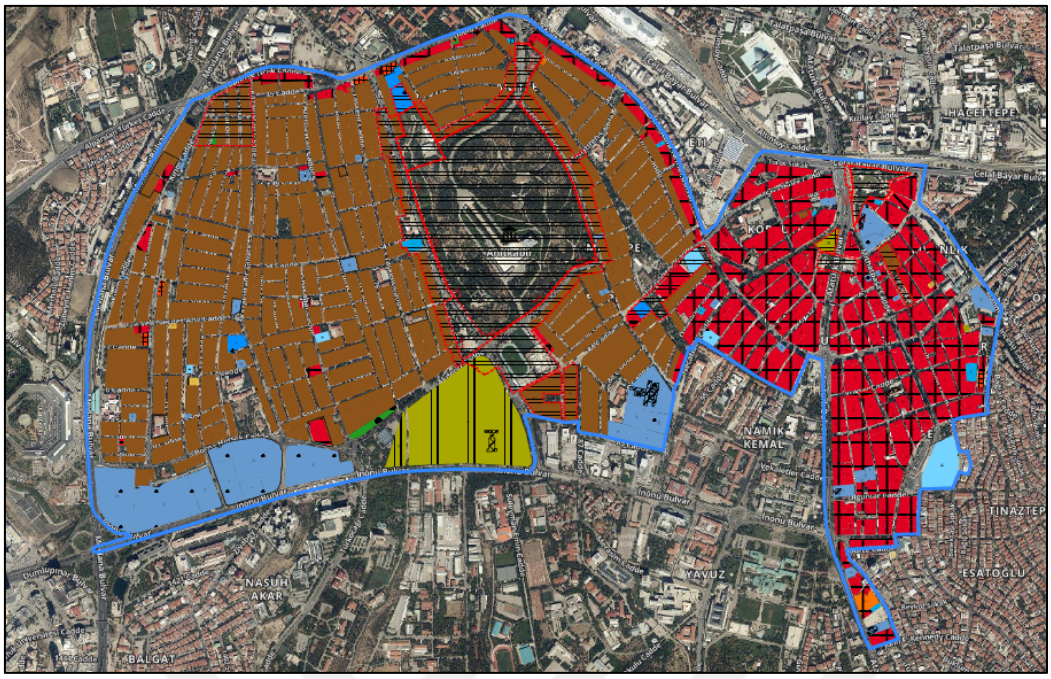


Figure 4.6. Boundaries of the neighborhoods in and around study area (Prepared by author)



Map 4.2. 1/1000 scale Implementation Zoning Plan in force (e-plan, 2021)

When the area is evaluated, Anıttepe, Mebusevleri, Yücetepe, Maltepe, Yukarı Bahçelievler, Bahçelievler, a part of Devlet and Emek Neighborhoods, where residential areas are dense, were considered suitable as the study area. Kavaklıdere, Korkutreis, Fidanlık, Kültür, Meşrutiyet, Kocatepe, Kızılay, Cumhuriyet Neighborhoods, which are included in the zoning plan, were excluded because they were not considered as 15-minute residential areas due to the density of commercial areas.

Anıttepe, Mebusevleri, Yücetepe, Maltepe, Yukarı Bahçelievler, Bahçelievler, Emek and a part of Devlet neighborhoods that consist the study area are shown in map 4.3. is located İsmet İnönü Boulevard on South, Mevlana Boulevard on West, Bahriye Üçok Street on North and Gazi Mustafa Kemal Boulevard on the Northeast.



Map 4.3. Case study area (Prepared by the author)

4.1. Cluster 1: Pedestrian Accessibility

The procedure of analysis involved mapping out locations that were within a 15-minute walk from people's homes, then calculating the number of amenities in each category that were situated there. The objective is to quantify the ease of access to various services and facilities within a 15-minute walk and to find spatial trends in the distribution of amenities that take walkability and population density into account. The GIS analysis is predicated on accessibility to necessities of daily life. The six urban amenities that have been mapped out are living, working, commerce, healthcare, education and recreation/entertainment. These six amenities were chosen because, according to Moreno (2021), they should be positioned within 15-minute in order to reach the ideal 15-minute city. The six categories and their types with explanations are given in table 4.1.

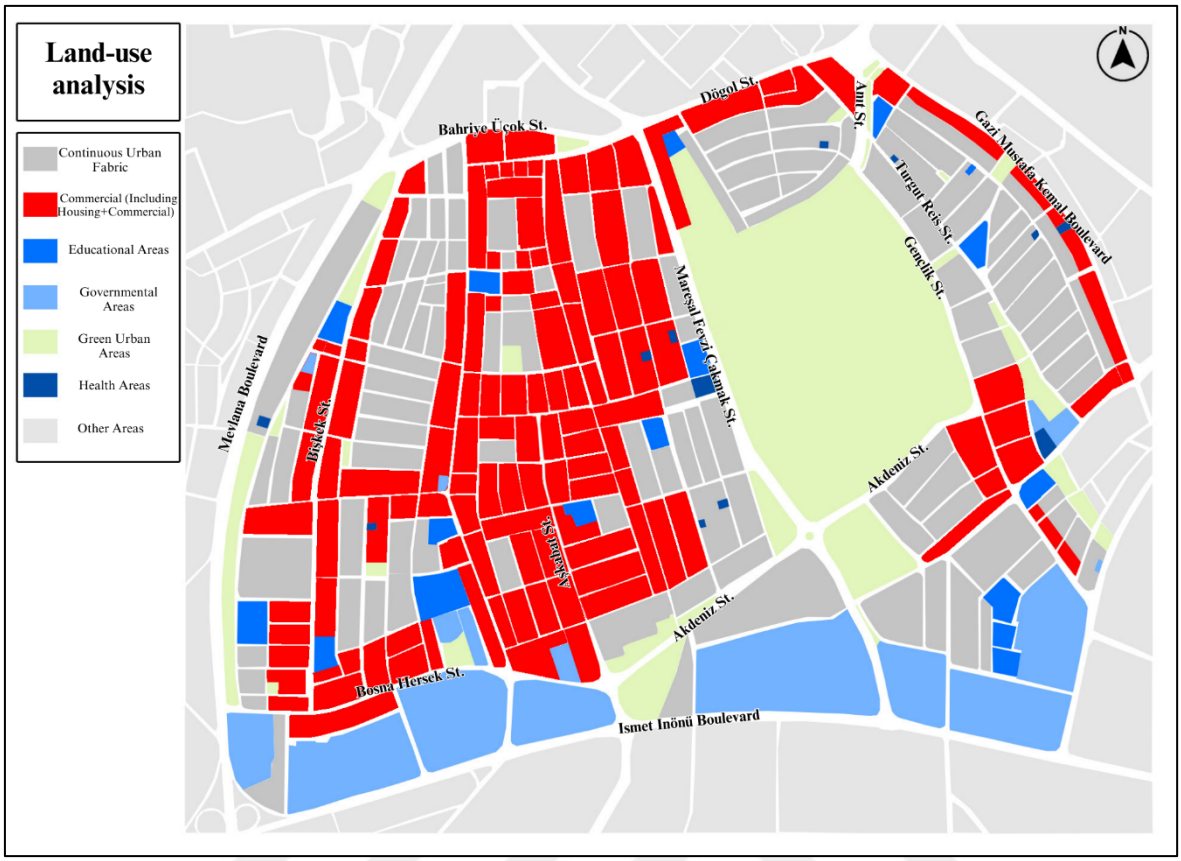
Table 4.1. Urban amenities (Prepared by the author)

Urban amenities	Data	Amenities explained	Example photo
Living	Residential Buildings Housing Estates	Residential buildings are generally detached and medium-low density	
Working	Governmental Buildings Offices	Governmental campuses are located on the south of the area but private offices are sprawled among	
Commerce	Grocery Stores Cafes and Restaurants Stores	All kinds of commercial needs, grocery stores and stores, and leisure time activities, cafes and restaurants, for people are located near or inside of the residential areas	
Healthcare	Hospitals Family Health Centers	Hospitals are often wanted for more urgent requirements and do not always need to be within a 15-minute distance, whereas clinics should be closer because they serve more day-to-day needs	

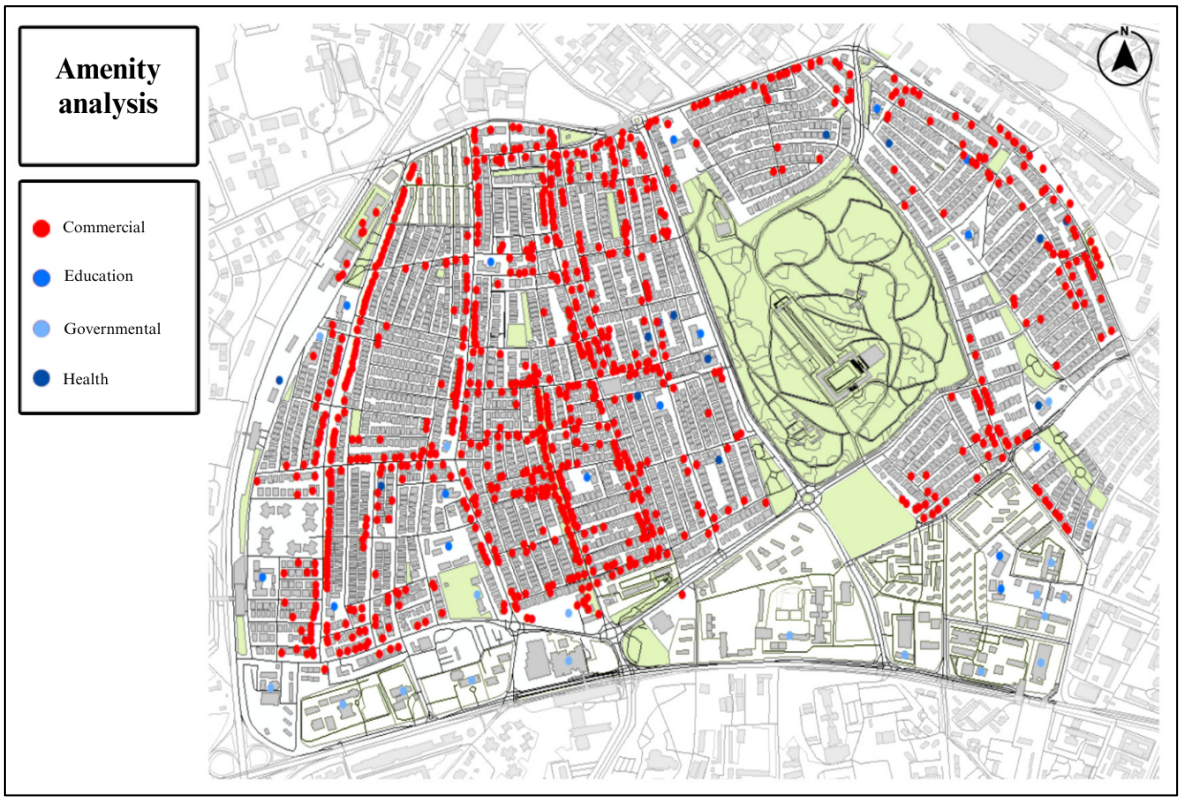
Table 4.1. (continued) Urban amenities (Prepared by the author)

Education	Schools (kindergarden, primary, secondary, high school)	Schools, universities and libraries, while not visited daily by every family, have been considered to be educational institutions. Schools, in addition to being educational, have been identified as a significant part in the flexibility of the 15-minute-city, since their schoolyards may be used for play outside of school hours	
	Library		
Recreation / Entertainment	Green Areas	Green areas have been understood as forms of recreation and entertainment.	
			

Field research and Google Earth data were used in the land-use mix analysis (map 4.4.) and amenity analysis (map 4.5.) prepared with the amenities given in the table 4.1. In amenity analysis (map 4.5.), commercial, educational, governmental and health amenities are determined in case study area. The distribution of commercial area is predominantly in the Emek and Bahçelievler neighborhoods. Urban texture and accessibility between streets are balanced. Education areas are located near residential areas and within accessible distances. Governmental areas are mostly located on İnönü Boulevard in the south of the area, yet they are large enough to provide employment for thousands of people living in the area and nearby neighborhoods. Health areas are consisted of hospitals and family health center.



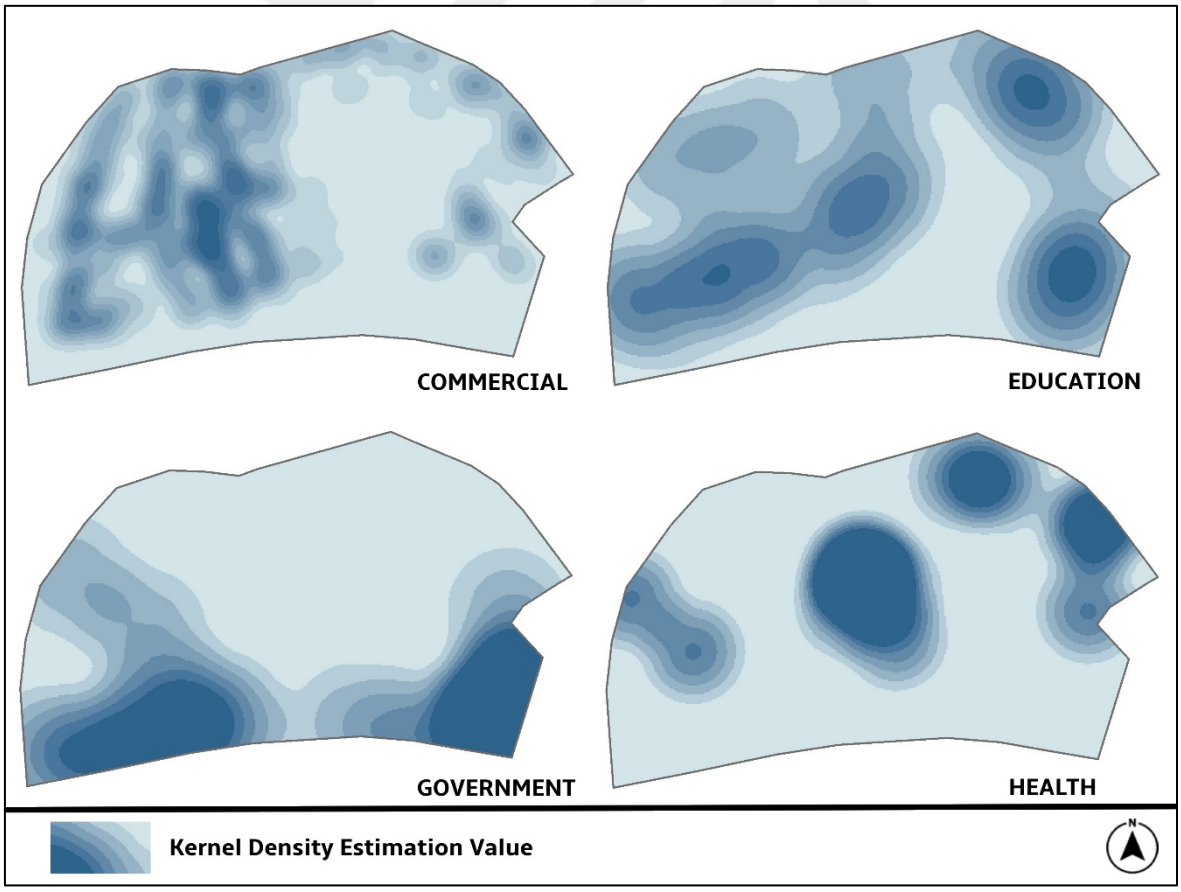
Map 4.4. Land-use mix analysis (Prepared by the author)



Map 4.5. Amenity analysis (Prepared by the author)

Three categories of restrictions with regard to the walkable network are distinguished. First, regarding the intersections that were properly connected and there is no potentially outdated, incomplete, or missing pathways. Second, the area is completely flat because slopes are not taken into account. Assuming that people are ready to travel both flat and steep paths equally, this suggests that certain paths are actually longer than they appear in the software. Third, Akrami (2024) also expressed concern that some populations, including children, the elderly, and those with physical limitations, may find a walking speed of 5 km/h to be excessively rapid.

The 6 main urban amenities located in the area and listed in table 4.1. are given in map 4.5. by using ArcMap. As mentioned, in order to increase reliability, the data was created with Open Street Map, Google Earth and the data obtained during the field trip. The spatial distribution pattern of every facility in the city is shown by the maps in map 4.6.



Map 4.6. Spatial distribution of facilities based on the Kernel density estimation value analysis in case study area (Prepared by author)

Under the section “2.3. The Literature on Cluster Analysis”, topic ““Search Rule 3:”15-minute city” and “accessibility” and “GIS”” there is an article “Walk further and access more! Exploring the 15-minute city concept in Oslo, Norway” by Akrami (2024). The methodology used in the article, which is examined in detail under the mentioned topic, was applied to the case study area by choosing Kernel density analysis in Arcmap as an example (Map 4.6.).

While the intervals were selected every 100 m for education, government and health, they were changed to every 50 m for commercial as it was found that there were no significant results. In the map 4.6., the neighborhoods of Emek, Bahçelievler, and Yukarı Bahçelievler have the largest concentration of commercial space. Schools are situated within easy reach and close to residential areas. Although government buildings are primarily found in the southern part of the region, they are sizable enough to employ thousands of local residents as well as those in surrounding communities. It has been determined that the health units in the area are not relatively evenly distributed and accessible.

4.2. Cluster 2: Mobility

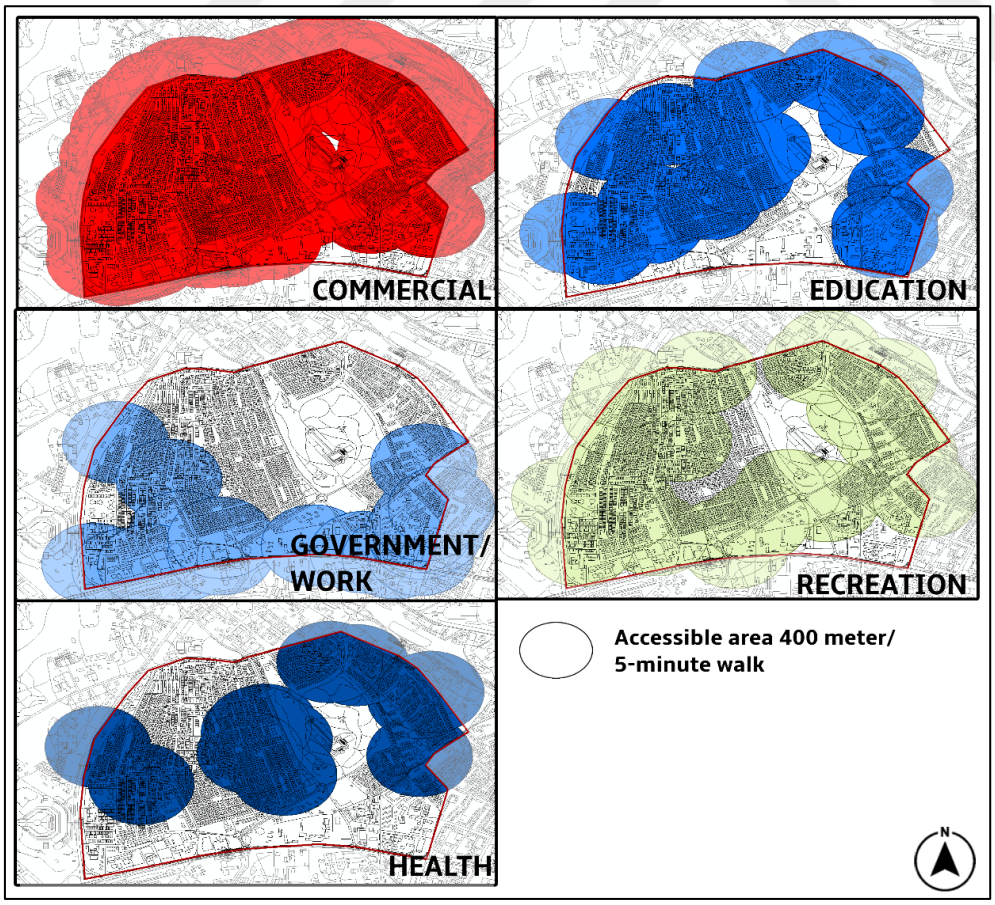
Finding locations where necessary services are within 5-, 10-, and 15-minutes walk was the first step in the spatial study. Zones pertaining to working, commerce, healthcare, education, and green spaces (Moreno, 2021) were mapped using Geographic Information System (GIS) technology. Buffer zones are created around each point using ArcMap software's features, particularly its network analysis capability, which marks places that are accessible within different isochrones. The sorts of critical services listed above were used to categorize these buffer zones. Afterwards, these distinct buffer zones for each category were combined to create a composite walkable area that matched each kind of necessary service.

Finding the intersections between these category-specific buffer zones is the key aspect. These intersections were operationalized to establish what is referred to in this study as "liveable areas," which are defined as locations where people may walk to daily necessities, reducing their reliance on cars. Walking constitutes up the majority of these patterns, which typically result in significantly shorter journey times. This could enable for the identification of particular regions that call for focused actions in order to promote sustainable development. Maps of "livable areas" were created.

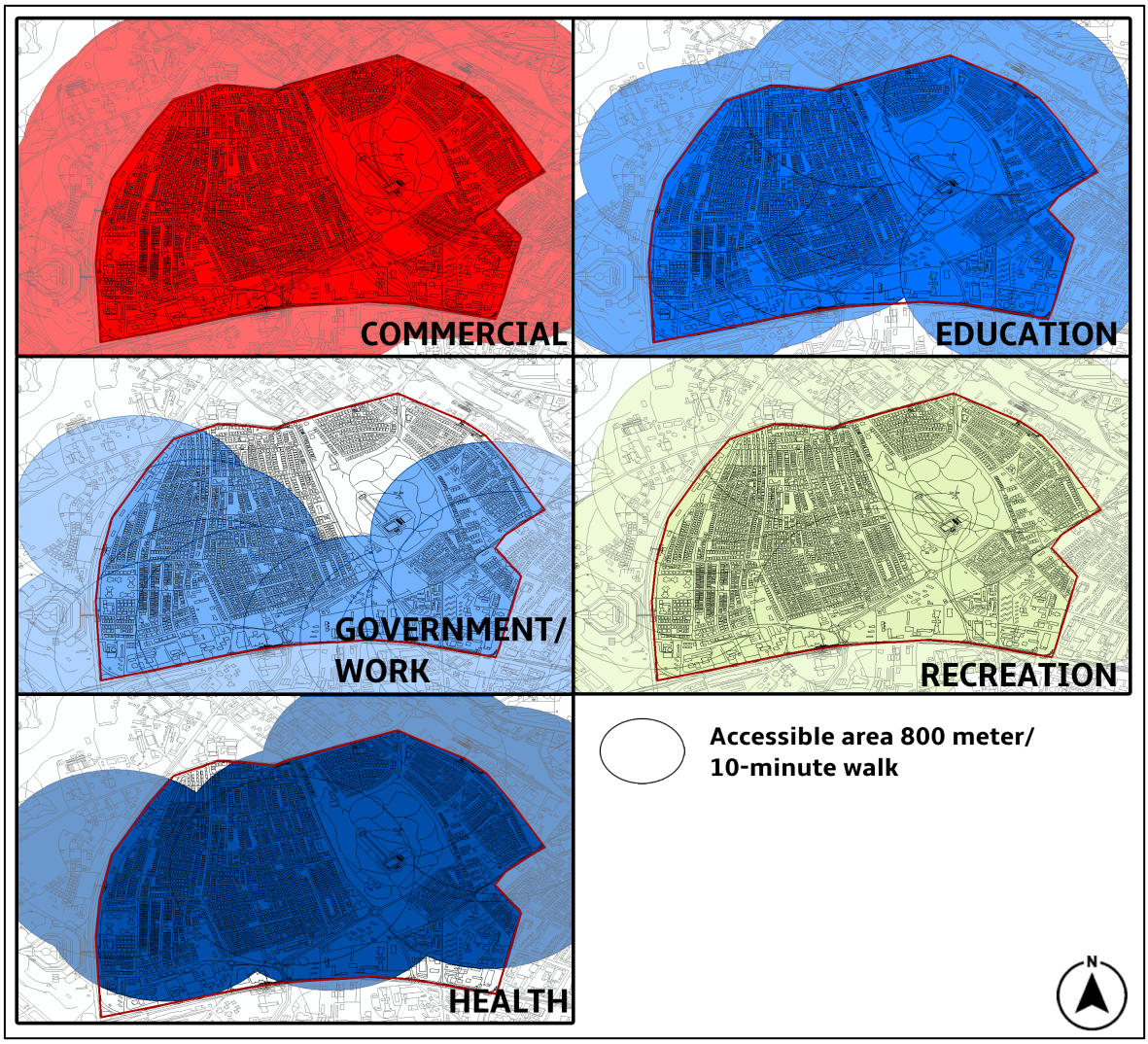
Based on three different isochrone radii of 400, 800, and 1200 meters (Wang, 2024) in the case study area, this study provides a thorough assessment of "livable areas" in terms of human movement. by examining how the inhabitants of neighborhoods with various structures differ in their patterns of movement. This analysis shows that while urban structure is the main factor influencing inhabitants' mobility patterns, other factors may also have a big impact.

Some assumptions were made in this analysis;

- That everyone can walk 400 meters in 5 minutes, 800 meters in 10 minutes and 1200 meters in 15 minutes, regardless of age, gender, physical capacities,
- The area was considered to be flat and without slopes,
- Government jobs were considered to be the only source of jobs in the area because there was no spatial access to private sector jobs.
- It is assumed that major roads and boulevards will allow pedestrian crossing at every point.

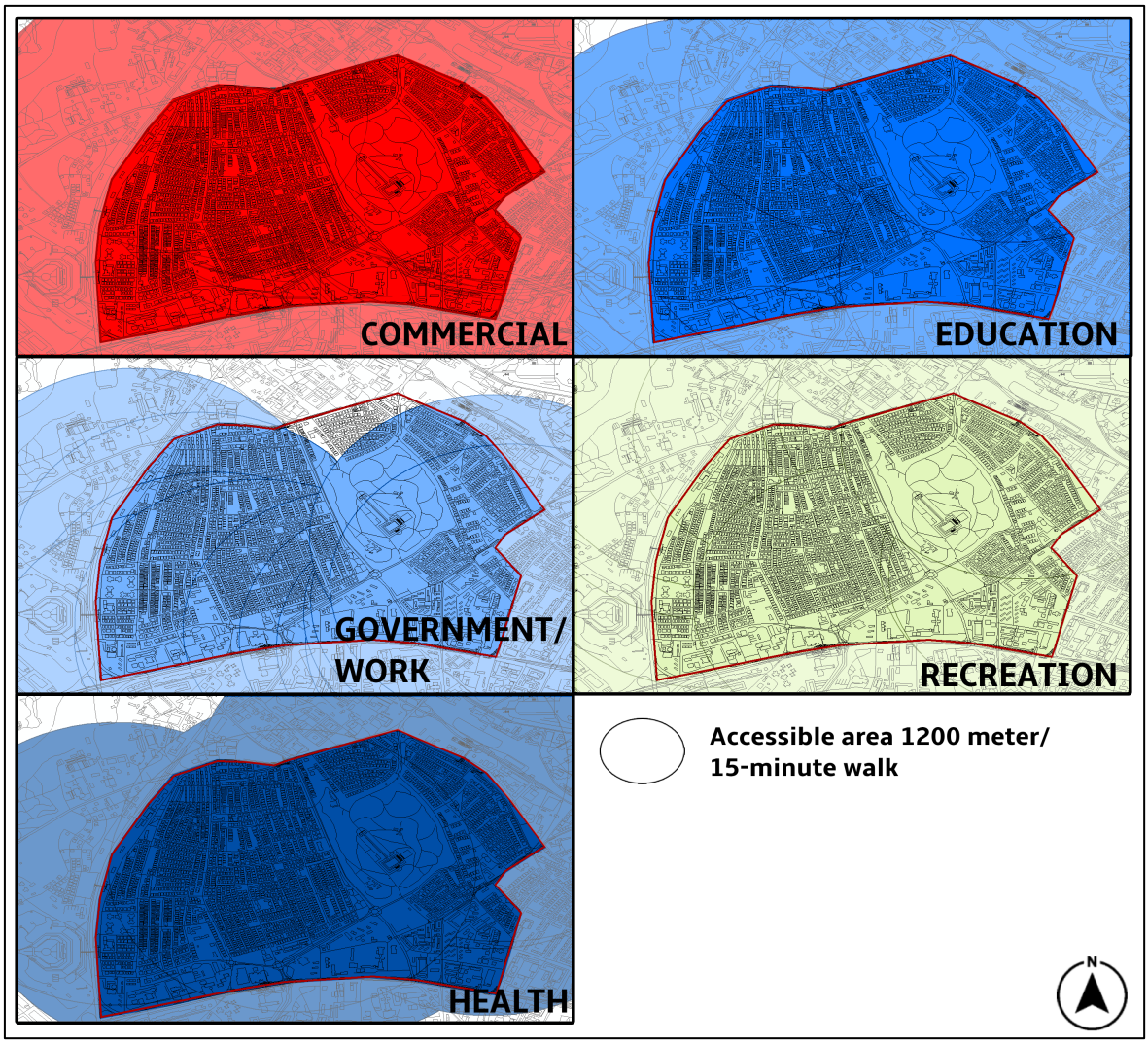


Map 4.7. Accessible areas 400 meter/5-minutes walk (Prepared by the author)



Map 4.8. Accessible areas 800 meter/10-minutes walk (Prepared by the author)

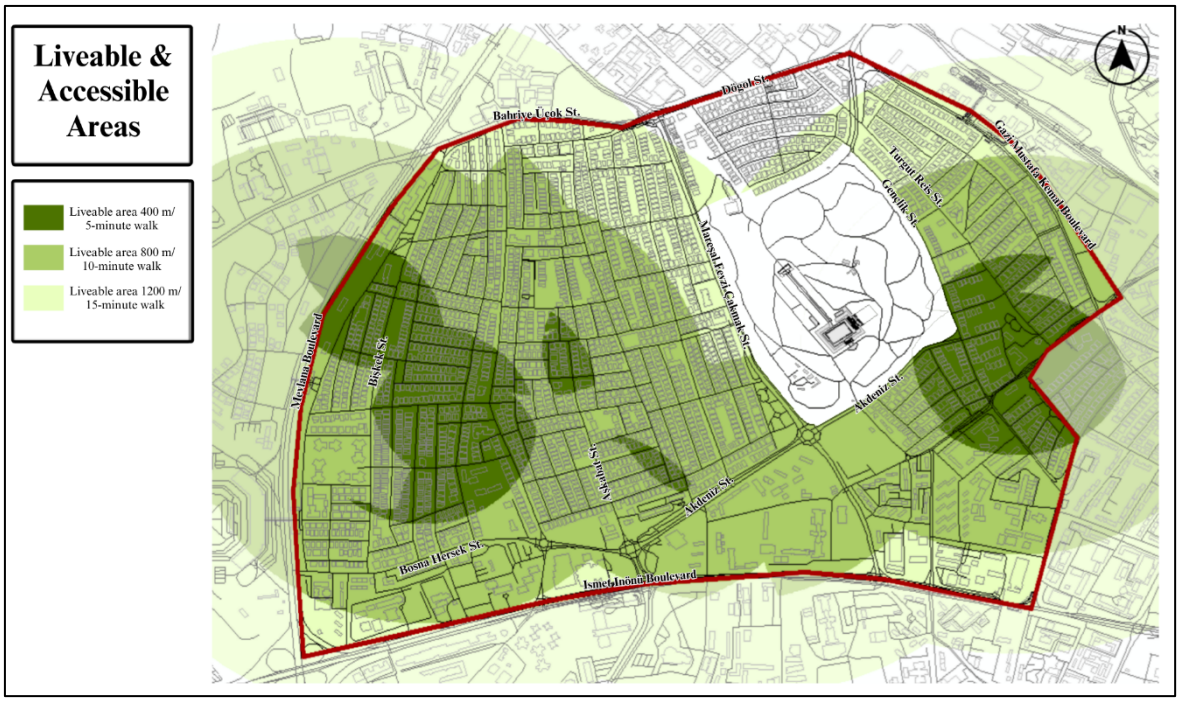
The 15-minute threshold has the most potential to serve the majority of citizens and efficiently connect different centers, according to the mapping of 5, 10, and 15-minute isochrones in terms of access to essential amenities (shown in map 4.7., map 4.8. and map 4.9.). Looking at the analysis, it is noteworthy that the commercial units can be reached in a very short time from anywhere in the area, even within a walking distance of 400 meters/5 minutes. The northern part of the area seems to suffer from this issue as the southern part of the area is completely filled with government institutions, mostly ministries, causing an agglomeration in that area. The parks and open green spaces shown as recreational areas are extremely accessible for people living in the area, within a 5-minute walking distance.



Map 4.9. Accessible areas 1200 meter/15-minutes walk (Prepared by the author)

It is crucial to understand that cities are made up of districts with different functions and features. Due to their distinct urban functions and development priorities, not all districts are able to encompass this ideal, nor will all regions achieve the criteria for "livable areas." However, the case study area seems to meet most of the requirements. The "liveable areas" of the various isochrones for case study area shaded areas on the map 4.10. The majority of the neighborhoods under investigation are included in the greatest isochrone of 15-minute "liveable areas," indicating that they have the fundamental spatial quality required for a 15-minute neighborhood where inhabitants may easily access essential services. Although the areas where 5-minute needs can be met are not very extensive, it includes a part of Emek Neighborhood and a part of Maltepe Neighborhood. The areas where needs can be met in 10 minutes include the entire area except for Mebusevleri and Bahçelievler neighborhoods.

A deeper examination of other urban transportation options is made possible by this analysis. Although there is a distinct general pattern of mobility throughout the city, a closer look at certain districts—each with its own distinct urban characteristics—reveals a deeper connection between the layout of urban areas and the patterns of resident mobility.



Map 4.10. Liveable and accessible areas 5-10-15 minute walk (Prepared by the author)

4.3. Cluster 3: Chrono-Urbanism

In the research by Sierra and Ortiz (2024), they follow the path; to determine distances based on city network analysis, a variety of tools are used. A final composite indicator that is regarded as a key performance indicator (KPI) will be created with four simple indicators that measure amenities and distances (table 4.2.). For each of the 9 different amenity typologies taken into consideration in the study, this procedure will be repeated.

In order to increase reliability, the data was created with Open Street Map, Google Earth and the data obtained during the field trip. Table 4.2. shows the grouping of indicators within the dimensions of "supply/commercial", “education”, “health” and “recreation”. 9 typologies of amenities that are regarded as social determinants of well-being have been identified for the four dimensions of the 15-minute city urban theory.

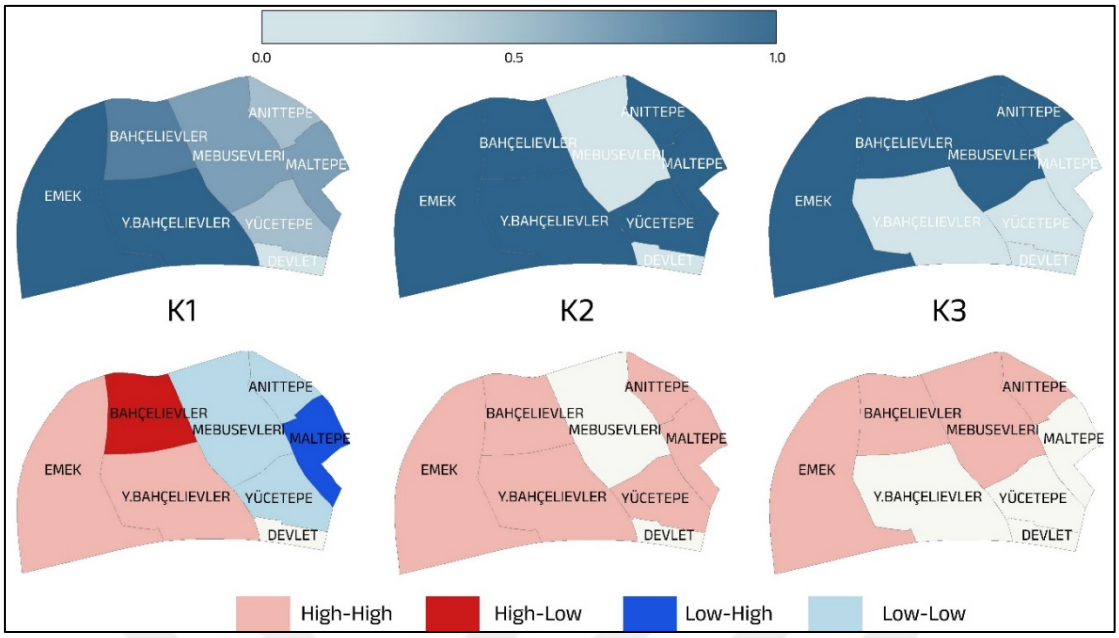
Table 4.2. Description grouping of resources for the calculation of indicators (Prepared by the author)

Indicator	Description	Dimension
K1	Grocery Stores Cafes and Restaurants Other Stores	SUPPLY/COMMERCIAL
K2	Primary School	EDUCATION
K3	Secondary School	
K4	High School	
K5	Library	
K6	Family Health Services	HEALTH
K7	Hospitals	
K8	Green Areas	RECREATION
K9	Sport Activities	

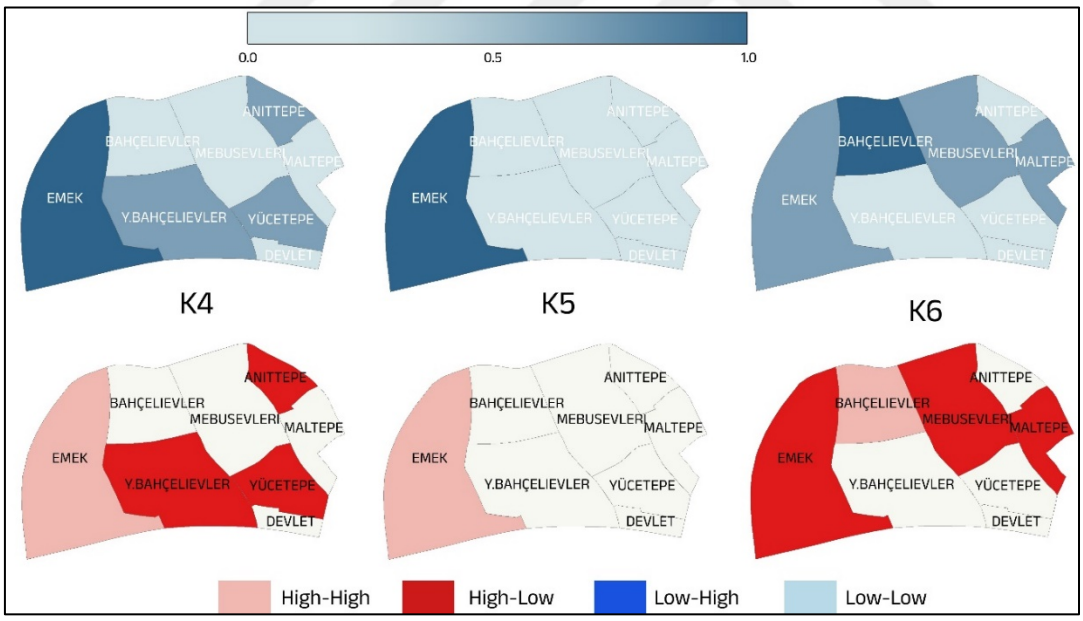
Table 4.3. Value ranges of indicators (Prepared by the author)

Indicator	High-High	High-Low	Low-High	Low-Low
K1	201<	200-101	100-51	<50
K2	1	-	-	-
K3	1	-	-	-
K4	2	1	-	-
K5	1	-	-	-
K6	2	1	-	-
K7	3	2	1	-
K8	5<	4-3	2-1	-
K9	1	-	-	-

As mentioned in the previous sections, ArcMap application was used to perform this analysis and high-low and low-high ranges were used instead of giving medium option in the legend part of this analysis (shown in table 4.3). Many neighborhoods have a different distribution of commercial units (K1) as shown in map 4.11. For example, while the western part of the area shows a high level of commercial units, the eastern part shows low-high results. This result is consistent with other cluster analyses. In the analysis of education, although the distribution of primary school (K2) and secondary school (K3) seems adequate, high school (K4) and library (K5) show poorer results. Since the Devlet neighborhood consists entirely of public buildings, its value is found to be not-significant in these analyses.



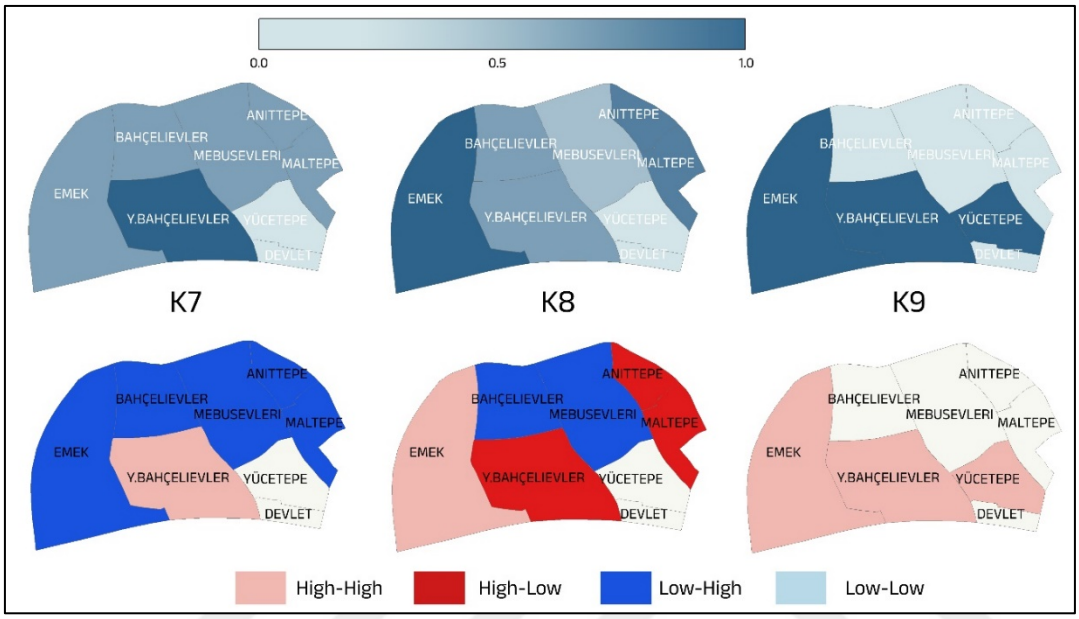
Map 4.11. Indicators of K1 (supply/commercial), K2 (primary school/education) and K3 (secondary school/education) and its local spatial autocorrelation (Prepared by the author)



Map 4.12. Indicators of K4 (high school/education), K5 (library/education) and K6 (family health services/health) and its local spatial autocorrelation (Prepared by the author)

Even though, hospitals (K7) are not required to be within 15-minute distance, they are also added to analysis and surprisingly they are spread over the area. Since Başkent Hospital and its dispersed campus are located in the Yukarı Bahçelievler neighborhood, the hospital value of the area is quite high. The presence of hospitals and family health services are evenly

distributed in the area. For example, there are no family health services (K7) in Anıttepe and Yukarı Bahçelievler neighborhoods, while the presence of hospitals (K8) compensates for this deficiency. However, both a family health service and a hospital could not be identified in Yücetepe neighborhood.



Map 4.13. Indicators of K7 (hospitals/health), K8 (green areas/recreation) and K9 (sport activities/recreation) and its local spatial autocorrelation (Prepared by the author)

Recreational activities were evaluated in two sections: green areas (K8) and sports facilities (K9). While it is observed that there is a balanced distribution in terms of green areas, the results are different in terms of sports facilities. Only Emek, Yukarı Bahçelievler and Yücetepe neighborhoods have sports facilities. Sports machines are not included in the parks, only fields, courts and walking paths are included.

4.4. Cluster 4: Sustainable Development

Both the public and politicians now put great importance on an equal and balanced use of sources. The primary goals of the changing approach to the use of the natural and built environments are to preserve and carry these resources into the future for future generations. These evolving perspectives are essentially where the concept of "sustainability" originated. As a general term, "sustainability" covers a wide range of topics and aspects. Among these terms and ideas are "sustainable urban areas," "sustainable communities," and "sustainable

neighborhoods." In order to assess and comprehend the neighborhood and community developments, these ideas are critical to the current study.

In the context of our country, the issue of sustainability in transportation can be linked to uncontrolled urban sprawl and car dependency. As a result of unplanned and uncontrolled development in the macro-form of cities, the use of private vehicles increases as urban sprawl increases the distances to be traveled; this creates air pollution and increases emissions that lead to global warming. This situation increases the ecological fragility of the city and negatively affects its resilience. As a result, the main problem definition in the current sustainability debates, especially in urban transportation, is before determining what we want to sustain; more accurately, what we can no longer sustain.

In order to make an analysis under this cluster, articles on the subject in Web of Science were scanned. After examining the most relevant article “The Theoretical, Practical, and Technological Foundations of the 15-Minute City Model: Proximity and Its Environmental, Social and Economic Benefits for Sustainability” is reached and three main themes were reached. By examining the absence of these themes instead of their presence, the sustainability of the area will be analyzed. The themes are; “(1) travel patterns and dependency on cars for transportation, (2) heavy traffic, (3) walkable pathways and cyclable bicycle lanes”.

Travel patterns and dependency on cars for transportation

For many years, the city of Ankara, with Kale and Ulus at its center, has continued to grow in the form of an oil stain and concentrated in the center. Due to the concentrating effect of the growth in the form of oil stains on the center, transportation services were also concentrated in the center and caused significant traffic problems. The rapid development of the city has increased the load on the urban roads that provide the connection between the center and the center-residence, and due to the lack of an alternative road network to the main arteries in the areas with planned developments, the urban roads have been concentrated in the center and in the center-residence connections.

Although Ankara seems to have two separate centers, Ulus and Kızılay, the spatial integrity of these areas and the fact that they are fed by the same transportation axes preserve the

characteristic of being the only center of the city. Over the years, Ulus has been serving as the traditional city center, while modern functions have been located along the Kızılay-Tunalı-Gaziosmanpaşa axis. Travel demands on the center cause congestion on the radial transportation axes towards the center. More traffic than the main arteries can handle is concentrated in the center, resulting in the congestion of major intersections and arteries. The fact that the city has not gained a polycentric structural character increases the traffic load of the existing center in the morning and evening peak hours.

Due to Ankara's sprawling and fragmented living surroundings, as well as its continuously expanding and uncontrolled urban regions, the primary mode of transportation depends mainly on motorways and private vehicles. There are no or very few plans for alternative modes of transportation, such as bicycles, subways, rail systems, and mass transit vehicles. The resistance of the 'private car' mobility paradigm, such as, the preference of using private cars even for short trips, is still strong in Turkey.

Table 4.4. Number of road motor vehicles (TÜİK, 2023)

Year	Total	Car	Minibus	Bus	Small Truck	Truck	Motorbike	Special Purpose Vehicles
2013	17 939 447	9 283 923	421 848	219 885	2 933 050	755 950	2 722 826	36 148
2014	18 828 721	9 857 915	427 264	211 200	3 062 479	773 728	2 828 466	40 731
2015	19 994 472	10 589 337	449 213	217 056	3 255 299	804 319	2 938 364	45 732
2016	21 090 424	11 317 998	463 933	220 361	3 442 483	825 334	3 003 733	50 818
2017	22 218 945	12 035 978	478 618	221 885	3 642 625	838 718	3 102 800	60 099
2018	22 865 921	12 398 190	487 527	218 523	3 755 580	845 462	3 211 328	63 359
2019	23 156 975	12 503 049	493 373	213 358	3 796 919	844 481	3 331 326	65 470
2020	24 144 857	13 099 041	493 395	212 407	3 938 732	859 670	3 512 576	70 309
2021	25 249 119	13 706 065	484 806	208 882	4 115 205	886 303	3 744 370	78 482
2022	26 482 847	14 269 352	487 381	208 442	4 277 424	919 125	4 141 914	85 276
2023	28 740 492	15 221 134	502 628	210 740	4 487 244	959 793	5 079 396	93 407

As it is illustrated in the table 4.4, car ownership in Türkiye has increased significantly in the last decade. When in 2013 the number was 9 283 923 and it reached 15 221 134 with an increase of around 64 percent. This increase in the number of car ownership is significant and does not seem to have a positive impact on the research topic. According to the TÜİK Geographical Statistics Portal, the number of private cars per thousand people is highest in Ankara with the number of 301. The neighborhoods selected for the case study are located in the central part of Ankara, and as such, there is an intense vehicle use in the area.

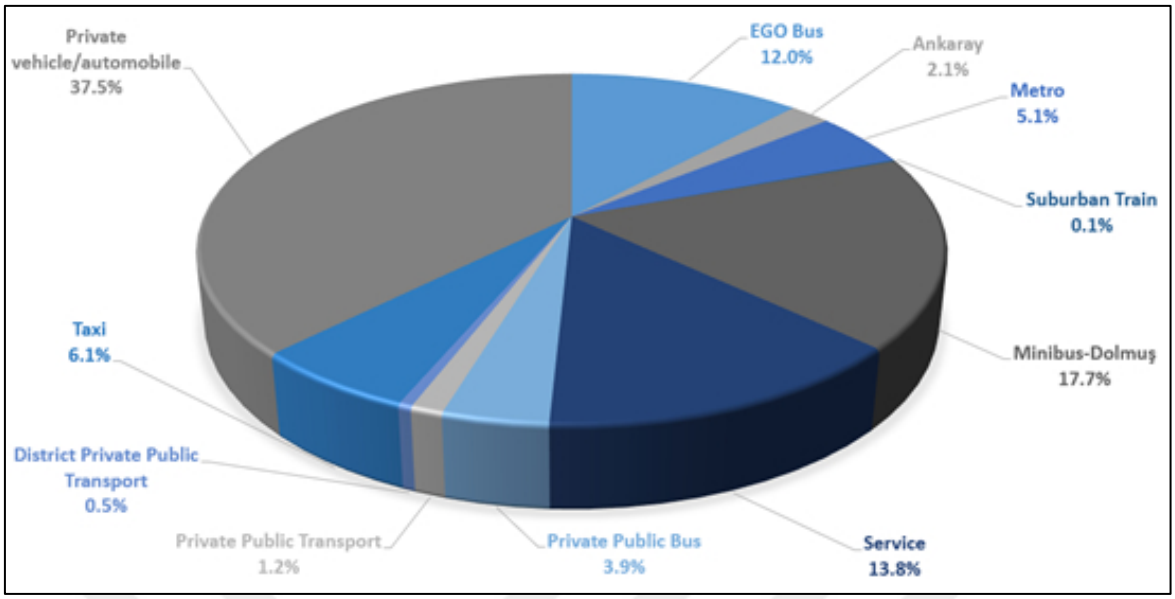


Figure 4.7. Modal-split analysis-ratio of workday travels in Ankara according to transportation types (Prepared by author adapted from EGO, 2017)

Table 4.5. Number of workday travels in Ankara according to transportation types (Prepared by author adapted from EGO, 2017)

Types	Number of Passengers Traveled	%
EGO Bus	728 400	12
Ankaray	130 270	2,1
Metro	307 800	5,1
Suburban Train	10 700	0,1
Minibus-Dolmuş	1 075 000	17,7
Service	840 000	13,8
Private Public Bus	240 000	3,9
Private Public Transport	74 000	1,2
District Private Public Transport	30 000	0,5
Taxi	370 000	6,1
Private vehicle/automobile	2 280 065	37,5

According to EGO, the number of workday travels different forms of transportation, a significant number of Ankara residents (43,5%) prefer to use their private vehicles or taxis. Additionally, 17,7% of respondents use minibus and dolmuş, while 7,3% use Ankaray, Metro, and Banliyö (Figure 4.7). The public transit system in Ankara is heavily dependent on dolmuş, while light rail and non-motorized forms of transportation are infrequently used. These same factors contribute to traffic jams and a decline in the city's walkability.

As can be clearly seen in the figure 4,7, the total share of rail systems among public transportation vehicles is below 10%. This ratio is quite low compared to cities with high population numbers in developed countries. As a general trend, cities with a population of more than 1 million tend to solve the public transportation problem with rail systems, whereas in Ankara, which has a population of nearly 6 million, the percentage of rail systems is only 7,2% among all vehicular transportation.

Table 4.6. Number of workday travels in Ankara according to transportation types in total (Prepared by author adapted from EGO, 2017)

Types	Number of Passengers Traveled	%
Public Transportation Total	3 436 710	56,5
Private Transportation Total	2 650 065	43,5
Total	6 086 775	100

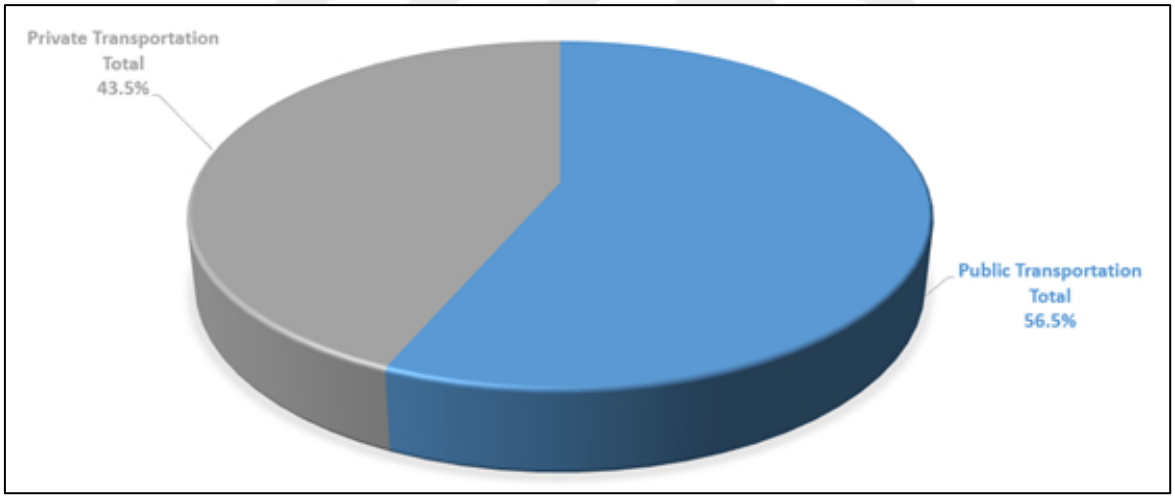


Figure 4.8. Modal-split analysis-ratio of workday travels in Ankara according to transportation types in total (Prepared by author adapted from EGO, 2017)

As a result of all these problems related to public transportation, citizens are pushed to use private vehicles. Although there are many measures can be taken and many investments can be made to enhance public transportation competitive with private car use, unfortunately this problem continues to be chronic.

Heavy traffic

When the city plan is created and the living spaces are expanding environmentally friendly transportation systems are given the least amount of consideration, unfortunately. In terms of the physical planning of transportation networks, the structure of the system that connects urban and suburban areas had been accepted before as being dependent on automobiles and having weak connections. This type of transportation planning destroys the ecology and environment, which results in unhealthy and uncomfortable living conditions, and it denies other alternative methods a chance. Sustainability of living areas is adversely impacted by an unorganized transportation infrastructure.

Today, policies based on human mobility and access are reflected in the solution of transportation problems of cities. Healthy cities that reduce the use of automobiles and adopt pedestrians as a complementary element of the urban public transportation system are targeted. However, in Ankara there is a lack of comprehensive system between public transportation modes. It is not only increasing travel times, but also causes individuals to turn to private automobiles and public spaces to gradually disappear. Increasing vehicle travel times in the city, incorrect traffic management and forced routes in the traffic flow due to signalization cause vehicles to travel longer distances than normal. It is understood that the continuously increasing use of motor vehicles, and especially the increasing number of automobile trips, causes dangerous levels of air pollution in cities; creates a city and national economy dependent on oil and foreign resources; high-capacity vehicle corridors passing through the centers of cities negatively affect urban life with their effects such as traffic safety, noise and fragmentation of space.

According to the results of the research by Bostancı (2024), the biggest urban transportation problem in Ankara is traffic congestion and parking problems. The reasons for this can be listed as the unplanned expansion and growth of Ankara and the intensive use of private vehicles. When the population information of Ankara between 2012 and 2022 is analyzed, it is seen that the population increase rate is between 0.1% and 0.2% compared to the previous year. The rate of increase in the number of motor vehicles is approximately between 0.3% and 0.6%, which is higher than the rate of increase in population (Table 4.7.). When Ankara is compared to Turkey, it is seen that the total number of accidents in Ankara is 10% of the total number of accidents in Turkey and 9% of the total number of motor vehicles in Turkey are located in Ankara.

Table 4.7. Comparison of the rate of increase in the number of motorized vehicles with population growth in Ankara (Prepared by author adapted from Bostancı, 2024)

Years	Number of Vehicles	Rate of Increase Compared to the Previous Year (%)	Population	Rate of Increase Compared to the Previous Year (%)
2012	1 436 349	0,5	4 965 548	0,2
2013	1 509 632	0,4	5 045 083	0,2
2014	1 577 134	0,6	5 150 072	0,2
2015	1 678 731	0,6	5 270 575	0,1
2016	1 777 756	0,6	5 346 518	0,2
2017	1 887 491	0,4	5 445 026	0,1
2018	1 974 577	0,3	5 503 985	0,2
2019	2 033 935	0,6	5 639 076	0
2020	2 158 111	0,5	5 663 322	0,1
2021	2 275 927	0,3	5 747 325	0,1
2022	2 284 765		5 782 285	

In another study that was conducted in Gazi Mustafa Kemal Boulevard, located in northeast of the case study area, a scale based on physical, mental, social, environmental and economic factors were developed to assess the effects of traffic congestion on quality of life of road users. Participants think that their quality of life has decreased the most due to negative conditions in the parameters of air quality, noise, walking and cycling opportunities, traffic safety and freedom of movement. In the social aspect, according to road users, traffic congestion has a negative impact on residents' sense of responsibility, reduces the sense of personal space and social interaction of the community, and reduces the space for people to gather. In the environmental aspect, the highest score belongs to road users' response to the question “air quality is negatively affected”. This score is followed by the scores for the answers to the questions “traffic noise increases”, “walking and cycling opportunities decrease” and “traffic environment becomes more unsafe”. Road users think that these four situations always have a negative impact on their quality of life. The highest score in the economic domain belongs to the drivers' answer to the question “increased fuel consumption increases my transportation costs”. Drivers think that traffic congestion always increases the cost of transportation (Öztürk, 2018). According to the results of this analysis, heavy traffic is not sustainable from the aspects of physical, mental, social and environmental and the main arteries around the four borders of the area have similar levels of density.

As explained in the previous topic “Travel Patterns and Dependency on Cars for Transportation”, an unsolved public transportation problem increases the dependency on private vehicles and thus creates a serious density on the boulevards, which are the main arteries in the city and within the boundaries of the case study area. In order to understand how widespread and intensive motorized transportation is, Yandex Maps were used to determine the volume of use on weekdays and weekends. The hours are selected as 8:30 on the morning and 18:00 on the evening as they are the rush hours and motorized transportation intensity can be best observed during these hours. As can be seen from the map 4.13, the main roads passing through the outer boundary of the area are the most heavily used.



Map 4.14. Traffic volume analysis-motorized transportation on weekdays and weekends (Prepared by the author, adapted from Yandex Maps)

Dögol Street and Bahriye Üçok Street in the north of the area has a significant vehicle density both on weekdays and weekends. As noticed and photographed (image 4.1) during the site visit, the right lane of the Dögol Street due to its intense commercial use, which is 2 lanes going and 2 lanes returning, is mostly used for short-term parking with commercial uses. For

this reason, transportation is interrupted on the already heavily used road. As can be seen from the hourly vehicle density (map 4.14), that not only the main arteries but also the streets inside of the area are busy during the day. For example, Aşkabat Street (image 4.2.) or Bişkek Street are also streets with a significant density both on weekdays and weekends.



Image 4.1. Dögol Street in weekdays at 18:00 (Taken by the author)



Image 4.2. Aşkabat St. commercial use photos by motorized transportation (Taken by author)

Walkable pathways and cyclable bicycle lanes

In urban transportation, bicycle and pedestrian trips are considered to be the most sustainable transportation modes in terms of their environmental impacts, and they are also considered

to be the preferred alternatives for improving health as they provide regular exercise in daily life. Bicycle lanes are being constructed in many cities around the world in order to make cycling an important alternative for urban travel. In cities that have developed the infrastructure for bicycle lanes, in the second stage, municipalities have started to provide bicycle rental services, in some cases free of charge.

The traditional approach of urban transportation problem-solving policies with a focus on demand increases greenhouse gas emissions and air pollution in cities. In addition, the adoption of the traditional approach has resulted in a significant portion of public open spaces being converted into new parking lots, urban spaces where roads are widened and sidewalks are narrowed, and a street structure that creates barriers to accessibility for pedestrians and negatively affects urban aesthetics. According to Chuang and Chen (2024), the needs of locals are not always met by a popular urban hotspot. Shorter outflow travel between neighborhoods, however, usually indicates well-served neighborhoods, emphasizing their capacity to facilitate daily necessities and encourage walkability. In other words, the main purpose is not to fix the sidewalks at an attraction point that already attracts pedestrians, but to arrange the sidewalks within and between neighborhoods and make them attractive for daily transportation.

Additionally, according to the “Urban roads - Design criteria for preventive barriers on sidewalks” handbook published by TSE, the qualities to be required for ideal sidewalks are as listed: the width of the sidewalk should be at least 1.50 meters on partially level crossing, semi-access controlled ring roads, and the width of the sidewalk should be at least 5 meters in central business districts where pedestrian traffic is intense, such as trade, offices, government offices and similar uses. The research of Chuang and Chen (2024), highlights the significance of sidewalk width in influencing traffic patterns and emphasizes the need for a comprehensive approach to urban planning that takes into account a wider range of factors that affect an area's usability and attraction. However, as identified in the case study area, pedestrian sidewalks are continuously narrowed on side streets and main boulevards due to road widening projects (image 4.3.), the sidewalks are mostly occupied by vehicles (image 4.4. and 4.5.) and existing sidewalks are unsuitable for walking. Moreover, pavement width is not the only factor affecting walkability. There are many other factors, but this method is analyzed here as the most measurable one.



Image 4.3. Narrowed pedestrian sidewalks (Taken by author)



Image 4.4. Sidewalks occupied by vehicles (Taken by author)

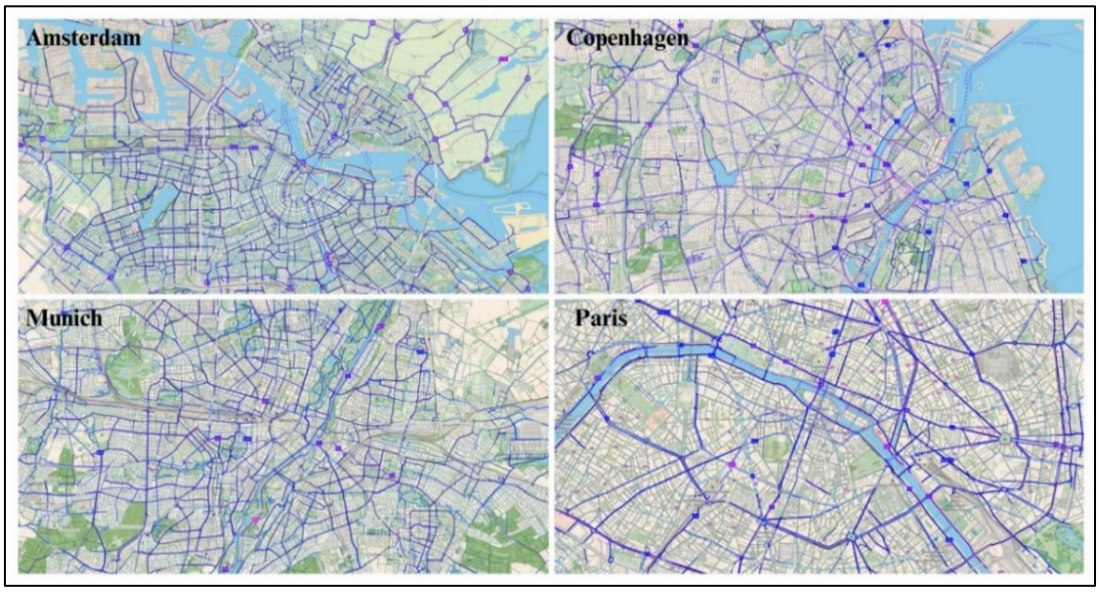


Image 4.5. Sidewalks occupied by vehicles (Taken by author)

Many countries around the world are fully embracing the importance of cycling as a mode of urban transportation. In recent years, central and local governments have been preparing urban policies and plans to realize the potential of cycling to improve the sustainability of transport systems and enhance the livability of cities. Bicycle-related programs and

investments are well developed and widespread in many countries. Northern European countries, with the Netherlands and Denmark in particular leading the way, have a historic cycling culture and are significantly improving their existing cycling infrastructure and policies that can increase cycling.

In Amsterdam, where cyclists are the main actors of urban mobility, an urban transportation system equipped with highly developed bicycle lane and parking infrastructure has been created and is being developed day by day. As in almost all cities in the Netherlands, safe bicycle lanes in Amsterdam, which cover the whole city and its surroundings, are used for transportation by all segments of the city, including the elderly and children. Another prominent city considered to be the cycling capital of the world is Copenhagen, the capital of Denmark. In Copenhagen, cycling as a means of transportation is actively used by various age groups throughout the city, regardless of weather conditions and time of day. Munich is one of the most bicycle-friendly cities in Europe. In the 1950s-1960s, as a result of car-intensive policies and the accompanying protests, local government started to think about new solutions. Beginning in the 1970s, important steps were taken in cooperation with the public and private sectors to develop and adopt bicycle transportation. Although Paris is not perceived as bicycle friendly at first glance, it is the most prominent city in Europe in terms of effective management and use of bicycle sharing systems, one of the most important parts of cycling (Erçetin, 2023). The bicycle roads in mentioned cities are illustrated on map 4.15.



Map 4.15. Bicycle roads in Amsterdam, Copenhagen, Munich and Paris (Openstreetmap-CyclOSM)

On the other hand, in Ankara, the formation of a cycling culture has not fully started due to barriers to cycling. These barriers include the inadequacy of existing bicycle lane infrastructure and parking spaces, variable weather conditions, long travel distances due to distant urban uses, irregular on-street parking, poor air quality, and finally the perception of cycling as a means of leisure and sport rather than as a mode of urban transportation (Erçetin, 2023). As it is illustrated in figure 4.7, bicycle use is not included in the analysis since it does not reach a proportional value. When Map 4.16. is analyzed, compared to other sample cities, disconnected bicycle paths stand out. Only the first phase of the Ankara Bikeway Project, which is located within the boundary of the case study area, connects two places, and the others consist of roads used for recreational purposes only within the park areas.

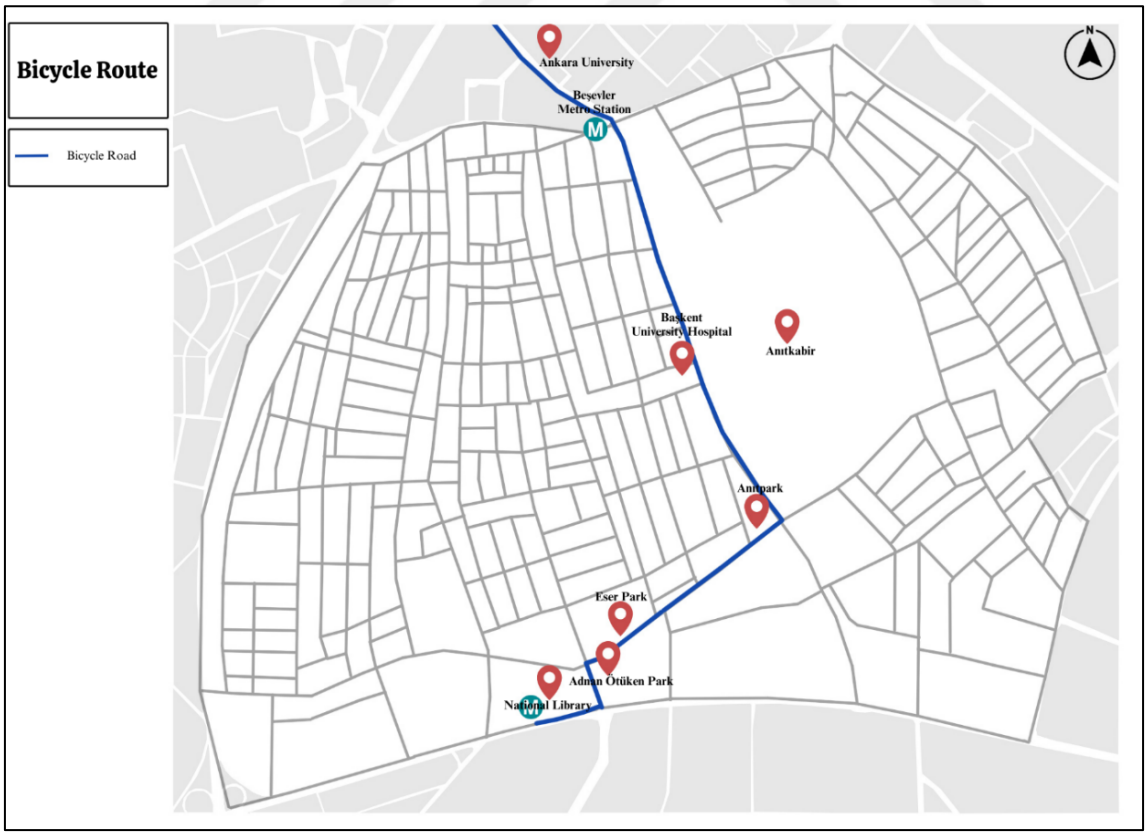


Map 4.16. Bicycle roads in Ankara (Openstreetmap-CyclOSM)



Image 4.6. Bicycle road next to Anıtkabir (Taken by author)

The first city-specific step in integrated bikeway planning was the Ankara Bikeway Project, the planning phase of which was carried out with the participation of important cycling groups, academics and implementing stakeholders in Ankara, under the coordination of EGO. The first phase of the bicycle road network shown in map 4.17. is the only bicycle road within the boundaries of the case study area. The map is adapted from the Ankara EGO page and it is stated that 900 meters of the 1st stage route has been completed. It is the corridor between National Library Metro Station and Ankara University Tandoğan Campus. On this corridor, there are urban parks (Adnan Ötüken, Eser and Anıt Park), Anıtkabir, Beşevler Metro Station, Başkent University Hospital, Ankara University Faculty of Science and dense residential areas. This corridor is especially the route where university students are densely populated and/or live. Although the bicycle lane project, which has been completed and other phases are underway in other regions, is a good step to start with, it should be integrated into the neighborhoods and provide door-to-door transportation. Compared to the world's cities with the highest rates of bicycle lane network (illustrated on map 4.15) and bicycle usage rates, there is still a lot of progress to be accomplished.



Map 4.17. Bicycle route (Prepared by the author)

Building efficient pedestrian and cycling infrastructure is a difficult task, which emphasizes how inadequate a one-size-fits-all sidewalk design strategy is. As for what can be done, pedestrian zones are mandatory, and should not be considered only as the closure of paved roads to vehicular traffic. These areas should have high accessibility to public transportation stops and parking areas. Pedestrian paths should be designed with human scale and aesthetic concerns in mind and are defined as focal points that can provide vitality and diversity throughout the day and should be taken as a fundamental part of the city's development strategies. Photographs of 3 main streets and boulevards selected from the area were uploaded to the artificial intelligence image creation program Leonardo.ai. The streets were asked to be redesigned by applying sustainable transportation methods. The comparative results are given in figure 4.9. In the example visuals generated, there are no cars on the streets and they are all pedestrianized. Sustainable transportation techniques not only reduce air pollution, high energy use and dependence on non-recyclable resources, but also increase interaction with the environment and other people.



Figure 4.9. Redesigned streets by applying sustainable transportation methods (Prepared by the author)

4.5. Concluding Remarks

As mentioned in the beginning of the chapter, after Anıtkabir Project Competition a report had announced titled 'Jury Report on the Atatürk Anıtkabir Project Competition'. The jury stated that caution should be exercised in the construction of buildings around the Anıtkabir site, as the Anıtkabir site is approximately 30 meters higher than the surrounding land. Stating that buildings should not be randomly constructed around Anıtkabir, the jury has decided that Anıtkabir should be surrounded by residential areas consisting of low-rise buildings organized with green areas. Starting with the construction of Anıtkabir, settlements in the region accelerated and reached its current appearance.

According to the cluster 1 analysis, the distribution of commercial area is predominantly in the Emek, Yukarı Bahçelievler and Bahçelievler neighborhoods. Urban texture and accessibility between streets are balanced. Education areas are located near residential areas and within accessible distances. Governmental areas are mostly located on İnönü Boulevard in the south of the area, yet they are large enough to provide employment for thousands of people living in the area and nearby neighborhoods. Health areas are consisted of hospitals and family health center and it has been determined that the health units in the area are not relatively evenly distributed and accessible.

According to cluster 2 analysis, that the commercial units can be reached in a very short time from anywhere in the area, even within a walking distance of 400 meters/5 minutes. The northern part of the area seems to suffer from this issue as the southern part of the area is completely filled with government institutions, mostly ministries, causing an agglomeration in that area. The parks and open green spaces shown as recreational areas are extremely accessible for people living in the area, within a 5-minute walking distance. The "liveable areas" of the various isochrones for case study area shaded areas on the map 4.9. The majority of the neighborhoods under investigation are included in the greatest isochrone of 15-minute "liveable areas," indicating that they have the fundamental spatial quality required for a 15-minute neighborhood where inhabitants may easily access essential services. Although the areas where 5-minute needs can be met are not very many, it includes a part of Emek Neighborhood and a part of Maltepe Neighborhood. The areas where needs can be met in 10 minutes include the entire area except for Mebusevleri and Bahçelievler neighborhoods.

According to the cluster 3 analysis, every amenity is numbered from 1 to 9 to analyze their presence in each neighborhood. The outcomes of the analyses appear to be consistent with the first two cluster analyses. Although the distribution of primary school and secondary school seems adequate, high school and library show poorer results. Even though, hospitals are not required to be within 15-minute distance, they are also added to analysis and surprisingly they are spread over the area. Since Başkent Hospital and its dispersed campus are located in the Yukarı Bahçelievler neighborhood, the hospital value of the area is quite high. The presence of hospitals and family health services are evenly distributed in the area. For example, there are no family health services in Anıttepe and Yukarı Bahçelievler neighborhoods, while the presence of hospitals compensates for this deficiency. However, both a family health service and a hospital could not be identified in Yücetepe neighborhood. Recreational activities were evaluated in two sections: green areas and sports facilities. While it is observed that there is a balanced distribution in terms of green areas, the results are different in terms of sports facilities. Only Emek, Yukarı Bahçelievler and Yücetepe neighborhoods have sports facilities.

Finally, for cluster 4 analysis, as a result of the data obtained from the article “The Theoretical, Practical, and Technological Foundations of the 15-Minute City Model: Proximity and Its Environmental, Social and Economic Benefits for Sustainability” examined for its methodology, it was analyzed under 3 main headings, which are (1) travel patterns and dependency on cars for transportation, (2) heavy traffic, (3) walkable pathways and cyclable bicycle lanes. As a result of problems related to public transportation, citizens are pushed to use private vehicles. Although there are many measures can be taken and many investments can be made to enhance public transportation competitive with private car use, unfortunately this problem continues to be chronic. The reasons for heavy traffic and dependency of cars are unplanned expansion and growth of Ankara and the intensive use of private vehicles. In the case study area, pedestrian sidewalks are continuously narrowed on side streets and main boulevards due to road widening projects and the formation of a cycling culture has not fully started due to barriers to cycling. These barriers include the inadequacy of existing bicycle lane infrastructure and parking spaces, variable weather conditions, long travel distances due to distant urban uses, irregular on-street parking, poor air quality, and finally the perception of cycling as a means of leisure and sport rather than as a mode of urban transportation.

As a result, the history of the region selected as the study area was examined. Considering that the formation of the area dates back to around 1945 with the construction of Anıtkabir and although it has not been named, it has been identified through the analyses that the case study area has been designed in accordance with the 15-minute city design concept in many respects. Since it was designed in this manner from the beginning, it has a hopeful future for people who wish to adopt the 15-minute city concept today, despite being in the center of a metropolis that has developed significantly over time.

As a consequence of this chapter, second and third of the research questions have been answered; an existing urban fabric can have a characteristic that is suitable for the 15-minute city concept even if it was not designed as such, because as explained in chapter 2, this theory is based on the garden city concept and the neighborhood unit theory. Additionally, as a result of the analysis, it has been concluded that the case study area meets the 15-minute city concept in many respects and with some interventions, it can be organized as an urban unit suitable for this concept.

5. CONCLUSION

The purpose of this thesis is to answer the research questions which are answered through the thesis in related sections. To answer them academically, a methodology should be constructed and in figure 2.1. the structure of thesis is depicted. For this, a bibliometric analysis was carried on Web of Science. The term “15-minute city” was searched in Web of Science and the most cited authors and researchers who produced the most documents on this topic were identified. The five publications that were cited the most were analyzed in detail in section 2.2. in order to establish a foundation for the literature evaluation, and this information was used in the next section.

In order to ascertain the direction and methodology of the study and to investigate the case study area, a keyword analysis was conducted to identify keywords that were used in together. The resulting group of words was then refined by selecting phrases that were repeated at least 5 times. This analysis resulted in 16 words, which were then grouped by the Vosviewer software to determine the relationships between these word groupings. As a consequence, 16-keyword narrowed down to 5 clusters. "Pedestrian accessibility" for cluster 1, "mobility" for cluster 2, "chrono-urbanism" for cluster 3, and "sustainable development" for cluster 4 are the labels chosen for these clusters, details of which are described in section 2.3.

With the cluster searches given under the title “2.3. The Literature on Cluster Analysis”, the articles on these topics were analyzed in detail with their methods, findings and results. The articles that are found by searching the word clusters are summarized one by one, and those with a methodology that is appropriate and applicable to the field of study are taken as examples. The schemes about this issue are explained in detail in section “3. Methodology”.

Section 2.4. provides a detailed examination of the 15-minute city, including its definition, history, and components. It also develops a theoretical backdrop by analyzing the parallels and contrasts between the 15-minute city and comparable theories. The concept of 15-minute city have sparked planners' imaginations and politicians' eagerness to provide a new planning bliss. As it was mentioned, 15-minute city term is defined as an ideal geography where most people’s daily needs and necessities are located in a distance of 15 minute by

walking or cycling. In other words, citizens can be able to reach a number of desirable community amenities and services with a 15-minute time. The list of amenities and services are playgrounds and parks, libraries, schools, markets, workplaces, health units etc. Therefore, neighborhood plan can be accepted as the keystone for this approach.

The idea came from Carlos Moreno and he believes that citizens will have a superior quality of life if they can do six important functions: living, working, commerce, healthcare, education, and enjoyment. To achieve those purposes in the neighborhood, the urban built structure must be modified to include elements such as closeness, diversity, density, and ubiquity. It has 4 components; density, proximity, diversity and digitalization.

Density is the concept that promotes the idea of a compact city where people may be comfortably sustained by the availability of resources, as opposed to the standard urban planning concept that views density purely in terms of built environment quotas. As previously stated, automobile transportation is a key source of the 78% of emissions ascribed to urban areas, hence the *proximity*-based urban idea immediately decreases travel demands and consequently urban emissions in general. *Diversity* is defined in two ways: (i) mixed use of the built environment, in which there is a healthy mix of residential, entertainment, and commercial aspects, utilizing available space and encouraging service closeness; and (ii) multiculturalism. *Digitalization* in all of its variations enables the other three dimensions to be realized, particularly through the automation of various processes and operations.

In order to find the answers to second and third research questions, which are “Can we find the characteristics of 15-minute city in an existing urban structure?” and “Is there a potential to create 15-minute cities in the city center with some interventions?”, a field analysis was required. When choosing the case study area, a number of variables and specifics were taken into account. The site selection process was supported by factors including strategic location of Anıtkabir, its accessibility from a variety of transportation choices, and its historical and cultural value. When the current zoning plans for the region are investigated, it is understood that the 1/1000 Scale Implementation Zoning Plan that covers the entire neighborhoods but commercially planned neighborhoods are excluded as 15-minute residential areas are intended to analyze.

As stated in chapter 4, the "Jury Report on the Atatürk Anıtkabir Project Competition" was published following the Anıtkabir Project Competition. The judges concluded that because the Anıtkabir site is around 30 meters higher than the surrounding land, consideration should be used when constructing buildings around it. The jury concluded that Anıtkabir should be surrounded by residential neighborhoods formed of low-rise structures planned with green spaces, stating that buildings should not be constructed around it randomly. Starting with the construction of Anıtkabir, settlements in the region accelerated and reached its current appearance.

According to the case study analysis, the neighborhoods of Emek, Yukarı Bahçelievler, and Bahçelievler are where the majority of the business sector is located. The commercial units can be reached in a very short time from anywhere in the area, even within a walking distance of 400 meters/ 5 minutes. Accessibility between streets and urban texture are balanced. Educational institutions are situated within easy reach and close to residential areas. The majority of the government buildings are situated on İnönü Boulevard in the southern part of the region, although they are sizable enough to employ thousands of people who live there and in the surrounding communities. Hospitals and family health centers make up health regions, and it has been found that the accessibility and distribution of these facilities are not fairly equal. The parks and open green spaces shown as recreational areas are extremely accessible for people living in the area, within a 5-minute walking distance. The majority of the neighborhoods under investigation are included in the greatest isochrone of 15-minute "liveable areas," indicating that they have the fundamental spatial quality required for a 15-minute neighborhood where inhabitants may easily access essential services.

On the other hand, people are forced to use private vehicles due to issues with public transportation and inadequacy of sidewalks and bicycle roads. Even though there are numerous ways to improve public transportation and make it more competitive with private vehicles, this issue is regrettably still persistent. The unplanned growth and extension of Ankara, as well as the extensive usage of private vehicles, are the causes of the excessive traffic and reliance on cars. Road expansion projects in the case study area have resulted in the constant narrowing of pedestrian sidewalks on side streets and main boulevards, and obstacles to cycling have prevented the development of a cycling culture. These barriers include the inadequacy of existing bicycle lane infrastructure and parking spaces, variable weather conditions, long travel distances due to distant urban uses, irregular on-street

parking, poor air quality, and finally the perception of cycling as a means of leisure and sport rather than as a mode of urban transportation. So, even if neighborhood design is planned in accordance with the 15-minute city concept, infrastructure deficiencies significantly affect accessibility of the neighborhood.

In conclusion, although it has not been named, it has been identified through the analyses that the case study area has been designed in accordance with the 15-minute city design concept in many respects. Since it was designed in this manner from the beginning, it has a hopeful future for people who wish to adopt the 15-minute city concept today, despite being in the center of a metropolis that has developed significantly over time. Since this theory is founded on the garden city concept and the neighborhood unit theory, as discussed in chapter 2, an existing urban fabric may contain a feature that makes it appropriate for the 15-minute city concept even if it was not intended as such. Furthermore, the analysis has determined that the case study area meets the 15-minute city concept in several respects and can be structured as an urban unit appropriate for this concept with a few modifications.

Critiques and discussion

The concept of 15-minute cities appears to have sparked planners' imaginations and politicians' eagerness to provide us with a new planning bliss. During the COVID-19 crisis, when there was a need to imagine the post-pandemic city, 15-minute cities developed as an urban development concept for the economic recovery of cities from an equitable perspective. Given that the neighborhood has always been viewed as an important component of city spatial and functional organization, the issue here is, what is new in the 15-minute city approach? The distinctive feature is that 15-minute cities have adopted the concept of resource proximity, rather than resource accessibility, into the heart of their land use and transportation planning strategies. A closer examination of the concept of 15-minute city reveals that it provides an opportunity to reconsider resource distribution on a citywide scale (Pozoukidou and Chatziyiannaki, 2021).

According to Jane Jacobs -who was an American-Canadian journalist, author, theorist, and activist who influenced urban studies, sociology, and economics- the sense of frustration with urban planning is blamed on cars, among other things. But the destructive effects of cars are a symptom rather than a cause of our inability to build cities. Planners are at a loss

about what to do with cars in cities because - with or without cars - they do not know what to do. The simple needs of automobiles are much more easily understood and met than the complex needs of cities, and so there is a growing number of planners and designers who think they can solve the city's problems simply by solving the traffic problem. Cities have much more complex economic and social problems than vehicular traffic. Without knowing how the city itself functions and what other things it needs its streets for, it is impossible to know how to solve the traffic problem (Jacobs, 1993). In my opinion, the 15-minute city theory actually addresses the issue in many ways. For example, yes, a lot of cities have a lot of problems with individual car use, but this is mainly because our cities are not built for walking or cycling. This theory tends to address the root cause of why people need to use cars, rather than just the problem of cars. If the transportation alternatives offered by the city compete with the car, people will turn to these alternatives instead of the car.

Additionally, she critizes Ebenezer Howard about garden city plan. In the towns he proposed in 1898, which he called garden cities, the urban poor would be able to get close to nature again. In regard to Jacobs, they would be able to make a living, and there would be industry in the garden cities, because what Howard was planning was not a city, and certainly not a sleeping suburb, where people spent most of their time working elsewhere in the city and then returned to their homes almost exclusively to sleep. Howard's intention was to create self-sufficient small towns, which are very nice towns if you are obedient and do not have your own plans (Jacobs, 1993) In fact, the garden city was conceived as an alternative to the city and a solution to the city's problems, and many designers who are not actually interested in it are basically designing cities by adopting its insights.

Even though the garden city plan and 15-minute city plan have some common features, in reality they are separated in many ways. The planning Howard had in mind was essentially paternalistic, if not explicitly authoritarian. In particular, he ignored the intricate, multifaceted cultural life of the metropolis. He was not interested in how metropolitan areas protect and secure themselves, how they exchange ideas, how they function politically, or how they reach new economic arrangements; he did not seek to find ways to strengthen such functions, since he was not designing for that kind of life.

Additionally, inspired by Jacobs, Mehaffy (2014), the edges, that are created between the neighborhoods, are the results of large single uses including the residential “superblocks”.

The challenge for urban designers is to turn these edges into seams that would work for connecting two-sides, increasing cross-movement of varied groups. Complex networks that highlight how huge, isolated residential islands affect universal dynamics in cities' relationships between space and service/retail location. In metropolitan systems, community services and businesses reinforce each other most successfully when they are spatially related with key avenues and thoroughfares, allowing them to capitalize on the "movement economy."

In another article, they search about whether should the commercial nucleus of communities locate on main thoroughfares or should they be intended to be located away from pedestrian environment to provide safety. As it was debated, 15-minute city design advocates for centered/shielded option, according to the classification in the research, where activities place at the core of the neighborhood. Neighborhoods and pedestrian sheds consequently overlap, ensuring the latter's efficiency. However, according to Mehaffy (2010) the disadvantage of this paradigm is that neighborhoods cannot expand beyond the boundaries imposed by nearby thoroughfares, and urban area stays fragmented in isolated patches. Additionally, they believe this process divides the local neighborhood community level of mixed-use places from the district-to-metropolitan level in various parts of the city, resulting in unresolved pressures that contribute to morphological instability.

Mouratidis (2024) identified seven overall pitfalls in the 15-minute city as a theory and as a spatial analysis tool. These issues emerged in light of the objectives of equity, livability, and sustainability in urban and transportation design and policy. These seven issues can be summed up as follows: (1) overstatement of the uniqueness of the 15-minute city; (2) strong decentralization, which is not economically or environmentally viable; (3) a focus on the number of destinations rather than their sufficiency; (4) improper facility collection; (5) disregard for the various forms of nature and their characteristics; (6) disregard for public transportation in the 15-minute city theory or spatial analysis; and (7) disregard for interpersonal differences in walking and cycling when conducting analyses based on the 15-minute city. The purpose of the study is to draw attention to potential misunderstandings, weaknesses and inconsistencies in the 15-minute city theory and spatial analysis tool among academics and practitioners. The study also hopes to encourage a discussion among academicians on how to address theoretical and analytical issues related to the 15-minute city and proximity-based urban design in general. In my opinion, some of the issues

mentioned in the research are really worth discussing and finding solutions, while others I find exaggerated, for example, increasing the accessible areas by truly integrating public transportation will provide much more advantages to the theory.

Further research suggestions and limitations

Since Ankara is a metropolitan city, should not avoid implementing the 15-minute city principles. In major metropolitan cities of the world, spaces are being reshaped with the mentioned principles. The important thing is that people can access their daily needs in an acceptable time period such as 15 minutes and the space should be organized accordingly.

In addition to that, this research has aimed to address current issues that the whole world has experienced and is still experiencing within the scope of an urban approach. In the fourth chapter of the thesis, quantitative research methods were used to analyze and evaluate the study. However, qualitative methods could have been added to this section, such as interviews, surveys, etc. conducted with the people living in the selected area, could have provided healthier results in the analysis phase and a better understanding of the problems.

REFERENCES

Akrami, M., Sliwa, M. W., Rynning, M. K. (2024). Walk further and access more! Exploring the 15-minute city concept in Oslo, Norway. *Journal of Urban Mobility*, 5, 100077.

Allam, Z., Bibri, S. E., Chabaud, D., Moreno, C. (2022a). The theoretical, practical, and technological foundations of the 15-Minute City Model: proximity and its environmental, social and economic benefits for sustainability. *Energies*, 15(16), 6042.

Allam, Z., Bibri, S. E., Chabaud, D., Moreno, C. (2022b). The '15-minute city' concept can shape a net-zero urban future. *Humanities and Social Sciences Communications*, 9(1).

Allam, Z., Jones, D. S. (2020). Proximity-Based Planning and the "15-Minute City": A Sustainable Model for Urban Development. In C. L. Berryman (Ed.), *Urban Studies and Planning: New Directions in Theory and Practice*, Springer, 1-25.

Allam, Z., Khavarian-Garmsir, A. R., Lassaube, U., Chabaud, D., Moreno, C. (2024). Mapping the implementation practices of the 15-Minute City. *Smart Cities*, 7(4), 2094–2109.

Boran, T. (2011) 'Anıtkabir'in İnşa Edildiği Rasattepe'nin Tespit Edilme Süreci ve Morfolojik Değişimi', *İdealkent*, 4, 148–173.

Bostancı, S., Tanrıvermiş, Y. (2024). Türkiye'de Kent İçi Ulaşım Sorunları ve Çözüm Önerileri: Ankara İli Örneği. *Kent Akademisi*, 17(2), 346-368.

Calafati, L., Froud, J., Haslam, C., Johal, S., Williams, K. (2023). Place and mobility in Wales: Challenges and opportunities for reducing car use in a car-dependent, low-density country. *Local Economy the Journal of the Local Economy Policy Unit*, 38(8), 773–793.

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.

Can Bilge, N. (2018). Anıtkabir yarışması bağlamında Paul Bonatz'a dair bir okuma. *Art-Sanat*, (9), 293–310.

Capasso Da Silva, D., King, D., Lemar, S. (2019). Accessibility in Practice: 20-Minute City as a Sustainability Planning Goal. *Sustainability*, 12(1), 129.

Chuang, I., Chen, Q. (2024). Urban street dynamics: Assessing the relationship of sidewalk width and pedestrian activity in Auckland, New Zealand, based on mobile phone data. *Urban Studies*, 8 (1).

Corbett, J., Mellouli, S. (2017). Winning the SDG battle in cities: how an integrated information ecosystem can contribute to the achievement of the 2030 sustainable development goals. *Information Systems Journal*, 27(4), 427–461.

Correa-Parra, J., Vergara-Perucich, J. F., Aguirre-Nuñez, C. (2020). Towards a Walkable City: Principal Component Analysis for Defining Sub-Centralities in the Santiago

Metropolitan Area. *Land*, 9(10), 362.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285–296.

EGO (2020, July). *Ankara Bisiklet Yolu Projesi.* Ankara Büyükşehir Belediyesi.

EIT Urban Mobility. (2022). *Urban Mobility Next 9 ±15-Minute City: Human-centred planning in action*. EIT, Munich.

Eraydın, Z. (2016). Kentsel Markalaşma Stratejilerinin Kent Belleği ve Kent İmgesi Üzerine Etkileri: Ankara Örneği. *İdealkent*, 7(20), 830-855.

Erçetin, C. (2023). Çevresel Sürdürülebilirlik ve Ulaşım Aracı Olarak Bisiklet: İyi Uygulama Örnekleri. *Çevre, Şehir Ve İklim Dergisi*, 5, 27-38.

Farr, D. (2007). *Sustainable urbanism: Urban design with nature* (1st ed.). Hoboken, NJ: Wiley.

Gaglione, F., Gargiulo, C., Zucaro, F., Cottrill, C. (2022). Urban accessibility in a 15-minute city: a measure in the city of Naples, Italy. *Transportation Research Procedia*, 60, 378-385.

Güngör, S., Özcan, U (2022). "Şehir Mimarı" Hermann Jansen'in Planlama Anlayışı ve Başkent Ankara'nın İmarı. International *Journal of Social and Humanities Sciences*, 6(3), 155-172.

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.

Harroucha, R., Chaouni, A. (2023). Mosques pedestrian accessibility analysis under the 15 min cities concept. *GeoJournal*, 88(4), 3575–3594.

Harroucha, R., Chaouni, A.-A. (2023). GIS-based approach evaluating sustainable spatio-functional accessibility to mosques. *Annals of GIS*, 5, 1–11.

Höjer, M., Wangel, J. (2014). Smart Sustainable Cities: Definition and challenges. *In Advances in intelligent systems and computing*, Springer, 333–349.

Internet: Openstreetmap-CyclOSM. URL: https://www.cyclosm.org/. Last Access Date: 07.02.2025

Internet: Reid, C. (2020, June 28). Anne Hidalgo reelected as mayor of Paris, vowing to remove cars and boost bicycling and walking. Forbes. URL: https://www.forbes.com/sites/carltonreid/2020/06/28/anne-hidalgo-reelected-as-mayor-of-paris-vowing-to-remove-cars-and-boost-bicycling-and-walking/?sh=ba645d11c852. Last Access Date: 01.01.2025

Internet: TÜİK-Geographical Statistical Portal. URL: https://cip.tuik.gov.tr/ . Last Access Date: 12.01.2025

Internet: Toprak, L. (2019, June 17) URL: https://www.transformative-mobility.org/news/mitigation-in-urban-transport-needs-integrated-planning. Last Access Date: 12.01.2025

Jacobs, J.M. (1993) *The Death and Life of Great American Cities.* New York: The Modern Library.

Jin, T., Wang, K., Xin, Y., Shi, J., Hong, Y., Witlox, F. (2024). Is a 15-Minute City within Reach? Measuring multimodal accessibility and carbon footprint in 12 major American cities. *Land Use Policy*, 142, 107180.

Kim, Y., Lee, S. (2025). Neighborhood-level determining factors of travel distance by trip purpose: Policy implications for the N-minute city. *Cities*, 156, 105464.

Korah, P. I., Cobbinah, P. B., Adu, P. (2023). Beyond the known: Walking accessibility twist to new cities. *Habitat International*, 144, 102997.

Kutty, A. A., Abdella, G. M., Kucukvar, M., Onat, N. C., Bulu, M. (2020). A system thinking approach for harmonizing smart and sustainable city initiatives with United Nations sustainable development goals. *Sustainable Development*, 28(5), 1347–1365.

Li, T., Kent, A., Dodson, J., Sima, Y. (2024). How workable is a 20-minute city in Australia? Re-examining the challenge of change in spatial labour and job relations. *SSRN*, 54, 450-470.

Logan, T., Hobbs, M., Conrow, L., Reid, N., Young, R., Anderson, M. (2022). The x-minute city: Measuring the 10, 15, 20-minute city and an evaluation of its use for sustainable urban design. *Cities*, 131, 103924.

Longo, D., Orlandi, S., Boeri, A., Turillazzi, B. (2022). "Proximity" as a design strategy for sustainable, collaborative and inclusive urban public spaces. *WIT Transactions on Ecology and the Environment*, 1, 3–14.

Mackness, K., White, I., Barrett, P. (2021). Towards the 20-minute city. *Build*, 183, 71–72.

Mehaffy, M., Porta, S., Rofè, Y., Salingaros, N. (2010). Urban nuclei and the geometry of streets: The 'emergent neighborhoods' model. *URBAN DESIGN International*, 15(1), 22–46.

Mehaffy, M.W., Porta, S. and Romice, O. (2014) 'The "neighborhood unit" on trial: A case study in the impacts of urban morphology', *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 8(2), 199–217.

Monteiro, J., Para, M., Sousa, N., Natividade-Jesus, E., Ostorero, C., Coutinho-Rodrigues, J. (2023). Filling in the spaces: Compactifying cities towards accessibility and active transport. *ISPRS International Journal of Geo-Information*, 12(3), 120.

Moreno, C., Allam, Z., Chabaud, D., Gall, C., Pratlong, F. (2021). Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities. *Smart Cities*, 4(1), 93-111.

Mouratidis, K. (2024). Time to challenge the 15-minute city: Seven pitfalls for sustainability, equity, livability, and spatial analysis. *Cities*, 153, 105274.

Nieuwenhuijsen, M. J. (2021). New urban models for more sustainable, liveable and healthier cities post covid19; reducing air pollution, noise and heat island effects and increasing green space and physical activity. *Environment International*, 157, 106850.

OECD. (2016). *The Economic Consequences of Outdoor Air Pollution*, Paris: OECD Publishing.

Öztürk, E., (2018). *Trafik Sıkışıklığının Kentsel Yaşam Kalitesine Etkileri*. TRANSIST 2018 11. Uluslararası İstanbul Ulaşım Kongresi ve Fuarı, 467-480.

Papas, T., Basbas, S., Campisi, T. (2023). Urban mobility evolution and the 15-minute city model: From holistic to bottom-up approach. *Transportation Research Procedia*, 69 (1), 544-551.

Pinto, F., Akhavan, M. (2022). Scenarios for a post-pandemic city: Urban planning strategies and challenges of making "Milan 15-minutes city.". *Transportation Research Procedia*, 60 (3), 370–377.

Pozoukidou, G., Chatziyiannaki, Z. (2021). 15-Minute City: Decomposing the New Urban Planning Eutopia. *Sustainability*, 13(2), 928.

Sierra, J. Ortiz, A. (2024). A quantitative model of the city in 15 minutes for decision-making. *Journal of Sustainable Development of Energy Water and Environment Systems*, 12(2), 1–12.

Singh, T., Solanki, A., Sharma, S. K., Nayyar, A., Paul, A. (2022). A Decade Review on Smart Cities: Paradigms, challenges and opportunities. *IEEE*, 10(2), 68319–68364.

Söylemez, E., Demiröz, İ., Kubat, A. (2016). *Jansen Planı'nın Ankara Kentinin Gelişimi ve Kentin Çeper-Kuşak Alanlarına Etkisi*, Jansen and Ankara Symposium, Ankara, Türkiye.

Tammaru, T., Sevtsuk, A., Witlox, F. (2023). Towards an equity-centred model of sustainable mobility: Integrating inequality and segregation challenges in the green mobility transition. *Journal of Transport Geography*, 1(12), 103686.

Tura, N., Ojanen, V. (2022). Sustainability-oriented innovations in smart cities: A systematic review and emerging themes. *Cities*, 126, 103716.

Van Eck, N. J., Waltman, L. (2017). Citation-based clustering of publications using CitNetExplorer and VOSviewer. *Scientometrics*, 111(2), 1053–1070.

Wang, T., Li, Y., Chuang, I., Qiao, W., Jiang, J., Beattie, L. (2024). Evaluating the 15-minute city paradigm across urban districts: A mobility-based approach in Hamilton, New Zealand. *Cities,* 151, 105147.

Weng, M., Ding, N., Li, J., Jin, X., Xiao, H., He, Z., Su, S. (2019). The 15-minute walkable neighborhoods: Measurement, social inequalities and implications for building healthy communities in urban China. *Journal of Transport and Health*, 13, 259-273.

WHO. (2021). *WHO Global Air Quality Guidelines,* Geneva: World Health Organization Publishing.

Yalçıner Ercoşkun, Ö. (2013). Successes and Failures in Urban Development of Ankara. *ICONARP International Journal of Architecture and Planning*, 1(2).

Yang, C., Qian, Z. (2024). The New Paradigm of future cities? facilitating dialogues between the 15-minute city and the 15-minute life circle in China based on a bibliometric analysis. *Transactions in Planning and Urban Research*, 3(3), 294-312.



Gazili olmak ayrıcalıktır