# WALKABLE NEIGHBOURHOODS IN SMART CITIES

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***Abstract***

At the beginning of the 21st century, smart cities became a favourite concept worldwide. There are many reasons why cities should be redesigned and continuously evolved into smarter ones. Of course, the realization of a smart society requires the cooperation of all stakeholders and various organizations. The concept of smart cities includes transport and transport systems management, smart urban and micro-mobility, logistics, smart infrastructure construction, etc. Noteworthy is also mobility to create connected transport systems that allow flexibility and efficiency. There is increasing emphasis on creating 'walkable neighbourhoods, i.e., safe walking and cycling infrastructure, preferably completely free of vehicles, with a regulated public ecosystem in interconnected areas, with quick access to a public or micro-mobile provider. Introducing walkable neighbourhoods and making; therefore, the city more liveable is one of the most talked-about methods of transforming a city into a smart city. The notion of walkability and walkable neighbourhoods has recently become an emergent narrative in city planning. Improving walkability in cities is very important and must ensure citizens safe walking environments, sidewalks and excellent and secure cycling infrastructure to meet most of their daily needs by foot, bicycle or local transport a few minutes from home. This study investigates smart mobility concepts, walkability, and walkable neighbourhood principles through a comprehensive literature review, representing essential dimensions of the smart city concept. This study aims to describe the conceptual framework for a better understanding and

define the idea of walkable neighbourhoods that are fundamental to creating a liveable, smart city.

**Key words:** smart cities, smart mobility, walkability, walkable neighbourhoods

## 1. INTRODUCTION

*"The 19th century was a century of empires, the 20th century was a century of nation states. The 21st century will be a century of cities."*
*– Wellington E. Webb, former Mayor of Denver, Colorado (2000)*

Urbanization and economic development go hand in hand. In 1800, only 2 % of the world's population lived in urban areas; by 1900, this had risen to 13 %. In 2000 this figure reached 47 %; according to the United Nations (2018), the urban population in 2018 had already exceeded 55 %. The United Nations thus predicts that by 2050, almost 70 % of the world's population will live in urban environments (United Nations, 2018).

Cities play an increasingly important role in every individual's life and are crucial for global social and economic development. Urbanization is a process of urban development that includes increasing the urban population, expanding existing cities, and establishing new ones. Such changes, therefore, also affect cultural, social, demographic, economic, and spatial transformations. Thus, to achieve sustainable development, it is necessary to consider all aspects of the urbanization process (Brdulak, 2017).

The city is a large and durable human ecosystem that provides various activities and opportunities for residents. According to Kumar (2018), rapid urbanization and population growth burden the city's infrastructure and public services. Current urbanization requires sound strategies and innovative planning to modernize urban life. Many cities are improving the quality and performance of urban services by making them more digitalized and smarter. The city's policymakers are exploring solutions to deliver new services efficiently, responsive and sustainable way that will suit a large population.

British Department of Business, Innovation, and Skills note that urban leaders in developed countries are increasingly recognizing that a smarter approach is needed to address the challenges facing today's society. Mainly this is important for improving the efficiency of public services, the sustainability of urban environments, and the quality of life in cities for its citizens. In addition, these cities use and promote sustainable and smart concepts to increase competitiveness to attract new businesses and talents because Smart Cities are attractive locations for living, working, and tourism (DBIS, 2013). One of the factors to improve the quality of life that has been promoting more lately is creating so-called walkable neighbourhoods or city centers.

It should be noted that there is no single definition of "walkability." Still, we know that this is an essential factor that raises the quality of living in cities or communities. In this respect, this paper aimed to answer the following questions. (1) How is the correlation between walkability and smart city? (2) What are the essential dimensions of the smart city concept? (3) What is the main idea of walkability and walkable neighbourhoods in smart city concept?

We conducted a literature review where we set up a conceptual framework to better understand walkability within the concept of smart cities and define walkable neighbourhoods, which are fundamental for creating a livable, smart city. The paper is structured as follows – the first part of the paper presents a literature review. At first, the meaning of the smart city is introduced, then follows the literature review of smart mobility, and the walkability is defined. The second part of the paper summarizes interlinked concepts that provide a comprehensive understanding of walkability in connection to the smart city in the conceptual framework. In the last part of the paper, conclusion thoughts are presented, and additional research proposals are given.

In this study, the limitation is put on walkability as an important component of the smart city system. It is a phenomenon of the multidimensionality of smart cities and the broader community issues. Another limitation was put on selecting the multidisciplinary data in the literature review, whereby we followed the Jabareen (2009) criteria for data analysis and searched the variety of data types (books, articles, newspapers, etc.). The limitation was also put on phases of conceptual framework analysis, whereby we limited our research only to six out of eight Jabareen purposed (2009) phases of conceptual framework analysis.

## 2. LITERATURE REVIEW

### 2.1. Smart cities

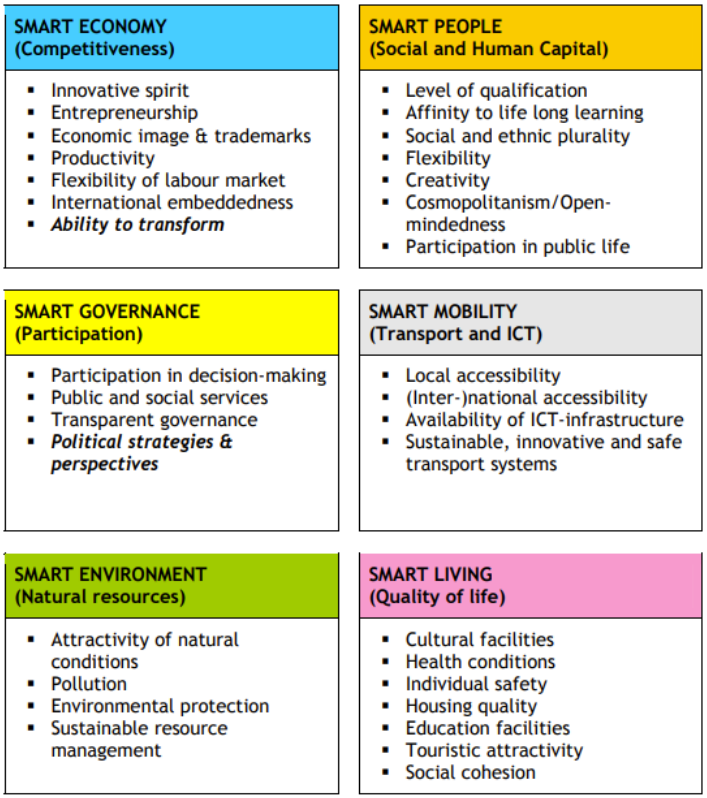
When did the idea of smart cities first appear? Hollands (2008) and Vanolo (2013) anticipate that the concept of smart cities grew in conjunction with two academic literary periods. One was the era of new urbanism, which began in the United States in the early 1980s. The movement criticized the urban development model, which focused primarily on car use and urban sprawl. The motion suggested that the quality of life could be improved by reducing urban development and land use. Many of today's smart city indicators (e.g., liveability, walkability, and sustainability) are associated with this (Konomi and Roussos, 2017). Another intellectual resource is the discussion of intelligent cities. This debate was triggered by the phenomenon that many cities worldwide have increased their budget in information and communication technology (ICT) for infrastructure, innovation, and e-governance (Crivello, 2015). According to Crivello (2015), both expert discourses most likely contributed to the first idea of "smart cities," but current smart city discourses mainly were developed outside of academic circles. Technology

corporations such as IBM, Cisco, and Siemens were the first advocates of smart cities. Their arguments are new technological solutions (such as IoT, Cloud) that will bring a better future for cities. As private stakeholders, these companies anticipate having the capacity to allow people to experiment with new ways of living, working, and moving safely.

The idea of smart cities emerged after an increased population in urban areas, followed by the economic growth and technological development of the last decade of the twentieth century. Advancements in information and communication technology have introduced a new way of identifying requirements and managing services to improve the quality of life for the residents (Keshavarzi, 2018).

As Maddox (2017) notes, the number of smart cities is overgrowing and is expected to continue to grow as smart cities have grown from about 20 to more than 100 in recent years, with more than 600 cities currently in development to become smart in the next few years. The term smart city is in use since 1998 (Van Bastelaer, 1998). Giffinger et al. (2007) defined smart cities as cities that work well in six areas built on a "smart" combination of talent and activity, decisive, independent, and aware citizens. However, Anthopoulos (2015) and the ITU-International Telecommunication Union note no clear definition of smart cities. The ITU (2014) found 116 definitions in its research. The ITU, therefore, identifies a smart city as one that uses ICT and other means to improve the quality of life, the efficiency of urban operations, and the competitiveness of activities while ensuring that the needs of present and future generations are met from an economic, social and environmental point of view. In its research, the ITU identifies eight categories that are key to smart cities; quality of life and lifestyle, infrastructure and services, ICT, communications, information and intelligence, people, citizens and society, environment and sustainability, leadership, governance and administration, economics and finance, and mobility. Smart life, smart people, smart environment and sustainability, smart leadership, smart mobility, and smart economy were exposed as the six main indicators of smart cities. European Parliament also recognizes the same indicators (European Parliament, 2014). Tsoutsa et al. (2020) define smart city as smart economy, leadership, mobility, healthcare, buildings, and plumbing. Giffinger et al. (2007) make a similar finding and describe smart cities as shown in Figure 1.

**Figure 1.** Activities and characteristics of smart city indicators




Source: Giffinger et al., 2007

The United Nations (2015) also has a significant influence on the development of smart cities, and in 2015 they presented 17 Sustainable Development Goals (as shown in Figure 2).

**Figure 2.** 17 sustainable development goals


Source: United Nations, 2015

They plan to achieve all 17 goals by 2030. 11th SDG's goal is Smart Cities and Communities. SDG11 was established to make cities and settlements safe, resilient, and sustainable. U4SSC-United 4 Smart Sustainable Cities (2017) has dedicated a large part of its plan of achieving Goal 11 to smart and sustainable mobility, letting us know that smart and sustainable mobility is a crucial factor in smart cities.

### 2.2. Smart mobility

Over the last decade, smart and sustainable mobility has become an essential solution to the problems associated with the intensive use of motor vehicles. For many years, cities were planned according to the needs of motor vehicle traffic. Still, the basic human needs for active movement and the harmful effects of motor traffic on the natural environment were neglected. However, walking is an environmentally friendly mode of transportation and a healthy way to engage in physical activity. Therefore, walking has become a crucial part of transport and urban strategies to achieve more sustainable development (Fonseca et al., 2019). Fonseca et al. (2019) note that the last century has been the century of cars. Private motor vehicles have nurtured a sense of individual independence and radically changed the way cities were designed and built. In the last century, cars have colonized the spaces of everyday life by creating a visible impact in cities worldwide, e.g., the occupation of public spaces with parked vehicles, wide streets serving huge suburbs. That has a considerable effect on uncontrolled urban growth that led to social isolation and segregation.

The concept of smart mobility was created mainly from the convergence of the digital revolution with the transport industry. Thus, new technologies have been used to improve the efficiency of the transport network, especially those related to ICT. According to Munhoz et al. (2020), the concept of smart mobility, which is closely related to smart cities, is an essential link for improving the intelligence of cities.

Nowadays, the use of private cars is intensive, even for short distances. About 30 % of car rides are shorter than 3 km, and 50 % are shorter than 5 km (Hooffman,

2018). A viable alternative to such short routes would be walking. The intensive use of cars in urban environments affects space and distance and has an impact on health and the environment. In European cities, 40 % of $CO_2$ emissions and 70 % of other pollutants are due to intensive car use (Nanaki, 2017). The European Union plans to reduce at least 60 % of transport emissions by 2050 with respect to 1990, to make cities more sustainable and liveable (European Commission, 2011).

The transition to a low-carbon society requires a new concept of mobility, supported by less car use. Thus, to overcome these problems, a new concept of smart cities and smart mobility has emerged. However, for mobility to be considered smart, it must also be sustainable. So basically, when we talk about smart mobility, we are also talking about sustainability. The concept of smart and sustainable mobility promotes more sustainable modes of transport, especially active options such as cycling and walking. According to Litman (2003), the best way to improve urban transport is to improve the conditions for walking and cycling. While this will not improve travel speed, it will enhance destinations' overall relevance, comfort, and affordability.

Walking is an environmentally friendly mode of transport and, at the same time, a viable alternative of transport for shorter routes in an urban environment. Walking has tremendous advantages over a car. In environmental terms, walking consumes much less non-renewable resources and reduces air pollutants, $CO_2$, and noise (Mizdrak et al., 2020). Walking and cycling are much more affordable and environmentally friendly than motor transport, as summarized in Table 1. It does not mean that they can serve any purpose, but they can save money and natural resources (Litman, 2003).

**Table 1.** Non-motorized transport is generally cheaper than alternatives

| AFFORDABLE AND EFFICIENT | EXPENSIVE AND RESOURCE-INTENSIVE |
|---|---|
| Walk and bike for transport | Own and operate an automobile |
| Walk and bike for exercise | Join a health club |
| Walk and bike children to school | Chauffeur children to school |
| Build sidewalks | Build roads and parking facilities |

Source: Litman, 2003

Walking reduces healthcare costs, improves work productivity, has high accessibility, and is very uncomplicated. In addition to having a significant impact on health and recreation, walking is also crucial active access to public transport. As the situation for pedestrians improves, the need to use motor transport reduces, which reduces many challenges urban transport is facing nowadays, such as congestion, pollution, road accidents, and personal safety. Walking has gained much interest in promoting sustainable mobility and a healthier lifestyle (The World Bank Group, 2018).

According to Turon et al. (2017), transport should be suitable for drivers and other people and their health, the environment, and the economy. As such, transport is linked to sustainable mobility strategies. Sustainable mobility seeks to reduce the

scale and effects of the dominance of individual car traffic in the urban environment. One of the ideas for achieving sustainable mobility goals was to focus on the demands of the population to create people-friendly cities. The idea of making cities more pedestrian-friendly has led to the concept of what we call Walkable Cities. The main principle of such cities is to create and manage public urban areas intended for pedestrians and walkers.

Ardila-Gomez (2020) notes that the pandemic has made walking even more attractive as it is Covid-safe. Pedestrians on sidewalks can mostly avoid three Cs, which significantly increase the risk of infection when they overlap; *closed spaces, crowded places,* and *close-contact settings.* Sidewalks are open spaces. Pedestrians can mostly avoid crowds and keep a safe distance of at least one meter. Pedestrians very rarely come into contact with strangers walking by; close interactions are very uncommon. If necessary, wearing a mask can be an added protection. The pandemic has forced cities worldwide to take urgent action to take a step closer to sustainable transport. Avoid unnecessary travel and improve transport infrastructure and services. The Covid-19 crisis has dramatically changed conversations about transport; people now see more clearly the value of sustainable mobility and are more receptive to the idea of moving resources to public transport, cycling, and walking.

The pandemic had an immeasurable impact on our daily life. Changes in our habits and routines came rapidly, from wearing masks to social distancing. Of all these changes, our movement from point A to point B has changed the most. Therefore, in the last year, mobility has wholly altered. We began to avoid previously faithful and reliable methods and replaced them with new transportation systems. People avoided overcrowded trains and buses and resorted to bicycles and e-scooters. With the development of cities and the phasing out of cars from city centers to improve air quality and citizen health, the pandemic has provided a unique opportunity to renovate urban mobility (Appleton, 2020), where walkability and so-called walkable neighbourhoods are becoming increasingly important aspects of it.

### 2.3. Walkability

Walkability means the ability to walk. Walkability is the appeal of an area for walking; a particular site's essential features offer easy walking without unnecessary turns and excessive effort (Mihelič et al., 2015).

Walkability is the set of capacities of any neighbourhood involved in urban morphology in three main ways: density (concentration) of buildings and population, diversity of activities and attractions, and the system of accessibility we use to move between them (Dovey & Pafka, 2018).

Walkable cities are not just a pleasant, idealistic idea. But they are simple, practically oriented solutions to a group of complex problems we face as a society, issues that daily harm economic competitiveness, public welfare, and environmental sustainability. Wealth, health, and sustainability are the most important arguments for establishing walkable cities (Speck, 2015).

Non-motorized transport (walking, cycling, and other variants) plays an essential and unique role in an efficient transport system (Litaman, 2003):

- Walking is a universal human activity that provides mobility, exercise, and satisfaction.
- Typically, 10-20 % of trips are made entirely non-motorized, and most motor vehicle trips include non-motorized connections, such as access to public transport and transport between parked vehicles and destinations. Parking spaces, transport terminals, airports, and commercial centers are an environment for pedestrians. Improving areas for non-motor vehicles is the best way to enhance motor transport.
- Walking and cycling provide affordable, basic transportation. Physically, economically and socially disadvantaged people tend to rely on walking and cycling. So improving non-motor transport can bring social equality and economic opportunities to them.
- Active transport is the most common way to exercise. Increasing the use of walking and cycling is the most practical way to improve public health.
- With non-motorized modes of transport, we can achieve traffic planning goals, including reducing congestion in traffic and parking, energy consumption, and pollution emissions. They can also help achieve goals in land use planning, urban renewal, and the more complex development of "smart cities."
- Walking and cycling are popular recreational activities. Improving walking and cycling conditions provides users with better conditions for enjoyment and health and can support related industries such as recreation, tourism, and retail.

In 2004, LtF-Transport for London published the first city walking plan, which set out London's vision to become one of the world's first walking-friendly cities by 2015. The walking program identifies several goals: improving the coordination between institutions for walkability planning, promoting walking in London, improving street conditions, improving the walkability of public spaces and public transport links, and improving pedestrian safety and protection (The World Bank Group, 2018).

Speck (2015) defines walking neighbourhoods as safe, full of choices, and qualities that offer walking as a positive experience. A positive walking experience means that the streets, sidewalks, and paths are comfortable and exciting.

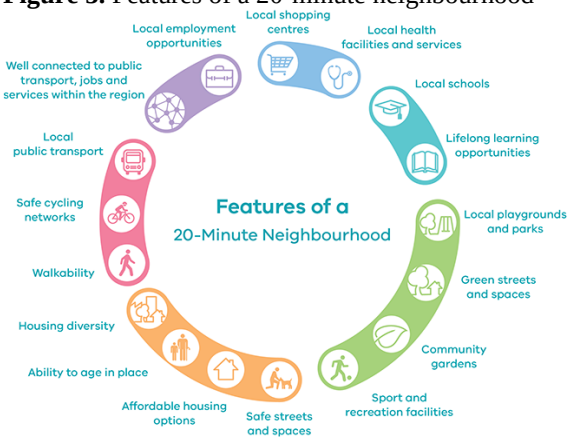
Technology and data are essential building blocks for creating a smart city. However, it is the city residents who can help make the most significant changes happen. By launching projects that focus on improving the lives of individuals and communities, smart cities can start growing on their own. One of the most mentioned methods of transforming a city into a smart city is introducing 15-minute neighbourhoods. Also known as 15-minute cities or even 20-minute cities, these strategies focus on improving the lives of citizens in a way that makes the city more accessible to all people (Appleton, 2020).

Because of the pandemic, many urban residents became confined to their homes with limited time to spend outside, so urban residents began to explore their

immediate surroundings. Many noticed a lack of pedestrian-friendly green spaces. Critics pointed out the disproportionate amount of space devoted to wide roads and parking lots instead of parks and recreational areas. Making cities more livable has become one of the main highlights for urban developers around the world. A good exaple are so called15-minute cities and walkable neighbourhoods, which are becoming an integral part of the development of the cities of the future (Appleton, 2020).

The 15-minute city is an urban planning strategy that aims to improve the quality of life for city residents. In short, the plan focuses on meeting the needs of residents by giving them access to everything they need within a 15-minute radius of their home. Work, school, healthcare, shops, restaurants, sports facilities, and parks should be accessible to all community members. All within a 15-minute walking distance (Appleton, 2020). Some cities promote 20-minute city programs; the principle is that it only has a wider radius. The concept of 20-minute neighbourhoods has been adopted as the main principle of all levels of government throughout Australia. Simply put, a 20-minute neighbourhood can be defined as "the ability to meet the daily needs of the surroundings, especially within a 20-minute walking radio (Plan Victoria: 2017-2050, 2017), as shown in Figure 3.

**Figure 3.** Features of a 20-minute neighbourhood




Source: Plan Victoria: 2017-2050, 2017

Historically, cities have evolved with a clear separation between industrial, commercial, and residential areas. By separating residential areas from heavy industry, residents can enjoy cleaner air and fewer crowds. The separation price was in longer transit times and dependent on private cars and public transport to travel to and from work, shopping, and the city. Today, cities have continued to develop. The industry has moved to the outskirts of cities so that there is currently no need for a clear separation between commercial and residential areas. However, the infrastructure remains, and the residents are still dependent on private cars and public transport to meet their needs. By moving the needs of residents closer to their homes,

the city can succeed in reducing its dependence on cars. It would allow the city to repurpose roads and parking spaces for more community-friendly projects. The latter would consequently make the city more accessible to all. By encouraging communities with a broad mix of residential and commercial buildings, cities can reinvent themselves for a car-independent future (Appleton, 2020).

## 3. METHODOLOGY

In this paper, we used Jabareen's (2009) methodology for building a conceptual framework. We generated and identified major smart cities concepts with conceptual framework analysis as an interpretative approach to social reality. They constitute the theoretical framework for better understanding the walkability issue. The concepts support each other, articulate their respective phenomena, and establish a framework-specific philosophy (Jabareen, 2009).

Following the procedure of conceptual framework analysis, our research followed the following phases (Jabareen, 2009):

- Phase 1: an extensive review of the multidisciplinary texts was made. Regarding the research aim and questions, the elected spectrum of multidisciplinary literature was mapped.
- Phase 2: Selected data was read and categorized within each topic.
- Phase 3: Main concepts were identified.
- Phase 4: The concepts were deconstructed – main attributes were identified, the description and categorization was made
- Phase 5: Integrating concepts and grouping concepts: *smart people, smart economy, smart mobility, smart environment, smart life, smart governance*
- Phase 6: In this phase, the synthesis of concepts into a theoretical framework was made.

This research did not validate the conceptual framework (Phase 7) and rethinking it (Phase 8). For applying those phases, we need a broader society from different fields to study this phenomenon. Those two steps are intended for future research, whereby we need a system approach to achieve a required holistic consideration of this multidisciplinary phenomenon.

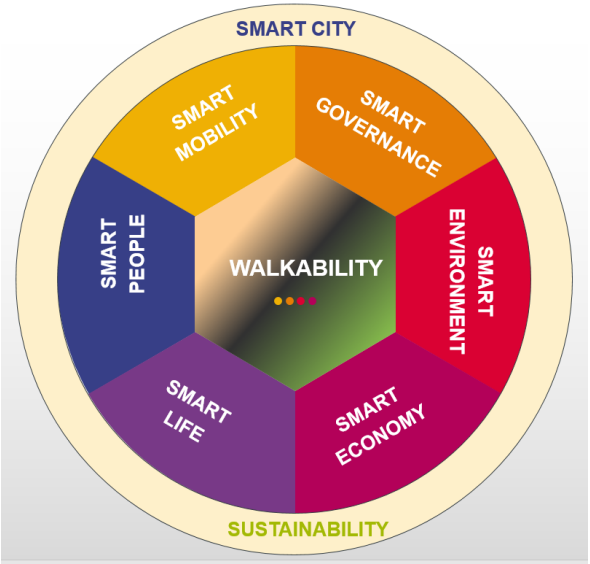
## 4. CONCEPTUAL FRAMEWORK

Based on conceptual framework analysis, we formed a conceptual framework. We synthesize the key factors of smart cities that significantly affect the concept of walkability. The conceptual framework shows the complexity of smart cities respecting sustainability, which illustrates the integration and co-dependence of the following key concepts:

- *Smart people*: are reflecting social and human capital, creativity, cosmopolitanism, an affinity for lifelong learning, social and ethnic plurality, etc. (Nam & Pardo, 2011).
- *Smart economy*: A smart economy is characterized by the use of human capital (knowledge, skills, and creativity), which transforms ideas into essential processes, products, and services and focuses on creating a "green economy" by developing "green companies" (engaging renewable energy sources) (Schaffers et al., 2011).
- *Smart mobility*: Smart mobility is a multifaceted theme that incorporates all smart city paradigms and creates a set of diverse benefits for all smart city stakeholders (Benevolo et al., 2016).
- *Smart environment:* use of technology to improve knowledge of environmental conditions and services (electricity, water, and gas), which would change people's habits and reduce waste, benefit the environment and improve resource efficiency (Talen & Koschinsky, 2013).
- *Smart life*: distinguished by solid and shared values of people, vibrant city centers, safety and protection of people, care for natural and cultural wealth for quality of life, access to public spaces and services, donation of art, culture, and natural heritage (Kumar & Dahiya, 2017).
- *Smart governance:* Smart governance covers all aspects related to political participation and services for citizens and the functioning of local government (Giffinger & Gudrun, 2010).

In the conceptual framework, we connected six smart city factors defined by Giffinger (2007) with walkability, which permeates all these factors and respects the sustainabilty goals. In this way, we have made the framework more comprehensive and, therefore, more practical. With the conceptual framework, we want to show the position of walkability within the concept of smart cities. We conclude that safe walking is associated or connected with all the components of the conceptual framework. Namely, these are synergy connections and effects that create a quality of life in cities and communities, so they must be included in the urban development plans of cities and neighbourhoods.

**Figure 4.** Conceptual framework




Source: authors

The conceptual framework shows that walkability as an alternative to smart mobility is based on understanding not only the concept of smart mobility but, more broadly, i.e., smart cities and communities as defined in our study. The conceptual framework shows connections between walkability and smart cities criteria that create better conditions for the development and future of smart cities and communities (in terms of sustainability, liveability, health, greener mobility, and safety, lower living costs, etc.) in co-dependence. Suppose we want to treat and understand walkability holistically enough - in that case, it is essential to consider it as a vital part of smart cities (concerning sustainability), in which different concepts are synergistically intertwined (Figure 4). Without them, the creation of walking neighbourhoods or city centers is impossible.

## 5. CONCLUSION

*' "We are at a unique stage in our history. Never before have we had such an awareness of what we are doing to the planet, and never before have we had the power to do something about that. Surely we all have a responsibility to care for our Blue Planet. The future of humanity and indeed, all life on earth now depends on us."*
*David Attenborough*

Despite the development of technology and technical goods, there is a shortage of space in cities for their use. On the one hand, we are facing an increase in the ownership of the superstructure, and, on the other hand, there is a lack of adequately located infrastructure. As a result, we will be even more forced to walk and/or use bicycles in the future. Given the modern way of life, people are increasingly running out of time for daily chores, so it is becoming more and more important to have everything at our fingertips. That could be achieved by the so-called walkable neighbourhoods or walkable cities that enable non-use of personal automobiles, consequently raising the quality of our living and health.

Through a literature review, we have shown the complexity of understanding the concept of walkability as part of smart mobility, respecting sustainability that, together with other factors, defines smart cities and communities. We summarized the findings from the literature in the initial conceptual framework that helps us understand the idea of walkability and safe, walkable neighbourhoods in a sufficiently comprehensive way that represents the paradigm of the modern way of life.

Since obvious limitation also refers to Jabareen's (2009) fact that different researchers can have different conceptions of the same phenomenon and may create other conceptual frameworks, the conceptual framework can be reconceptualized and modified according to new data in the future research. We also encourage future research on safe walkability factors that give a city or neighbourhood the walking neighbourhood stamp. The literature review otherwise shows that many studies about walkability and walkable neighbourhoods have been made. However still, many European countries have the potential to create better conditions that define such communities.

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