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M MASTER DEGREE IN
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Sustainable Mobility, Urban Planning Strategies and Cycling: What Can Portugal Learn from The Netherlands

Rafaela Marques Raposo

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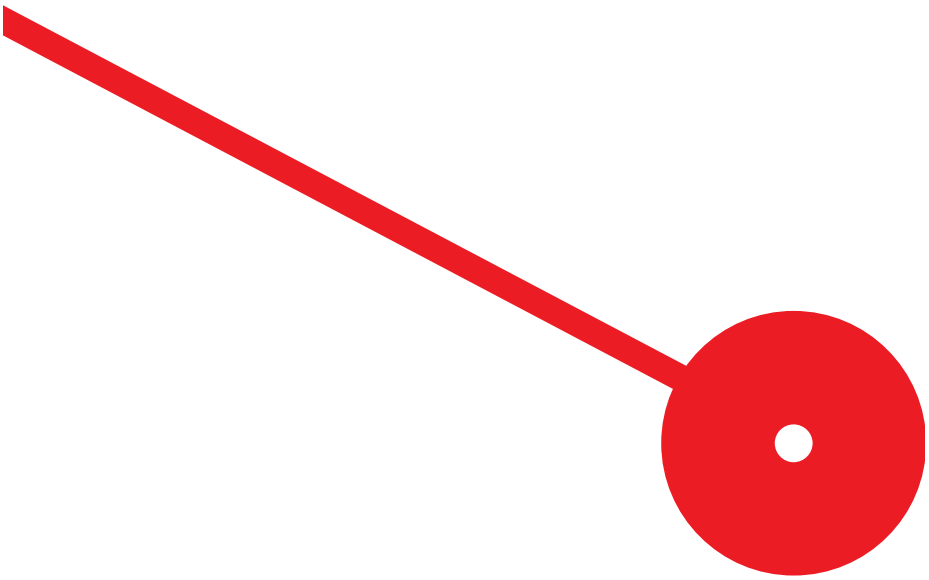

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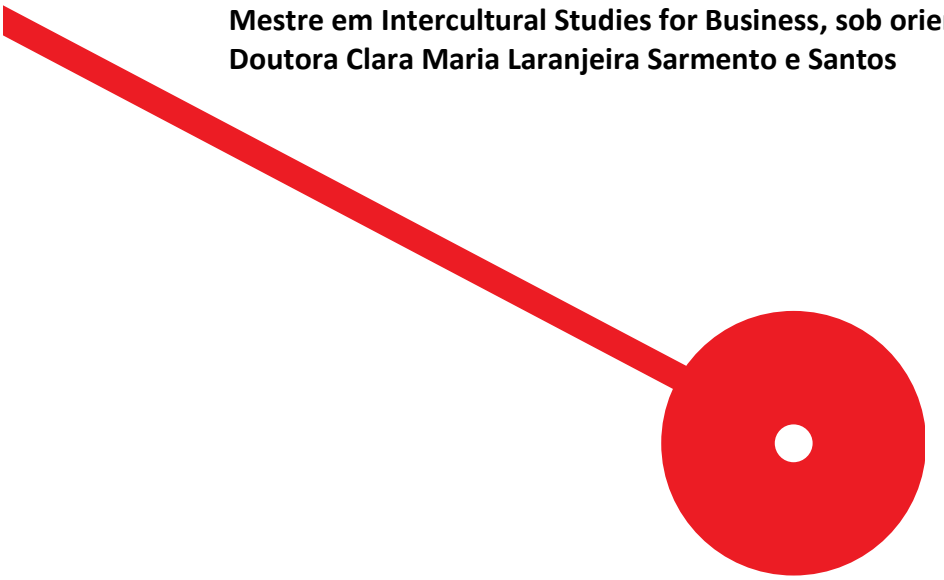
Dissertação de Mestrado apresentado ao Instituto Superior de Contabilidade e Administração do Porto para a obtenção do grau de Mestre em Intercultural Studies for Business, sob orientação de Doutora Clara Maria Laranjeira Sarmento e Santos



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First of all, I would like to thank both of my parents for the immense support and love they have given me during this journey. There have been ups and downs, but without your guidance, encouragement and a lot of patience I would not be where I am today. You both serve as an inspiration to me every single day.

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Resumo:

A presente dissertação foi realizada no âmbito do programa de mestrado de Estudos Interculturais para Negócios do Instituto Superior de Contabilidade e Administração do Porto (ISCAP). Esta dissertação insere-se num contexto de crescente necessidade de transitar tanto para práticas como para um estilo de vida mais sustentável em espaços urbanos. A dissertação procura apresentar uma análise detalhada dos conceitos de planeamento urbano e sustentabilidade na mobilidade, seguindo-se uma análise específica das boas práticas de um país como os Países Baixos na integração da bicicleta nas suas áreas urbanas. Desta forma, é possível compreender como Portugal pode melhorar a sua transição para uma sociedade livre de carbono, através de uma implementação bem sucedida de práticas verificadas nas cidades holandesas e desenvolver uma cultura da bicicleta. Esta dissertação foca-se em destacar as ligações históricas portuguesas ao ciclismo e como estas podem desempenhar um papel crucial no cumprimento dos objectivos de sustentabilidade do país, bem como fomentar o desenvolvimento cultural das comunidades. Como tal, o investimento em bicicletas nas áreas urbanas portuguesas, através da implementação das diferentes estratégias exploradas ao longo desta dissertação, poderá proporcionar grandes oportunidades culturais, económicas, ambientais e sociais para estas áreas.

Palavras chave: Sustentabilidade; Bicicleta; Multimodalidade; Países Baixos; Portugal

Abstract:

The following dissertation was completed as part of the master's degree program in Intercultural Studies for Business at the Porto Accounting and Business School (ISCAP). This dissertation is part of a growing need to move towards more sustainable practices and lifestyles in urban spaces. It seeks to present a detailed analysis of the concepts of urban planning and sustainability in mobility, followed by specifically examining the good practices of a country like The Netherlands in integrating cycling in its urban areas. This way, it is possible to understand how Portugal can improve its transition to a carbon-free society, through a successful implementation of practices verified in Dutch cities, and develop a bicycle culture. This dissertation focuses on highlighting the Portuguese historical connections to cycling, and how these can play a crucial role in the fulfilment of the country's sustainability goals, as well as promoting its cultural development. As such, bicycle investments in Portuguese urban areas, through the implementation of the different strategies explored throughout this dissertation, could provide great cultural, economic, environmental and social opportunities for these areas.

Key words: Sustainability; Bicycle; Multimodality; Netherlands; Portugal.

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INTRODUCTION

Sustainability and the transition to more sustainable practices has been a trending topic for most of the 21st Century, particularly due to the necessity of reducing non-renewable resources. The transition within the mobility sector to more environmentally friendly practices has also experienced a surge in popularity. Environmental mobility is one of the strategies for decarbonization, while addressing territorial planning is pivotal for creating more human-scaled urban areas. However, one of the biggest obstacles to those purposes is the environmental transitional process. This involves establishing circumstances favourable to change as well as making alternatives to "unsustainable" transportation methods. These conditions require high-quality, innovative and efficient systems, the confidence and acceptance of numerous stakeholders and governmental agents, as well as the active engagement of citizens.

Nevertheless, sustainable mobility and urban planning are intrinsically connected to one another, and they are also directly connected to the potential expansion of bicycles as a form of transport in shorter distances within Portuguese urban areas. At a global scale, one of the countries at the forefront of sustainable mobility, particularly in cycling, is The Netherlands. Van Ommeren *et al.* reflect this belief, writing that "[a]n increasing number of scholars, practitioners, and policy-makers are regarding The Netherlands as an inspiring example to follow in their implementation of bicycle policies." (van Ommeren, Ruffino, de Boer, & Buls, 2017, p. 7). Mário José Meireles (2020) states that, in order to achieve its sustainability goals, Portugal - a country still in the early of its transition towards sustainable mobility - needs to study the good practices and regulations of other countries, such as those from The Netherlands. The goal of this dissertation is to bring forward that perspective, by highlighting some of the practices of The Netherlands in cycling mobility and suggesting their adoption in Portugal.

The first chapter of this dissertation is divided into three subchapters, each of which delving into two crucial concepts. Firstly, it thoroughly defines sustainability, sustainable mobility, and urban planning. This thorough examination is crucial, because it establishes the underlying background necessary for interpreting the coming chapters and their practical application. Within this section, we analyse the implementation of sustainability and sustainable mobility policies within the European Union. Specifically, we investigate the financial investments provided by the European Union to facilitate the transition towards sustainable mobility in member countries. Additionally, this chapter scrutinizes the role of bicycles as a sustainable alternative to personal motor vehicles. It assesses the

widespread adoption of bicycles within European cities and underscores their significance in achieving sustainability objectives.

The second chapter of the dissertation has as its main theme the presentation of The Netherlands as an example for the application of the aforementioned subjects of sustainability, particularly within the mobility sector, with its widespread adoption of cycling as a sustainable transport, an agent of cultural change and a product interlinked with the country's culture and identity. To achieve this, there will be a presentation of the country's current cultural urban planning and sustainable mobility implementation, followed by an in-depth analysis of the historical and cultural presence of bicycles. This includes the urban planning changes and consequences in the 21st Century and the social consequences of a cycling culture in The Netherlands. Finally, there will be section discussing the verified business and economic impacts of the promotion and existence of a bicycle culture in Dutch society.

The third chapter will present the situation in Portugal regarding urban planning, sustainable mobility and the current state of integration of cycling infrastructure and development in Portuguese urban areas. To achieve this, there will be an analysis of the historical context and cultural background for cycling in this country between the 20th and the 21st Century. These topics will then allow us to transition to the subject of understanding the issues about their implementation in Portugal and of why sustainable mobility - particularly what pertains to cycling – is so far behind in Portugal compared to The Netherlands and other European countries. The better implementation of measures that foster cycling will also be analysed from an economically viable lens with great potential.

To conclude the dissertation, we will scrutinize the strategies implemented in the past and present by Dutch policymakers and stakeholders to increase its sustainable mobility, reduce car dependency and develop a cycling culture. Through this process, we propose the adaptation of certain measures to the Portuguese context, to achieve goals similar to those established by The Netherlands in the past. We will also present the perspective, considering Portugal's historical link with cycling and bicycle manufacturing, of turning the bicycle into a more significant cultural product for the country and its identity.

Sustainable mobility and urban planning are both concepts trending in popularity in recent history. This is especially noticeable within the jurisdiction of the European Union, in which the topics have experienced renewed interest both politically and socially. These two elements together are presented quite commonly when discussing themes connected to the current worldwide Climate Crisis. The Global Climate Crisis is one of the biggest challenges that humanity is presently facing, that has potentially devastating consequences for the entire planet. As such, prioritizing a fast and smooth transition to sustainable and environmentally conscious practices is more and more a main focus for many of the world's strongest economic powers, including those who are member-countries of the European Union. It is within this context that cycling as a transportation method appears as an alternative to fuel-based motor vehicles. The importance of cycling as a carbon-neutral activity, that is not reliant on any sort of non-renewable fuel, places this activity as a high-priority investment level towards eco-conscious practices.

However, it is not only due to the need for sustainability that cycling has gained relevancy in recent times. In particular, cycling is now being analysed from the perspective of allowing the development of social trust within local communities. This means that the social and cultural qualities of this activity and transportation method have repercussions in the areas where they prevail, allowing for people to fulfil more easily their physical and social needs. For these reasons, bicycle travelling in certain locations has, to an extent, transitioned into a sort of cultural movement that has become directly linked with local identities, especially in cities within the European Union.

It is now crucial to understand what conditions have led the European Union to shift its focus to promote sustainable mobility and adequate urban planning. But what exactly entail these two concepts when put into practice? How is the European Union, as an entity, working to address sustainable mobility issues? And how is cycling being integrated into some of the most important European urban areas? This chapter will explore these questions, first by presenting the definition of sustainable mobility, urban planning and other relevant concepts, followed by the perspective of the European Union at integrating and promoting them, before concluding with the analysis of the utilization of bicycles in some of Europe's most important cities.

1.1 Defining the main concepts

In order to understand how sustainability and mobility are put into practice in their different forms within the European Union, it is first important to define these concepts on their own and how they can potentially interact with each other.

1.1.1 Sustainability, mobility and sustainable mobility

As human societies continue to evolve and expand in size and scope, the resources needed to fulfil the demands of civilization continue to grow as well. In other words, historically, the necessities of human civilizations have adapted to a number of factors, such as demographic alterations, life expectancy, weather conditions, existing technology, among other changes, and these have not remained constant throughout history. The most drastic economic and social changes were a direct consequence of the Industrial Revolution, in the 18th Century, as the conversion to more mechanized labour and heavy industrialization led to the expansion of urban spaces around factories, increased world trade and triggered a wide number of technological advancements. Since then, the exponential growth in production and fast-paced market changes have resulted in an intense competition for resources at a global scale by countries in all continents. It is estimated that humanity currently uses around 60 billion tons of material per year, eight times as much as in comparison to numbers from a century ago (Krausmann, et al., 2009).

This rather sudden and extreme increase in resource utilization has put a lot of pressure on their availability, especially when these are finite and not renewable. It is within this context that the concept of sustainability has started to be discussed more thoroughly by society and governmental bodies and organizations, as the awareness of environmental concerns and the consequences of unsustainable consumption and practices have become leading social challenges. However, it is first crucial to understand what exactly comprises sustainability and what elements compose it, in order to better understand how to put it into practice.

Sustainability is generally defined as a way to fulfil our needs, in this case applied to humanity as a whole, whilst not compromising the capability of the generations that will follow to fulfil their own needs (World Commission on Environment and Development, 1987). In other words, this means that the goal of sustainability is therefore to balance current needs with predicted future needs. These needs are often integrated as part of three

different components, which are often designated as the "pillars of sustainability", constituting the elements to consider when pursuing sustainability as a goal. The components of sustainability are then economic sustainability, environmental sustainability and social sustainability (Purvis, Mao, & Robinson, 2019). These are often represented by three intersecting circles, converging into a single area represented by the overarching subject of sustainability, showcasing just how their interaction is unavoidable:

Figure 1- Representation of sustainability as three intersecting circles. Source: (Purvis, Mao, & Robinson, 2019, p. 682).

The action of understanding these three components of sustainability can also make it easier to understand the ways in which they can potentially be implemented by governmental bodies, businesses or even on an individual basis.

Economic sustainability was first established in the aftermath of the Second World War, as during this period there was a huge focus on the economic development of nations in a post-war and post-colonial world. According to Purvis, Mao & Robinson, in the text "Three pillars of sustainability: in search of conceptual origins", the authors state that "The core elements of 'eco-development' are described as the meeting of 'essential human needs', participation, environmental considerations, and the unifying principle of 'self-reliance" (Purvis, Mao, & Robinson, 2019, p. 684). The self-reliance, in this case, refers to the necessity to shift away from material reliance on nations, such as the exploitation of the resources from developing nations to benefit the interests of transnational corporations. This means that economic sustainability incorporates certain points, such as the economic development desired by corporations and businesses, but also the allocation of resources in the most effective way possible. This can include actions that involve principles of social equality, such as sustainability related to former colonial territories which were utilized for their natural resources by international corporations (Purvis, Mao, & Robinson, 2019).

Robert Goodland, instead, defines economic sustainability as the "portion of the natural resource base that provides physical inputs, both renewable […] and non-renewable" (Goodland, 1995, p. 2). This definition makes sense in presenting the perspective that we are directly responsible for the way we use the resources available. Nevertheless, in order to achieve the desired economic sustainability, the environmental and social well-being of communities from a certain area should not be jeopardized, in that resource exploration may bring negative consequences to the involved parties. This includes, for example, the application of initiatives towards economic sustainability that minimize the economic effects towards certain marginalized communities, especially those that are part of developing nations. Although this may seem rather complicated to achieve in a globalized economy, transitioning towards a more efficient utilization of resources is one of the most commonly agreed upon strategies to properly implement economic sustainability. The importance of minimizing waste and utilization of resources still makes it possible to achieve economic development whilst also moving towards goals that focus on the sustainability of the resources used in our society (Purvis, Mao, & Robinson, 2019).

Environmental sustainability can refer to the protection of humans and animals from harm caused by the utilization of raw materials by humans. Goodland very shortly defines environmental sustainability as the "maintenance of natural capital" (Goodland, 1995, p. 10). In practice, this means that renewable sources should be maintained in such a way that their renewability is not threatened by human usage, whilst non-renewable sources should be limited in their use to incentivize the creation and development of continuous sources of more renewable alternatives. The natural ecosystems and biodiversity that sustain life on Earth must therefore be preserved and, when possible, restored in order to maintain environmental balance, which does not threaten the present and future of mankind. Promoting sustainable economic growth and development, while ensuring that economic operations are carried out in an ethical and responsible manner, are both necessary for economic success (Purvis, Mao, & Robinson, 2019).

Finally, social sustainability relates to society's ability to preserve and improve the well-being of its members, while at the same time allowing that social and cultural elements are preserved for future generations. Goodland addresses the subject of social sustainability by saying that this concept can only be achieved "by systematic community participation and strong civil society" (Goodland, 1995, p. 3). In other words, social sustainability typically deals with concepts that generally seem broader and more abstract

to interpret by people, which in turn makes it a rather complex and difficult one to put into practice. Concepts such as fraternity, tolerance, diversity and community spirit are the foundation of social sustainability. Robert Goodland (1995) calls them "human-capital investments", which refers to the investments in elements that improve the quality of life and sense of community of a certain area and are often linked with human values and necessities. This is often done through a more targeted focus on the health, education, wellbeing, economic and emotional stability of individuals of a certain area.

Social sustainability can therefore be more strictly defined as the participation in behaviours that encourage social inclusion or unity. This is done by ensuring that all members of society, regardless of origin or economic condition, have access to fundamental services, opportunities, and resources. The process of building robust communities, capable of addressing shared difficulties and achieving common goals, is also what social cohesiveness requires to function in society. Social resilience means ensuring that societies can adapt and respond to differences in circumstances and material conditions, as well as recover from any potential setbacks and obstacles. It is only in this way that it is possible to promote social equality, inclusivity, and equality. Complementary to this, it is just as important to additionally foster conditions that allow as many people as possible to live fulfilling lives in peace with others and their environment (Purvis, Mao, & Robinson, 2019).

When it comes to sustainable mobility, Mário Alves (2012) presents the perspective that its implementation requires three elements. These constitute the different branches towards an effective transition process and consist of the commitment to urban and spatial planning, investment policies in public and non-motorised transport, and finally car-restrictive measures (Alves, 2012). These elements have to be conjugated in an articulated manner, in order to successful promote sustainable mobility. However, the participants and stakeholders that promote sustainable mobility can come from various sources and include multiple strategies. In particular, in recent years, the focus on sustainability as a business model has become increasingly popular. Corporations now want to ideologically align themselves with customers and stakeholders, who are increasingly more aware of the environmental challenges facing humanity and thus are also more demanding of environmentally conscious practices by corporations.

According to Everett et al., on the research paper "Economic Growth and the Environment", from the United Kingdom's Department for Environment, Food and Rural

Affairs, there has been a verifiable increase in demand for sustainable business practices by newly created or already established companies, as "[w]ith many key natural resources and ecosystems services scarce or under pressure, achieving sustained economic growth will require absolute decoupling of the production of goods and services from their environmental impacts." (Everett, Ishwaran, Ansaloni, & Rubin, 2011, p. 7). In other words, due to the decrease in availability of materials or goods from non-renewable sources, such as the pressure and overreliance on fossil fuels or petroleum-based products, corporations now see sustainable practices as the safest way to potentially achieve economic growth and a strong presence in the market at a long-term timeframe.

It is within this context that we see the emergence and consequent popularization of companies whose values are built upon sustainability. Possible examples include corporations within the realm of produce and apparel retailers, those dealing with information technologies and even involving transportation. However, it is this latter sector that proves to be the most relevant for the subject of this work. The transportation sector has seen some advances towards such goals, with the popularization of Electric Vehicles (EV), for example, which attempt to diminish the reliance on petrol-based fuels, the emergence of ride-sharing services through mobile phone applications or even the investment and promotion of alternative transportation methods, such as e-scooters.

Nevertheless, it is important to consider that the transition towards sustainability within the mobility sector is not solely based on the actions and interests of corporations, but there is a strong social component as an integral part of mobility. As Tim Cresswell writes, in his book *On the Move: Mobility in the Modern Western World*: "Mobility, as a social product, does not exist in an abstract world of absolute time and space, but is a meaningful world of social space and social time. Mobility is also part of the process of the social production of time and space" (Cresswell, 2006, p. 5). In other words, mobility and its purpose does not exist isolated from the way it allows us to physically and socially connect with other people and objects. Cresswell's perspective is that mobility and the way humans choose to mobilize to their destinations, whether in a conscious or subconscious way, affects the way we perceive the spaces we travel to in our daily lives. Therefore, when considering this transition towards sustainability, it is also important to consider the social role of mobility, as ignoring this component has the potential of creating barriers to its adoption. Tim Cresswell expresses this point clearly by stating that

places are much more connected to human experience, rather than being simple geographical displacements (Cresswell, 2006). Cresswell writes:

> Writing on mobility remains either very specific (about commuter patterns, migrations, or dance for instance) or maddeningly abstract—the kind of work that talks of points A and B. Connections need to be made between the determinedly different approaches applied to the different facets of human mobility […] (Cresswell, 2006, p. 7)

We can interpret Cresswell's words as the belief that there is a shortage of balanced discussion about mobility. On the one hand, the topic seems heavily focused on specific and material dislocations done by people. However, approaches to mobility are often disconnected from the motivations that drive humans, ignore the previously mentioned social factor of mobility and can also be unclear regarding their true utility. The shortcomings in how mobility is presented and discussed create difficulties in understanding and better implementing sustainable ways of mobility. This can only be avoided by presenting a proportional or even perspective of the aforementioned elements, which will be attempted during the course of this work.

If we want to look at mobility from a macro perspective that involves governmental, business and social input, there is no greater example of such an achievement than through the existence of the European Union. As a political and economic union, the free movement of goods and people have allowed the European Union to approach mobility as a source of economic potential. The social potential has been enabled through the promotion of cross-cultural interactions in a more accessible way. As stated in the European Mobility Atlas: "Cross-border mobility is a prerequisite for a united EU and the experience of inter-connectedness on all levels." (Keim & Cerny, 2021, p. 6).

As previously mentioned, mobility, especially within urban settings, plays an important role when it comes to the discussion of the transition to sustainability. The term sustainable mobility encompasses a lot of different elements and requires direct intervention on different sectors of activity. In the year 2016, the United Nations Secretary-General High-level Advisory Group on Sustainable Transport presented the definition of sustainable mobility in the report *Mobilizing Sustainable Transport for Development* as the following:

> The provision of services and infrastructure for the mobility of people and goods— advancing economic and social development to benefit today's and future generations—in a manner that is safe, affordable, accessible, efficient,

> and resilient, while minimizing carbon and other emissions and environmental impacts. (United Nations Secretary-General High-Level Advisory Group on Sustainable Transport, 2016, p. 7)

In essence, sustainable mobility can be described as the ability of people and products to travel in an environmentally and socially responsible manner, while also promoting current and future economic growth and development. Particularly, one can more clearly understand the application of sustainable mobility by interpreting two conditions. The first is the amount of people or goods the method of transport is allowed to carry and mobilize to the destination, which translates into its core transport efficiency. The second condition is its impact on the environment, in particular through its carbon dioxide emissions into the atmosphere, which are highly pollutant. Because of this, vehicles and transport that combine their capacity with the lowest levels of carbon dioxide should be prioritized as the most environmentally conscious.

Nevertheless, in some areas of the globe, safe and affordable public transport infrastructures or infrastructures not reliant on personal use motor vehicles are still not being prioritized at a sufficient level. Especially considering that there has been, according to the United Nations' Interagency report for second Global Sustainable Transport Conference, a "global increase in public transport demand of almost one-fifth between 2001 and 2014" (United Nations, 2021, p. 19). This means that there is a serious risk of climate issues continuously being aggravated by more people using personal motor vehicles for their travels.

However, one method of transportation stands out as the most efficient in terms of resource consumption and especially regarding its low levels of pollution. In this case, we are referring to cycling and bicycles, as part of what is considered soft mobility. Soft mobility, which is defined by non-motorized transport of people and goods, allows for less reliance on fossil fuels and, when combined with adequate infrastructures for its use, contributes to a safer and more inclusive public space (Coplák & Rakšányi, 2003, p. 43). Because of this, cycling has the potential of being the most sustainable form of transport besides walking and, as the three pillars of sustainability previously mentioned, can be positively affected through meaningful changes made to improve cycling levels. Firstly, economic sustainability is positively affected by its material usage efficiency in comparison with other transports, as it requires less supplies and financial investment to develop its infrastructure, for example. Secondly, when it comes to environmental

sustainability, cycling allows for less reliance on fossil fuels and a reduction in their use. Finally, regarding social sustainability, it facilitates the building of a sense of community and social trust, by allowing people to be closer together in a public space and has the potential of promoting a more inclusive society (Purvis, Mao, & Robinson, 2019).

Cycling, while it has a more limited capacity in carrying people in comparison to other methods of transportation, such as buses and trains, benefits from being the only mode of transport besides walking that is completely emissions-free. This aspect is really important because, in addition to other reasons for its possible adoption (which will be presented in a more in-depth way later into this dissertation), it showcases that cycling is an opportunity for urban spaces to significantly reduce their fuel consumptions and provide citizens with a healthier lifestyle, in an environment with less pollution and stress factors. As Mário José Meireles writes "we can't plan a street by dedicating 80 per cent of the space to the car" (Meireles, 2020, p. 17), and the streets also have to reflect that change in priority, particularly towards pedestrian and cycling-friendly spaces.

However, in order to properly address the subject of transportation and its subsequent implementation, it is just as important to understand the circumstances which lead to the development of relevant infrastructures. It is within this context that the definition of urban planning is necessary, in order to fully comprehend what can allow the expansion and normalization of soft mobility within the space that comprises the European Union.

1.1.2 Urban planning

Urban planning plays a significant role in the development and maintenance of land within urban spaces. At its core, urban planning can be understood as the process of decision-making about land use and its intended goals (Manea, Cocoş, & Iuliana, 2014).

Urban planning has been defined by Manea, Cocoş, & Iuliana as a “concept that encompasses the entire set of prospective activities aiming at regulating the development of urban territorial systems (the regulation of land use, infrastructure planning etc.)” (Manea, Cocoş, & Iuliana, 2014, p. 462). In other words, urban planning decides the possible uses of land and how to extract value from it, whether this is economic or social value. Allocating land use is important for the cohesion of urban spaces, as balancing out the needs of people, businesses and the government can be quite challenging for planners,

so these need to be considered thoroughly. Urban planning is responsible for aspects such as residential, commercial and industrial area delimitations, public and private transportation accessibility, or even community-based and cultural infrastructural initiatives.

An important element of urban planning relates to its connection to the physical site, in particular the cultural and societal link between communities and the creation of new infrastructure. In fact, a lot of the locations that are currently appreciated by many people, such as local residents or tourists, were developed as a natural response to local circumstances (Department of the Environment, Transport and the Regions, 2000, p. 19). Urban planning should ideally remain connected to cultural identity, otherwise its distinctiveness might potentially disappear, and the necessities of local communities could be replaced by an exclusive focus on the interests of marketing and corporations. This can be avoided through urban planning policies and structures that prioritize an intrinsic connection to its environment:

> Development that responds sensitively to the site and its setting, […] is likely to create a place that is valued and pleasing to the eye. Designing for local distinctiveness involves the creative reconciliation of local practices, […] with the latest technologies, building types and needs […]. There is no reason why character and innovation should not go together. (Department of the Environment, Transport and the Regions, 2000, p. 19)

Urban planning currently follows set stages in promoting active change, usually moving towards sustainability and cohesiveness. These include focusing on objectives tailored to the local context and clarifying how the local authority will determine whether a proposed development can be applied satisfactorily. Additionally, it also requires a clear justification, including an explanation of how the policy relates to other existing policies and goals, and a detailed explanation of how the policy might be implemented by urban planners (Department of the Environment, Transport and the Regions, 2000, pp. 44-69). This means that for active change to be implemented in any context, it is vital to recognize the local impact, customize it to the local environment, and take into account the requirements of the local population.

Historically, European urban spaces were first designed with different priorities than those of today. Before the Industrial Revolution, Europe heavily relied on its agricultural sector and production. Rural spaces played an important role in the subsistence of the population, not just by providing communities with their means of survival, but also by

being the labour source of their inhabitants. Cities, on the other hand, "were centers neither of trade nor urban industry but instead the homes of bureaucrats and the favoured dwelling places of landlords." (Bradford de Long & Shleifer, 1993, p. 675).

Even so, and according to Bradford de Long & Shleifer (1993), cities played a major role in terms of commerce (in particular of the goods produced in rural settings) and cities with the largest size and higher number of people were historically linked with economic prosperity (Bradford de Long & Shleifer, 1993). Through this knowledge, we can understand that European cities had some importance when it came to attracting economically privileged people, thus allowing them to also become synonymous with development and culture. Whilst cities grew in importance as centres of trade in the aftermath of the Age of Discoveries[1], the symbiotic relationship between rural and urban spaces continued relatively stable until the period of the Industrial Revolution. It was then that cities began to change and their design changed as well. The emergence of large factory units for mechanized production required heavy labour work, which led to much of the population of Europe to relocate from rural spaces to newly developed suburban areas, in closer proximity to their workplace. However, the fast-paced business-related needs of such industrial places for a sufficient workforce led to a sudden urban development without much regard for the conditions, both in terms of health and comfort, of the new city-residing population. Robert Riddell refers to this moment in urban planning in his book *Sustainable Urban Planning* as that of the "unhealthy cities" (Riddell, 2004, p. 40), attributed to the disregard for careful planning of suburban areas, lack of fulfilment of the necessities of the population, and overall aesthetical dismissal of the public space. Because of this, this period in history was marked by a shortage of green spaces, heavy pollution caused by large number of factories and the unsanitary working conditions of the workforce (Riddell, 2004).

As a response to the unbridled urban and suburban developments rampant during this period, movements began to emerge as an attempt to counter such practices in both North American and European cities. The "City Beautiful" movement and the "Green City" movement both pushed for the investment in spaces of leisure and more thoughtful planification of public spaces, respectively. However, these movements proved to be insufficient to address the issues of heavy industrialization, as the existing social issues

[1] Historical period between the 15th and the 17th Century, marked by the exploration of territories outside of Europe and their subsequent colonization by European countries.

and inequality meant that spaces were not accessible to most people and the seeking for urban balance and harmony directly competed with the interests of industries (Riddell, 2004, p. 40).

While the Industrial Revolution led to great changes in the way people lived their lives and in society as a whole, it also led to developments in technology. In particular, one important sector, relevant for the subject of this dissertation, was the evolution experienced in the transportation sector. During this period, the invention of the locomotive made it possible for goods and people to travel longer distances with relative ease. Additionally, the invention and rapid popularization of personal motorized vehicles during the later part of the 19th century had a tremendous impact on the design of cities and urban planning. In the 20th century, urban planners were changing the way cities were designed to more adequately fit this new method of transport. Hildegard Schröteler-von Brandt explained this process by stating: "The effects of Fordism[2] on city planning were expressed not just in the increase in car traffic, but also in decentralisation and in the tendency towards the deconcentration of the city." (Brandt, 2018, p. 9). In short, cars allowed cities to expand in size, making it possible for people to travel from the centre of a city to outside of it much faster than ever before. This affected European cities as well, which became more extensive and vaster as cars gained an increasing importance in public space, so that they started requiring and occupying more and more of it.

The expansion of Fordism and its consequences for urban planning continued throughout the 20th century and reached its peak in Europe during the ascension of fascist regimes, before and during the Second World War. This was especially prevalent in Nazi Germany. Such authoritarian regimes based many of their principles in the disdain for urban spaces and cities and reinforced the belief that small towns and rural areas had intrinsic nationalistic value, which should be preserved due to their connection to traditional practices. As Brandt writes "In many towns, the demolition and rebuilding of 'unhealthy' residential areas began, which was predominantly aimed at the political cleansing and breaking up of the inhabitants" (Brandt, 2018, p. 12). The separation of industrial, residential and commercial areas ultimately popularized car infrastructure even more,

[2] System of standardized mass manufacturing of products, which contributed to the easy access to motor vehicles, in particular the Model T, due to its lower prices compared to other vehicles in the market. It was named after Henry Ford, founder of the Ford company.

with the destruction of entire neighbourhoods by urban planners, in order to create social barriers between local communities.

In Europe, urban planning and city development became a priority due to the necessity of requalified infrastructure in the aftermath of the Second World War. The destruction of many European cities created the necessity of rebuilding, redeveloping and adapting buildings to new circumstances. Urban planners therefore prioritized the construction of housing, particularly social housing, in countries like Germany and Poland, for example. Since the late 20th and 21st century, urban planning has seen a divergence in strategies. Nevertheless, a new movement of urban planning gains momentum in many European cities – The New Urbanism. Inspired by the "City-Beautiful" movement, the New Urbanism seeks to prioritize pedestrian infrastructures and accessibility to those not travelling in motor vehicles. Coplák & Rakšányi describe New Urbanism in the book *Planning Sustainable Settlements* as "the concept of livability and variety" (Coplák & Rakšányi, 2003, p. 14). As such, it should combine characteristics that allow residents to support business in their communities through planned neighbourhoods. As Coplák & Rakšányi write: "New Urbanism is more concerned with restoring human-scale and "place" to developments by creating genuine neighbourhoods, towns and villages." (Coplák & Rakšányi, 2003, p. 14). The humans-scale, in this case, refers to accessibility for most people to dislocate no matter their socio-economic conditions.

As such, we see the emergence of discussions about implementing sustainable modes of transportation, such as bicycle infrastructures and public transit, which reduces the necessity of fossil fuel vehicles and the investment in the development of local communities. These alternatives prove to be the main focus of the New Urbanism, a concept that is being promoted not just by local communities but also by governmental agencies and even large-scale political and economic entities, such as the European Union, wishing to address issues related to the climate crisis.

1.2 The perspective of the European Union

The European Union's commitment to addressing the issues related to the environment and the climate has been one of the leading subject matters of this entity, especially in the 21st Century. It is recognized by the European Union and its member-countries that the challenges that humanity is facing regarding sustainability are the biggest threat to this

generation. However, sustainability has already been established as a multi-faceted concept, including issues within the realm of economics, environment and society. As such, any potential response to sustainability challenges, in particular those connected to mobility, needs to consider these three elements equally, in order to efficiently fulfil its designated goals.

With a population of around 447 million, the European Union stands at an especially environmentally vulnerable place. According to numbers from 2016 by the Joint Research Centre (JRC), the European Union has an urbanisation rate, that is the percentage of people residing in urban areas, of 72% (European Commission, 2016). Urban areas are some of the most affected by environmental issues, in particular regarding pollution. Atmospheric/air pollution, specifically due to road traffic, is one of Europe's largest pollutants. Additionally, Europe's temperature has increased significantly in the last years, in comparison to numbers from before the Industrial Revolution. This has consequences regarding the increase in frequency of heatwaves, unavailability of water resources and also difficulties in the agricultural sector, for example. These potentially devastating consequences have led the European Union to begin discussing new potential strategies to address them, which has resulted in the implementation of new policies.

1.2.1 European Union's Green Deal and the Sustainable and Smart Mobility Strategy of the European Union

The European Union heavily focuses on its environmental policy and legislation, keeping itself at the forefront of environmental and sustainable issues. In other words, the European Union seeks to emerge as the leading force towards sustainability and combating climate change. In order to achieve this goal, the European Union approaches the subject of sustainability and environmental causes in a multi-targeted way. It has created different bodies, committees and programmes that, at their core, have similar goals of sustainability and environmental focus. In 1973, the European Union created its first ever set of common policies aiming to address the environmental issues within its territory, which was designated the "Environment Action Programme". These policies have continued to be adapted and expanded in eight subsequent programmes, with the last being established in 2022. Here, the European Union establishes a compromise referred to as "Think Sustainability First", with a focus on prioritizing "well-being

economy", defined in such a way that "the growth is regenerative and should also ensure that the green transition is achieved in a just and inclusive way, whilst contributing to reducing inequalities" (European Union, 2022, p. 24).

However, it was through the development of the European Union's Green Deal that a more concrete and comprehensive policy was created to address sustainability issues. While recognizing the vulnerability of the European Union regarding the consequences of climate change, it addresses these challenges through direct change. According to the official report for the Green Deal by the European Commission:

> The European Green Deal is a response to these challenges. It is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use. (European Commission, 2019, p. 1)

It is possible to interpret the Green Deal as the European Union's solution for a growing demand in policy which sets to extinguish all greenhouse gas emissions and achieve environmental neutrality. Even so, it is important to understand what exact changes this Green Deal intends to put in practice. According to the European Commission, for the Green Deal to be actually put into practice, it is first important to analyse and even rethink existing practices and apply them considering an investment in clean energy on all sectors of activity. This is because using clean energy allows for positive consequences in sectors like construction, agriculture, transportation and "large-scale infrastructure" (European Commission, 2019). Exploring other sources of energy may be advantageous for a multitude of reasons, such as technological development, economic benefits and environmentally conscious consequences.

The Green Deal places a lot of emphasis on the European Union's investment in mobility. Several approaches are presented in order to fulfil that role. According to the European Union, transport activities account for around one quarter of the Union's total greenhouse gas emissions (European Commission, 2019). Sustainable mobility goals can be achieved by giving the citizens affordable, convenient and more environmentally conscious mobility alternatives, compared to the ones currently used and available for people in many European urban areas. The European Commission concludes that "Transport should become drastically less polluting, especially in cities" (European Commission, 2019, p. 11) and that it requires special attention from the Commission itself and local

governments. Traffic congestion and the lack of availability of mass public transport alternatives are some of the issues referenced by the Commission. To address these issues, the Green Deal presents a selection of areas to prioritize more investment. Particularly, the focus on multimodal transportation, that is, utilising more than one method of transport to reach the final destination, would allow higher efficiency in transport. From the European Commission's Green Deal communication report:

> Automated and connected multimodal mobility will play an increasing role […]. The EU transport system and infrastructure will be made fit to support new sustainable mobility services that can reduce congestion and pollution, especially in urban areas. [...] (European Commission, 2019, p. 10)

One of the strategies adopted by the European Union is related to prices and cost comparisons in transport. According to the European Union, the price of each transport should match both "its environmental impact and consequences on health" (European Commission, 2019, p. 10). This means that transportation systems that more heavily rely on fossil-fuels should be disincentivized by the cease of governmental subsidies and tax exemptions, and those which use less fossil fuels should be financially supported and be provided with more investments in infrastructure (European Commission, 2021). The goal of zero emissions in mobility in the European Green Deal strongly references both the necessity to improve public and/or sustainable transport and the need to reduce the dependency on personal vehicles that have fossil fuels as their main energy source.

1.2.2 Financial investments to achieve sustainable mobility in the EU

To fulfil the goals by the year of 2030, the European Commission is making it a larger priority in its total budget. It is allocating around €260 billion of annual investment of its budget for the Green New Deal (European Commission, 2019, p. 11). Additionally, the Commission mentions the necessity of intervention both in public and private sector initiatives to achieve its sustainability goals. This amount corresponds to around 1,5% of the European Union annual Gross Domestic Product from 2018 (European Commission, 2019). However, according to the recent estimates, a proper investment in sustainability potentially requires more than a budget of €260 billion. For instance, such financial investments ignore investments in climate adaptation technology and biodiversity maintenance. Additionally, they mostly disregard the social aspects and costs in both the inaction and the transition process (European Commission, 2019, p. 15).

In other words, while in terms of Gross Domestic Product the financial investment in sustainability seems rather limited, being less than 2% of the EU's budget, this amount misrepresents the total investment in sustainability. It is expected that the necessary investment is around the "trillions" of euros, if we include the EU's partnerships with countries outside of its border (European Investment Bank, 2023). These include, for example, the €200 million in loans to the government of Jordan to facilitate water distillation initiatives in the country, deeply affected by the growing water scarcity; the €70 million used by the European Union to finance the expansion of the water supply of the public services of Senegal; or even the €4 billion reserved by the European Investment Bank (EIB) to the Clean Oceans Initiative, whose goal is to finance the removal of plastic waste from rivers and the oceans (European Investment Bank, 2023, p. 6).

As part of other financial investments, the European Investment Bank has also focused on initiatives to tackle environmental sustainability within an urban context. The Climate Bank Roadmap (CBR) is one of those initiatives, which sets out a budget of €1 trillion specifically for the development of sustainable practices in cities, between 2021 and 2025. One of the sectors prioritized by the CBR is on investing in sustainable transport. As stated by the European Investment Bank (EIB): "The EIB Group will continue to support the lowest-emission forms of transport, with many rail, metro and port projects already in its portfolio." (European Investment Bank Group, 2020, p. 17). Included in such projects is the explicit support by European Directors, in particular by the Management Committee, the European Investment Bank's permanent executive body, to cycling infrastructure and financial investment (Haubold, 2020). As a matter of fact, many initiatives using EIB funds implemented in cities have been directly related to cycling. However, it is also important to establish which cities in Europe have seen higher rates of bicycle usage earlier or even throughout time and what cities are only now beginning to pursue this system of transport. We will now analyse the past and present circumstances of bicycle usage within the European Union's borders.

1.3 Utilization of bicycles and cycling in the European Union

The European Union has a long and convoluted history with bicycle usage. Historically, cycling rates have varied greatly depending on the territory, even within the same country. Even so, cycling was seen as a reliable form of transport in Europe until the 1950s.

However, cycling rates decreased significantly during and after the 50s, a lot due to the increased levels of car ownership of the time (Pucher & Buehler, 2008). According to Pucher & Buehler, on the 2008 report *Cycling for Everyone: Lessons from Europe*: "A Dutch study showed that from 1950 to 1975 the bike share of trips fell by roughly two-thirds in a sample of Dutch, Danish, and German cities, from 50-85% of trips in 1950 to only 14-35% of trips in 1975." (Pucher & Buehler, Cycling for Everyone: Lessons from Europe, 2008, p. 6). During this period there was a focus on expanding car infrastructure, such as an increase in motorized vehicle roads and car parking. In turn, pedestrian and cycling infrastructure were largely ignored by city planners and local governments in certain cities.

It was only after 1975 that priorities began to shift again, this time favouring bicycle and pedestrian infrastructure in European cities. This happened particularly in Northern and Central European countries like Germany, Denmark and The Netherlands (Pucher & Buehler, 2008, p. 7). As Pucher & Buehler wrote: "Most cities vastly improved their bicycling infrastructure while imposing ever more restrictions on car use and making it more expensive. That policy reversal led to turnarounds in the previous decline of bike use." (Pucher & Buehler, 2008, p. 7). Differences in the way cities were being designed and planned led to people naturally gravitating to cycling as a reliable transport within urban spaces again. Since then, while car ownership and usage have continued to increase in most European countries, the number of people using bicycles for daily travelling has also increased significantly (Pucher & Buehler, Cycling for Everyone: Lessons from Europe, 2008, p. 7).

European cities benefit from certain conditions that make them suitable for cycling and pedestrian infrastructure. One of the conditions is the European population's density levels. According to a 2017 report by the World Health Organization, partnered with the European Commission, regarding the transition to physically active forms of transport:

> The population size of European cities is markedly different from the patterns seen in most other regions of the globe. Europe is characterized by having the largest proportion (65%) of the urban population living in cities with fewer than 500 000 inhabitants, and close to 95% living in cities with fewer than 5 million inhabitants. *(World Health Organization, 2017, p. 18)*

Given the characteristics of European cities, both the World Health Organization and the European Commission conclude that Europe's "relatively compact" urban areas allow it

to benefit more from cycling and pedestrian infrastructure (World Health Organization, 2017). In other words, Europe's lack of a large number of so-called "megacities", such as those in Asia and Africa, means that it has been easier to encourage and transition to active forms of transportation – in this case walking and cycling – as an alternative to motorized vehicle transportation.

When it comes to cycling in Europe, its demographic appeal is quite broad. Nowadays, in European cities with established bicycle infrastructure, gender disparity is relatively balanced, with a close to fifty per cent split between men and women that cycle in Northern and Central European countries like Denmark, Germany and The Netherlands (Pucher & Buehler, 2008). Additionally, research suggests that these European countries see higher rates of cycling among the youngest population, especially children and teenagers. However, in countries that have a more ingrained cycling culture and planned infrastructure for this purpose, cycling levels remain quite high even for elderly populations (Pucher & Buehler, 2008, p. 8).

While the access to cycling infrastructure and the existence of a strong cycling community in many European countries has continued to expand in particular areas, it is important to consider the fact that investment in such causes has not been done at the same pace or intensity throughout Europe. As a matter of fact, some countries, or even different cities

within the same country, have varying levels of cycling implementation (World Health Organization, 2017).

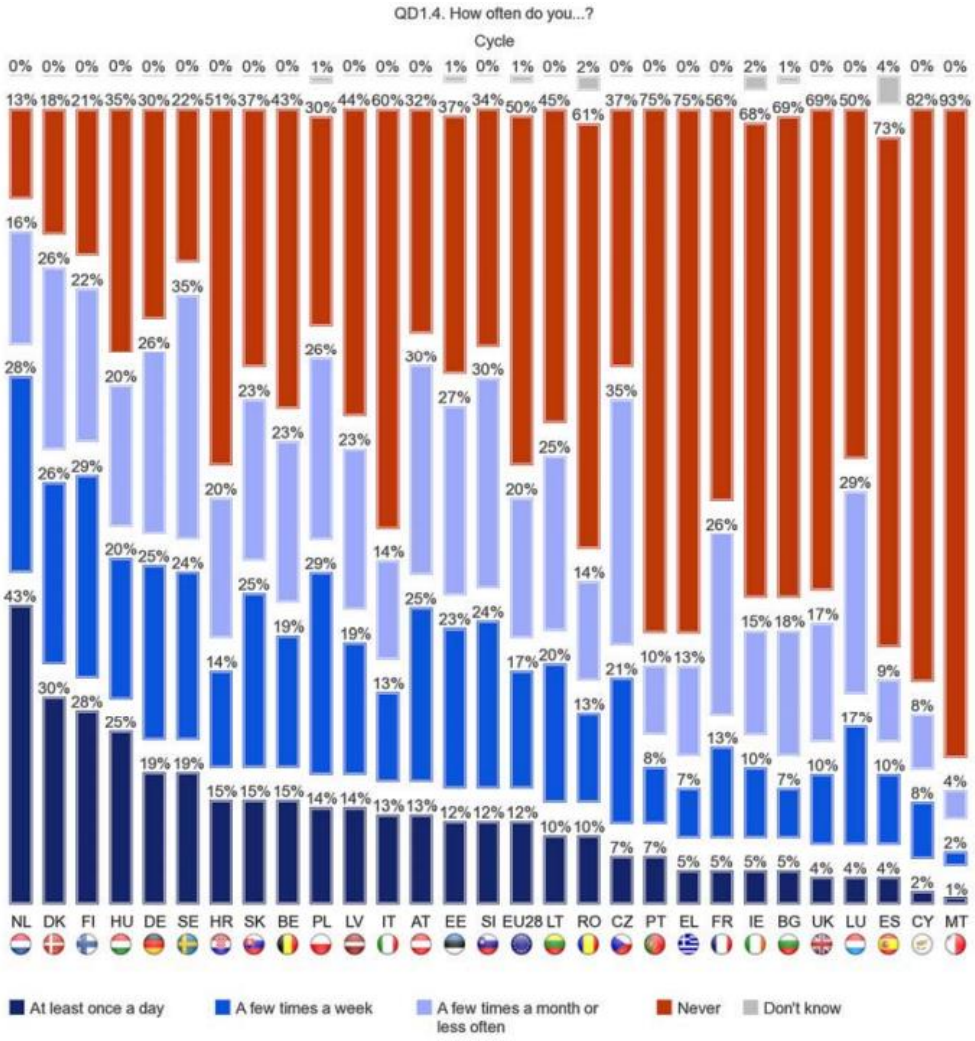

Figure 2- Graphic representing the percentage of people in EU member-countries that cycle and the frequency of cycling. Source: (TNS Opinion & Social, 2013, p. 10).

According to data from Figure 2, there is still a significant discrepancy between cycling ridership rates within Europe. The European countries with the highest percentage of daily cyclists are The Netherlands (43%), Denmark (30%), Finland (28%), Hungary (25%) and Germany (19%). By contrast, the European countries with the lowest percentage of daily cyclists are Luxembourg (4%), Spain (4%), Cyprus (2%) and Malta (1%). (TNS Opinion & Social, 2013, p. 10). From such data we can understand that there is a wide discrepancy in bicycle use within the European Union itself. Particularly, countries with the highest percentage of bicycle usage are also the countries which have made more intense efforts at developing infrastructure and programs incentivising cycling within urban settings. The most internationally recognized example of such practices is The Netherlands, a country with the largest scale of bicycle infrastructure, developed and

planned at a national scale. The example of The Netherlands as a leading country in bicycle infrastructure and its culture around bicycles will be presented further into this work.

However, within the last few decades, other European cities from countries besides The Netherlands, which have invested in bicycle-friendly initiatives much later, have begun to allow the flourishing of local bicycle initiatives and develop appropriate infrastructure (World Health Organization, 2017). The most notable examples are Copenhagen, in Denmark, and Oslo, in Sweden. These were chosen as they provide a variety in levels of implementation of bicycle infrastructure and varying levels of how ingrained such practice is in local communities.

As a European city, Copenhagen is one of the urban areas where cycling is one of the fastest growing transportation methods (Technical and Environmental Administration of the City of Copenhagen, 2022). It has been one of the earliest cities to research the subject of the mobility patterns of its urban population and utilise that data as a tool to directly influence local urban planning laws and construction (World Health Organization, 2017, pp. 72-3). One of the important tools used by the city of Copenhagen is the Bicycle Account. This report aggregates local cycling-related data through digitally-implemented methods and provides an in-depth presentation of past achievements and future cycling investments and goals in Copenhagen. According to the Bicycle Account of 2022: "Over the past 10 years, the City of Copenhagen has invested a total of 0.84 billion krone[3] to create a better and more cohesive cycling experience" (Technical and Environmental Administration of the City of Copenhagen, 2022, p. 12). This measure was created to accomplish the city's goal of having a 50% bicycle share on all city trips by the year 2025, which in 2021 stands at 35% (2022, p. 12). In particular, Copenhagen is investing substantially on social programmes that incentivize changes in people's perception of cycling as a form of transport, besides the construction of relevant infrastructure. The city of Copenhagen believes that an important factor to a city developing a cycling culture is both through community building and by making interactions between different groups of people easier, as well as through the investment in promoting cycling as the most convenient way to move through urban areas:

> Concerning citizen motivation, the Bicycle Accounts have demonstrated, year after year, that the number one reason for cycling among Copenhageners is

[3] In April 2023, 0.84 billion Danish Krone corresponded to a total of roughly €113 million (Source: Forbes)

> that “it’s the fastest way to get around”, followed by “it’s the easiest way to get around”, while the third most common reason for cycling is “to get exercise”. (World Health Organization, 2017, p. 73)

The convenience and safety during journeys create further incentives for people to continue cycling, while also attracting new cyclists who are motivated by the new advantageous conditions. In this way, we can understand what is rapidly turning Copenhagen into a *de facto* bicycle city. The accumulation of relevant transportation data which details the citizen’s needs in transit, the financial investments by the city of Copenhagen in cycling infrastructure which makes cycling safer and more convenient than other alternatives, and the existing programs that create a sense of community, union and focus on having a healthier lifestyle, are all significant elements that, when combined, have transformed Copenhagen into an emerging bicycle city.

Another currently relevant European city that is moving towards investments in cycling is Oslo, in Norway. While not being part of the European Union, Norway is a member of the European Economic Area, participating in the free movement of goods, people and services, and has common legislation with the European Union, even benefiting from its economic programs. The city of Oslo has an historical connection with cycling, this being one of the most prevalent forms of transport until the 1960s. Cycling was especially important during the Nazi German Occupation of the country during the 1940s, as bicycles were commonly used to help residents buy food and basic necessities at the black market during the Second World War (Gustvasson, 2014, p. 79). While during the latter part of the 1900s this transport gradually became less popular because of the explosion in popularity of cars, there has been a recent resurgence in cycling. One of the reasons for this is the prioritizing of cargo-bicycles, that is, bicycles which allow the transport of heavier objects and materials. As they are specifically adapted for the commonly snowy landscape, these bicycles have been heavily encouraged by the Norwegian government, through designated parking infrastructure. Additionally, Oslo has seen a strong increase in bike ridership since the introduction of bicycle-sharing services in the city. The European Cyclists Federation states, regarding bike sharing in Oslo, that the service “has more than 3000 bikes available, with 2.2 million trips registered in 2019” (Bashford, 2021). The city really started to specifically focus on its cycling network in 2015, with the development of The Oslo Bike Strategy 2015-2025. This local plan aims to increase local bicycle ridership levels from 8% to 16%, in addition to improving people’s perceptions of cycling by prioritizing safety. All of these, in addition to an increase by

tenfold of the city's expenditure on cycling infrastructure in general, has led to a peak in the utilization of bicycles, estimating at an "increase of 77% between 2014 and 2020" (Bashford, 2021). From these circumstances we can understand Oslo as a city that, despite facing some challenges that hinder cycling's attractiveness, such as its difficult weather conditions, it has successfully adapted and made substantial investments to overcome these obstacles. By understanding the local characteristics of Oslo, local authority figures and urban planners have been able to develop a plan which embraces the local environment for the benefit of the residents.

Considering all these points, The Netherlands stands out as case study for a place where bicycles are not just a reliable form of transport at the national level, but also as an important cultural element that promotes values of inclusivity. Additionally, The Netherlands is an example of turning cycling into an economic propulsor, which has allowed for the creation of new and innovative markets and business strategies. The potential of the Dutch cycling infrastructure, in addition to the economic and business benefits created could be adapted to other countries, for example in Portugal, with the goal of creating a local bicycle culture. Even though Portuguese urban areas are not yet developed enough towards clearly establishing a bicycle culture, steps towards creating relevant infrastructure and awareness campaigns have been progressively increasing in frequency. These elements, along with other potential incentives and the economic innovation of the market, might be a source of possible change towards cycling becoming more prevalent in Portuguese cities.

However, before understanding how cycling can be integrated into Portuguese urban areas, it is first important to analyse The Netherlands as a country where urban planning and sustainable mobility stands at the forefront of its priorities and what role cycling has on Dutch society. To achieve this, we will first describe how urban planning and sustainable mobility are integrated into Dutch cities. This will be followed by a presentation of the historical and cultural background of cycling in The Netherlands, ending with an overview of the economic impacts cycling has on Dutch society. So, what exactly makes The Netherlands a special case for cycling in the world?

CHAPTER II – THE NETHERLANDS

Before understanding the complexity of urban planning in the Netherlands towards sustainability and the bicycle culture around this country, it is first necessary to present some basic information about this country. As such, the first part of this chapter will focus precisely on the general elements of The Netherlands as a country, as well as some of its characteristics.

The Netherlands is a country located in the north-western part of the European continent and its capital is the city of Amsterdam. The official language of this country is Dutch and it has a population of around 17 million people. It is bordered by both Germany, on the east, and Belgium, in the south. The Netherlands is also part of the Kingdom of The Netherlands, which includes the territories in the Caribbeans of Aruba, Sint Maarten and Curaçao (Overheid, 2017). Additionally, the Caribbean Netherlands also include special island municipalities located in the Caribbean. These are the islands of Bonaire, Sint Eustatius and Saba, which are not considered independent countries but rather they are overseas territories of the country of The Netherlands. These six territories maintain a very close relationship with The Netherlands politically and economically (Overheid, 2017).

The Netherlands is a constitutional monarchy, that is, the head-of-state is the monarch. This figure exercises its power limited through what is established in the constitution. A coalition of political parties holding a majority of seats in the parliament's lower chamber, which is known as the chamber of Representatives, the *Tweede Kamer*, forms the government of The Netherlands (Netherlands Institute for Multiparty Democracy, 2008). The Prime Minister is the leader of the majority or coalition party who heads the government. This figure is also responsible for directing the government, making policy choices, and representing the country internationally. The Dutch have a long history of consensus politics, described as the “polder model”, with political parties forming coalitions to create administrations. This is visible in the country's multi-party system, in which multiple prominent political parties compete for parliamentary seats (Netherlands Institute for Multiparty Democracy, 2008). The consensus politics is important for the way policy is applied in the country. At a local level there are intense consultations during the decision-making process of policy, fostering a culture of compromise between all the parties (Otjes, Louwerse, & Timmermans, 2018).

In terms of its geography, The Netherlands is recognized for its flat land, so attached to the identity of the country that it is even referenced in its name, as its meaning can be translated from the Dutch language, *Nederland*, to signify "low lands". Furthermore, the country suffers from challenging circumstances in terms of its low altitude, being practically at sea level. According to van Alphen, Haasnoot & Diermanse: "About 26% (10,500 km^2) of The Netherlands' territory is below mean sea level, and about 60% is vulnerable to floods from the North Sea, rivers, or lakes" (van Alphen, Haasnoot, Diermanse, & Jos, 2022, p. 2). We can understand the fragile position of this country in environmental terms. These circumstances are able to provide us with more substantial context for the way in which the country heavily prioritizes its land use and environmental impact. Because of this, developing measures towards climate neutrality are essential for the country's existence, in order to avoid massive floods.

As a country, The Netherlands is considered one of the strongest economies of the European Union and of the entire world. As stated by the International Trade Administration: "The Netherlands is the seventeenth largest economy in the world and the fifth largest in the European Monetary Union (the Eurozone), with a gross domestic product (GDP) of $1 trillion in 2021." (International Trade Administration, 2022). Its strategic location, which is in close proximity to a market of around 170 million consumers, has made it favourable to international trade and investment from foreign companies. The Netherlands also houses the largest Port of Europe, the Rotterdam Port, and the fourth largest airport in Europe, Amsterdam Schiphol Airport. In addition to this, according to the World Economic Forum, The Netherlands is ranked as the most competitive economy of Europe, placing in fourth at a global scale (World Economic Forum, 2019). Essentially, the country is a highly economically attractive country, which has consequently attracted a large number of people, such as investors and workers, to relocate to the country, since it concentrates a large number of international headquarters of large-scale businesses and new companies in the process of expansion.

When it comes to the demography of The Netherlands, the way this country has managed to attract a large number of people from abroad means that there is a wide variety of nationalities, ethnicities and cultures within its borders. The immigrant communities represent almost a quarter of the total number of inhabitants. According to numbers from 2022, from the roughly 17.5 million inhabitants of the country, 4.4 million of them have an immigrant background, with 2.4 million of these being first generation migrants

(Statline, 2022). This means that the Dutch society is rather multicultural, with participants from various backgrounds. In particular, the largest immigrant groups in the Netherlands are Turks, Moroccans, Surinamese, from outside the European Union, and Germans, Poles and Belgians, from within the European Union (Statline, 2022).

Because of its very innovative and competitive business climate, the country has successfully attracted a large number of people to work there. This, combined with the relatively low land area of 41.000km^2, has made The Netherlands a rather compact country, in particular in the Randstad area, the country's most densely populated region (Chapman, 2001). The Randstad represents the very densely populated western part of the country, consisting of the four major Dutch cities of Amsterdam, The Hague, Rotterdam and Utrecht, and it also includes smaller municipalities in between these cities. Additionally, the Randstad has almost half of the entire country's population within its radius. According to Chapman: "The levels of density exhibited today in the Randstad are, in part, due to the successful implementation of 'compact-city' policy" (Chapman, 2001, p. 43). Originally, the "compact-city" policy wanted to attract residents from the rural areas of The Netherlands to the urban areas, however nowadays the original plan has been adapted to facilitate foreign investment and the movement of people between the largest Dutch cities (Chapman, 2001). We can therefore understand that the structure of the country's urban distribution has been deliberately decided by the Dutch government, through the application of conscious strategies towards conveniency and sustainability within the urban setting. In other words, The Netherlands has successfully moved towards promoting "compact-cities" as a way to address its demographic, environmental and geographical challenges.

After presenting this general overview of the country, we can now understand The Netherlands as a diverse nation, both in terms of its demographics and also in terms of its geography. As such, we can now proceed into analysing how this country inserts sustainable mobility into its urban planning policy and practices, considering its own circumstances.

2.1 Sustainably mobility and urban planning in The Netherlands

When it comes to sustainable mobility, The Netherlands has been internationally regarded as a country of reference for the way it has approached multimodal transport and

incentivized sustainability in transport. The Dutch have heavily invested in developing infrastructures and policies in such a way that they directly target the established European Union goals towards sustainability.

According to the 2004 report resulting from the CODATU XI Congress, aimed at exchanging knowledge and expertise from the urban mobility and transport sector, Alpkokin, Kuriyama, & Hayashi reference this focus of The Netherlands to its strategy for sustainable mobility: “From the perspective of Dutch planning doctrine, sustainable development policy is to combine the urban polices that are land use, transport and environmental policies” (Alpkokin, Kuriyama, & Hayashi, 2004, p. 7). Analysing this perspective, the Dutch see the transition to sustainable practices as not an isolated set of goals being addressed separately by various sectors. Instead, they follow a model of considering those sectors as a single unity working towards sustainability, in particular regarding the interests related to mobility.

An important aspect of the way The Netherlands organizes itself to address both sustainable mobility and land development is through positioning itself as a “network society” (Alpkokin, Kuriyama, & Hayashi, 2004, p. 3), which involves the creation and expansion of networks in urban centres. This process involves two steps in order to be successful. Firstly, the Dutch prioritize the development of urban centres, particularly investing in intracity planification of residential, commercial and industrial areas (Alpkokin, Kuriyama, & Hayashi, 2004, p. 3). This is followed by a prioritization of the connectivity between different city centres, by linking them with efficient transportation networks. This can be done through public transit such as buses, trams, roads and trains, or through the construction of large-scale bicycle infrastructure (Alpkokin, Kuriyama, & Hayashi, 2004, p. 3). Connections to and from the Randstad are also placed at a higher level of priority by city developers and mobility planners when creating network programs. This is because the Randstad is both the densest area of the country population-wise and it has a high concentration of economic activities at a national level, making these connections important for moving people and goods in the most convenient and sustainable way possible, in order to obtain the highest level of benefits for the country’s economy and high levels of efficiency.

The way the Dutch apply urban planning policy and infrastructure involves a system of cooperation between multiple different entities. However, its core practices stem from the

legislation imposed by the Dutch Ministry of Infrastructure and Water Management. This Ministry is in charge of the country's road infrastructure, water treatment, cycling policy, sustainable transportation, traffic emissions and fuels, public transportation, and environmental evaluation (PBL Netherlands Environmental Assessment Agency, 2022). The Netherlands and its Environmental Assessment Agency promote the idea of cities being "nature-inclusive", precisely to incorporate natural characteristics onto their infrastructure. In 2022, The PBL Netherlands Environmental Assessment Agency writes:

> […] A nature-inclusive design of the Netherlands can make an important contribution to the realization of current social challenges, such as climate mitigation and adaptation, (drinking) water quality, biodiversity restoration and a healthy living environment […] (PBL Netherlands Environmental Assessment Agency, 2022, p. 10)

The Dutch Government sees the urban planning of its cities as a way to foster the connection with nature and provide residents with a healthy living space. One of the most important components towards that goal is through the Transport Planning in The Netherlands, in particular through investments and outlining goals regarding transport in the country. The implementation of urban planning-related policies, in particular within the transport sector, usually involves a five-step process, activated by the previously mentioned Ministry. The first step is the enactment of a 10-year general policy for transport in cooperation with departments from the economy, environment, spatial and water planning, followed by the second step, which consists in organizing the transport infrastructure for each transportation method through a yearly revision (Alpkokin, Kuriyama, & Hayashi, 2004). The third step involves the application and assessment of the policy, through a multidisciplinary team which evaluates the results of the policy from the perspective of their respective fields. This is where the concept of the Dutch consensus policies, through the "polder model", becomes relevant again, as it is utilized by the competent authority figures to deliberate on the application of new policy. It is also during this step that adaptations to the urban transport plan are considered, depending on the results, and improvements to the original plan are also decided by the stakeholders (Alpkokin, Kuriyama, & Hayashi, 2004). The fourth step involves the presentation of the end results to the relevant ministries, concluding with the inclusion of the policy on local governments or programs (Alpkokin, Kuriyama, & Hayashi, 2004).

The Dutch government has recognized that, in order to achieve its sustainability goals while also increasing the use of public transports, it is necessary to plan infrastructures at

a local and national level, with sufficient allocation of resources. To do this, The Netherlands has invested in a multitargeted strategy to increase its transportation sector's efficiency. Alpkokin, Kuriyama, & Hayashi mention that variety in strategies in the report *Analyzing urban planning in the Netherlands for dissemination of know-how and experience*, in which they name some of the approaches taken by the Dutch infrastructure planners and urban developers regarding their investment priorities:

> This does not only cover the new infrastructures but also renewal of existing systems for increasing the level of service. Also complementary policies like park and ride, road pricing and tax deduction as given above are the future concern for increasing the share. Especially the intercity large rail infrastructures are at the beginning of their investment list. (Alpkokin, Kuriyama, & Hayashi, 2004, p. 9)

It is also important to understand some of the main transportation systems of The Netherlands, in particular within urban settings. Due to the multimodal nature of transports in this country, understanding how these systems function, both as separate entities and as integrated networks, provides an overview of how transit is managed for efficiency purposes.

When it comes to public transit, two methods of transport stand out in this country: buses and the national train system. These two have a cooperating relationship with each other, through matching timetables and joint infrastructure, for accessibility and convenience purposes. These two main systems, in addition to every other public transit option of the country, such as trams in designated cities, also share the same card with smart-payment options, the OV-Chipkaart (Nederlandse Spoorwegen, 2023). There are two types of OV-Chipkaart, the anonymous card and the personal card. The former can be purchased on any convenience store of the country and be charged on ticket machines, while the personal card requires proof of identity. This system was created to avoid paper waste from the use of disposable cards in each journey, as the disposable cards for infrequent public transit users are significantly more expensive because of surcharges applied to their use (Nederlandse Spoorwegen, 2023).

The bus system in The Netherlands functions mostly through intracity services provided by exclusively public companies. However, some regional bus lines exist specifically in areas where train connectivity is less expanded. When it comes to the bus network of the country, it varies depending on the region. Some of the companies that operate buses in are GVB, Connexxion and Breng, for example. It is important to note that, when using a

bus in The Netherlands, a “kilometre rate” is used, that is, the cost of the trip depends on the amount of kilometres the user does inside of the bus, in addition to the preestablished starting rate for using the bus service without considering the travel distance. To obtain the total cost, users need to both check-in on a trip and check-out when exiting the bus. Because of this, rates vary by province and are frequently dependent on the region, line, city, or time of the day. Finally, almost all of the bus stops of the country offer free bicycle parking within its premisses.

Regarding the subject of trains in The Netherlands, these are operated by the national Dutch company NS - *Nederlandse Spoorwegen*. This transportation method is mostly used in longer distance journeys between different urban areas. This vast and dense rail network, reaching a total of 394 railway stations all over the country, in addition to its punctuality, travelling within a 5-minute margin of the timetable 91,6% of the time, makes it preferable for residents over intercity buses (NS Nederlandse Spoorwegen, 2022, p. 31). This company is a significant part of the country’s investment in transport infrastructure, totalling over €450 million, in the year 2022, for its maintenance and expansion (NS Nederlandse Spoorwegen, 2022, p. 5). Additionally, there are also 960,000 train passengers in the country every single day (NS Nederlandse Spoorwegen, 2022, p. 5).

Despite all this, bicycle usage has a noteworthy role as the “connecting link” in multimodality. Van Ommeren, Ruffino, de Boer, & Buls refer to the importance of cycling for the country, as “The Netherlands is considered by many to be the “bicycle capital of the world” for its high level of bicycle use and its extensive and high-quality network of bicycle paths” (van Ommeren, Ruffino, de Boer, & Buls, 2017, p. 7). For example, trains and buses, through multimodal connections, are fully integrated in the extensive cycling infrastructure of the country, which includes the extensive bicycle parking in railway stations and bus stops, and through partnerships with a national bike rental scheme in railway stations, destined for travellers wishing to easily move within a city. Cycling therefore serves as a complement to public transit and its ally.

Particularly, cycling as an activity in this country is not regarded as a mere transportation method. It is a core element of the Dutch cultural identity. However, this aspect did not occur spontaneously in the country. In fact, it was specifically achieved as a result of a long process of activism and public financial investment, which resulted in cycling becoming integral to the country’s infrastructure, and consequently its culture. We can

therefore understand the bicycle in The Netherlands as a connecting tool, both in the abstract sense, as being part of the identity and culture of the country, with its heavy focus on sustainable mobility, and in the physical sense, as it is often utilized as a connector to other forms of transport, such as trains, buses, trams and the metro.

2.2 Historical and cultural background

The history of The Netherlands' connection with bicycle begins during the late 19th Century. The Dutch government, in 1899, instituted a luxury tax, but this levy was repealed in 1919 when the retail price of bicycles decreased drastically and bicycles could no longer be maintained as a luxury commodity (van Ommeren, Ruffino, de Boer, & Buls, 2017, pp. 9-10). Cycling during this period was primarily seen as a form of transport. It was rather popular in the country, and continued to grow in popularity until right after the Second World War, when it experienced a significant decline (Holligan, 2013; van Ommeren, Ruffino, de Boer, & Buls, 2017). In spite of that, although the Dutch cycling rate was relatively high during that period, it was also common in other European countries. The rate of cycling in a few other European cities was at similar levels to the rates of those in The Netherlands (Bruno, Dekker, & Lemos, 2021, p. 524).

A number of factors led to the high decline in popularity of cycling in other European countries, while its decline in The Netherlands was less intense. These were, for example, the emergence and popularization of other alternatives to cycling, in particular personal motor vehicles, the poor implementation of cycling in the new traffic regulations, the differences in cultural status of cycling, and the different impact of social movements throughout Europe during the mid-20th Century (Bruno, Dekker, & Lemos, 2021, p. 524). We will analyse each of these factors in the context of how the Netherland's history has evolved to make this country an example for cycling in the 21st Century.

The decline in popularity of bicycle usage coincided with the rapid growth of car use in The Netherlands, particularly after the 1960s, even if it was at a slower pace than other European countries. According to Bruno, Dekker & Lemos, "In 1960, The Netherlands had 45 cars per 1000 inhabitants, half that of Belgium (82) and Switzerland (89)" (Bruno, Dekker, & Lemos, 2021, p. 525). Nevertheless, car-centric infrastructure was beginning to occupy more public space, and car ownership rates continuously increased, until they reached its peak during the 1970s. The significant abandonment of the bicycle as a form

of transport, replaced by a sudden increase in car ownership, was also in part due to the country's abolishment of policies that established a maximum salary to its workers. This was a consequence of The Netherlands' fragile post-war economic situation. After the challenging economic circumstances were overcome and such policies were disbanded, the purchasing power of Dutch citizens increased drastically, which allowed them to more easily have financial access to cars (Oldenziel, Emanuel, de la Bruhèze, & Veraart, 2016).

However, it was not just an alteration in the way that people travelled between locations that led to an increase in the number of people abandoning cycling and replacing it with personal motor vehicles. Frame, Ardilla-Gomez & Chen (2017) were able to explain this phenomenon. Fundamentally, one can verify that the pattern of urban space development caused a shift in Dutch citizens' mobility during this period:

> In the 1960s, new high-rise residential areas were built 25-50 km away from city centers and commuting by car increased. […] Until the 1960s, passenger kilometres travelled by bicycle were still higher than those by car, but that position was reversed in the 1970s as a result of rapid motorization and suburbanization, and bicycle space reallocated to car use (Frame, Ardila-Gomez, & Chen, 2017, pp. 5049-50).

As such, we understand that it was the combination of the popularization of personal motor vehicles and the major differences in the urban planning strategy and execution in Dutch cities that created an environment that made cycling less reliable for its people. But above the aspect of reliability, the changes verified between the 1960s and 1970s also made cycling extremely unsafe, with a relatively large increase in the number of traffic injuries, particularly affecting children. Another consequence was the growth in pollution levels and in the land use for cars (Bruno, Dekker, & Lemos, 2021).

Nevertheless, as a response to these previously mentioned alterations to Dutch urban planning and society, through the increase in car ownership and its consequences, a new cultural movement emerged, attempting to combat this new reality, from the 1960s onwards (Bruno, Dekker, & Lemos, 2021). Residents in The Netherlands began to protest the mobility issues arising in the country. Noticeably, one specific factor that boosted the relevancy of these cultural movements was the surge in severe and fatally injured children involving car accidents. The number of children victims of cars almost doubled between the 1950s and the 1970s, from 278 to 460 (Bruno, Dekker, & Lemos, 2021).

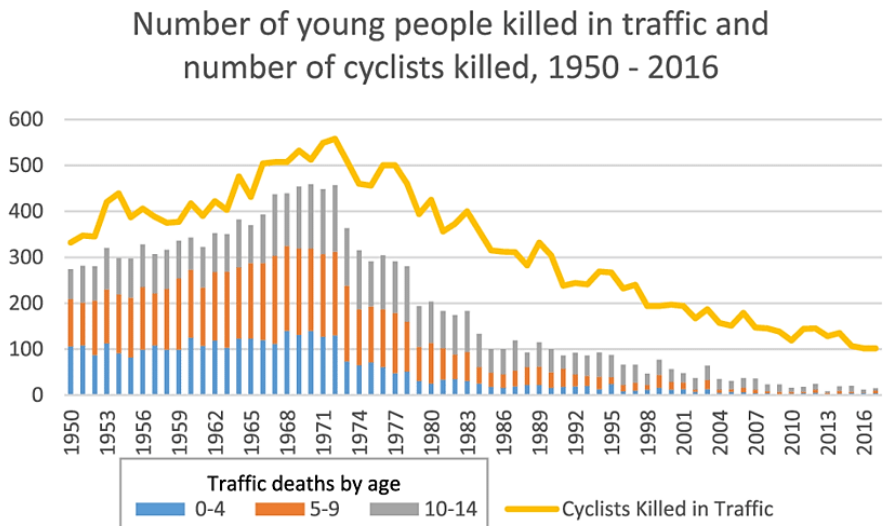

Figure 3- Number of young people and cyclists killed in traffic, between 1950-2016. Source: (Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV, 2019)

In short, the difficulties between the conjugation of public space between cars and bicycles meant that bicycles were very often sharing a limited space with motor vehicles. This particularly put bicycle riders in an unsafe, fragile position on the road, as their users' bodies were considerably more exposed to the environment compared to car riders. The resentment against cars by the population resulted in intense outcry by citizens, with such protest movements beginning to emerge during the 1960s. Some of these were the *Stop de Kindermoord* Movement, the Provo Movement, which went from 1965 to 1967, and the Kabouter movement, during the 1970s (Bruno, Dekker, & Lemos, 2021).

The *Stop de Kindermoord* movement, whose English translation can be literally interpreted as "Stop the Child-murdering", particularly focused on the previously mentioned increase in child and teenager victims of car accidents. The main goal of the movement was not directly aimed at improving cycling rates in the country, but instead it was aimed at reducing car ridership rates, especially in city centres, and discourage driving in shorter distances. Through this goal, the movement hoped to improve pedestrian and cyclist's road safety and quality (Bruno, Dekker, & Lemos, 2021).

The Provo movement heavily focused on the car traffic issues that were affecting The Netherlands during this time period. However, the movement did not originally start its protesting activities by promoting bicycles and opposing the emergence of cars. Instead, it had anarchist counterculture origins, which transferred to anti-car behaviour (O'Sullivan, 2022). This was particularly visible in the movement's "White Bicycle Plan", which provided a small number of bicycles painted in white for free use, with the goal of

promoting free and unlocked bicycle use for residents through a public offer system (O'Sullivan, 2022). The Kabouter movement, instead, wished to address the arising issues of air pollution, and also the huge amount of space that was being taken over in Dutch cities to support car-centric infrastructures (Bruno, Dekker, & Lemos, 2021).

2.2.1 Urban planning changes and their consequences in the 21st Century

The previously mentioned movements aimed at reducing car traffic, discouraging car journeys for short journeys, removing motor vehicles from the centre of urban spaces and improving air quality. This resulted in an increase of car-restricting policies and infrastructures, leading to a reprioritization of The Netherlands urban planning policy. Its focus shifted from expanding car infrastructure to promoting car-free city centres and improving the safety conditions of pedestrian infrastructure. Such goals could be accomplished by reducing vehicle speed with traffic-calming infrastructure and reducing the number of parking spots in urban and suburban areas (Bruno, Dekker, & Lemos, 2021). As stated by Bruno, Dekker & Lemos:

> Those advocating for more pedestrian and cyclist-friendly neighborhoods also recognized that their goal of shifting the balance away from car mobility could not be achieved if everyone could park directly outside of their home […] Having a bicycle immediately accessible and a car some distance from the house increased the bicycle's comparative efficiency (Bruno, Dekker, & Lemos, 2021, p. 527).

Bruno, Dekker & Lemos refer to the fact that urban planners acknowledged that pedestrian and cyclist-friendly spaces are only possible by discouraging driving as much as possible and by making driving a more inconvenient action than simply walking or cycling to a destination. This could be done by forcing a reduction in speed of the vehicles or even cutting off car-access to certain roads, in order to force a longer route on drivers. In other words, dissuading driving as much as possible in urban areas indirectly leads to an increase in bicycle ridership rates again.

There was also a significant increase in cycling infrastructure, particularly during and after the 1980s. The Netherlands Ministry of Traffic and Water Management developed the country's Bicycle Master Plan, which established funds of around €15 million for the expansion and construction of bicycle infrastructure in the country (Bruno, Dekker, & Lemos, 2021, p. 528). Frame, Ardilla- Gomez & Chen acknowledge this growth in

investment in the report *The kingdom of the bicycle: what Wuhan can learn from Amsterdam:* "In the late 1970s, the government realized that large-scale car use was unsustainable. Bicycle use began to slowly recover assisted by infrastructure investments […] toward bicycles" (Frame, Ardila-Gomez, & Chen, 2017, p. 5050). These investments were regarded as massively successful at the time, and led to a continuous expansion of their funds and scope in the subsequent decades.

Nevertheless, the biggest step that led to the large-scale increase in cycling was through the heavy effort done by The Netherlands' government to limit car access in urban centres. Notably, during the mid-1970s, some of the largest Dutch cities, such as Utrecht, Groningen and Enschede, approved legislation which severely limited car use in urban centres, with the country's capital, Amsterdam, also implementing limitations on car use in the late 1970s (Bruno, Dekker, & Lemos, 2021). Since then, all of the twenty largest cities of the country have established similar regulations meant to dissuade car use (Bruno, Dekker, & Lemos, 2021, p. 527). The previously mentioned idea that The Netherlands has accomplished in large part its sustainability goals through concrete measures against car use is summarized in the report "*Mobility protests in the Netherlands of the 1970s: Activism, innovation, and transitions":*

> [T]he history of cycle activism in the Netherlands suggests that creating cycling infrastructure is just part of the solution and that cars' restrictions were crucial for the outcomes because it made cycling more convenient than driving […] (Bruno, Dekker, & Lemos, 2021, p. 530)

In short, we can understand the strategy of The Netherlands as initially not specifically focused on directly pushing for bicycle mobility. Instead, the focus was on providing people with areas devoid of cars, for the safety of pedestrians and the improvement of air quality, traffic noise and congestion levels. The large-scale utilization of bicycles was therefore a consequence of the application of such policies, which saw their appeal increase with the reduction of car traffic in city centres (Bruno, Dekker, & Lemos, 2021).

Some scholars have begun dividing cycling integration, following a Dutch model, into two different types of measures. According to Van Ommeren, Ruffino, de Boer & Buls, we can distinguish between two concepts: hardware measures and software measures (van Ommeren, Ruffino, de Boer, & Buls, 2017). Hardware measures are physical measures, which include the various types of infrastructure, enticing and convenient routes and the bicycle user's safety. As such, bicycle infrastructure should strive to be

cohesive, direct, attractive, safe and comfortable (van Ommeren, Ruffino, de Boer, & Buls, 2017). Software measures instead focus on the prioritization of the "change perceptions, beliefs, and attitudes thereby motivating voluntary change in transportation choices" (van Ommeren, Ruffino, de Boer, & Buls, 2017, p. 33), achieved through sensibilization programs and education of all age groups. Van Ommeren, Ruffino, de Boer & Buls recognize that only through the combination of these types of measures can cycling become appealing to people in urban spaces and cities in countries wishing to transition to sustainable mobility. Improving cycling rates should consider the application of hardware and software measures as equally important for success.

When it comes to the creation of bicycle infrastructure, there are five parameters that help develop a successful biking city: planning, land use, policy, infrastructure and culture (Gunn, 2018, p. 10). When it comes to planning, the most successful cycling locations have established regional and national cycling plans, which has also been the Dutch strategy. For example, the *Meerjarenplan Fiets*, the City of Amsterdam's most recent cycling plan, addressed its long-term objectives for 2017–2022. A number of surveys, counts of bicycle parking spaces, and suggestions from the Dutch Cyclists' Union and Amsterdam inhabitants were used for the concept, which includes 53 improvements to riding in Amsterdam and it is anticipated to cost €50 million (Gunn, 2018, pp. 24-6).

Regarding land use, it refers to how urban planning is put into practice through the way the land of an urban area is utilized by citizens. Residents may go farther in shorter amounts of time in areas that are heavily inhabited and are mixed-use, that is, housing both residential and commercial areas in close proximity to each other. As a result, people are naturally encouraged to move within their neighbourhood in an urban area through walking and bicycling in order to visit friends and family or do their shopping at local commerce. In the concrete case of The Netherlands, planners wish to transition housing density from single-use construction to mixed-use, with more housing and green areas, in addition to restrictive measures, such as the prohibition of out-of-town shopping centres (Gunn, 2018, p. 26).

When it comes to policy, cycling is heavily influenced by policy changes at a national, regional and local level of government. Policy is also connected with the aspect of planning, as programs are planned by the responsible bodies and they are also dependent on established policy. This aspect is also heavily dependent on the amount of monetary funds available to enact such policies. In the case of The Netherlands, bicycle regulations

and special protections for children and elderly that use bicycles in the country are included in the country's nationwide bicycle planned policy (Gunn, 2018, pp. 26-7).

The discussion of the subject of infrastructure is also important, as this element is responsible for the creation of convenient bicycle routes and connections, parking for the bicycles, and how these integrate into other types of traffic. According to Amy Gunn, in the 2018 report "*Bicycle Planning in European Cities and Its Applicability to American Cities"*, the city of Amsterdam has been able to fully develop infrastructure that places the interests of cyclists at the forefront of priorities, with special requirements and standardized constructions:

> The bike network has as few intersections as possible, with priority given to cyclists at the necessary intersections. In addition, the average waiting time at traffic lights through an intersection are at most 30 seconds. Cyclists are also given priority in shopping streets. Bicycle lanes are mostly one-way paths [...]. (Gunn, 2018, p. 28)

Nowadays, cycling has been fully integrated into the landscape and society of The Netherlands, in great part due to measures such as those referenced previously by Gunn (2018). Its effects are present in the country not just through its designated red bicycle paths, which in the Dutch language are referred to as *fietspad*, but also through bicycle-exclusive streets, the *fietstraat*, and even bicycle highways, the *fietssnelweg*. Municipalities are, for the most part, responsible for the infrastructure of their region, with the Dutch government allocating roughly €410 million per year of direct spending to be split between municipalities for the construction of cycling infrastructure (Koolhof, 2013). This contributes to an expansive cycling network that is able to reach most of the country, and intracity and intercity bicycle connections are available in most urban areas.

However, it is not just at the macro level, through their interconnected networks, that The Netherlands has invested into its cycling infrastructure. The design of the streets themselves are meant to prioritize safety for pedestrians and cyclists above the convenience of car drivers (Bruno, Dekker, & Lemos, 2021), is, as previously mentioned, achieved by reducing the speeds of motor vehicles, in particular in residential areas. Some of the examples of car and pedestrian infrastructure that heavily influence people into feeling safer while cycling are: continuous sidewalks and raised crossings, which, rather than ending at the curb into the opposite side of the street, continue at the same height over streets, requiring automobiles to slow down; lane narrowing; speed bumps; or even alterations to the pavement material and appearance on the road, which encourages speed

reduction and cautious driving behaviour (Global Designing Cities Initiative, 2017). In short, cities that built bicycle-friendly infrastructure increased cyclist safety. This was done through measures such as giving precedence to cyclists in urban areas by lowering travel times and distances for bicycles, which proved to attract more cyclists. This was also especially visible in cities where there is no historic riding culture or interest in cycling (Koolhof, 2013).

Figure 4- An example of the integration of bicycle infrastructure within Dutch road traffic. The red paths on the floor represent the bicycle lanes. Source: (Andersen, 2019)

Finally, culture is also essential at promoting bicycle usage and making it safe to cycle for all residents. As Amy Gunn states: "Having a culture that promotes the car as the societal norm will also have residents who are less likely to bike. A pro-environmental culture will always produce more cyclists." (Gunn, 2018, p. 12). As such, we can understand bicycle culture as how integrated cycling is in the daily lives of citizens and the cultural and social promotion of cycling education. In the case of The Netherlands, cycling has been almost fully integrated into society, albeit with some exceptions, which we will discuss in the following chapter of this dissertation.

Overall, the educational aspect of cycling is crucial to understand how the country has been able to develop a social and societal link with cycling that is not just dependent on the sustainability of this transportation system. In spite of this, it is not just through the education of children that we see the social role of cycling. As we will now understand, cycling as an activity has also brought a lot of consequences into society as a whole,

through its role in socialization, community building and integration of different cultures into Dutch society. In short, bicycles are not mere sustainability tools; they can also be tools to bridge the gaps between different groups of people across all demographics and lead to the unity of an urban community.

2.2.2 Social consequences of cycling infrastructure

Besides the push for sustainable mobility through the previously mentioned measures, Dutch society was also heavily altered by its transition to car-free cities and prioritization of multimodal transportation systems. As such, these measures helped establish a society in which bicycles and cycling are normalized and perfectly integrated into Dutch culture. As Thijs Koolhof writes, referring to The Netherlands' societal connection to cycling, **"**To understand cycling culture is actually to understand culture. As Dutch cycling culture is a result of the relation between practice and the context in which it occurs." (Koolhof, 2013, p. 26). Indeed, the cycling culture of The Netherlands is, at this point, so ingrained in Dutch society as a whole, that it is practically synonymous with the definition of culture itself, carrying a variety of social consequences for the country.

One of the consequences for Dutch society derived from its policy in infrastructure, particularly the existence of a cycling culture, is reflected in children and teenagers and their level of independence. The heavy focus of the country on investing in the education of its younger generations to navigate the transport system has led The Netherlands to rank the highest in child well-being-outcomes (UNICEF, 2020). Additionally, 90% of children in the country report having high life satisfaction, besides having one of the lowest obesity rates in Europe (UNICEF, 2020, pp. 12-6). The normalization of cycling in this country begins from an early age, in primary school (Gunn, 2018), through mandatory teaching and examining of students at schools, through the designated *VVN Verkeersexamen*. Through this process, students are not just required to learn how to ride a bicycle, but also how to navigate a bicycle through various environments, such as through traffic or in dark conditions (Gunn, 2018). The fact that children and teenagers have access to bicycle infrastructure independently means that cycling is often a social activity between young students, and they often cycle together to and from their local school or extracurricular activities. This leads to a relative ease in children from The Netherlands at moving in urban areas in a completely independent way.

Continuing the exploration of how cycling influences younger generations, an often-overlooked consequence of this early exposure to the city is that they become more closely connected to their environment. This is visible if we compare children whose only perception of their own city landscape is from the back of a car, versus a child who has been able to physically navigate the streets of its urban area through walking or cycling. As Freeman and Tranter write: "Children do not gain […] sense of place from the back seat of a car: they may see more, but they learn less." (Freeman & Tranter, 2011, p. 183). Establishing a connection with the surrounding urban area is important for a child's development. This connection to the surrounding area plays a key role in helping the child solidify a social network within the community and forming a cultural attachment to physical and abstract elements of the community (Freeman & Tranter, 2011), such as the actual physical locations of a community and also its intangible values and practices. In other words, motor vehicle usage can potentially create barriers between children and elements of their own culture, making it more difficult for them to experience an authentic connection with their community. In The Netherlands, this is put into practice by prioritizing the tight relationship with its territory, through infrastructures that incentivize children and teenagers to explore their own communities alone or with their peers.

The existence of cycling inserted in a framework of community-building activities and closer proximity to others impacts other social elements, such as accessibility, social inclusion and equity, as riders are in close proximity to other riders bodily wise: "Cycling also offers high potential of being exposed to spatial and social diversity" (te Brömmelstroet, Nikolaeva, Morten, & Chan, 2017, p. 8). This way, it is possible to assert that cycling becomes a social and physical activity, which starts being nurtured from childhood and continues well into adulthood. Particularly, this concept of the transport as a unifying activity within urban areas has been presented in the 2017 report *"Traveling together alone and alone together".* In this report, we see that even the way the bicycles in The Netherlands are shaped allows for the facilitation in interactions with others during the process of mobility for leisure or for transit:

> Differences in cycling postures and physical requirements naturally influence the potential for social and spatial interaction. Up-right bicycles ("Dutch style") where the rider sits at a 90-degree angle offer the highest sensory potential. Upright cycling allows the user to continually scan at human eye level and a great distance in front of him and generally encourages a moderate pace […]. In this posture, it is easy to make eye contact with other road users,

> to recognise faces, read advertisements, have a conversation and even window shop (te Brömmelstroet, Nikolaeva, Morten, & Chan, 2017, p. 8).

As such, the country's success in their infrastructure can be regarded as a manifestation of the country's high social trust at an interpersonal level. High social trust can be defined as an elevated level of trust on both public institutions and the local community. Tamara Krawchenko writes on *Social trust: An invisible glue for better urban planning* that "Th[e] culture of social trust and collaboration has enabled Amsterdam to adopt more flexible approaches to land-use planning" (Krawchenko, 2020, p. 2). The social trust element of the country can express itself in more outwardly ways, such as the previously mentioned "polder model". It can also be more subtle, as in the way it affects the interpersonal relationships between residents of The Netherlands.

The Netherlands' culture of consensus-based practices translates itself into interpersonal practices, whether at a workplace or a family setting, leading to a closeness between parties towards a common goal (Hofstede, Hofstede, & Minkov, 2010). The strong social trust fosters a sense of safety and mutual respect, which extends to public places, such as bike paths and pedestrian areas. Social trust is what gives bikers the confidence that others will follow traffic regulations and fosters common understanding, which allows for seamless interactions between bicycles, pedestrians, and automobiles (Bruno, Dekker, & Lemos, 2021). To the same degree, the bicycle is seen as an equitable and accessible mode of transportation for people of all socioeconomic backgrounds, occupations, or ages. This fosters a sense of unity and improves social trust as well, by breaking down social barriers and building connections between individuals from various backgrounds.

Nevertheless, in practice, The Netherlands has successfully allowed for cycling to become appealing to almost every single demographic group. A quarter of the country's trips are done by cycling and "[f]or distances up to seven and a half kilometre the bike is the most popular mode of transport" (Koolhof, 2013, p. 32). Although they are more commonly utilized by teenagers and young adults for shorter trips - with utilization rates of 66% and 46% for both these demographic groups respectively - it is still also used by the country's elderly population at a significant rate, having a 27% share in short-distance trips (Koolhof, 2013). Additionally, within the country "[t]he bicycle is most used for daily purposes: going to school, work, supermarket or friends. Use for recreation and sports is considerably lower." (Koolhof, 2013, p. 27). On an average working day, approximately five million people use bicycles for approximately fourteen million trips,

with the busiest hour on Dutch bicycle paths occurring between eight and nine in the morning, when 1.75 million trips are made on average in the country (Koolhof, 2013).

Despite this, even The Netherlands, a country known for its dedicated infrastructure to cycling, has seen some obstacles when it comes to the total adoption of cycling by all members of a community. Part of that is due to cultural differences of immigrant groups residing in this country or even people with lower levels of education and financial resources. Social issues are an important factor to consider when planning out campaigns and infrastructure that promotes cycling, as some social groups are more resistant to its adoption. According to researcher Thijs Koolhof, in the study "Does One's Origin Affect One's Bicycle Use?", which analysed the cycling rates of immigrant communities residing in The Netherlands, it was observed that immigrant's cycling rates were heavily influenced by their own country of origin's cultural perceptions towards bicycles and their usage, rather than their actual application in The Netherlands (Koolhof, 2013). Particularly, Turks, Surinamese and Moroccans immigrants are shown to have lower rates of adoption of the bicycle, compared to native Dutch citizens or immigrants from other European and Asian countries. In other words, even though the cycling network of the country is one of the most convenient and accessible for users and its policy is designed to be protective of cyclists and pedestrian interests, for some immigrant communities these aspects are not enough to persuade them into cycling. Koolhof refers to the importance of the cultural perception of cycling for its adoption by analysing the Moroccan immigrant's perception of cycling:

> [C]ulture might be an explanation for the differences in bicycle use. Some perceive the bicycle as a mode of transport for the poor and are therefore ashamed to cycle. But maybe more important are traditional attitudes on male and female relations that cause differences in cycling. These attitudes make that Moroccan women do not often go out, and when going out they are not allowed to cycle. (Koolhof, 2013, p. 31)

According to Koolhof, the cultural background of a person plays an important role in their cycling adoption rates. Consequently, second-generation immigrants have higher cycling rates than first-generation immigrants, and the gap between generations is much higher in immigrant communities where cycling is uncommon or unfavourable, such as those from South American and African countries (Koolhof, 2013) This shows that, even when infrastructure exists that actively encourages cycling, social and cultural barriers pose challenges to equally include everyone. Notably, the cycling rates of women from non-

Western countries in The Netherlands are even lower than those of men from non-Western countries. These women typically favour the country's public transportation system due to different cultural perceptions of women cycling, not knowing how to ride a bicycle and a fear or cycling (Koolhof, 2013).The Dutch government and Dutch cyclist's organizations have made significant investments in projects that focus on promoting cycling to immigrant communities residing in the country. Both of these parties go as far as to consider that barriers to the adoption of cycling are also barriers towards the integration in the country itself. Such projects aim at providing cycling lessons for Dutch non-natives in designated cycling schools and marketing campaigns to encourage cycling in their daily activities (Koolhof, 2013), particularly targeting non-Western women.

The discrepancy between the adoption of cycling in The Netherlands by Dutch natives and immigrant communities allow us see that the acceptance and adoption of cycling by residents is not exclusively dependent on existing cycling infrastructure. Although it helps some people transition to this form of sustainable transport, the perception that the community has towards cycling plays a crucial role in its proper integration in urban areas. As such, cities wishing to transition towards cycling as a sustainable transport and develop their own cycling culture need to consider this role and adapt their strategy to make cycling appealing for people through sensibilization campaigns, marketing and efforts to change people's perception of this transport (Koolhof, 2013). Additionally, we can attribute much of the Netherland's success in integrating cycling in people's daily lives not just to its expansive infrastructure and cycling network, but also to the people's reception to cycling and culturally liberal values.

Cycling is therefore not just a mode of transportation in The Netherlands, but also a way of life. The Dutch government and municipalities convey their interest in the well-being of their population by focusing on safe and efficient bicycle routes, which helps preserving confidence between the government and its people. However, this transport is not just important for the country's culture at an interpersonal level; much of the country's economy has been built around sustainability, in particular through cycling infrastructure and businesses and local commerce related to bicycles. The next part of this dissertation will focus on presenting the economic benefits experienced by The Netherlands from their investment in this cultural product.

2.3 Business and economic impact of bicycles for the Dutch society

Bicycles and cycling have had a significant impact on the economic development of The Netherlands. Notably, the country's cycling culture has made it appealing to both residents and tourists, particularly in the way the Dutch approach the subject of sustainable mobility. The Netherlands' infrastructure and urban planning are the result of many investments and a manifestation of the reclamation of urban areas by the people who frequent them daily. This had consequences in five important sectors: tourism, local commerce and services, industries and manufacturing activities, healthcare, and transportation (Yanocha & Mawdsley, 2022). It is also relevant to discuss and compare the costs of bicycle infrastructure for the Dutch government, in comparison to other forms of transport, particularly to fuel-based motor vehicles. In short, every part of the decision-making process, in the way the population decides to mobilize itself within an urban area, has a net gain and a net loss for the country as a whole, whether it is economically or socially. This means that the government's decisions to incentivize cycling will have a net result different from the encouragement of personal motor vehicles, for example.

Expanded infrastructure for cycling and bicycle access fosters new business opportunities, such as bicycle tourism. This has been especially noticeable in the case of The Netherlands, whose touristic appeal and cultural branding relies heavily on the country's bicycle infrastructure and the symbolic imagery of the "bicycle" associated to the country's identity. Souvenirs in the country's touristic gift shops representing bicycles (such as fridge magnets, tote bags, mugs, and clothing apparel) are sold commonly to visitors. But besides the retail products sold at merchandise stores, The Netherlands has successfully implemented a new type of touristic activity in their own territory: bicycle tours. Bicycle tours are an opportunity for visitors to explore many of the country's cities with a guide by bicycle, utilizing the cycling infrastructure to navigate intracity and intercity areas through multiple-day journeys. These have been extremely successful with tourists, as they allow for a more personal experience within the targeted travel destinations, following an itinerary that is not limited by the car accessibility of a given location.

Regarding the connection between culture, cycling, and the tourism sector, the Dutch government and stakeholders promote the idea of infrastructure as being inherently linked with the country's cultural sector. The cultural sector is extremely important for the

country, as "[i]n The Netherlands, culture is explicitly considered to be a factor of social and economic development." (Russo & van der Borg, 2010, p. 675). In other words, the access to culture is regarded as an important indicator that the country is successful, both economically and socially. The Dutch government, in collaboration with other interest groups, understands the significant value of cultural initiatives, creative industries and heritage in establishing the nation's identity. In fact, the Dutch have indirectly used mobility as a way to promote cultural development in the entire country. This was done by utilizing the country's bicycle infrastructure, for example, as a way to move people to developing areas with cultural potential that are investing in culture-related infrastructure. In other words, cultural development is being fostered through the way that citizens and tourists are transiting throughout the country and being allocated to different cultural points of interest. This means, that culturally speaking, there are more practices and products being promoted and invested in. Due to the country's multimodal approach to transportation with a heavy focus on bicycle infrastructure, these products are more easily accessible to a wider number of people. Russo & van der Borg refer to this process in their report *An Urban Policy Framework for Culture-oriented Economic Development: Lessons from the Netherlands*:

> […] new user groups characterized by increasing degrees of mobility, such as the younger generation of highly skilled workers, tourists, and business travelers, are lured into the city. At the same time, new cultural infrastructure and programs are used to change the spatial focus of development efforts. These include easing tourist pressure away from congested historical centers and dispersing visitors to more peripheral districts in need of revitalization [..] (Russo & van der Borg, 2010, p. 670)

According to Blondiau, van Zeebroeck & Haubold, one of the economic benefits of cycling is the fact that cyclists are overall better for the local economy of stores, local city centres and services (Blondiau, van Zeebroeck, & Haubold, 2016, p. 2311). Studies in both European cities and American cities have shown that the increased presence of cyclist infrastructure within cities leads to an increase in local retail sales (Blondiau, van Zeebroeck, & Haubold, 2016). Cyclists and non-motorized clients are more loyal towards local stores than motorized clients (FUBicy, 2003). While cyclists and non-motorized spend less on average on a trip to a local store, they also visit their local store more frequently than motorized clients (FUBicy, 2003). Customers who shop by bike currently contribute for more than €111 billion in consumption in the European Union. If cycling's modal share in the EU was doubled, local shops' retail turnover would increase by more

than €27 billion (Blondiau, van Zeebroeck, & Haubold, 2016). The Netherlands corresponds to €16.4 billion of the current volume of shopping by bike in the European Union, the second highest volume in the Union. However, when we consider these values per capita, The Netherlands become the highest volume of shopping done by bicycle. Bicycles are utilized by Dutch people to do their shopping in their local city centres or even to purchase groceries. Consequently, Dutch residents typically do their supermarket shopping multiple times a week, between two to four times weekly, a frequency slightly higher than other European countries (van Gelder, 2022).

Bicycle usage and its infrastructure can also be useful for a business logistics plan, more specifically for companies which need their goods delivered to them or do deliveries on their customers' residences. Cargo bicycles are very common in The Netherlands as a more environmentally sustainable and cheaper alternative to trucks and vans (Yanocha & Mawdsley, 2022). Known in the country by the Dutch name *bakfiets*, these are often used by private and public companies that focus on deliveries to other businesses or residential areas. They are used, for example, by food delivery services and restaurants, by the country's Post Office services to deliver mail, for grocery shopping or the transportation of tools and cargo. These types of bicycles are often electrically powered, to facilitate the transport of heavier goods.

When it comes to the country's manufacturing sector, bicycles have played a significant role in the country's economy. The Netherlands is the third highest in bicycle export value in the world and the highest in Europe, with a total market share of 9% in exportations (Yanocha & Mawdsley, 2022). This represents a combined value of €700 million in exports for the Netherlands. According to data by the Government of The Netherlands, "bicycle manufacturing, sales, maintenance and rental together account for 13.000 fulltime jobs in The Netherlands, divided over more than 3.350 companies" (Government of the Netherlands, 2022). Furthermore, employment creation in the cycling industry exceeds that of other forms of transportation, particularly in the manufacturing sector, where the process is less reliant on automation (Blondiau, van Zeebroeck, & Haubold, 2016, p. 2310).

Cycling as an activity has also consequences on The Netherlands healthcare system. Particularly, cycling infrastructure contributes significantly to public health by encouraging moderate daily physical activity and lowering premature mortality among cyclists (Yanocha & Mawdsley, 2022). In The Netherlands, it is estimated that 6.500

deaths were prevented because of the time spent cycling by Dutch adults (Fishman, Schepers, & Kamphuis, 2015), but it particularly contributed to the reduction in mortality rates of adults between the 65 to 70 age range (Fishman, Schepers, & Kamphuis, 2015). The prevention of deaths, the increase in life expectancy and the improved quality of life of Dutch residents who frequently engage in cycling activities, translates into reduced costs in healthcare for Dutch citizens and the Dutch government. The economic health benefits directly connected to cycling are estimated at €19 billion per year (Fishman, Schepers, & Kamphuis, 2015). Fishman, Schepers & Kamphuis (2015), when analysing The Netherlands' association between cycling and its consequences for the healthcare sector, refer to the country's high investment in safe cycling infrastructure as particularly benefitting the more elderly population of the country:

> […] infrastructure and safety measures are important to facilitate cycling. For instance, elderly, the group among whom the largest health and economic benefits can be achieved, indicated a preference for separate bicycle paths. The Dutch case shows that investments in bicycle-promoting policies would likely yield a high cost–benefit ratio in the long term. (Fishman, Schepers, & Kamphuis, 2015, p. 93)

Finally, the transportation sector in The Netherlands has experienced some benefits from the constant expansion of the bicycle infrastructure and the investments made in this form of sustainable transport. Parking garages, surface parking lots, signals, and other car-specific infrastructure involve high development and maintenance expenses, as well as social costs such as intense urbanization. The construction and upkeep of car infrastructure is much more expensive for governments and local municipalities than its bicycle infrastructure equivalent. While The Netherlands Government invests €500 million per year on bicycle infrastructure, in turn, this investment delivers a total of €19 billion in health benefits alone (Fishman, Schepers, & Kamphuis, 2015). As such, the return in investment of this transport is thirty-eight times higher than its spending. For example, in The Netherlands, the average cost in €/1000 price per kilometre of passenger car infrastructure was €37,94, trains infrastructure was €195,83 and bicycle infrastructure was €11,38 (Vanpée & Van Zeebroeck, 2022, pp. 41-2), the latter being the cheapest and most sustainable option for transport.

To summarize, bicycle infrastructure can result in positive consequences in many important economic sectors. When considering all the factors previously mentioned, in the case of cycling in The Netherlands, every individual bicycle user in the country is

generating a net benefit of €0,89€ to the country's economy, while each personal motor vehicle user is responsible for a net cost of €1,04 (Vanpée & Van Zeebroeck, 2022, p. 55). Furthermore, it is important to note the role that the adoption of this type of sustainable transport has on the creation of jobs in a multitude of sectors, such as tourism, manufacturing and small local businesses. This means that, at a macro level, cycling can be important in an economic sense because it leads to lower governmental expenses on transportation infrastructure and healthcare and generates revenue at the tourism and business level. However, the role of cycling at an individual level is also important, as bicycles are an affordable way of transport which has the potential to directly reduce household costs in transportation for low-income families. A dependency on the motor vehicle infrastructure leads to low-income families having to afford a substantial amount in the purchase and maintenance of a motor vehicle, in addition to the high volatility of fuel costs, due to the reduction in the petroleum available in the market (Vanpée & Van Zeebroeck, 2022). As Vanpée & Van Zeebroeck write:

> Our analysis of the total costs of ownership showed that cycling is the most affordable transport mode. Once purchased, riding a bicycle is free of any charge and maintenance costs are minimal. So the more the bicycle is used, the lower the total cost of ownership. Therefore, cycling can be an important tool to combat mobility poverty. (Vanpée & Van Zeebroeck, 2022, p. 93)

The Netherlands has successfully integrated cycling into their identity and culture, so much so that it has become an indirect symbol of the country, utilized as imagery that represents the country's values and goals. And while the adoption of cycling is not unanimous by all those residing in the Netherland's urban areas, the country nevertheless financially and socially invests in programs and infrastructure that strives to attract more people to perform their daily activities and socialize with their communities through this form of transport.

Due to the pressures put on humanity as a result of the Global Climate Crisis, countries who do not have the same historical and cultural connection are seeing this sustainable transport as a possible alternative to fuel-based motor vehicles, particularly in shorter distances. One of these countries is Portugal, which has slowly begun to devote more funds to bicycle infrastructure, particularly in urban areas. But what is the cycling scenario that Portugal is currently experiencing in its urban areas? What sort of programmes are being created in Portugal that promote sustainable mobility? And does

Portugal have the potential of integrating cycling into its culture, similarly to The Netherlands? In the next chapter, we will explore these topics in an in-depth way, focusing on the past and current role of cycling in Portugal.

In order to go into further detail about the urban planning, sustainable mobility and the circumstance of cycling in Portugal, it is first important to provide some context on the country's main characteristics, such as geographical aspects, political system or even its primary demographics. As such, the first part of this chapter will focus on developing these topics, before proceeding to the eventual presentation of the past and current cycling paradigms in Portugal.

Portugal is a European country located on the utmost south-western part of the continent, sharing its border with Spain. Its capital is the city of Lisbon, located on the centre of the country, close to the Atlantic Ocean. The official language of Portugal is Portuguese and it is spoken on the entirety of continental Portugal, in addition to both the Autonomous Regions of Madeira and Azores, which all combined constitute the Republic of Portugal. The country itself has a population of 10.4 million. (INE - Statistics Portugal, 2023).

When it comes Portugal's political system, the country is considered a semi-presidential constitutional democratic republic. This means that Portugal has two head of states; the President of the Republic, who has non-executive power but possesses certain limited powers, and the Prime Minister, who is the main head of state and exercises the country's executive power, integrated in the country's Government, along with the other ministers. Finally, the Legislative power is primarily vested in the Assembly of the Republic, elected by popular vote (Assembleia da República, 2010). The powers of each element of the Portuguese political system are dictated by its constitution, drafted in 1976, two years after the country's 1974 Revolution, which dismantled the previous dictatorial regime.

In terms of the country's geography, Portugal possesses a wide variety of terrain and features. Unlike The Netherlands, which is almost exclusively associated with flat, low altitude lands, Portugal's geographical features vary greatly within its 92.212 Km^2 of total area (Lusa News Agency, 2012). The extensive coastline of Portugal is filled with steep cliffs, beaches and coves. In addition to these, the nation features tall mountains, particularly in the more inland north and centre part of the country, with the highest of them being the Serra da Estrela, in the centre of the country. Furthermore, the country has vast plains and plateaus, more commonly associated with the southern landscape of the Alentejo region. Nevertheless, it is important to note the topography of the country's two largest cities, Lisbon and Porto, as both of these insert themselves geographically as in close proximity to river systems, the Tagus and Douro River respectively. Because of

this, both of these cities are marked as being relatively hilly, especially in the areas directly next to the rivers.

The geographical conditions of Portugal, such as its extensive coast and warm climate with Mediterranean influence, mean that Portugal is also in an extremely vulnerable place to the consequences provoked by the Global Climate Crisis. According to Schleussner, Menke, Theokritoff, van Maanen, & Lanson (2020), while the impacts of the climate crisis are already causing changes on the Portuguese climate and its likelihood of experiencing extreme natural phenomenons, there is an expected tendency for these to become more frequent and destructive:

> Severe heatwaves, storms and droughts have already affected Portugal and will continue to do so, with increasing frequency and intensity. […] Wildfires are, furthermore, occurring more frequently and on a greater scale than originally expected. Relative to other Mediterranean countries, Portugal is the country which has suffered by far the most from forest fires: during the last 30 years, 35% of the region's fire incidents and 39% of the area affected each year were located in Portugal. (Schleussner, Menke, Theokritoff, van Maanen, & Lanson, 2020, p. 2)

David R. Boyd, an internationally recognized United Nations Special Rapporteur on human rights and the environment, described the fragile environmental position of Portugal. Boyd especially notes the country's high air pollution rates, particularly in the country's urban areas, as especially concerning for the population. Boyd references that, in 2019, Portugal had, on average, an annual concentration of fine particles of 8,2 micrograms per cubic meter, which corresponds to almost double of the 5 micrograms per cubic meter recommended by the World Health Organization (Boyd, 2022, p. 6). High rates of these fine particles are linked with increased rates of respiratory illnesses, lung cancer and cardiovascular diseases. Boyd also references that, in 2020, there were 2.410 premature deaths in Portugal caused by high levels of air pollution (Boyd, 2022, p. 6).

When it comes to the country's economic conditions and characteristics, Portugal is regarded as relatively strong economically at a global scale, albeit if its economic situation can be rather delicate. The country's Nominal Gross Domestic Product, representing the entire monetary or market worth of a country's finished goods and services, which allows us to understand the level of economic progress of a given country and economically compare it to other countries in the international market trade, places Portugal in the 18th position at a European level and the 51st position at a global level (International Monetary Fund, 2023). While the Portuguese economy has continued to

grow and expand since the opening of the country to international markets in the aftermath of the 1974 Revolution, the country has faced severe economic issues, more notably in the aftermath of the 2009 Eurozone debt crisis. This resulted in the reduction of government expenditure, through government-sponsored economic austerity, to minimize the budget deficit of the country (Pedroso, 2014). Nevertheless, Portugal's current economic situation, while it has improved substantially since the 2009 Eurozone crisis, with a relatively stable decrease of the unemployment rate since 2013 (International Monetary Fund, 2023) and an increase of the country's Gross Domestic Product within the last decade (International Monetary Fund, 2023), it is still rather fragile. This is in large part due to the continuous accumulation of debt by the Portuguese government, poor management of funds and a rather lacklustre economic dynamism and entrepreneurship by governmental bodies and national corporations (International Monetary Fund, 2023). In other words, Portugal has the potential to become even more economically relevant and stable if the available resources are allocated more efficiently (Pedroso, 2014), and in ways that improve the quality of life of its citizens even further. According to 2019 numbers from the report The Productivity of the Portuguese Economy, by the National Productivity Board, the Portuguese Productivity rates have been consistently "sluggish" (National Productivity Board, 2019, p. 7), in comparison with other European countries. One of the reported reasons for that stagnation of Portuguese competitiveness is the quality of its infrastructures (National Productivity Board, 2019, p. 47). The transportation sector in particular is referenced as a direct link to the country's issues with productivity and economic expansion. This affects both local businesses and the national market and larger corporations with an international reach, particularly those from the manufacturing, commerce and service sectors (National Productivity Board, 2019).

Nevertheless, some important advancements have been made to improve Portugal's delicate economic situation, particularly in the environmental field, with the production of sustainable energy from renewable sources. According to numbers by the Portuguese General Directorate of Energy and Geology, 60% of the electricity produced in Portugal comes from renewable sources, the majority being from hydro and wind infrastructure (Direção-Geral de Energia e Geologia, 2023). This may help Portugal be at the forefront of new business opportunities and become a source of investment in the expansion of sustainability as a source of economic potential. According to the 2022 EY Attractiveness Survey Portugal, which analyses the business potential and attractiveness of Portugal

across multiple economic sectors, Portugal has the potential of capitalizing on sustainable practices by being on the forefront of their application:

> The overall perception of Portugal being a leader in environmental sustainability has grown from 2021, with more than 65% of investors believing the country is performing similarly or better than the European average. In a world where environmental sustainability represents a growing role in the mind of customers, politicians and business leaders, capitalizing on a good environmental reputation will foster a competitive position for investment attraction. (EY, 2022, p. 48)

Additionally, the country's recent explosion in tourism popularity has made Portugal one of the most popular travel destinations in the world, corresponding to €22 billion in revenue from just this sector alone (PORTUGAL.GOV.PT, 2023). As such, the cultural attractiveness of Portugal and the development of economic activities that allow for the exploration of these elements has great economic potential for the country, as this sector alone is responsible for 18% of the country's Gross Domestic Product (Ferrão, 2023). Because of this, Portugal continues to invest in activities that enhance the cultural sector and the tourism sector.

Regarding its demographic characteristics, Portugal has a population of around 10.4 million people. However, compared to a country such as The Netherlands, the Portuguese population is more ethnically homogenous. According to number from the 2021 Portuguese Population Census, foreign citizens represent 5,4% of the country's population, corresponding to an increase of 555.299 people between the years of 2011 and 2021 (Esteves, 2021). This number depicts an increase of 40% during this 10-year period. When analysing the largest foreign demographic residing in the country, 27,8% of Portugal's immigrants from Brazil, meaning that a quarter of all non-native Portuguese residents are from this country (SEF/GEPF, 2020, p. 21). Other significant immigrant groups in the country are those from the United Kingdom, Cape Verde, Romania and Ukraine (SEF/GEPF, 2020, p. 21). Additionally, the foreign population is concentrated mostly on the country's coast, with 68% recorded in the districts of Lisbon, Faro, and Setúbal (SEF/GEPF, 2020, pp. 23-4). While Portugal still remains fairly homogenous, the recent increase in the country's immigrant population means that there has been a cultural broadening, which has transformed Portugal into a "melting pot" of sorts. That is, the assimilation and mixing of different demographic aspects in which peoples, cultures, or individuals combine into one entity, limited within a geographic space.

Considering what has been presented thus far related to Portugal's economic development and demographical alterations, the country's urban areas have become more attractive to people from both rural areas within Portugal and foreign countries. Portugal's urban areas have increased in popularity with an abundance of people, particularly tourists, immigrants, digital nomads and remote workers. These cities have characteristics which add to their attractiveness, notably in the Metropolitan regions of Lisbon, Porto, and Faro, which have had striking economic growth and development through the creation of numerous job possibilities in industries such as technology, tourism, finance, and services (EY, 2022, pp. 22-33). Furthermore, incentives to enhance infrastructure and digital connections have made Portugal an attractive location for remote workers (EY, 2022, pp. 17-23). Cities provide reliable internet access, co-working spaces, and amenities tailored to workers' requirements.

Following this in-depth exploration of the country's geographical, demographic, and economic aspects, we are now able to see Portugal as a nation with a few financial challenges, but that also benefits from an appealing environment and cultural components which have contributed to the improvement of its historically fragile economy. However, as we will soon understand, Portugal has more recently started making significant investments in its mobility infrastructure, as a way of increasing the economic potential within its territory and facilitate the movement of an increasingly large number of people. In other words, Portugal, and in particular Portuguese urban areas, have become more economically and culturally attractive to tourists and immigrants and this has led to an increase in pressure on the country's transportation infrastructure, which is now being addressed by an incentive on multimodal transport and alternatives to personal motor vehicles.

3.1 Sustainable mobility and urban planning in Portugal

The importance given to sustainability and sustainable practices in Portugal has been steadily increasing, particularly in the last two decades. However, these two elements have only played a more prominent role in civil and political discourse within the last decade.

When analysing Portugal's current urban planning situation, it is crucial to also understand the country's evolution when it comes to urban policy. Manuel Leal da Costa

Lobo, one of Portugal's most renowned urbanists, who was responsible for substantial developments on the Portuguese urban planning sector and was a Professor of Urban Planning in the Civil Engineering Department of the University of Coimbra, wrote extensively about the historical evolution of the urban policy and urban planning of Portuguese cities.

According to Manuel Leal da Costa Lobo, Portugal's urban planning policy started during the 1930s, with the creation of the Commission for the Supervision of Aero-photogrammetric Surveys. This Commission sought to obtain more topographic data about the country, in order to have more information about its land surfaces, for the purpose facilitating new constructions (Costa Lobo, 2011, p. 6).

A generalized approach to urban planning evolved in the 1940s. In 1944, the General Directorate of Urbanization Services was first established, which included an Urbanization Studies Department (Costa Lobo, 2011, p. 6). Nevertheless, during the 1960s, Portuguese urban planning was heavily shaped by the non-application of the then-existing urban policies in place, due to the "explosion of allotments and so-called "clandestine" constructions" (Costa Lobo, 2011, p. 7). This translates to a growth in the number of new developments built illegally and disregarding terrain conditions or how these integrated into the urban landscape of the time. This, according to Costa Lobo, made the Portuguese urban planning situation "very confusing" (Costa Lobo, 2011, p. 7) and, as such, governments tried to address the ever-growing uncontrolled urban developments through an assortment of measures. While some governments attempted to mitigate clandestine developments by facilitating their legalization, other subsequent governments reinforced the municipalities' responsibility for their local communities (Costa Lobo, 2011). This sought to provide local communities with a more direct intervention by the local political power, instead of relying on the central government's directions and it was put into place in the aftermath of the Carnation Revolution. However, such policies, which were designated as *Municipal Master Plans* – in Portuguese these were the "Planos Diretores Municipais" - proved to be unsuccessful at eradicating such clandestine developments, and these continued to exist well into the 1990s (Costa Lobo, 2011).

Despite this, according to Costa Lobo, in the 1990s, the country made a significant shift with the emergence of more pressing environmental issues (Costa Lobo, 2011). In other words, it was during this time that sustainability began to more directly integrate

Portugal's urban planning policy, through the application of strategies towards sustainability and environmental standards in new constructions. In addition, there was an increased effort in analysing and implementing sustainability in new public and private developments (Costa Lobo, 2011, p. 8).

All things considered, significant progress has been made to establish territorial and regional planning in conjunction with municipal planning (Costa Lobo, 2011). However, as stated by Costa Lobo, more could be done to further develop the urban planning scene in Portugal. In his 2011 essay *Planeamento Urbanístico em Portugal* (Urban Planning in Portugal), Costa Lobo writes about what should currently be the focus of urbanists in Portugal, in order to create cohesive and attractive urban spaces:

> [U]rban planning is increasingly being asked to integrate environmental and ecological fields, the law, [...] (aiming at an administration process based on the public interest and the participation of citizens) and the permanent organisation of the urban planning process (comprising the awareness of problems, the structuring of sustainable solutions [...]). (Costa Lobo, 2011, p. 15)[4]

According to Costa Lobo, Portuguese urban planning should directly target the environmental and civil needs of its citizens. Notably, there needs to be a higher level of involvement of citizens into the decisions made about urban areas, in order to develop spaces that have social, economic or cultural value to local communities.

While Portugal has not yet reached the point of fully integrating sustainability into its entire *modus operandi*, it has successfully begun the process of making investments in sustainable practices, particularly within urban settings. Nevertheless, the steps that the country has taken towards sustainability have presented sufficient results that have turned Portugal into a country with great economic potential in the sustainability sector at the eyes of financial investors. According to the 2022 EY Attractiveness Survey Portugal:

> The policy approach to climate change and sustainability are factors of attractiveness for 67,5% of investors surveyed. This represents a growth of 13.5 p.p. compared to 2021. Portugal has demonstrated a strong commitment to renewable energies and circular production processes. (EY, 2022, p. 17)

[4] [O] planeamento urbanístico é pedido, cada vez mais, que integre os domínios ambientais e ecológicos, o direito, [...] (visando um processo de administração alicerçado no interesse público e a participação dos cidadãos) e a orgânica permanente do processo urbanístico (compreendendo a consciencialização dos problemas, a estruturação das soluções sustentáveis [...]). (Costa Lobo, 2011, p. 15), Translation by the author

As such, from the previous citation, we can understand Portugal as a country with a not-yet fully explored capacity to become a nation of reference in sustainability, achieved through the financing of projects in this sector. Significant investments made by both private businesses and corporations, as well as local or national government agencies, have the ability to promote an entrepreneurial attitude even further. These have the ability to stimulate economic activities, such as those in the cultural sector, making Portugal more appealing to national and international talent and financiers, while also contributing to enhancing the quality of life of local residents by providing the social, environmental, and economic benefits mentioned previously in this work. The 2022 EY Attractiveness Survey Portugal mentions this necessity to increase its efforts towards sustainability:

> Portugal is committed to the transition to a more environmentally friendly world but, for investors, there is room for more ambition […]. It is essential to promote an environmentally sustainable awareness in civil society and in the business context. (EY, 2022, p. 51)

Nevertheless, as it has been mentioned, Portugal still has the ability to increase its investment in sustainability, more specifically sustainable mobility within urban centres. There has also been some positive evolution when it comes to the development of infrastructure, initiatives and programmes whose main goal is to foster a positive environment for the utilization of soft transportation methods. Indeed, Portugal has seen some positive development in sustainability investments, in both infrastructure and initiatives, particularly during the 2010s. On the 2nd of August 2019, the Portuguese Council of Ministers approved the establishment of the National Strategy for Active Cycling Mobility, in place for the years 2020 until 2030 (Presidency of the Council of Ministers, 2019). According to the official gazette from the Resolution of the Council of Ministers No. 131/2019, which established the country's National Strategy for Active Cycling Mobility 2020-2030,

> [t]he implementation of this strategy will put Portugal at the same level as other countries where this practice is already in place, allowing the maximisation of health benefits for the population, removing cars from the streets, returning public space, relieving urban congestion, lowering noise levels and reducing atmospheric pollution. (Presidency of the Council of Ministers, 2019, p. 47)[5]

[5] A concretização desta estratégia colocará Portugal ao nível de outros países onde esta prática já está enraizada, permitindo maximizar benefícios para a saúde das populações, retirar carros das ruas, devolver o espaço público, aliviar o congestionamento urbano, baixar os níveis de ruído e reduzir a poluição atmosférica. (Presidency of the Council of Ministers, 2019, p. 47), Translation by the author

The goal of such a nationwide strategy is to provide with investors for more opportunities in the sector of sustainability, while also allowing for the improvement of the living conditions of Portuguese citizens. Additionally, one can understand that more frequent and better structured sustainability investments, with the goal of improving cycling infrastructure and related initiatives, is recognized by the Portuguese government as having the potential of increasing the economic potential of the country, reducing single-family motor vehicle use and improving the health of its citizens by a reduction of pollution (Presidency of the Council of Ministers, 2019). Nevertheless, the National Strategy for Active Cycling Mobility 2020-2030 also recognizes that Portugal still requires significant investment in order to reach the same level of sustainable mobility utilization as other countries, specifically other member-countries of the European Union (Presidency of the Council of Ministers, 2019).

When it comes to the context for the establishment of the National Strategy for Active Cycling Mobility 2020-2030, the Portuguese government more specifically recognizes four different factors which have led to its creation. These are a) the health benefits associated with an active lifestyle and physical activity, b) job creation and the strengthening of the country's economy, c) environmental concerns, particularly the fulfilment of the compromises in the Paris Agreement[6]; d) the promotion of citizen participation within a local community (Presidency of the Council of Ministers, 2019, pp. 48-50). The National Strategy for Active Cycling Mobility 2020-2030 seeks to address issues that hinder the implementation of sustainable mobility practices in the country, particularly those connected with cycling, through two distinct approaches of execution.

Firstly, the National Strategy for Active Cycling Mobility 2020-2030 determines the increase in availability in infrastructure and equipment related to cycling, specifically through the financing of projects involving the construction of bicycle paths in urban and suburban areas of Portuguese cities. The Strategy has as its overarching goal for the year 2050 the ability to reach cycling ridership rates of 7,5% at a national level and of 10% in the country's main urban areas. Additionally, the National Strategy for Active Cycling Mobility 2020-2030 also establishes the goal of developing 10.000 kilometres in cycling infrastructure and reduce bicycle accidents and injuries in half (Ferreira, Isidoro, Moura

[6] The Paris Agreement, established in 2015, is a legally-binding climate change agreement between 195 countries, which seeks to mitigate the effects of global warming by limiting the globe's temperate increase to 1,5°C above pre-industrial levels and reduce greenhouse emissions.

e Sá, & Mota, 2022, p. 90). Secondly, it promotes social initiatives which aim to address local communities, by fostering cultural activities connected to cycling and create a stronger link between cyclists and their communities. This is seen through social programmes, for example, that promote group cycling for adults or even for children. Despite this, the situation of sustainable mobility in Portugal is very fragile. As stated by the gazette from the Resolution of the Council of Ministers No. 131/2019:

> Why have we not enjoyed the enormous advantages of active mobility? In our country, the car culture and the use of individual transport are deeply rooted and sustained by a context that has generally undermined active mobility. (Presidency of the Council of Ministers, 2019, p. 55)[7]

We can see that Portugal's transition efforts towards sustainable mobility as being insufficient. This is not just from an urban planning perspective, due to the lack of development of a significant cycling network within urban settings, but also as a failure to promote cycling as a transportation method with significant potential to foster communal integration and cultural activities, alongside the environmental and health-related benefits (Presidency of the Council of Ministers, 2019). But what has led Portugal to be so far behind other European countries when it comes to cycling development? And does Portugal have any historical background for the utilization of bicycles? We will now try to understand the historical context for cycling within this country and what has led it to its current state in sustainable mobility and urban planning, that is, what changes have occurred which have made alterations to the Portuguese perception and utilization of sustainable forms of transportation.

3.2 Historical and cultural background for bicycles and cycling in Portugal

Regarding the subject of the historical presence of bicycles and cycling, not just as a leisure activity but also as a form of transportation, the earliest data available dates back to the 1950s (Junta Autónoma de Estradas, 1965). Nevertheless, the presence of cycling in Portugal has been recorded since the 19th Century, particularly in the second half of the century. In most cases, this activity was associated with cycling as a sports modality and the upper-class and bourgeoisie of the country's urban areas. However, cycling was also

[7] Porque não temos usufruído das enormes vantagens da mobilidade ativa? No nosso país, a cultura do automóvel e o uso do transporte individual estão profundamente enraizados e são sustentados por um contexto que tem, de uma forma geral, despromovido a mobilidade ativa. (Presidency of the Council of Ministers, 2019, p. 55), Translation by the author

utilized by such demographics as a leisure activity within the city's parks, or even to travel within urban areas, more specifically in the city centers.

While it is common for our current perception of transport utilization rates to be limited to the more recent past, it is very often forgotten the relative popularity of cycling in Portugal, particularly between the early 1900s until the period of the 1970s (Junta Autónoma de Estradas, 1970). Indeed, it was in 1955 that the cycling rates in Portugal reached their ultimate peak. According to numbers by the Portuguese Junta Autónoma de Estradas[8] from 1955, velocipedes that year equated to 34% of the average traffic composition in the entire country. In contrast, motorized vehicles corresponded to around 61% of the total traffic composition (Junta Autónoma de Estradas, 1970). During that period, the cycling volume in Portugal was even higher than the current cycling volume of The Netherlands, which stands at 27% for short-distance trips (Koolhof, 2013). This data can provide us with the perspective that cycling has somewhat been a reasonably sized part of Portugal's history and its practice was certainly widespread in the country, until the drastic decrease from its registered peak of 34% in 1955 to 17% in 1965 (Junta Autónoma de Estradas, 1970).

The diminishment of almost half of the bicycle ridership levels in Portugal during a 10-year period coincides with an alteration in priority by infrastructure developers, these now moving towards a focus on car-centric infrastructure (Direcção de Planeamento; Gabinete de Controlo de Gestão e Sistemas de Informação, 2010). This was similarly experienced during this period in other European countries, such as The Netherlands. The accessibility and attractiveness of personal motor vehicles, seen as an emancipative symbol, combined with the significant investments done in road constructions within urban areas, particularly in Porto and Lisbon, in addition to new highway developments, resulted in a drastic alteration in people's choice of transportation. This resulted in an increase in traffic levels, particularly in Porto and Lisbon (Direcção de Planeamento; Gabinete de Controlo de Gestão e Sistemas de Informação, 2010). While in The Netherlands that tendency towards car-centric infrastructure shifted towards pedestrian and car-free policies in the 1970s, this trend was not verified in Portugal, who continued to

[8] The Junta Antónoma de Estradas was the main Portuguese body responsible for the construction and development of pavement and roads in the country. This body existed since 1927. However, by 1999, it has seen subsequent merges - with other governmental bodies connected with transportation infrastructure - and its restructuring. Nowadays, this body corresponds to the Portuguese state-owned company Infrastruturas de Portugal.

increasingly move to car-centrism (Pucher & Buehler, 2008). The car-free movement therefore had no real presence in Portugal during the 1970s and subsequent decades.

The subsequent decrease in percentage of the cycling ridership rates of Portuguese cities continued as the motorized vehicles also continuously increased its rates. In 1970, bicycles already only accounted for 8% of the average traffic composition in the country, while motorized vehicles corresponded to 91% of all traffic registered in Portugal (Junta Autónoma de Estradas, 1970). During this period of time, consistently larger car-centric infrastructure projects were developed, notably the expansion of the country's national road network. According to the document "Relatório de Monitorização da Rede Rodoviária Nacional 2010", which presents a comprehensive report of the history of Portugal road infrastructure, the total length of national roads by the end of the 1950–1965 era was 17860 kilometres, a massive increase compared to previous decades (Direcção de Planeamento; Gabinete de Controlo de Gestão e Sistemas de Informação, 2010). Elsa Pacheco (2001) writes about the heavy investments done to the country's car infrastructure during the second half of the 20th Century. Pacheco describes the multiple projects happening throughout the country, particularly those affecting its largest urban areas, such as the cities of Porto and Lisbon:

> [...] in the 1960s, the initiatives for the development of the international road network gained momentum, of which not only the Valença - Porto - Lisbon axis should be part, but also the one that would come to be called Main Itinerary No. 5 (IP5), between Albergaria-a-Velha and Vilar Formoso, at a time when the A1 (Lisbon / Porto Motorway) works continue. The early 1960s also saw the construction of the Arrábida Bridge in Oporto, and the Salazar Bridge (now the 25 de Abril Bridge), as well as the inauguration of another section of the A1 [...].[9] (Pacheco, 2001, p. 127)

This expansion of the country's car-centric infrastructure continued through the rest of the 20th Century (Pacheco, 2001). With the acceptance of Portugal as a member of the European Economic Community (currently designated the European Union), more funds were made available towards the development of Portuguese infrastructure, with many of these resources being allocated to the propelling of road transport (Pacheco, 2001). At the same time, the country's investments towards sustainable forms of transportation

[9] [...] na década de 60 ganham força as iniciativas para o desenvolvimento da rede rodoviária internacional, da qual deveriam fazer parte, não só o eixo Valença - Porto - Lisboa, como aquele que viria a designar-se por Itinerário Principal nº5 (IP5), entre Albergaria-a-Velha e Vilar Formoso, numa altura em que prosseguem as obras da A1 (Autoestrada Lisboa/Porto). No início dos anos 60 também a construção da Ponte Arrábida no Porto, e a Ponte Salazar (actual Ponte 25 de Abril), bem como a inauguração de mais um lanço da A1 [...]. (Pacheco, 2001, p. 127), Translation by the author

stagnated, particularly the investment in cycling infrastructure and the promotion of transportation methods which allowed for multimodal utilization, notably the country's railroad system (Pacheco, 2001). In other words, we can consider Portugal's transit situation entering the 21st century as, for most part, being very car-centric, even if, as previously mentioned, historically there had been a significant presence of cycling as a form of transport in the country's urban areas.

Nevertheless, despite the general tendency described above, some Portuguese areas have been more successful at maintaining a higher presence of cycling in their urban planning policy. These Portuguese cities or locations have established themselves as being more bike-friendly and continue to have a visible historical connection with cycling. Some examples of cities or locations in Portugal which have a considerable cycling culture or presence nowadays are Murtosa and Ílhavo, both in the district of Aveiro, Vila Real de Santo António, in the district of Faro, Entroncamento, in the district of Santarém, and finally and more recently a resurgence within the Metropolitan Region of Lisbon (Faculty of Architecture, University of Lisbon, 2018). It is interesting, however, to note the importance of cycling in places all over the broad Aveiro region. Here, cycling maintains a deep connection with the locality's history that has persisted for decades, in part due to its relatively flat and smooth land, which plays a significant role at making it a rather accessible form of transport (Faculty of Architecture, University of Lisbon, 2018). Additionally, cycling has also become an identifiable cultural symbol visible even to this day, which has even contributed to the district's cultural sector and local economy. As such, the country's only bicycle museum is also located in Aveiro, more precisely in the municipality of Anadia. In spite of what has been mentioned so far, while these places experience the highest cycling rates of the country, besides the Metropolitan Area of Lisbon their utilization continues to decrease, albeit at a slower rate than in other locations in the country, and their appeal and use is being threatened by the consistent growth in popularity of motor vehicles (Ferreira, Isidoro, Moura e Sá, & Mota, 2022).

Nevertheless, as we will soon understand, the role of bicycles in Portugal, notably in the areas where they have been more historically connected to the local identity is not simply limited to their utilization as a mode of transport. It is important to highlight the role of bicycle manufacturing for the country's economy as a whole, but more noticeably in the regions where they have historically experienced the highest ridership levels. We will

look into the importance of the bicycle manufacturing sector both locally and nationally further into this work.

However, it is first crucial to have a better understanding of the current Portuguese strategies at attempting to integrate cycling into its urban areas. As such, we must understand the current situation of urban Portugal when it comes to cycling development, in order to comprehend what obstacles currently persist to the wider integration of bicycles into Portuguese society and culture. Again, this is even more relevant when one bears in mind that Portugal had, in the recent past, a much more prominent cycling culture and significant rates of bicycle ridership which have been in decline for decades.

3.2.1 The current bicycle situation in Portugal

Overall, the tendency towards the continuous increase of the motorized vehicle ridership rate has not slowed down. This is for the most part due to insufficient investments in sustainable transportation alternatives and their respective infrastructure – particularly those within the category of soft transports – combined with the lack of dynamism and entrepreneurial initiatives involving bicycles (that make these attractive to local communities). Additionally, there is a generalized lack of educational activities presenting the social, cultural, economic and health benefits of cycling to citizens.

According to data from 2017, in Portugal, the automobile is the main mode of transport within urban areas, corresponding to 67,6% of the total trips in Porto and 58,9% of the total trips in Lisbon (Instituto Nacional de Estatística, 2017). Ferreira *et al.* (2022) mention this expansion of the "motorization of society", describing it as a direct consequence of the "individualization of the modes of transport", in addition to the "extensive and fragmented occupation of the [Portuguese] territory" (Ferreira, Isidoro, Moura e Sá, & Mota, 2022). We can say that the current gaps in the Portuguese cycling environment are connected to both social and urban planning issues.

The Portuguese Assembly of the Republic submitted, in 2012, a "recommendation to the Portuguese Government to begin the promotion of sustainable mobility", particularly those involving soft transportation, by the means of presenting concrete and practical measures to improve cyclist's safety conditions and multimodal integration with other forms of public transit (Félix R. M., 2012, p. 1). Around this time, and more assertively since then, municipalities have made varying levels of investment towards the

development of cycling infrastructure. The municipality of Lisbon, for example, has built around 60 kilometres of dedicated cycling lanes and installed 300 bicycle parking locations between 2007 and 2015, which allowed the number of cyclists to triple by 2017 (Félix R. M., 2012, p. 4). Currently, the city's cycling network exceeds 106 kilometres (Félix, Orozco-Fontalvo, & Moura, 2023). The municipality of Porto tried to promote more carbon-neutral forms of transport by developing cycling infrastructure, such as dedicated lanes and parking in areas like Boavista, Foz do Douro and Matosinhos.

Moreover, much like the municipality of Lisbon, the municipality of Porto has seen an increase in the availability of shared e-bikes and e-scooters. In 2020, Porto had 2.100 shared e-bicycles and e-scooters to be utilized, with 700 more expected to be made available by 2027, in addition to around 210 drop points for their utilization (Porto., 2022). In Lisbon, the shared e-bicycle and e-scooter system has 7.000 vehicles available through private corporations, not including the 700 vehicles available through the public e-bicycle system of the municipality (Félix, Orozco-Fontalvo, & Moura, 2023, p. 3). Furthermore, as recently as the year of 2023, the municipality of Lisbon has integrated its e-bike sharing system into its Metropolitan-wide public transport system "Navegante", allowing users with a monthly subscription for these services to utilize the bicycles without any additional fees. These have allowed Lisbon to be one of the European cities with the highest offer of shared e-bikes and e-scooters (Clean Cities, 2023).

More recently, particularly within the last decade, there have been some attempts in Portuguese urban areas to re-integrate cycling into the daily lives of its citizens. Rosa Melo Félix (2012) writes about the process in which Portuguese cities have been attempting to integrate cycling to its landscape, stating that, recently "there has been a growth of bicycle users and the emergence of a culture of cycling as a mode of urban transport in Portugal."[10] (Félix R. M., 2012, p. 1). According to Félix, this transition is a consequence of significant financial investments in the construction of urban bicycle paths, in addition to other complementary cycling infrastructure, such as public bicycle parking and even shared-used bicycle systems (Félix R. M., 2012).

[10] "Nos últimos anos tem-se assistido a um crescimento de utilizadores de bicicleta e à emergência de uma cultura de utilização de bicicleta como modo de transporte urbano em Portugal" (Félix R. M., Gestão da Mobilidade em Bicicleta: Necessidades, factores de preferência e ferramentas de suporte ao planeamento e gestão de redes. O caso de Lisboa., 2012, p. 1), Translation by the author

Figure 5- Some efforts have been made to integrate bicycle infrastructure in Portuguese cities. An example of these changes is visible on Avenida 25 de Avril, Aveiro. Source: Author

Some of the integration processes towards sustainability have also been achieved through the creation of programmes that promote cycling as an activity and transportation method. For example, the *Bicification* project, in Braga, which is funded by the European Union's European Institute of Innovation and Technology, promotes a transition to green mobility through monetary incentives and local shop discounts to bicycle users. In Braga, this project has allowed for a reduction of 8 tonnes in CO_2 emissions and gave its users 5.500 euros in vouchers to spend in local commerce (EIT Urban Mobility, 2023). This programme has been regarded as highly successful for the city's transition to multimodal transportation and attracted a significant number of people to begin utilizing bicycles in their commutes, as well as establishing social groups that socialized together through this transport. As such, it has contributed to the building of a sense of local community and impacted social behaviour, besides also providing economic benefits to local stores in Braga (EIT Urban Mobility, 2023).

Additionally, multiple initiatives within a school setting have been developed to promote cycling among children. The "*Ciclismo Vai À Escola*" ("Cycling Goes to School") educational programme, for example, has been implemented in public schools from around the country, particularly in the districts of Porto, Aveiro, Santarém and Setúbal (Federação Portuguesa de Ciclismo, 2018). This programme, targeted at young children, aims to raise awareness of the advantages of cycling, as well as improving children's

motor abilities. Another initiative that currently promotes active mobility, this time targeting the academic community, especially students and staff of twelve Portuguese higher education institutions is the U-Bike programme. This program corresponds to a total financial investment of €4.48 million towards the purchasing of 2.249 electric bicycles to be used by members of the academic community (Lusa News Agency, 2022). In total, the beneficiaries of this programme travelled 1.65 million kilometres in multiple cities (Lusa News Agency, 2022). This includes the P.Porto (Porto Polytechnic) as a participant of the project, singlehandedly responsible for a reduction of 3.06 tonnes in CO_2 emissions and a total 34.643 kilometres travelled by the institute's academic community (P.PORTO, 2023). Another strategy is the *Bike Buddy* programme, currently active in the city of Lisbon. The *Bike Buddy* is an initiative from MUBi, the Portuguese "Associação pela Mobilidade Urbana em Bicicleta" ("Association for Urban Mobility by Bicycle"), one of the largest organizations in Portugal promoting the use of bicycles within an urban context in Portugal. This programme supports the use of bicycles in urban settings by offering personal guidance and accompanying new riders on their first trips. Fundamentally, it helps new users to familiarize themselves with cycling as a means of transport within an urban setting through the assistance of a local cyclist with more experience.

However, despite these programs providing some significant contributions towards diminishing the barriers of the adoption of bicycles and soft mobility transport within urban areas, they have not been successful at properly establishing a true bicycle culture in Portuguese cities. The challenges that threatened its full integration need to be understood, in order to allow for the growth of cycling in urban areas.

3.2.2 Challenges for the growth in bicycle ridership in urban settings

Cycling was a relatively popular activity in Portugal in the first half of the 20th Century, but its decline in popularity and ridership rates through the second half of the last century has been challenging to address, particularly in the country's most urban areas. Nowadays, the country is facing issues of integrating sustainable mobility in urban areas in the three pillars mentioned by Mário Alves (2012). This means that Portugal is not yet successfully implementing urban and spatial planning policies that maximise resource efficiency, it is not making significant investments that encourage soft transport and/or

mass public transport, and it is also not imposing enough restrictions to automobile circulation in city centres.

Some of the challenges faced to their adequate integration are geographical in nature, while others involve more social or lifestyle-based circumstances. For example, the general perception is that the city of Lisbon is inadequate for this type of transport to be used effectively, due to its hilly terrain. Félix makes a reference to this argument in their article "Maturing urban cycling: Comparing barriers and motivators to bicycle of cyclists and non-cyclists in Lisbon, Portugal", in which they state that, despite the common misconception, reality is that "54% of the streets are almost flat, and 75% of the streets are below a 5% grade", making them "good enough to cycle" (Félix R. M., 2019, p. 4). In reality, the obstacles to cycling in Portuguese urban spaces are rather complex and multifaceted. Félix made significant research to the perceived obstacles to cycling within the Lisbon municipality, by surveying locals. The data allows to better understand the overlying issues facing the city of Lisbon. However, as we will now understand, due to the nature of these barriers, it may be possible to apply the results to other Portuguese urban areas and obtain similar conclusions.

The researcher requested respondents from the Lisbon area to identify their primary barriers to cycling in the area. Moreover, they were also asked to rate the significance of each barrier in relation to their chosen most significant selected barrier. The results were then presented graphically, demonstrating the average of the relative relevance attributed for respondents on a scale, with values closer to 0 being irrelevant to respondents and values closer to 100 being the most relevant barrier (Félix R. M., 2019). Additionally, current Cyclists were also inquired about their past barriers to adopt bicycles as a form of transport and their motivations for that adoption. Since we are trying to understand the barriers to cycling in Portugal, we are prioritizing the information from Non-Cyclists. From the 1.079 responses obtained from the survey, 765 (79,9%) were from Non-Cyclists (Félix R. M., 2019), and both groups from the sample reported a majority commuting distance of between one and five kilometres (Félix R. M., 2019).

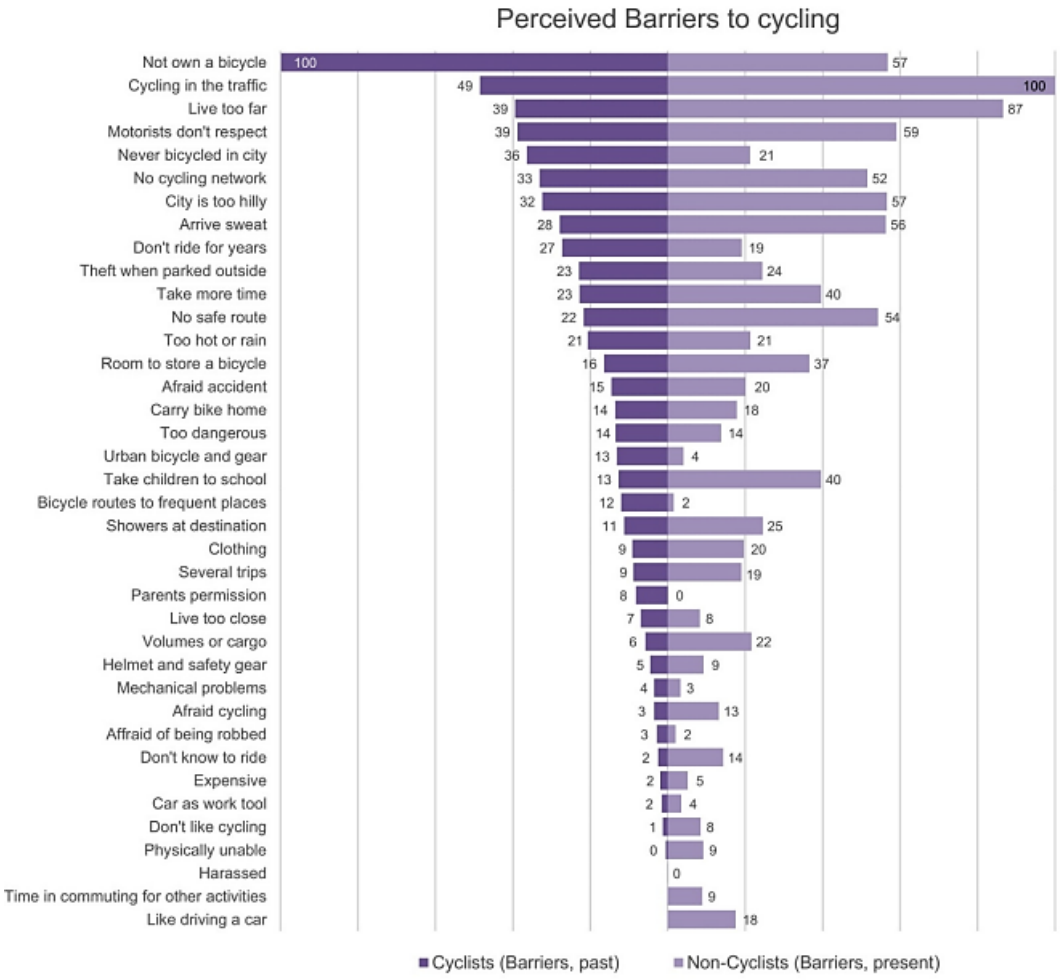

Figure 6- Comparison of the barriers to cycling between Cyclists and Non-Cyclists ranked according to the relevance of Cyclists' barriers. Source: (Félix R. M., 2019, p. 6)

Interpreting the data from Figure 4, by Rosa Félix, from the Non-Cyclists perspective we can identify the most common barriers for cycling within a Portuguese city. The most prevalent of these barriers are the feeling of discomfort with the thought of cycling within or in close proximity to traffic (100), the perception of living too far from the workplace (87), the impression that motor drivers do not respect cyclists (59) and perceiving the city as too hilly (57). Other additional obstacles mentioned at a significant level are, for example, not owning a bicycle (57), the inexistence of safe bicycle routes (54) and an

inconvenient cycling network for day-to-day activities (52).

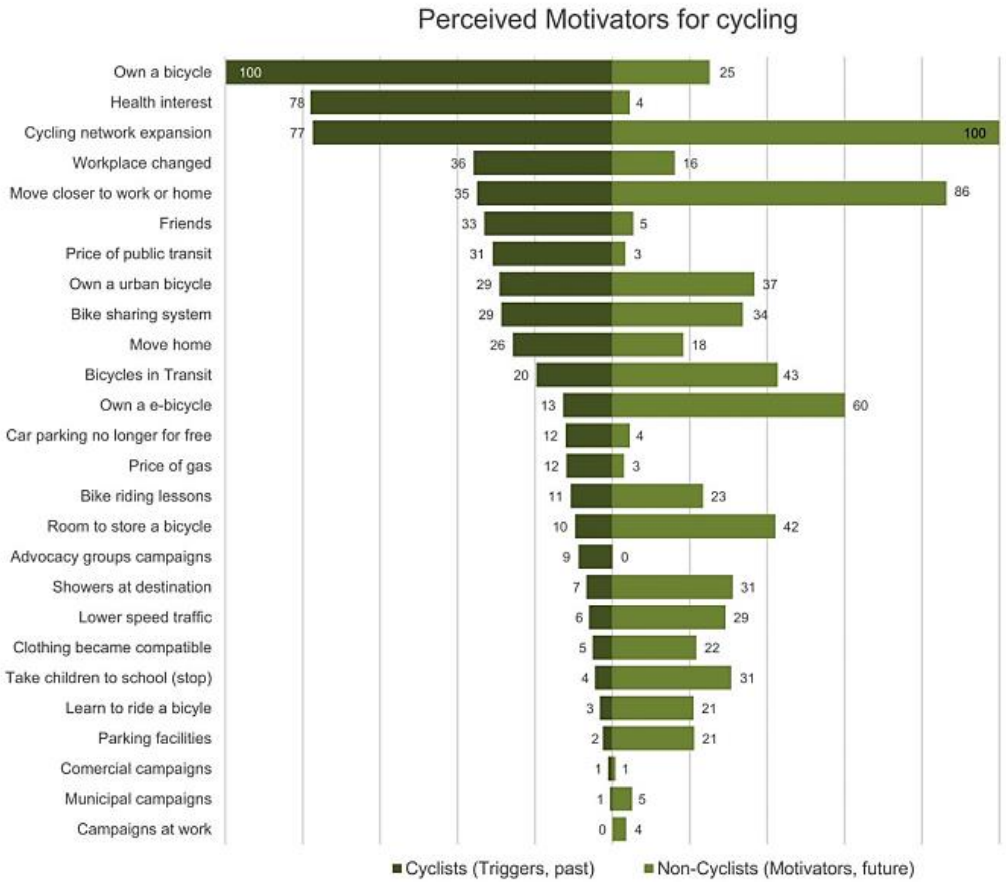

Figure 7- Comparison of the triggers and motivators for cycling between Cyclists and Non-Cyclists ranked according to the relevance of Cyclists. Source: (Félix R. M., 2019, p. 7)

In essence, Non-Cyclists' resistance in the biggest Portuguese Metropolitan area stems in large part from the local community's perception that cycling is not safe when done in an environment that encourages extensive car use and has severe issues with its existing cycling network. Félix (2019) directly references these issues, writing as key demotivators for cycling the unsafe conditions and inconvenience for users' daily life with the existing infrastructure (Félix R. M., 2019).

Regarding the subject of possible motivators to cycle by Non-Cyclists, the data demonstrates that investment on specific areas have greater potential of attraction. Among the most relevant and preferred factors that would encourage cycling in Portuguese cities are the expansion of the cycling network (100), as well as being able to move closer to the place of employment or education (86). Other factors considered important towards the sustainability goals and establishing a cycling culture are having an electric-bicycle (60), and having storage space to be able to keep a bicycle (42) (Félix R. M., 2019, pp. 6-7), as presented on the graph of the Figure 5.

Félix (2019) also make reference to the currently in place social campaigns by Portuguese municipalities towards promoting sustainable mobility and soft transportation. Their conclusion is that these are insufficient to achieve the established goals for bicycle mobility. The researcher writes that "the segments of the population that do not need to improve their health might not be receptive to such a message, alone." (Félix R. M., 2019, p. 9). That is, a health-based campaign to advocate for soft transport does not wield the necessary results to remodel Portuguese urban areas into areas that foster a bicycle culture. Instead, respondents showed to be more receptive to cycling if the "community-based" elements involving this activity are improved substantially. These are conditioned by the development of safe cycling networks and adequate bicycle infrastructure (Félix R. M., 2019), as presented on the graph in Figure 5. Interestingly enough, Portuguese Cyclists' attribute their interest and motivation to begin cycling in their day-to-day activities as due to personal motivations, such as financial goals and individual beliefs (Félix R. M., 2019). However, they also mention the social and community aspects of cycling as an influential motivator:

> Other factors that were assessed less relevant but were still among the most frequently chosen were [..] interest in conveying a political message (29); the influence of friends (23), and the participation in Critical Mass (9) - a monthly activist bicycle ride in the city. (Félix R., 2019, p. 7)

Therefore, we can also confirm the existence of a connection between cycling within an urban area and the connection to a social group or part of an individual's identity. The cultural element of cycling is, in this case, linked with a sharing of social space and community engagement inherent to cycling. But it is also associated with the sharing of a lifestyle philosophy and comradeship by those who cycle, particularly in a Low-Cycling Rate country like Portugal (Félix R. M., Gestão da Mobilidade em Bicicleta: Necessidades, factores de preferência e ferramentas de suporte ao planeamento e gestão de redes. O caso de Lisboa., 2012).

Fundamentally, the issues that prevent Portuguese urban areas from attaining sufficient levels of bicycle ridership rates and reaching the same rates as other growing European cities are related to poor cycling networks and infrastructure in its denser urban areas. Research by Rosa Félix (2012), on the accounts of urban cyclists in Portugal, emphasize the necessity for expanded road infrastructure, including segregated or shared paths, to enhance safety, with approximately half of the feedback emphasizing traffic calming measures and improved driver attitudes for safer coexistence (Félix R. M.,

Gestão da Mobilidade em Bicicleta: Necessidades, factores de preferência e ferramentas de suporte ao planeamento e gestão de redes. O caso de Lisboa., 2012, pp. 38-39).

3.3 Business and economic impact of bicycles for the Portuguese society

While the current application of cycling infrastructure in Portugal is not adequate enough to result in significant numbers of urban cyclists, the reality is that the potential for growth in the sector is still considerable.

There are two main elements to consider when examining the economic benefits to Portugal of adopting a more widespread bicycle culture. First is the direct economic potential in the expansion of the Portuguese bicycle industry, which includes the expansion of its manufacturing in the country, the construction of new infrastructure and the creation of new business opportunities in various sectors, such as the tourism and the service sector. The second is indirect advantages in the health, energetic and environmental outcomes and decrease in government expenditure on car-centric infrastructure, as a consequence of the discouragement for motor vehicle use.

As previously mentioned, bicycle manufacturing has played – and still continues to play - an important economic role for the country. In fact, by 2020 Portugal was the European leader of number of bicycles manufactured within its territory, producing over 2.6 million bicycles every year (Eurostat, 2021). In 2021, Portugal was also the sixth largest bicycle exporter in the world by value and the third largest in Europe, behind only The Netherlands and Germany (Yanocha & Mawdsley, 2022). The exportation of bicycles in Portugal corresponds to a generated value of roughly €300 million (Yanocha & Mawdsley, 2022). The bicycle manufacturing sector in Portugal is also a source of innovative technologies and entrepreneurship utilized for sustainability goals, through the international expansion of Portuguese corporations that produce bicycles and bicycle parts. Portugal is home to the largest bicycle assembly facility in Europe, RTE, in Vila Nova de Gaia. It is also home to the largest maker of tires, Rodi, in Aveiro, and the first European carbon fibre frame plant, Carbon Team, in Vizela, the product of a joint venture including Chinese, Portuguese and German capital (Pinto, 2023). Additionally, to help two-wheeled companies in Portugal expand nationally and internationally, many of the country's largest bicycle manufacturers have joined forces through Portugal Bike Value. Through this union, it is possible to promote Portugal internationally as the ideal location

for new industries in the sector and to create partnerships with local institutions. Nevertheless, it is in the district of Aveiro that the bicycle manufacturing sector has its stronger presence. Many of the country's largest bicycle industrial areas are located within different municipalities in Aveiro. In the region surrounding Águeda there are over 60 companies that can be designated as related to the bicycle industry, employing roughly 8,000 people (Sutton, 2022).

Nevertheless, while Portugal is a large manufacturer of bicycles, the reality is that the demand for bicycles is mostly outside of the country, since Portugal exports most of the bicycles the country produces (Pinto, 2023). Therefore, the potential for an intra-Portugal bicycle market has not yet reached its full potential. The increase in ridership levels in Portugal could lead to an increase in demand in Portugal, which in turn could allow for an increase of the production of bicycles by these manufacturers. Additionally, the utilization of electric bicycles means that we could replace an imported energy source, in this case petrol used in cars, by energy produced in the country to charge them.

Another aspect is the tourism and cultural sector, which benefit greatly from the presence of bicycles and their relevant infrastructure. Cycling tourism has been a presence in the country for many decades, and the recent rise in popularity of Portugal as a tourist destination has led to an increase of bicycle tour businesses within the country's most popular tourism spots, notably the centres of Lisbon and Porto. Bicycle excursions through both of these city's most popular attractions have boosted in popularity, in order to get a flexible and direct connection to locations. However, the country's lack of bicycle infrastructure in its urban centres and the presence of cars and heavy traffic within city centres severely limit their accessibility. Miguel Padeiro (2022) asserts that this disregard for the existence of accessible cycling infrastructure in city's historical centres, which affects their touristic and cultural potential, is due to a focus on the reduction of transportation costs in those areas, instead of the implementation of measures to help cities reach their fullest potential:

> A […] reason lies in the predominance of an approach to the planning of infrastructure that is more technical and linked to costs and less social and linked to the need to rebalance the means of mobility between various social groups. In this approach, bike lanes are predominantly directed to locations where their construction and urban insertion is technically easier or less expensive. In Lisbon, the avoidance of steep, narrow streets in the historic centre may be part of this rationale. (Padeiro, 2022, p. 15)

Padeiro (2022) also refers to the fear that local populations have of the expansion of cycling networks within urban areas as a possible source of "gentrification processes", which may be exclusionary for local Portuguese residents. In other words, the enhancing of the "visual quality and local character of neighbourhoods" through cycling infrastructure might make the cities' low-income areas become more appealing and, as such, "reinforce local exclusionary dynamics" and "touristify" residential neighbourhoods (Padeiro, 2022). In essence, while the investment of bicycle infrastructure in urban areas is fundamental for reaching sustainability goals and provides great economic benefits, local governments need to also provide reassurance to local communities about their maintenance and the preservation of the local identity, without its destruction in favour of mass tourism.

When it comes to the more indirect benefits for the economy of Portugal, cycling allows the reduction of energy costs and provides positive environmental consequences. This is due to the reduction of fuel consumption, associated with motor transportation (Ferreira, Isidoro, Moura e Sá, & Mota, 2022). Additionally, through internationally established agreements, high levels of CO_2 emissions are subjected to heavy fines, which add to the expenses allied to car-dependency (Ferreira, Isidoro, Moura e Sá, & Mota, 2022). Recent data shows that an increase in the ridership levels of cycling in Portuguese urban areas to an average of 2% modal share – while it currently stands at less than 0,3% on the ten municipalities of the country with the highest population - would decrease government spending by €26 million per year, corresponding to €105 thousand per day (Ferreira, Isidoro, Moura e Sá, & Mota, 2022, pp. 98-9). It is important to note than an increase to 2% cycling modal share represents a relatively marginal increase, which makes the potential for an even larger increase to provide even greater economic benefits.

The economic impacts on health are also significant, especially those associated with the reduction of the mortality rate and the fostering of a more active lifestyle through cycling. Safety conditions connected with cycling infrastructure have been shown to decrease the risk of accidents and injuries for cyclists, causing less costs associated with vehicle accidents (Félix R. M., Gestão da Mobilidade em Bicicleta: Necessidades, factores de preferência e ferramentas de suporte ao planeamento e gestão de redes. O caso de Lisboa., 2012). Also, the decrease in the pollution levels in urban spaces leads to a reduction in the risk of developing health conditions, such as lung cancer, and respiratory and cardiovascular diseases. The reduction in mortality linked with physical activity, as well

as the reduction in air pollution, have the potential to provide a positive economic effect of more than €140 million for Portugal throughout a ten-year period (Ferreira, Isidoro, Moura e Sá, & Mota, 2022).

Finally, the Portuguese overreliance on road infrastructure has led to increasing costs in its maintenance and expansion. In 2013, the OCDE mentions for the first time on its Portuguese annual report the country's overemphasis on car centric infrastructure. The country's road infrastructure and maintenance spending have a share of GDP 25% above the OECD average (OCDE, 2013), a trend which has remained for the following years.

In short, the benefits of cycling for the Portuguese economy would greatly improve the country's ability to directly and indirectly address issues pertaining the economic, environmental, energy, health and social sectors. These benefits would also improve the quality of life of local urban communities, provide expanded business opportunities for existing sectors and establish new ones, and allow the Portuguese government to economize significantly.

After analysing the current Portuguese transportation sector situation and understanding the existing gaps in the expansion of the bicycle infrastructure, it is now crucial to see what good practices from The Netherlands Portugal can adapt into its own circumstances and local conditions, keeping in mind the aforementioned issues. Even if it is not possible to reach Dutch levels of cycling integration, the discouragement of the utilization of personal motor vehicles in urban settings and the transition to cycling combined with other forms of public transit is still essential, if done effectively and keeping in mind the needs and motives of local communities. As such, we will now look at what compelling strategies can be enforced to improve cycling conditions in Portugal.

CHAPTER IV – INTEGRATION OF CYCLING IN PORTUGAL BY USING DUTCH STRATEGIES

As it has been established so far, the Portuguese integration of sustainable mobility within urban settings has struggled to maintain enough momentum to result in significant lifestyle changes. Notably, cycling in urban areas is still often disregarded as an alternative to motorized personal vehicles. This is due to a multitude of factors, such as the lack of a cohesive plan that promotes cycling in a multi-faceted way or the absence of strong, structured and coherent policies. Pucher & Buehler (2008) refer the need to make cycling "safe and feasible for a broad spectrum of the population" (Pucher & Buehler, 2008, p. 510), in order to achieve its full potential and develop a sustainable cycling culture in Low-Cycling cities:

> [Dutch, German and Danish] success in making cycling so appealing is largely attributable to the coordinated implementation of […] measures, so that they reinforce the impact of each other in promoting cycling. Indeed, that is perhaps the key lesson to be learned: the necessity of a coordinated, multi-faceted approach. (Pucher & Buehler, 2008, p. 510)

In other words, through the perspective of a symbiotic relationship between policy, infrastructure and education, it is possible to conceive a structured plan involving these three factors that promote cycling as a form of transport. This has been successfully implemented in other European countries, with particular emphasis on The Netherlands, and it should therefore be the strategy adopted by Portugal as well.

One of the issues for the implementation of cycling in Portugal is the lack of financial investment towards programmes and infrastructure. The country has a severe issue with fund allocation, notably only investing 30 cents per person each year in the promotion of cycling (Tribuna & Esteves, 2023). In fact, other European countries are spending significantly more on the development of cycling infrastructure. And while countries with high cycling levels and an established cycling culture, like The Netherlands and Germany, are spending more on their National Cycling plans than Portugal – €13,6 and €9,2 per capita, respectively – other Low Cycling countries, like Italy and Ireland, are also investing considerably more on its development, financing €3 and €36 per capita every year, respectively (European Cyclists' Federation, 2022, pp. 62-5). In practice, this makes Portugal the European country with the lowest total annual investment in cycling per capita (European Cyclists' Federation, 2022).

While the financing of sustainable projects and infrastructure can be obtained from multiple sources, The Netherlands, for example, mainly funds its cycling infrastructure from two sources: a) central government and respective national budget, and b)

investments from funds from the European Union, although the former represents a larger share of the resources. A significant part of these funds is used to expand or improve its national cycling network, but they are also used to construct infrastructure and invest in social inclusion programmes for low-cycling communities (particularly non-Dutch residents) within the country. Another example is Germany, which utilizes revenue from motor fuel taxes and specifically appropriates them for funds towards local governments, so that these develop cycling infrastructure (Pucher & Buehler, 2008). Therefore, as Portugal does not allocate enough funds from its central government budget to cycling initiatives (European Cyclists' Federation, 2022), similar programs could be adopted by the central government and more financing from the European Union could be utilized for these purposes, for instance, as from the Interreg programme, which "helps finance transnational and cross-border bikeway projects" (Pucher & Buehler, 2008, p. 510) .

Finally, it is important to understand the concrete and necessary measures that may allow Portuguese urban areas to become areas with increasing cycling ridership levels. This is done through the application of the good practices in cycling from The Netherlands into a Portuguese context, while keeping in mind the different circumstances between Dutch and Portuguese cities. The second and last perspective is the development of cycling towards the goal of establishing a cycling culture in order to promote urban sustainability. Thus, it is also possible to foster the country's cultural sector, by transforming bicycles from mere utilitarian products in transport into an essential part of the experience of Portuguese urban areas.

4.1 Good practices for sustainable mobility

The National Strategy for Active Cycling Mobility 2020-2030 suggests that different solutions to improve cycling rates should be implemented, depending on the context or type of city. The implementation of measures towards sustainable mobility, particularly soft mobility, should consider a variety of factors, ranging from local topographic characteristics, native urbanization features and an analysis of the existing constraints and obstacles to cycling by non-cyclists (Félix R. M., 2012), among others. From there, we can begin the process of transitioning to sustainable mobility, through the elaboration of a mobility plan that includes a network of different approaches towards this goal. When it comes to the application of measures and policies towards sustainable mobility through

cycling, Pucher & Buehler (2008) present three wide-ranging in Low Cycling Countries and, in this case, their respective urban areas. These are: main policies and measures that encourage safe and convenient cycling, the promotion of cycling, and measures that indirectly favour cycling, such as taxation and urban planning policies (Pucher & Buehler, 2008). These have been developed based on the strategies defined by the Dutch government to improve their own cycling rates and cyclist's safety conditions. Therefore, by observing the best strategies utilized by The Netherlands to make cycling as attractive as possible for a broad spectrum of people we can adapt them to a Portuguese context.

Another way of implementing cycling-friendly measures is through the division between hardware and software measures (van Ommeren, Ruffino, de Boer, & Buls, 2017). It is possible to divide the transition towards soft mobility alternatives into physical differences in infrastructure planning and facilities, as well as into measures that change the citizen's perceptions and beliefs about their transportation options. However, in addition to these two elements, van Ommeren *et al*. refer that Dutch cycling implementation deeply involves the need to incorporate and gather scientific knowledge into the decision-making process, that is, it involves a variety of experts from various fields, such as geography, urban planning and engineering. These provide input to implement soft mobility measures through "multiple perspectives" (van Ommeren, Ruffino, de Boer, & Buls, 2017, p. 34). Van Ommeren *et al*. mention the necessity of good urban planning towards soft mobility which, as it is the case within The Netherlands, involves "multiple stakeholders from different levels (government, provinces and city regions) and domains (both private and public) during all phases (from problem definition to implementation and evaluation" (van Ommeren, Ruffino, de Boer, & Buls, 2017, p. 36). In other words, there are often partnerships between organizations and companies from both the public and the private sector, who discuss and share resources among them towards a common goal. This sort of collaborative effort is crucial for the development of a cohesive and interconnected cycling network, which has great potential to be effective in Portugal, particularly within large urban areas, such as Lisbon and Porto, but also in medium-sized cities with a recent tendency for expansion in size and population, such as Braga or Aveiro. Using such resources from a multitude of different fields and the cooperation between the public and the private sector is a source of great business potential for all parties. In addition to providing vast opportunities for urban developers

and the construction sector, as we will see on section 4.2., it also fosters the country's cultural sector and reintegrates cycling culture back into Portugal.

The main policies and measures in which there is an encouragement for safe and convenient cycling relate to the development of the infrastructure relevant for these purposes. As established by the research of Félix, Moura & Clifton (2019), one of the largest barriers to the adoption of cycling by Portuguese Non-Cyclists is the unsafe conditions when navigating through traffic in urban areas. Fundamentally, in order to increase ridership rates, it is necessary to develop, as Pucher & Buehler write, "extensive systems of separate cycling facilities" (Pucher & Buehler, 2008, p. 512). This means creating separate areas for cycling, pedestrians and motor vehicles as often as possible in new urban projects. They establish higher safety criteria for a broad demographic, particularly on women and the elderly, who exhibit greater aversion to cycling in the absence of adequate safety precautions (Koolhof, 2013; Pucher & Buehler, 2008). It has been used by The Netherlands, with remarkably positive results of higher rates of cycling adoption and reduction in accidents involving bicycles and motor vehicles (van Ommeren, Ruffino, de Boer, & Buls, 2017).

Figure 8- This image of Rua da Pega, in Aveiro represents the road model that provides sufficient safety to cyclists and pedestrians, by creating a physical barrier between these and motor vehicles. Source: Author

However, not every street has the ability to be torn down and rebuilt to accommodate to cycling, and in Portugal the reconstruction of many of the oldest urban residential neighbourhoods would be extremely destructive to the local identity, local communities and their cultural traditions. In such situations, as Pucher & Buehler write, "It is neither possible nor necessary to provide separate bike paths and lanes […]" (Pucher & Buehler, 2008, p. 514). The solution in Portugal would be to create new or expand already existing traffic calming measures in more residential areas. In fact, traffic calming measures are a necessity for the transition to increased ridership rates involving soft transports. These would include, for example, the implementation of a speed limit of 30 kilometres per hour in streets with very narrow widths or high pedestrian traffic, so that motor vehicles are naturally forced to reduce their speeds. The design of the streets during and after maintenance projects could also be altered to reflect the decrease in speeds in residential areas, implementing different changes to their layouts for this purpose. Pucher & Buehler (2008) once again recognize that the approach of making physical changes to street designs is a common tactic by Dutch urban planners:

> […] many cities—especially in the Netherlands—introduced considerable alterations to the streets themselves, such as road narrowing, raised intersections and crosswalks, traffic circles, extra curves and zigzag routes, speed humps and artificial dead-ends […] (Pucher & Buehler, 2008, p. 514)

This would allow bicycles to compete more directly with cars in terms of convenience, while also making cycling safer, due to a decrease in the speed of the vehicles using the roads. The layout changes can contribute to an increase in the safety conditions of cyclists, as the cars' reduced speed helps cyclists manoeuvre through traffic with less risk. Traffic calming not only reduces vehicle speeds, but it also improves bicycle visibility, thereby making them more visible to drivers. As a result, the probability of cyclist-vehicle incidents decreases, resulting in a safer and more favourable environment for cyclists to navigate and commute (Ferreira, Isidoro, Moura e Sá, & Mota, 2022; Pucher & Buehler 2008). In Portugal, traffic calming is seen, for example, in designated "coexistence zones", which are areas where motorised traffic is restricted or even forbidden and where pedestrians and non-motorised cyclists are permitted, and speeds are limited to 20 kilometers per hour. However, their use in Portuguese urban planning is still quite rare, so there is potential for a more widespread use. Municipalities should therefore push for the expansion of the "coexistence zones", typically with raised intersections and

crossings, in highly pedestrianized areas or areas that need lower vehicle speeds, in order to ensure pedestrian and cyclist safety.

Both separate cycle lanes and traffic calming measures have been successfully implemented in The Netherlands. In this country, traffic calming without separate bike lanes is typically implemented in smaller residential streets, with facilitated access to connecting roads. Connecting roads instead usually have separate bicycle lanes. As such, there is potential to accommodate more easily to local urban characteristics. This urban design technique allows more flexibility in constructions, as it recognizes the fact that not every street requires separate bike lanes in order to be bicycle-friendly, and reducing vehicle speed in certain zones can be just as significant for the progress of sustainable mobility. This strategy of combining both traffic calming and an extensive separate cycling infrastructure is also referenced by Pucher & Buehler (2008):

> Since most bike trips start at home, traffic calming of neighbourhood streets is crucial to enabling bike trips to start off in a safe, pleasant environment on the way to the separate bike paths and lanes that serve the rest of the trip. (Pucher & Buehler, 2008, pp. 514-5)

Similarly, the transition to a system practiced in most Dutch cities - having practically car-free city centres - would significantly contribute to traffic calming goals. By making it "virtually impossible" to go to city centres by car and forcing these to take longer routes to cross the city, it is possible to reduce pollution, traffic and safety issues in high-density locations (Pucher & Buehler, 2008), a common strategy used by Dutch urban developers. This would be especially important in the centres of Lisbon and Porto, as they experience high-levels of pollution from cars and frequent conflicts between pedestrians and drivers. Car-free zones would also potentially spread the commercial appeal of certain areas within city centres. For example, the already existing practically car-free streets in the centre of Porto, such as Rua de Santa Catarina and Rua das Flores, are also the streets which experience some of the highest commercial volume. In fact, since car-free areas in Portugal are usually the ones that have higher commercial volume, more car-free commercial areas in Portuguese urban areas would allow greater economic potential for more commercial establishments.

The development of safe intersections for cyclists is a key element in ensuring cyclists' safety in urban areas. As established previously, the perceived fears of cycling in traffic by cyclists and non-cyclists reduce the chances of them utilizing this transport more often

in their daily activities or transitioning to this form of transport, respectively (Félix R. M., 2019). One of the places of higher risk for cyclists specifically is intersections, as it is here that many of the accidents between cyclists and car drivers occur, which potentially leads to serious injuries or death. In order to improve the safety conditions of cyclists, Dutch street designers and urban planners have designed, for example, advanced stop lines for cyclists in street intersections, located in front of waiting cars (Pucher & Buehler, 2008, pp. 515-6). These are already beginning to be implemented on very specific streets in Portuguese cities, such as on the crossings at Rua Carlos Malheiro Dias, in Porto or at Avenida da Liberdade and adjacent streets, in Lisbon. Nevertheless, the safety conditions they provide to cyclists against motor vehicles waiting in intersections, particularly when these intersections have traffic lights, means that their utilization must be expanded to even more areas. The design of the intersections themselves must also accommodate the sense of safety of cyclists. Mário José Meireles (2020) refers some of the changes necessary to these places in order to make them appealing to cyclists and dissuasive of cars, which should also be applied in Portuguese urban areas:

> When designing the intersection, it is necessary to ensure that there is visual contact between the cyclist and those driving in the traffic lane, that speeds are reduced when approaching the intersection due to the narrowing of the lanes or the existence of islands and islets, and that cycle lanes have priority when passing. (Meireles, 2020, p. 31)[11]

Another issue referred to as a barrier to cycling in Portuguese urban areas is the lack of bicycle parking. For example, in the urban areas of Lisbon and Porto, while there are certain areas that offer some bicycle parking, the availability is often rather limited, with places for only 5 or 6 bicycles. These are also installed in inconvenient locations. Notably, in the Portuguese urban areas there is still very little parking facilities in close proximity to bus, metro, trains and trams stops. When these exist, they are not particularly safe, and the worry of bike theft when parked outside hampers some Non-Cyclists from using bicycles more frequently in their daily commutes (Félix R. M., 2019). While in Dutch urban areas bicycle theft is still a major concern, it is being combatted with the development of indoor and outdoor bicycle facilities monitored by cameras and, on occasion, security personnel. Local ordinances also stipulate minimum bicycle parking

[11] No desenho da interseção é necessário garantir que há contacto visual entre quem circula na bicicleta e quem circula na via de trânsito, que se reduzam as velocidades na aproximação à interseção pelo estreitamento das vias ou pela existência de ilhas e ilhéus, e que as pistas cicláveis tenham prioridade na passagem. (Meireles, 2020, p. 31), Translation by the author

requirements for designated developments, such as supermarkets, public transportation stops and schools. From the acquisition and application of these good practices in Dutch urban planning, Portuguese cities should plan their bicycle parking facilities to be located closer to important points in local communities. Additionally, existing and new parking spots should have more security measures, such camera monitoring. When it comes to motor vehicle parking, the management of their availability should be reconsidered in Portuguese urban spaces. Particularly, Mário José Meireles (2020) recognizes that excessive prioritization of car parking can contribute to even more car dependency:

> One mistake planners used to make (and sometimes still make) is assuming that more parking is better. An abundant supply of car parking increases car use in the city and promotes urban sprawl, resulting in an increase in demand. This abundant supply is part of a cycle that contributes to increased car dependency [...] (Meireles, 2020, p. 71)[12]

This abundancy of car parking in Portugal, combined with the existence of minimum parking requirements, and the lack of regulated maximum parking requirements, implemented in many European cities, leads to an "excess in offer" in car parking (Meireles, 2020, p. 76) in suburban areas. In city centres, parking demand exceeds availability, resulting in issues such as traffic congestion and unlawful parking. In order to address this issue, it is proposed that parking restrictions are put in place, through time restrictions on street parking and/or paid parking just outside city centres (Meireles, 2020, pp. 75-6). The Netherlands was the first country in Europe to introduce parking meters, specifically in the city of Amsterdam (Meireles, 2020), and now they are common practice in the entire country.

Connected to the previous point, one of the issues with the way bicycle infrastructure is currently implemented within Portuguese urban spaces is the lack of interconnectivity with other forms of public transit. This element is particularly important for the viability of cycling in Portugal. Conversely, in Dutch cities, cycling is often analysed from the perspective, as Pucher and Buehler (2008) write, of being a "feeder and distributor" for public transport, that is, a connecting link between different forms of public transit. For example, it is common practice for residents of Dutch suburbs to ride their bicycles to the nearest suburban railway station, park them, then take the train into the city centre, in

[12] Um erro dos planeadores era (e por vezes ainda é) assumirem que, no que toca ao estacionamento, mais oferta é melhor. Uma oferta abundante de estacionamento aumenta o uso do automóvel na cidade e promove a dispersão urbana, tendo como consequência um aumento na procura. Esta oferta abundante é parte de um ciclo que contribui para o aumento da dependência automóvel […] (Meireles, 2020, p. 71), Translation by the author

which they continue their journey with another bicycle at the main railway station. Mário José Meireles (2020) writes that, in order to reduce the car dependency in Portuguese cities, the bicycle must transition to a similar strategy as those already in place in The Netherlands. Bicycles must therefore become an "ally of the urban public transportation system" (Meireles, 2020, p. 37). It is crucial to strengthen the synergy between personal use bicycles and urban public transportation systems, making them compete with cars, through the application of the measures above, particularly those involving bicycle parking in bus stops and train stations, in conjunction with the availability of rental bicycles in these stops. In other words, Portugal needs to adopt a similar strategy as The Netherlands in planning its mobility infrastructures at larger scales, both locally and at a national level. It should consider separate forms of transit, such as buses, trains, bicycles, etc. as integrating the same mobility network and consequently being compatible with each other in terms of accessibility and timetables.

Finally, The Netherlands makes serious effort when it comes to enforcing traffic laws, particularly those involving the safety of cyclists and pedestrians. Motorists in the eyes of Dutch traffic laws are considered to be legally liable for collisions with cyclists unless they can prove the crash was deliberately caused by the cyclist (Pucher & Buehler, 2008). There is also stricter enforcement of parking laws than in Portugal. In Portugal, vehicles parked on top of bicycle paths, pedestrian sidewalks and crossings cause massive obstructions on city streets, making streets unsafe for those outside of a car (Félix R. M., Gestão da Mobilidade em Bicicleta: Necessidades, factores de preferência e ferramentas de suporte ao planeamento e gestão de redes. O caso de Lisboa., 2012). This especially affects people with reduced mobility or children, who are often forced into walking directly on car lanes, in close proximity to car traffic. Cyclists are forced to do manoeuvres which also reduce their safety distance with motor vehicles (Meireles, 2020). Stricter enforcement of Portuguese traffic laws would therefore also contribute to improvements in the safety conditions of pedestrians and cyclists. This could be done by more intensely integrating digital solutions to traffic control. For example, in The Netherlands, residential traffic control is often done through scan cars with cameras which, through AI identification systems of registered license plates, automatically issues fines.

Regarding the subject of the promotion of cycling, cycling programs aiming to grab people's attention and spark interest are relatively widespread in European countries who

want to transition to soft transportation methods (Pucher & Buehler, 2008). These are mostly educational in nature, and while they do not provide incentives to cycling within urban settings, they help to normalize the existence of cycling and of bicycles as occupiers of public street space.

When it comes to the measures such as the taxation and urban planning policies, they do not directly contribute to making cycling safer and more convenient. However, these indirect governmental measures and local policies help to foster an environment that encourages cycling in a complementary way. While these can include strategies already mentioned in this dissertation, such as the reduction of car speed in residential neighbourhoods, they can also include nationwide policies. For example, petrol and new-car sales taxes, import taxes, registration costs, petrol prices, driver training expenses, or parking fees that are substantially higher than in most other European countries (Pucher & Buehler, 2008). That way, it is possible to indirectly make the costs of car ownership higher, encouraging citizens to opt for cycling as a more cost-effective transportation method, often utilizing bicycles in combination with other forms of public transit.

Additionally, The Netherlands makes significant investments regarding transportation infrastructure and urban designs are planned considering pedestrian, cycling, public transit and motor vehicles, in that order of priority. And while street infrastructure is a crucial element if we want to consider the transition to soft transportation methods in Portugal, this is not the only possible strategy. Another important Dutch practice is the land-use and urban design of cities themselves. Particularly, in The Netherlands, there are tightly regulated limits for the development of "low-density sprawls" (Pucher & Buehler, 2008, p. 522), since these often lead to longer travel distances, which limits the convenience of cycling and walking. Instead, The Netherlands chooses to prioritize mixed-use zones, that is, land-use that combines residential and commercial spaces in very close proximity to each other. Pucher and Buehler reinforce the importance of this practice in Dutch cities, writing that "[Mixed-use zoning] facilitate the proximity of residential areas to commercial establishments, schools, churches and a range of services. The resulting trip distances are shorter and thus more bikeable" (Pucher & Buehler, 2008, p. 522). New neighbourhoods are built considering these demands, which allows for higher density areas in cities and less wasted land space. Portuguese urban areas are not subjected to such tight restrictions in new developments, facilitating constructions of different zone types. In order to help the transition to sustainable mobility, forethought

regarding land-use needs to be put in place, by prioritizing mixed-zoning constructions and planning that combines new urbanizations, public transit and cycling network. Furthermore, as explained above, utilizing The Netherlands as an example, these alterations to the design of cities should involve different stakeholders and experts, in order to get multiple perspectives involving different fields in their implementation. This way, it is possible to maintain cohesion and balance between the environmental, social and economic needs of a certain location.

Scepticism about Portugal's possible transition to cycling under a similar system to The Netherlands' points out this country's relatively flat terrain as a significant contributor for the adoption of cycling, in contrast to Portugal's more irregular terrain. While this can present some challenges in selected contexts in some urban areas, it is not representative of the entire topography of these areas, ignores the technological advancements in recent decades in soft transportation methods to facilitate mobilizations, and also ignores the possibility of cycling as an alternative to cars in shorter distances. As previously mentioned, in the city of Lisbon for example, 75% of the streets have adequate inclination to cycle (Félix, R. M., 2019, p. 4; Félix, 2012, p. 34). In the municipality of Porto, 65% of the area is on slopes that are appropriate for cycling. Additionally, the establishment and normalization of electric bicycles and electric scooters in urban areas, particularly within a shared network, have facilitated the utilization of these transports, even in hillier terrains. This means that sustainable mobility is attainable in Portuguese urban areas, particularly in short distances for people's day-to-day activities.

In summary, Portuguese urban areas should utilize strategies used by Dutch urban planners and experts in order to fulfil its own sustainable mobility goals. Particularly in the case of soft transportation, a network of dedicated cycling facilities, along with considerable traffic calming in residential neighborhoods, is essential in order to make cycling safe and convenient. Separate facilities, however, are just one component of the solution to this problem. With extensive bike parking and a reduction in car parking, car-free areas, and the integration with public transportation, for example, Dutch cities reinforce the safety, convenience, and attractiveness of cycling. These are the policies and infrastructural changes that also need to be applied in Portugal in order to witness similar results in urban areas. Nevertheless, there must be agreement between the various political players in the country's urban municipalities.

4.2 Adapting a cultural product for the promotion of urban sustainability in Portugal

The reintroduction of cycling in Portugal and changes in urban planning policy and infrastructure development would lead to an improvement in the country's environmental footprint, health and safety conditions of citizens, in addition to other economically beneficial consequences. However, one important puzzle piece missing is understanding how cycling can truly transform itself into a cultural product in Portugal, and how the investment on cycling can have consequences for the cultural sector. Furthermore, it is crucial to understand what business opportunities this can bring more concretely.

The country's historical connection with cycling, in addition to its current important position in the bicycle manufacturing sector at a worldwide scale, means that there is great potential for the social and cultural development of business opportunities and the cultural sector. However, it is always important to remember that the full untapped potential for cycling in both business and cultural sectors can only be achieved through the investments in cycling and the integration of good practices from The Netherlands, referenced extensively in the course of this work. Nevertheless, the capability to innovate in cycling business and cultural initiatives is possible, by analysing cycling under two different perspectives: a) entrepreneurial and business potential for the purposes of increasing the ridership rates, by facilitating the establishment of a cycling culture in the country, and b) the integration of cycling in the existing cultural sector of the country.

These three elements – cycling, culture and entrepreneurial innovation – can become interconnected with each other. For example, the investment in innovation in the soft mobility sector can increase cycling ridership rates which, in turn, cements the local and national importance of cycling culture. Likewise, the application of good practices by governmental agencies and stakeholders (utilizing Dutch strategies), in which cycling becomes safer and more convenient, encourages the utilization of this transport. This requires entrepreneurial innovation in Portugal for the purposes of cycling, and of fostering a bicycle culture.

4.2.1 Digital entrepreneurial opportunities in urban cycling

When it comes to entrepreneurial integration and business opportunities to increase bicycle ridership rates (thus stimulating a cycling culture), plenty of resources that have not yet been fully explored can contribute to that goal. Mário José Meireles (2020) develops the idea that, in Portugal, there should be more effort to invest in a system that presents Mobility as a Service (MaaS) (Meireles, 2020, pp. 80-4). This concept aims to combine numerous modes of transportation and transportation-related services into a single, all-encompassing and on-demand mobility solution, which includes payment options for the multiple forms of transport of a journey through a single channel, instead of several forms of ticketing (Meireles, 2020, p. 80). Intelligent technology can provide users with journeys that suit their needs in the most convenient and personalized way possible. While some steps towards integrating Mobility as a Service in Portuguese urban areas have been successfully implemented, particularly in the bus and metro systems, most often this system does not integrate bicycle mobility. This is aggravated by the fact that, so that Mobility as a Service works in urban areas, it is necessary to have developed bicycle route planners. For example, when it comes to calculating the optimal route from a certain point A to a point B by bicycle, no Portuguese city offers a bicycle route planner that provides sufficiently reliable route recommendations that meet the consumers' real options (Félix R. M., 2012; Meireles, 2020). After analysing each mobility application related to bicycle use, Meireles (2020) concludes:

> With regard to the digital solutions on the market, it can be concluded that of the applications and digital platforms presented, those related to the bicycle are dedicated only to this purpose, with no integration with other modes of transport, nor with applications that relate to the territory. (Meireles, 2020, p. 90)[13]

As such, digital solutions have the potential of providing better integration of cycling into Portuguese society. There is currently a gap in the market for digital cycling integration and, consequently, the creation of digital innovative solutions for Portuguese cities could provide advantageous business opportunities for the transportation sector, for example. But the development of such tools and digital platforms for customers could also be a way for local municipalities to have access to data about the existing cycling network and

[13] Já relativamente às soluções digitais existentes no mercado, conclui-se que dos aplicativos e plataformas digitais apresentados, os que são relacionados com a bicicleta dedicam-se apenas a esse fim, não havendo uma integração com outros modos de transporte, nem, tampouco, com aplicativos que digam respeito ao território. (Meireles, 2020, p. 90), Translation by the author

the number of daily users, while contributing to a better management of the urban planning and management of mobility (Félix R. M., Gestão da Mobilidade em Bicicleta: Necessidades, factores de preferência e ferramentas de suporte ao planeamento e gestão de redes. O caso de Lisboa., 2012). It would intrinsically be viable to monitor the evolution in urban mobility at a frequency that matched the rate of bicycle growth in cities, something which Portuguese urban areas have had difficulty doing so far, notably due to a lack of ways to gather cycling data.

4.2.2 National bicycle production as an ally of other sectors

It is also important to reinforce the bicycle manufacturing sector that already exists in Portugal. The association of Portugal with this sector can be an important ally in the establishment of cycling as a culture. As previously mentioned, bicycle production is already a culturally symbolic activity of the country, particularly in the district of Aveiro. So, in that regard, bicycles already have a precedent of being a cultural product. However, most of the current production is focused on the exportation to European markets, due to a low national demand. This is an opportunity for national cycling businesses to also cater for national clients, which would lead to an increase in customer's demands and less reliance on foreign markets. Indeed, the proximity between producers and consumers could also create a link between the bicycle as a cultural symbol produced in Portugal and their users. However, in order to increase national bicycle needs, it is necessary to improve the existing cycling network, through the application of the measures specified in section 4.1.

Finally, there can also be dialogue, cooperation and sharing of resources between businesses that operate in the bicycle and soft mobility sector and local governments. As an example, shared bicycle and e-scooter businesses and/or rental businesses can benefit greatly from a "permanent dialogue" between corporations and governments. That is, these have the potential to establish partnerships with each other and trade resources in such a way that is mutually beneficial to both parties. For example, governments could create bike parking and rental sections within metro and train stations that benefit these companies and, in return, the companies would play a small space rental fee.

4.2.3 The expansion of cycling activities in urban areas

The utilization of bicycles for cultural purposes – notably when connected to tourism – can be a great opportunity that has not yet been fully explored. The Cyclin' Portugal programme, developed by the Portuguese Cycling Federation in partnership with Tourism of Portugal, analyses the Portuguese potential for cycling as a touristic activity with the ability to boost this sector. However, the majority of the focus of these organizations has not been on developing the urban cycling tourism sector, instead prioritizing nature routes in the country's low-density and rural regions (Federação Portuguesa de Ciclismo, 2016). Nevertheless, on the Orientation Guide developed by these organizations for improving urban cyclo-tourism two elements are mentioned: a) bike-sharing systems in cities, available at stations scattered throughout the city, and b) the availability of e-bikes and "pedelecs", particularly for older tourists (Federação Portuguesa de Ciclismo, 2016, p. 8). Since the cultural sector and the tourism sector have a symbiotic relationship with each other, the expansion of the tourism sector to allow for a more bike-friendly environment can also serve to develop new touristic bicycle routes in Portugal. An example of this would be, for example, the creation of urban bicycle tour programmes in cities like Matosinhos, Coimbra, Ovar, Vila Real de Santo António and Braga, for example, as these have made significant investments towards bicycle mobility, have significant touristic appeal and/or have an established presence of this form of transportation.

A higher focus on cycling development could also create new opportunities for social integration, through community programs that link cycling with local elements and members of that community. For example, there are social programmes that more directly target local communities, such as shopkeepers, local residents of specific neighbourhoods of urban areas, as a way to promote sustainable transportation. These initiatives and organizations can elucidate these groups of people for the benefits of cycling and anti-car dependency, boosting community support for such practices. This in turn can create a sense of unity between the community and, in a way, "empower" them. Guareschi & Jovchelovitch write:

> The capacity of communities for effective participation generates gains at the personal, community and political levels. It not only empowers individuals and the community, but also poses to the institutional structures of the state the need to incorporate and take into account the insights and demands coming from grassroots movements. (Guareschi & Jovchelovitch, 2004)

In other words, these unifying movements are essential for giving locals a voice, by establishing connections between individuals and their community. The unity of people also gives more power to those communities to demand change at an institutional and political level, to improve their circumstances. Guareschi & Jovchelovitch (2004) refer to this as the "participation for empowerment" strategy, which has been utilized by many European cities and their respective neighbourhoods to forge spaces "by locals, for locals". In short, cycling can be a tool for the intensification of the sense of community of a neighbourhood, by making residents closer to each other and local small business-owners. This in turn makes them more likely to actively engage with the community-members and defend each others interests, politically and socially (Guareschi & Jovchelovitch, 2004).

Social initiatives that seek to promote cycling as a form of reliable urban transport are already relatively common in Lisbon, with organizations such as "Lisboa Possível" and "Lisboa Para Pessoas", which promote and develop local initiatives that eliminate cars from the city and establish pedestrian and cycling-friendly zones. However, very few organizations exist in other urban areas of the country besides Lisbon. In Porto, for example, only MUBi has a significant presence in the city, albeit rather small compared to its dimension in the capital. Coimbra has the "Coimbr'a Pedal" movement, which promotes cyclable routes and cycling information specific about the city. There is also the "Braga Ciclável" movement, with similar purposes as those mentioned above but focused on the city of Braga. Nevertheless, these organizations and movements are rather small in scale and, more importantly, they are fully independent. This makes them harder to integrate into more direct political action and play a more direct and active role in concrete measures. There should be more cultural and community events that promote and integrate bicycles in their agenda outside of the country's capital. Other possible solutions that benefit all parties are cycling events for children; and communal bicycle events, promoted by local municipalities and business-owners across different points of interest and traditional commercial areas.

Also, the national relevancy of cycling may be restored by better cementing the historical role in the country, particularly in areas where it had a stronger presence. The historical connection between urban areas and cycling could also be promoted through the association of touristic activities in multiple Portuguese cities with the bicycle production sector of Aveiro and other areas of manufacturing.

4.2.4 Connecting bicycle rental with other forms of transport

As mentioned previously, the issues of lack of cohesive transportation network also translates itself into issues of integrating cycling into others forms of transport. In other words, it is often a challenge in Portuguese urban areas to combine different forms of transportation in a seamless way. This obstacle can be a great opportunity for the expansion of bicycle rental services in these areas.

For example, within or nearby Portuguese train, bus or metro stations there is a considerable potential to offer the option of renting bicycles, particularly electric bicycles. These could be used by residents or temporary visitors to conveniently move around. Residents could therefore more easily walk, drive or even cycle to a station, and then, directly from the station, temporary rent a bicycle to utilize while in their destination. This bicycle could then be brought back to the station on the return.

All of these strategies involving potential entrepreneurial opportunities can be used to increase the ridership rates of cycling and help move Portugal towards more sustainable forms of transport. This can be achieved while fostering a culture that incentivizes cycling.

The urgency of the Global Climate Crisis means that a transition to sustainable mobility is now more necessary than ever in all countries of the world. Particularly, as emissions from motor vehicles in urban areas represent a very large portion of the total pollution levels, urban planners and environmental specialists are now prioritizing cities design and planning that favour pedestrian and cycling- friendly spaces, rather than accessibility by cars. However, as it has been detailed through the course of this dissertation, the reduction of city's car dependency and the investment in other forms of sustainable mobility presents significant advantages. There can be environmental, health, economic, cultural and social advantages, for example. Particularly, in the case of the cultural and social advantages, these can lead to the establishment of closer connections with local communities by residents, increasing sustainability in the tourism sector, and boosting the national mass-scale bicycle manufacturing sector, as is the case of in Portugal.

Sustainability is therefore now being seen as a new opportunity for countries and for businesses. The European Union has made available numerous programs with financial incentives to governments and corporations to incorporate these sustainable practices. As we have seen in this dissertation, Portugal is not obtaining the full potential of these incentives. By utilizing these resources more intensely and in a more structured way, the sustainable transition of the country can be achieved at a more consistent and incremental pace.

When it comes to the integration of sustainable practices within the transportation sector in Portuguese urban areas, there are multiple possible approaches to achieved the goals established by the European Union. This is especially true for the practices involving soft forms of mobility, which have been successfully implemented in many European cities, such as Copenhagen and Oslo. The country which has made more significant advances towards a mass-scale, national and local bicycle network is The Netherlands. While in the past this country was on the verge of becoming car-dependent, the emergence of anti-car dependency social movements and the desire to provide safe streets for vulnerable demographics, created a shift in the country's urban planning policy. The Netherlands became more focused on human-scaled urban planning, interconnectivity of bicycles with other forms of public transport and pedestrian and cycling-friendly infrastructure and policy. These practices served as an example to follow by countries with lower cycling rates. Portugal, currently being a low-cycling country, should adapt and adopt some of the Dutch practices and policies to increase its own ridership rates.

Throughout this dissertation, it has been detailed how Portugal also has the potential to utilize the knowledge and practices of The Netherlands for its own development. By changing its street design while maintaining its cultural identity, by developing more and better bicycle infrastructure, restricting car-use in city centres and reducing vehicle speeds, it is possible to create better safety conditions for cycling and improve its competitiveness with cars. The alterations in street design and the shift in urban planning prioritization that happened in the Netherlands during the later part of the 20th Century had such positive results in the country that cycling became synonymous with the country's identity and linked with the country's culture.

In Portugal, achieving the country's sustainability goals is important for its overall environmental stability, as this is an extremely vulnerable spot in the Global Climate Crisis. But this is also important under an entrepreneurial perspective. As we have seen, cycling has an historical presence in Portugal and the abandonment of this form of transport was mostly due to the massive increase in car-centric infrastructure and policy, particularly during the second half of the 20th Century.

Additionally, Portugal also has municipalities, notably in the Aveiro district, where cycling is to this day important for local communities, both as a form of transport and, economically, because of bicycle production. As such, the investment in cycling allows for the flourishment of a tighter and mutually-beneficial relationship between the large bicycle manufacturing sector of the country, the largest in Europe, and the cultural and tourism sector. In other words, bicycle development following a Dutch model, can propel new entrepreneurial opportunities in this sector.

Ultimately, streets in urban areas should be seen as a "unity", a place where the community comes together and residents talk to other residents, neighbours, shopkeepers and people from different groups. Streets are meant to be synonymous with proximity to others and the combination of people's basic needs. Streets should combine social interaction, cultural activities that celebrate the history and traditions of the community, and local commerce with a sense of "belonging" to a particular place. In the end, the transition to more sustainable forms of mobility is going to happen sooner or later, and bicycles are an integral part of soft mobility. What is left to be answered is: does Portugal want to be in the margins or at the forefront of progress, inclusivity and sustainability? This dissertation tried to put forward the belief that Portugal should be one of the leading countries in this transition to sustainability. The arguments presented in this work serve

to demonstrate that it is possible to make alterations to the urban design of Portuguese cities to be better suited for cycling, avoiding car-dependency. The solutions offered in this work, inspired by a Dutch innovative model, serve as the foundation for a continuous and permanent work to combat fossil fuel dependency and promote social inclusion. In short, this work allowed for the presentation and discussion of various concrete measures adopted by The Netherlands and, if also adopted by Portugal, could establish a cycling culture that adapts to the needs of all in the country.

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