Chapter 1
Identifying Methods and Tools Toward More People-Friendly Environment: A Scoping Review

Mahgol Afshari, Alenka Temeljotov-Salaj, Agnar Johansen, and Jardar Lohne

Abstract Cities are contending with issues such as traffic congestion, air pollution, road accidents, and urban sprawl as the world's population grows at a rapid rate. Cycling and walking are nonmotorized modes that use no fossil fuel energy and require comparatively little infrastructure. They also have lower implementation and maintenance costs for users and governments than motorized forms of transport. Therefore, this study aims to identify methods and tools for more active mobility. The identification of approaches that can be used as incentives to increase walkability or bikeability in the Elgeseter district in the city of Trondheim has been done through a scoping literature review. The analysis is carried out according to the following research question: what can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking or biking? The findings are divided into four groups: active mobility advantages, bikeability motivators, walkability motivators, and active mobility barriers. Though almost all cities around the world are eager to address these issues, they will need integrated planning approaches that include everything from land use to city infrastructure design. Such approaches are necessary to encourage people to embrace green-sustainable modes of transportation as a lifestyle choice rather than a forced obligation. The study contributes to the knowledge about determinants that are important for encouraging commuters toward active mobility in the Elgeseter district.

Keywords Active mobility · People friendly environment · Walkability · Bikeability

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1.1 Introduction

It is an ongoing trend that people are moving into cities, and there is a focus on the development of smart cities in many countries in Europe (Collins et al., 2021). The location, design, and operation of a residential or commercial complex have an impact on how often people walk, bike, use public transportation, or drive, as well as whether their commuting experience is pleasant or unpleasant. Other factors can also influence people's travel behavior, such as geographical characteristics, cultural backgrounds, and awareness of traveling habits' effect on climate change. Active mobility including walking and cycling may result in cost savings, lower CO_2 emissions, less noise and air pollution, and less car congestion (Rabl & de Nazelle, 2012).

In accordance with the Trondheim city commitment to reduce greenhouse gas (GHG) emissions based on (Trondheim kommune., 2017), the city is attempting to overcome the effects of urbanization, city expansion, and highways as barriers to efficient collaboration in a part of the city called the Elgeseter district. In the area, the largest university and the largest hospital in Norway as well as many technologies and other companies are situated. There are different goals for the Elgeseter project, and the project is moving toward Sustainable Development Goals. Achieving zero emission, consolidation of sustainable lifestyles, supporting mental and societal health, moving toward innovation and development in an urban context, and achieving a systemic change toward a sustainable society are some of the targets of the project. Furthermore, improving active mobility in the Elgeseter district will achieve three Sustainable Development Goals at the same time which are good health and well-being, sustainable cities and communities, and climate action.

Elgeseter gate is an urban thoroughfare just south of Trondheim city center, between Professor Brochs gate in the south and Klostergata in the north. The road is a continuation of main road from the city center toward south. In this paper, the term Elgeseter district will be used to refer to the area surrounding Elgeseter gate. Figure 1.1 depicts the case study area, with the whole red circle representing Elgeseter gate and surrounding area; the red dotted circle includes the connecting routes to Elgeseter gate.

1.1.1 Scope of the Study

This paper reports on a scoping literature review focusing on identifying methods and tools that increase people-centric and active mobility that is relevant for the Elgeseter district. More specifically, the analysis ambitions to recognize incentives toward increasing walkability or bikeability in the Elgeseter district. Based on this, the research presented in this paper addresses the following main research question: *what can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking and biking?* In the upcoming chapter, a

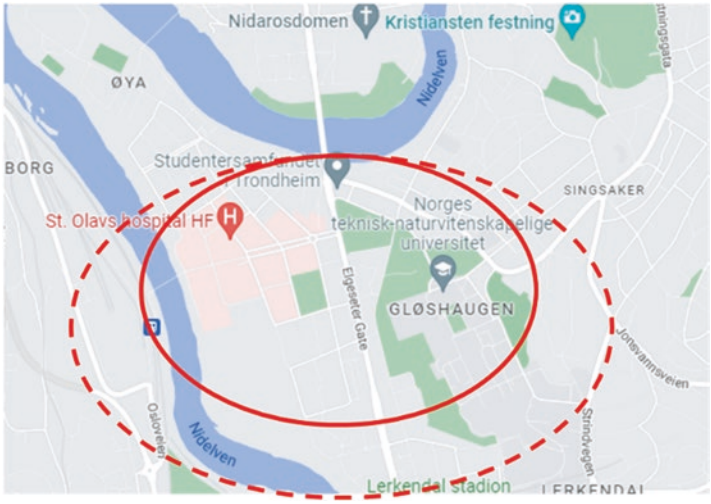

Fig. 1.1 The focus area of the case study. (Map data: Google, 2022)

theoretical background about active mobility as part of developing a new town area is discussed according to previous studies.

1.2 Theoretical Background: Active Mobility as Part of New Town Development

In 122 nations around the world, more than 30% of adults were found to be physically inactive (Hallal et al., 2012). A considerable proportion of people in countries all over the world have adopted sedentary and physically inactive lifestyles (Van Dyck et al., 2013). This chapter provides a theoretical background on the relevance of physical activities in people's daily life, as well as how active mobility might meet this requirement. Furthermore, walking and cycling as two major types of active transportation are discussed, with bikeability being the more popular way of transportation among the general public. Finally, a summary of active mobility as part of the development of a new town area is presented.

Physical activity has been shown to increase emotion, sense of recognition, overall life quality, anxiety neurosis (Ohmatsu et al., 2014), and lower depression (Dunn et al., 2001). Regular physical activity can assist to reduce the risk of a variety of chronic diseases and their risk factors, thereby improving global public health. On the other hand, *active mobility* (i.e., walking/cycling to get from one place to another) can be done regularly, is cost-effective, and is an easily accessible form of physical activity. It is simple to incorporate into adults' daily lives; it may be an important contributor to meeting the daily physical activity guidelines for health (Mertens, 2016). Active mobility (also known as nonmotorized mobility) is critical to the development of

efficient and equitable transportation networks as well as the transition to more sustainable communities (Victoria Transport Policy Institute, 2016).

Walking and cycling activities, among other sorts of physical activities, have recently gotten more attention from both civic and academic sectors to increase people's physical activity levels. Their popularity has been aided by a variety of factors. First, walking and cycling are suitable for people of all ages because they do not necessitate any special skills or equipment. Second, even though cycling is better for longer excursions, walking and cycling allow people to choose their preferred movement intensity. Finally, walking and cycling can assist people, particularly those from low-income groups, in breaking free from sedentary and inactive lifestyles (Brownson et al., 2000).

From the perspective of commuter cyclists, a city's cycling culture is the most important determinant in commuter riding levels (Sager, 2002). In various places throughout the world, policies and initiatives targeted at boosting the use, accessibility, and safety of cycling have increased during the previous decade (Pucher & Buehler, 2017). Furthermore, according to Waitt and Stanes (2022), barriers to "commuter cycling" as "stop-start" journeys filled with interruptions from traffic lights, crossing main roads, sharp corners, or pedestrians in the same lane as the bikers are important elements to be considered to increase bikeability in an area.

In sum, the natural and man-made environments, as well as individual and household characteristics, all have an impact on the decision to travel by bicycle (Heinen et al., 2009). Bicycling infrastructure can help reduce greenhouse gas emissions, while other measures that promote human-powered modes can help improve air and noise pollution. These advantages motivate towns to encourage greater riding, but doing so necessitates legislative changes that bring bicycling on par with other modes of transportation (Desjardins et al., 2021a, b).

During the research presented in the paper, walkability and bikeability motivators and barriers appear to be little analyzed in the literature. Not many papers are identified focusing solely on the methods for motivating people toward more active mobility. Therefore, the current paper tries to fill this knowledge gap by, firstly, identifying the methods and tools for increasing active mobility, and, secondly, by analyzing the factors which can affect citizens' commuting behavior. This latter concerns especially the factors that can motivate and encourage toward more walking and biking.

1.3 Methodology and Research Design

Scoping literature reviews are useful when the research intends to overview an existing body of literature within a specific field to find potential research gaps (Munn et al., 2018). The structure of the scoping review was inspired by the framework developed by Arksey and O'Malley (2005). Scoping reviews are also adequate methods when the research questions asked are broad and holistic without the

intention of confirming or denying existing practices within the selected field (Arksey & O'Malley, 2005; Colquhoun et al., 2014; Munn et al., 2018).

1.3.1 Systematic Search

Four databases were chosen for the scoping literature review: Google Scholar, ScienceDirect, Web of Science, and Scopus. The study was limited to articles and books that have been published in the last 10 years. By defining "motivation AND commute AND walkability AND bikeability" as the main search string, 447 results appeared in GS, 694 results appeared in SD, and no results in WoS and Scopus. Based on the research question, the titles of the findings were read to select the most relevant literature for the topic. After transferring all 346 relevant articles based on their titles to Mendeley, five sets of duplicates have been found. So, for the next step, we started to read the abstracts of the 341 remaining documents and transfer the relevant ones to the comparison table. By reading abstracts, 53 final documents were chosen as the most relevant to the research topic. The framework for the scoping review performed in this paper is visualized in Fig. 1.2. In addition, two studies with pertinent data were added to the references after a particular search with the keyword "cycling commuter" in Google Scholar.

1.3.2 Search Procedure

Following the protocol of the scoping review, the steps are explained as follows (Fig. 1.3).

1. One research question is defined.
2. After several trials and errors, an initial search of relevant studies was conducted using available scientific databases with the following search string: "motivation AND commute AND walkability AND bikeability."

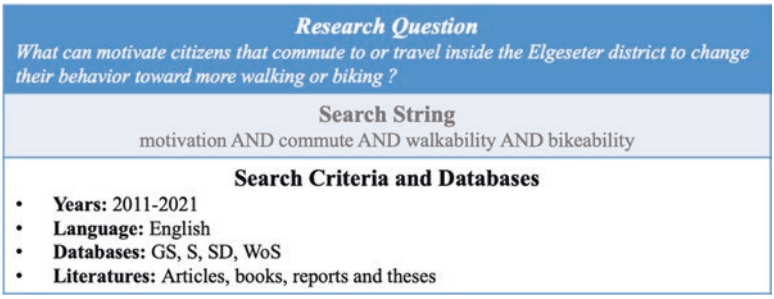

Fig. 1.2 Framework scoping study

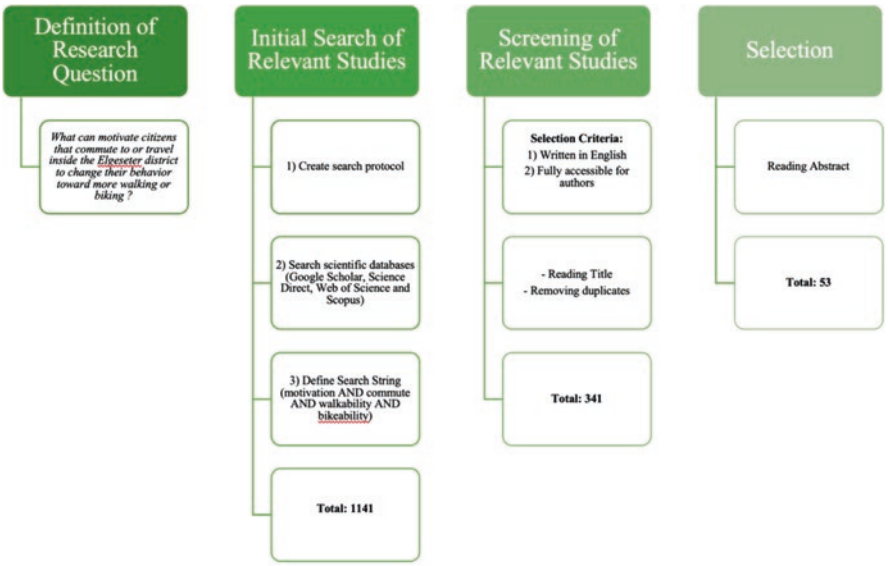

Fig. 1.3 Scoping review process as followed in the research presented in this paper

3. The selected databases were Google Scholar (GS), Scopus (S), ScienceDirect (SD), and Web of Science (WoS).
4. The language is limited to English, and the year of publication was set from 2011 to 2021.

In the upcoming chapter, the findings from the literature review are presented.

1.4 Results: Active Mobility, Bikeability, and Walkability Factors

In this chapter, the results are presented in two different categories. In the first section, the focus is on descriptive analysis, and in the second section, an overview of the overall findings from the literature is presented.

1.4.1 Descriptive Analysis

In this section, the descriptive findings from review are analyzed from two different aspects. In the first part, the number of publications of the examined papers during the last 10 years is provided, and in the second part, the top journals are identified.

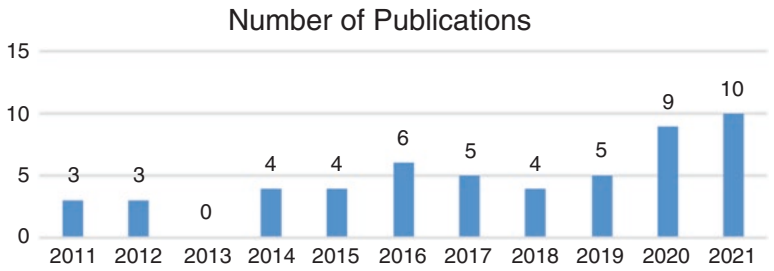

Fig. 1.4 The number of publication trends between 2011 and 2021

1.4.1.1 Number of Publications

In general, there was a notable increase in the number of publications connected to active mobility in 2020 and 2021, with nine and ten publications, respectively. Between 2011 and 2019, the number of papers published ranged from three to six, except for 2013, when no relevant papers were found. Figure 1.4 depicts the number of publication trends from 2011 to 2021.

1.4.1.2 Top Journals of the Examined Papers

The number of papers in the most prestigious journals for the examined 53 papers is depicted in Fig. 1.5.

"Transportation Research Part A: Policy and Practice" and "Environmental Research and Public Health," each with four papers, were the top journals in the field of study of this report, according to the analysis. In addition to them, three other journals, each with two papers, were active in this instance. The remaining papers originate from grey papers, other journals, conference proceedings, and publishers, with each having less than two papers.

By presenting the descriptive analysis in this section, the main focus of the next part will be on four different sets of findings from the literature.

1.4.2 Findings from the Literature

In order to identify approaches to increase active mobility, the main findings from the scoping literature review are categorized into four groups. First, the benefits of active mobility are presented. Then, bikeability and walkability motivators are discussed respectively, and finally, the barriers of active mobility are mentioned.

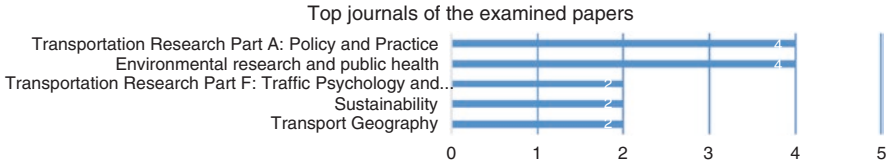

Fig. 1.5 Top journals of the examined paper

1.4.2.1 Active Mobility Advantages

Active mobility modalities are a low-cost means of commuting with a low environmental impact. Because of their low cost, flexibility, beneficial physical and psychological health impacts, and zero emissions, active modes (such as walking and bicycling) are deemed green, economic, equitable, and convenient (Gan et al., 2018). Walking or cycling as an alternative to motorized transportation for everyday journeys is example of active mobility modes. Based on previous studies, each of these alternatives is beneficial for the communities, and they have many advantages for the people, societies, and environment.

Physical activity can benefit people physiologically by having a favorable impact on their mental health, in addition to enhancing their physical health. Therefore, active mobility, which is linked to health, physical activity, and the prevention of chronic diseases, is increasingly being included in transportation and urban planning studies looking for alternatives to motorized transportation (Arbab et al., 2020a). Cycling as one of the active mobility modes has been shown to reduce the incidence of obesity, increase cardiovascular fitness, and reduce the risk of heart disease, diabetes, high blood pressure, and a variety of cancer-related side effects (Oja et al., 2011).

Kim and Dumitrescu (2016) believe that bicycling is critical for creating a city with sustainable development by lowering pollution from motorized vehicle emissions, improving inhabitants' health and physical fitness, and, most critically, minimizing road traffic accidents. As a result, promoting bikeability and walkability as a mode of transportation can help communities become more sustainable and livable.

1.4.2.2 Bikeability Motivators

Changes in travel behavior have been demonstrated to be one of the most effective ways to reduce greenhouse gas (GHG) emissions in transportation. Based on this fact, cycling, in particular, is becoming increasingly popular as a non-automobile means of transportation. Therefore, the main focus of this section is introducing some incentives which can lead to an increase in the rate of biking between people.

According to prior research, there are a variety of bikeability motivators that can encourage people to choose riding as a mode of transportation. Winters et al. (2010) present that in Vancouver, Canada, different sorts of bicyclists, both existing and

potential, rated "routes with magnificent scenery" as a top motivator, slightly higher than routes with divided bicycle tracks or a flat slope. In another research, Heesch et al. (2012), compared biking incentives between men and women and mentioned that women were significantly more motivated by fun and enjoyment, getting fresh air, incorporating physical activity into a busy lifestyle, confidence in their cycling abilities, seeing other people cycle, encouragement from others, convenient or inexpensive mode of transportation, and environmental concerns than men.

According to Dill and McNeil (2013), protected bike lanes, known as "gold standard" bike lanes, are perceived to be safer than their non-protected counterparts because they use a barrier to separate cyclists from motorists. This sense of security, or comfort, could be critical in drawing more bicycles to the roads. In another study, Habib et al. (2014) indicated that people who have a greater perception of a city's bikeability and a low level of safety awareness are more likely to pedal for utilitarian reasons. It is also important to consider the quality of the urban environment.

While many research studies are discussing bikeability motivators without focusing on the specific areas, some other researchers present their findings based on different case studies in different geographical locations. For example, based on research in Brisbane, Australia, shorter distances to destinations, such as a commercial district with jobs and a river with bicycle routes, enhanced the likelihood of riding (Heesch et al., 2015). According to another study, bicyclists in Seattle, Washington, choose short, flat routes with well-connected amenities on highways with low traffic speeds. Their research discovered higher variation in preferences for views along routes with mixed land use, street trees, illumination, and city elements (Chen et al., 2018).

1.4.2.3 Walkability Motivators

A neighborhood's walkability is a measure of how walkable it is considered to be for people that walk in the district daily. The availability or absence of footpaths, sidewalks, or other pedestrian rights-of-way, traffic and road conditions, land-use patterns, building accessibility, and safety are all factors that can influence people's decision to walk as their primary means of transportation. According to Hess et al. (1999), in more walkable communities that have a higher density and a diversified land-use mix, there is a higher use of active modes and transit. Safe accessibility, such as strengthening personal security and improving transportation safety, and physical setting, such as boosting comfort level and providing supporting facilities, can be also some incentives toward active mobility (Arbab et al., 2020b).

Hillnhutter (2022) and Vukmirovic and Gavrilovic (2020) approached the stimulators in the urban environment, which influence the experience of walking (non-monotone environment, not boring streetscape, green features, artistic elements, gathering places, good visibility, safety). Alfonzo et al. (2008) believe that sidewalks' width and quality, benches, and crosswalks all had a beneficial impact on the number of pedestrians and/or the amount of time they spent walking. In other words, well-designed green street facilities contributed to more attractive walking

environments (Adkins et al., 2012). Moreover, the likelihood of preferring to walk for both access and egress trips was positively and significantly linked with enough perceived walking amenities and comfortable walking space (Wu et al., 2018). Zhang and Mu (2020) also mentioned that if it's busy, dark, or hazardous, people will avoid walking. While strolling, pedestrians often consider additional facilities such as a water fountain, a restroom, and shade.

1.4.2.4 Active Mobility Barriers

Identifying the constraints that prevent individuals from walking or cycling to their destinations is the first step toward promoting active mobility. Greater distance, increased household income, and increased car ownership are consistently related to lower rates of active mobility among the factors that cannot be controlled for. According to Pucher and Buehler (2006), bicycle journeys are less common in low-density areas, as there are fewer places that can be visited in a short amount of time. Elgeseter district can be described as a low-density area. There is the potential for some restaurants, cafes, businesses, and perhaps a shopping mall to be built there, but currently, there are not enough places there to be visited or make the district attractive to walk or bike.

Ma et al. (2014) investigated active mobility barriers from an age standpoint. Ma et al. believe that younger individuals are more likely to bicycle. Older adults are less likely to ride a bike, which could be explained by the fact that as people get older, they become more concerned about safety and fear of being injured in an accident. However, Habib et al. (2014) explored cycling barriers from the perspective of gender. Based on his findings, women are more concerned about traffic and safety conditions, which is why they are less likely to cycle.

Based on Rojas López and Wong (2017), the most commonly reported walking difficulties in Singapore were distance limitations, sluggish transport speeds, and hot, wet weather. The need of carrying stuff (particularly for students) was also emphasized. Users, primarily younger users, stated that they must commute a significant distance to work or education. As a result, walking trips were frequently overlooked. Some people said they have to carry a lot of stuff to go to work (notebooks, lunch, paperwork, etc.), which makes walking more than a few blocks difficult.

1.5 Discussion

This study aimed to get a better knowledge of the advantages of active mobility for people and societies as well as the barriers that exist in the growth of walking and biking in the city as a genuine mode of transportation in such a constrained area. Moreover, this paper tries to identify some motivators toward more walkability and bikeability by using scoping literature review as the main research method to answer

the research question: *what can motivate citizens that commute to or travel inside the Elgeseter district to change their behavior toward more walking and biking.* Here the results are discussed concerning the theoretical framework. In comparison to active mobility advantages and barriers and bikeability motivators, walkability motivators were discussed less in the literature.

Physical activities have been shown to help people's health by lowering the risk of becoming overweight or obese, as well as in the primary and secondary prevention of a variety of chronic illnesses (Warburton et al., 2006). Therefore, in recent years, numerous studies have attempted to discover various techniques for promoting physical activity in the general public, with a particular focus on active mobility as one of the most essential ways to improve an active lifestyle by utilizing walkability and bikeability as modes of commuting.

Trondheim municipality has aimed to introduce Trondheim as a model and a collaborative arena for green value creation and the development of a climate-friendly lifestyle. Furthermore, based on Trondheim kommune (2017), the municipality's goal is to reduce the greenhouse gas emissions by 80% before 2030, compared to the 1991 level. Therefore, improving active mobility in the Elgeseter area will simultaneously entail three Sustainable Development Goals: good health and well-being, sustainable cities and communities, and climate action.

According to Zhang (2016), although individuals care about the walking environment, the current metrics are insufficient in several ways. First, present methodologies do not take into account aspects of urban planning such as sidewalk quality, walking buffers, and other elements that impact people's walking behavior. Second, understanding the neighborhood's purpose and, more crucially, local people's preferences for the walking environment is vital for evaluating walkability. In a business center, a residential neighborhood, and a university campus, people have various walking requirements and expectations.

Inactivity and decreased physical activity/active transportation may be caused by poor sidewalk conditions, restricted access to recreational amenities such as parks, and a lack of local attractions (Arbab et al., 2020b). Moreover, areas with trees and green space are also associated with more bicycling. Currently, there is not enough green space in the Elgeseter district, and the area is mostly surrounded by old buildings which makes it a bit less attractive for the bikers. In other words, more walkable and bikeable communities may increase inhabitants' views toward active commute modes.

As unsafe paths discourage walking and biking, pedestrian safety is crucial to improving active transportation. One of the significant issues which make citizens less motivated to walk in the Elgeseter district is the lack of walking amenities in the area. In most places, the sidewalk is not divided from bicycling paths, and the sidewalks are either too wide or too narrow. As a walkable city is one with safe, accessible, and comfortable walkways, trails, and street crossings for people of all abilities, planners should emphasize constructing paths to connect residences with services and investing in more recreational facilities within walking distances in rural regions, where physical activity and active mobility alternatives are severely limited (Pavlick et al., 2020).

Finally, findings indicate that it's crucial to recognize that various users have distinct travel habits and requirements. As a result, measures to encourage walking and cycling should be tailored to the requirements of everybody, resulting in a greater number of prospective users.

1.6 Conclusions

Elgeseter district as one of the most important streets in Trondheim city is experiencing challenges such as increased traffic, toxic pollutants, and noise pollution. Increased active mobility in the area can help solve a lot of these problems. In accordance with Temeljotov-Salaj and Lindkvist (2021) to holistically approach the regeneration of urban spaces, the contribution to health and well-being is important, from both physical causes and symptoms of poor health, and the social, economic, and environmental components of individual community and overall well-being. In other words, based on the importance of considering walking and cycling as a way to improve the quality of life in cities, particularly Trondheim in Norway, with the added benefits of enhancing public and private health and lowering harmful emissions, traffic congestion, and noise associated with excessive automobility, the main focus of this paper is on looking for incentives that will motivate residents to change their behavior and choose walkability and bikeability as their preferred means of transportation.

According to the practical findings in this study walking and cycling for transportation ("active mobility") are usually thought to minimize CO_2 emissions by substituting for at least some motorized travel (de Nazelle et al., 2010). This is only one of the benefits of active mobility in Elgeseter gate. Active mobility may not only boost health as a source of physical activity, but it may also help achieve social and environmental goals such as promoting social cohesion and lowering CO_2 emissions by offsetting air pollution from motorized cars on such travels. So, to achieve these environmental goals and move toward greater sustainability, certain recommendations are made based on the research conducted by the authors of this paper, particularly for the Elgeseter district in Trondheim. Moreover, as one of the aims of UN SDG is to protect the planet, by improving active mobility, this goal will be more achievable.

It is important that urban area developments be rethought and reconfigured to improve traffic flow by including and supporting nonmotorized, less polluting modes of transportation such as cycling and walking. In other words, the main street just south of Trondheim city center, between Professor Brochs gate in the south and Klostergata in the north, must be adapted to include walkways, crossing junctions, and distinct cycling and pedestrian lanes with end-to-end connections. Secondly, to reduce dependency on unsustainable modes of transportation, Trondheim kommune has to construct a more inexpensive, accessible, and appealing transportation infrastructure that is available to the commuters of Elgeseter district at any time.

As a result of these insights, policymakers of Trondheim will be able to establish more effective policies for encouraging and developing active forms of transportation in the Elgeseter district. Therefore, it is critical for infrastructure and regulations to match existing and future users' expectations to provide an acceptable walking and bicycle transportation network service and entice people to utilize it. Furthermore, given the important public health, economic, and climatic implications of transportation behavior, for future work, researchers and funders should pay particular attention to finding motivators for active mobility more specifically.

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