

Article

Barriers to Implementing Pro-Cycling Policies: A Case Study of Hamburg

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Abstract: Cycling is gaining increasing attention as a convenient, environmentally friendly, and fitness-improving mode of transport. While many policy interventions have been made to promote cycling, not enough research has focused on the barriers to implementing pro-cycling policies. For effective policy implementation, identifying major barriers and removing them is critical. This study took an in-depth look at Hamburg which started a major cycling promotion in 2008. According to expert interviews and literature surveys, the author found that the major barriers are physical, political and institutional, and social and cultural. Specifically, the city lacks enough physical space, political support, and the evaluation of travel behavior and demand. Also, some private stakeholders are reluctant to give up on-street car parking space for cycling lanes, and the negotiation process is difficult and time-consuming. To overcome these barriers, Hamburg requires cycling-oriented urban design, a strategic and integrated cycling action plan, strong political support, and target group-oriented communication.

Keywords: cycling; policy implementation; barrier; Hamburg

1. Introduction

Cycling is gaining increasing attention as a zero-emission, low-cost, and convenient mode of transport [1,2]. Compared with motorized transport, cycling can not only mitigate rush-hour traffic congestion [3], but also be less aggressive for children and older adults. Cycling, particularly the bike-sharing system, helps address the “last mile” issue and enlarge service areas of public transport [4]. Moreover, cycling can increase physical activity levels and improve physical and mental health [5–9]. Though there are risks of traffic accidents and exposure to pollution, researchers found that the health benefits of cycling would outweigh the risks [5,6].

Given the various benefits of cycling, an increasing number of cities around the world have committed to increasing cycling [10–12]. Some European cities—for instance, Copenhagen, Amsterdam, and Muenster—already have a high percentage of people cycling for transport. These cities have relatively long cycling cultures, well-developed pro-cycling policies and programs, as well as adequate cycling infrastructure [13].

In recent years, some big German cities have expended great efforts in promoting cycling, for example, cities like Berlin, Munich, and Hamburg [12,14]. However, cycling promotion in big cities in Germany is challenging. First, Germany has a high level of car ownership and a sufficient and high-quality road infrastructure supply that can facilitate convenient car use [15–17]. The passenger car is the major mode of commuting for employees (67.7% in 2016) [18]. When many people already use a car as part of their daily routine, it is possible that they are reluctant to change their travel behavior [19]. Second, the automotive industry is important to Germany both economically and politically. German economic lobby groups strongly support the automotive industry and motorized transport to ensure

thriving development [16]. Therefore, the implementation of pro-cycling policies and measures may encounter various barriers.

Many studies have investigated barriers to cycling. Studies have found that potential barriers include: safety concern [20–22]; vandalism [20]; impracticality for daily use and perceived physical discomfort [23]; lack of cycling infrastructure [24]; and viewing cycling as a subcultural choice [25,26]. To help mitigate these perceived barriers and increase the public image of cycling, implementation of pro-cycling policies and the provision of a better cycling infrastructure are recommended [8,13,24]. However, not enough studies have focused on barriers to the actual implementation of pro-cycling policies.

To promote cycling more efficiently, planners need to better understand the characteristics of the barriers to policy implementation, the underlying reasons, and the possible solutions to address them. This study took an in-depth look at Hamburg. Hamburg is a city state and the second largest city in Germany with a population of over 1.8 million [27]. Hamburg has been a car-friendly city for the last few decades, and 68% of households have at least one car [28]. According to the 2016 “Bicycle Climate Test” survey, which is a nation-wide survey on cyclists’ perception that is organized by the German Cyclist’s Association (ADFC), Hamburg ranked 31 out of 39 German cities with a population over 200,000 [29]. This survey implies that many cyclists are unsatisfied with the cycling environment in Hamburg.

Promoting cycling as a mode of transport and improving the cycling environment are gaining increasing importance in Hamburg’s agenda. Hamburg started a major cycling promotion in 2008, which was a few years later than other big German cities including Berlin, Munich, and Frankfurt [12]. With many actions being planned and implemented, Hamburg serves as a good example for exploring the challenges in transitioning from a car-dependent city towards a cycling-friendly city. The experience is helpful for other cities with similar goals. According to the study in Hamburg, this research aims at answering: (1) What are the barriers to implementing pro-cycling policies in Hamburg? (2) What are the underlying reasons for the barriers? Based on the findings, suggestions for overcoming the barriers are proposed.

2. Literature Review

2.1. Policies to Promote Cycling

Existing studies have summarized different types of interventions to promote cycling, such as infrastructure provision, policy and legal intervention, communication, marketing, community design, and a comprehensive policy package [2,30,31]. In many cities, improving the cycling infrastructure is the main task for pro-cycling policies. Different cycling infrastructure includes cycling lanes (separated from motor traffic by painted lines), cycling tracks and paths (physically separated from motor traffic), and various parking facilities [32,33]. Other than cycling lanes, tracks, and paths, German cities are innovative in establishing bicycle priority streets (Fahrradstrasse) where cyclists have priority on the entire street with minimal car traffic [14].

Notably, a comprehensive policy package was found to be highly effective in promoting cycling [2,13,30,34]. Some studies highlight the combination of pull and push measures [2,33,35]. Pull measures are policies to improve cycling infrastructure and services, provide incentives for bicycle use, and so forth. Push measures try to make car use more expensive and less convenient [2]. Some highlight the combination of hard and soft measures [12,36]. Hard measures focus on the structural change, for example, constructing cycling infrastructure. Soft measures focus on psychosocial aspects to achieve modal shifts, for example, a communication campaign [36,37]. Measures with different focuses can complement each other to achieve a higher efficiency in promoting cycling for transport [13].

2.2. Barriers to Implementing Sustainable Transport Policy

Barriers can be understood as obstacles that limit or even prevent policy implementation [38]. Many studies have investigated barriers to implementing sustainable transport policies [38–41]. In one of the studies, Banister [41] summarized six possible types of barriers: resource barriers, institutional and policy barriers, social and cultural barriers, legal barriers, side effects, and other (physical) barriers (see Table 1 for further description). According to a review of 61 policies, Banister [41] found that resource barriers, institutional and policy barriers, and social and cultural barriers occurred the most. May et al. [38] grouped barriers to transport policy implementation as legal and institutional, financial, political and cultural, and practical and technological. Legal, institutional, and technological barriers are highlighted as more difficult to overcome. Vigar [39] categorized barriers into four types: financial, organizational, cultural, and political. By examining the barriers to adopting sustainable transport planning approaches in the UK, Vigar [39] found that cultural and political barriers notably slow down the transition in transport demand management. In sum, these studies provided various frameworks for analyzing barriers to sustainable mobility transition and highlighted some important barriers. However, not enough research has focused specifically on barriers to cycling transition [10].

Table 1. Category of barriers to implementing sustainable transport policies.

Category of Barrier ¹	Description ¹	Cycling—Related Example
Resource	Problems in acquiring an adequate amount of financial and physical resources in time	Not enough investments [42]
Institutional and political	Problems in the cooperation between organizations and conflicts among different policies	Lack of leadership and political will [42]
Social and cultural	Problems in public acceptability of the measures	The public's resistance to construct or use certain types of cycling infrastructure
Legal	Measures can be restricted or even cancelled by laws and regulations	Cycling lane construction is not permitted on certain roads
Side effects	The effects on other activities	Increased traffic risks for cyclists
Other (physical)	Space or topography restriction	Lack of space for cycling lanes, unsuitable topography [41]

¹ The category and description of barriers are from [41].

2.3. Barriers to Implementing Pro-Cycling Policy

Cycling has been marginalized in many cities' modernized transport planning [43,44]. Several studies in the UK have examined the barriers to pro-cycling policy adoption and implementation and have highlighted the lack of funding and leadership [42,45,46]. Moreover, many European cities have a compact urban structure and scarce street space, in particular in inner city areas. It is challenging to implement cycling infrastructure in a restricted space [47]. In the German context, there is a higher national cycling modal share than the UK; however, a stronger influence of car lobby groups possibly exists [10]. It is possible that the major barriers are different across European cities.

Given various potential barriers to implementing pro-cycling policies, identifying the major barriers could help to design more targeted and context-specific measures [34]. To identify the barriers, experiences could be learned from general sustainable mobility studies. The barrier framework of Banister, as described above, is suitable for analyzing a wide range of sustainable mobility policies' implementation [41,42,48]. Since cycling is a typical approach towards sustainable mobility, this research employed this framework to explore the barriers to pro-cycling policy implementation in Hamburg.

3. Materials and Methods

This study took Hamburg as a case city. Data was collected through semi-structured expert interviews, document surveys, and was complemented by field observations. The rationale for adopting these methods was to get an in-depth and comprehensive understanding of the barriers faced by Hamburg in cycling promotion. Existing studies showed that both government and non-governmental organizations play roles in policy implementation [49,50]. In Hamburg, staffs from local authorities are the main implementers of pro-cycling policies. The authorities cooperate with several companies to deploy, construct, and maintain the cycling infrastructure [51]. Also, local authorities consult non-governmental organizations (NGOs) and a wide range of experts for better policy implementation. In this study, the selection of interviewees aimed to include experts that were closely related to cycling for transport in Hamburg. Therefore, experts were invited from local authorities, organizations that cooperated with authorities, and academics. Five interviewees, including both males and females, accepted the interview invitation. It was planned that two more transport planners would be interviewed; however, they declined. The collected information on the major barriers was consistent across all interviewees. The barriers mentioned by the fifth interviewee are repetitive without new information. Therefore, no new interviewees were recruited after the fifth interview.

Information about the five interviewees is listed in Table 2. For ensuring the anonymity, the interviewees were coded as H1–H5 in the results. All five interviewees were pro-cycling, and they were familiar with the cycling development and planning process in Hamburg. Moreover, they had expertise in different aspects, e.g., theory and practice on cycling planning and policy implementation, integration of bike and ride, and communication with a variety of stakeholders.

Table 2. Profile of interviewees in Hamburg.

Reference Code	Position	Organization
H1	Senior transport engineer and researcher	Hamburg University of Technology (<i>Technische Universität Hamburg</i>)
H2	Cycling planner	Ministry of Economy, Transport and Innovation (<i>Behörde für Wirtschaft, Verkehr und Innovation</i>)
H3	Senior transport planner	Ministry of Economy, Transport and Innovation (<i>Behörde für Wirtschaft, Verkehr und Innovation</i>)
H4	Staff and transport policy consultant	The German Cyclist's Association (<i>Allgemeine Deutsche Fahrrad-Club e. V.</i>) (ADFC)
H5	Staff for B + R (bike-and-ride)	The Hamburg Public Transport Association (<i>Hamburger Verkehrsverbund GmbH</i>) (HVV)

The interviews were guided by a list of semi-structured questions. First, the researcher asked background information about the interviewees, including their work experience, current work projects, and subsequent plans. Second, the interviewees were asked to express their opinions on the changes in the cycling environment, as well as opinions on key policies related to cycling in recent decades. Third, and most importantly, interviewees were asked about barriers (difficulties, challenges, and conflicts) to implementing pro-cycling policies. Subsequently, interviewees were asked to provide recommendations for policy implementation. When interviewing the expert (H5) from the Hamburg Public Transport Association, the researcher asked more detailed questions about B + R (bike-and-ride) programs. The interviews were conducted between June and September 2017. Four of the five interviews (H1, H2, H4, and H5) were recorded with permission and each lasted approximately 70 min.

The four recorded interviews were transcribed into text and were analyzed using a qualitative content analysis method developed by Schreier [52]. The transcripts were coded one by one, which was assisted by the software NVivo 11. The software helps to generate a node hierarchy (a coding framework) with clear references to the transcripts. The node hierarchy includes parent nodes (main categories) and child nodes (subcategories), where each parent node could contain one or more child

nodes and the child node could contain further child nodes, forming a node hierarchy [53]. In the coding process, transcripts were read line by line and were summarized as nodes. Passages with the same topics were assigned to the same nodes and each assigned passage was coded as a reference under the node. The major parent nodes included “cycling trends and policies”, “barriers to policy implementation”, and “recommendations”.

The coding of “barriers to policy implementation” used both concept-driven way and data-driven way [52]. The concept-driven way means that the main categories of barriers were adopted from the barrier framework that was developed by Banister [41]. The data-driven way helps to further generate subcategories of barriers by summarizing the related passages from interviews. Table A1 (in Appendix A) shows the main categories and subcategories of barriers, as well as examples of coding passages. The importance of each specific barrier was determined by the number of references of each subcategory (child node), which represents the frequency that they were mentioned by the interviewees.

A document survey was conducted to collect information on cycling trends and policies in Hamburg. The analyzed materials are listed in Table 3, for example, action plans and progress reports. Most documents are from official websites of the Free and Hanseatic City of Hamburg. Some documents were recommended by interviewees and local planners.

Table 3. Summary of analyzed documents.

Type	Document	Year	Source
Action plan	Cycling Action Plan for Hamburg	2007	[54]
Action plan	Alliance for Cycling	2016	[51]
Progress report	Cycling strategy for Hamburg: Progress report 2015	2015	[55]
Progress report	Hamburg—European Green Capital: 5 Years On.	2016	[56]
Development concept	B + R development concept for the Free and Hanseatic City of Hamburg	2015	[57]
Mobility program	Mobility program 2013—Basis for continuous transport development planning in Hamburg.	2013	[28]
Planner’s presentation	Cycling in Hamburg	2017	from a local planner

In addition, field observations were conducted based on the locations that interviewees mentioned in the interviews. Cycling infrastructure and people’s travel behaviors are observable, and observation helps to better understand local infrastructure for cyclists [58]. Photos taken by the author during the field observations were used to facilitate presenting the results.

4. Results

4.1. Cycling Trends and Policies in Hamburg

In recent decades, the number of people cycling in Hamburg has increased. The modal share of cycling was 7% in 1982, 9% in 2002, 12% in 2008, and 15% in 2017 [28,59].

To promote cycling, the Senate of the Federal State of Hamburg agreed on a “Cycling Action Plan” in 2007. It included seven key fields of action: cycling paths, parking, bike and ride, security, public relations/communications, tourism, and services [54]. The plan aimed to double the modal share of cycling from 9% in 2002 to 18% in 2015 [12,54]. Hamburg has had a cycling coordinator since 2015 to act as the public face of cycling in the city and to coordinate activities across authorities to promote cycling.

In June 2016, representatives of the Senate, the borough offices and councils, and the mayor of Hamburg signed an agreement called “Alliance for Cycling” (Bündnis für den Radverkehr), which aims to develop Hamburg into a cycling-friendly city and to increase the modal share of cycling to

25% by the 2020s [51]. In this agreement, there are three main action fields: *infrastructure*, *service*, and *communication*.

The most important action field is *infrastructure*. The priority in infrastructure is to construct and refurbish the Veloroute network, which is the citywide cycling network in Hamburg. The concept of the Veloroute network was developed in the late 1990s, encompassing 14 Veloroutes with a total length of approximately 280 km and aiming to connect the suburban area and city center [51,55]. Only 80 km of the 280 km network has been completed, and the remaining 200 km is planned to be finished by 2020 [51]. To consolidate the Veloroutes, the city is also constructing cycle parking facilities, leisure cycling routes, and cycling paths at the suburban and district levels [51].

Regarding *service*, the main focuses include cleaning of cycling paths and winter surface clearance, planning and implementing B + R facilities, and developing the public bicycle hiring system. Surface clearance is particularly important in autumn and winter to ensure the safety and usability of cycling paths. In recent years, Hamburg has introduced high-quality B + R facilities, which include two-story parking racks, parking boxes with locks, and storage boxes for cyclists' equipment (Figure 1). The city plans to deploy about 28,000 B + R parking places by 2025 [51,57]. For long-distance railway stations, there will be an increased number of cycle stations and enclosed parking garages. The public bicycle hiring system of Hamburg, StadtRAD (Figure 2) was established in 2009. In 2016, there were about 2500 bicycles at 206 docking stations, with over 402,000 users [56]. Now it is one of the most successful bicycle hiring systems in Germany and Europe [56].

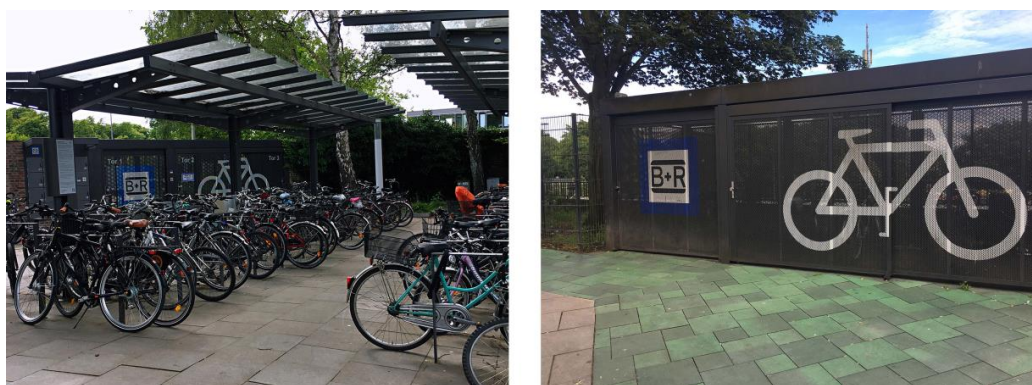


Figure 1. Bicycle parking facilities near public transport stations. (Photos by author.)



Figure 2. StadtRAD, the public bicycle hiring system in Hamburg. (Photos by author.)

Communication is an essential tool in encouraging people to use bicycles. Hamburg plans to have a significant cycling campaign in 2018. The campaign will not only provide general support, such as education and instructions to facilitate safe and enjoyable cycling, but it will also focus on groups of people who do not favor cycling or have biased attitudes towards cycling. For better cycling conditions, Hamburg already has an internet platform called “Melde-Michel” on which citizens can

report deficiencies in the current road infrastructure so that the related governmental administrations can be informed and can deal with the deficiencies [51].

4.2. Barriers to Implementing Pro-Cycling Policies in Hamburg

This section presents the barriers to implementing pro-cycling policies that emerged from expert interviews. Each barrier and the frequency that it was mentioned by interviewees are summarized in Table 4. Based on the barrier framework from Banister [41], the most frequently mentioned categories of barriers are “physical barriers”, “political and institutional barriers”, and “social and cultural barriers”. The frequently mentioned barriers were consistent across different interviewees. Since no content fits into the category “side effects”, this category is not included in the following sections.

Table 4. Summary of barriers to implementing pro-cycling policies in Hamburg.

Category of Barriers	Number of Times Mentioned
<i>Physical</i>	
Lack of space	12
<i>Political and institutional</i>	
Lack of political support	10
Lack of evaluation of travel behavior and demand	6
Time-consuming negotiation with private stakeholders on road space redistribution	4
Lack of long-term and integrated planning	3
Landscape conflicts between cycling infrastructure and local landscape	3
<i>Social and cultural</i>	
People’s reluctance to give up on-street car parking space	4
People’s reluctance to use on-road cycling lanes	3
<i>Resource</i>	
Lack of engineers	3
<i>Legal</i>	
Not permitted to build new bridges for cyclists	1

4.2.1. Physical Barriers

The lack of space for cycling infrastructure was the most frequently mentioned barrier ($n = 12$) and was mentioned by all interviewees (Figure 3). Most existing cycling paths are narrowly located alongside sidewalks and cannot meet current standards and needs (Figure 4). This is partly due to historical reasoning as cycling paths were built in a car-friendly time using an old standard. As explained by one interviewee:

“So all the area as it is now—the split up between pedestrian, parking cars and bicycle—[are] from 1970s and 1980s, that means the time when Hamburg has the main goal to be a car-friendly city. [. . .] They [the cycling lanes] are very very small, about 80 cm to 1 m. Of course there are very much conflicts with pedestrians.”

[H2 Cycling planner]



Figure 3. The lack of cycling lanes. (Photos by author.)

However, planners nowadays have difficulty in constructing and refurbishing the cycling infrastructure when most areas of the city are already built up. The street space is scarce, particularly in the inner-city areas with dense population. The interviewees mentioned street trees and on-street car parking (Figure 5) which hinder the broadening of cycling lanes and the addition of cycle parking facilities.

“There are lots of cars parking there and also there are illegal parking. [. . .] To modernize this road, many of this illegal parking had to gone. People are buying more and more cars, statistics shows they don’t drive these cars they buy, and of course they want to put them in front of their house.”

[H2 Cycling planner]



Figure 4. Cycling lanes located alongside the sidewalks. (Photos by author.)



Figure 5. On-street car parking. (Photos by author.)

4.2.2. Political and Institutional Barriers

Lack of political support was the second most frequently mentioned barrier ($n = 10$). Not all the political parties have a proactive attitude towards promoting cycling, and different districts have different political majorities. Interviewees agreed that the political commitment to promote cycling is improving. However, the overall transport policies are still in favor of motor traffic in Hamburg.

“To be fair to the politicians, in general cycling is a good thing, and as soon as you get conflict of interests with motorized traffic or even with the public transport, then cycling does tend to fall aside quite quickly. [. . .] As an example, when there was debate about having citywide 30 km/h rules with the exception in certain places and some of the main roads, they said that Hamburg economy will come to a standstill. [. . .] So cycling has been moved up to the agenda but I would not say it’s a priority in Hamburg, definitely not.”

[H1 Researcher]

It is widely considered that the harbor is the economic backbone of the city. To boost the economy, freight transport is crucial from the perspective of politicians and economic lobby groups. However, the challenge is that cyclists have to use the same roads with heavy freight traffic. Many cyclists are afraid of the giant trucks due to possible blind spots and dangerous accidents.

“The port and the logistic lobby is very strong in Hamburg. And partly because of the problem of non-existence ring road, I mean we have Ring 1 and Ring 2, [. . .] but we don't have a sort of ring road in terms of a motorway where you could bypass Hamburg. If you go from east to west, you have to go through the city. [. . .]. And then of course a lot of the port traffic, the lorries also have to travel across the city. [. . .] This is an additional, in some cases an obstacle from the point of view of cycling.”

[H1 Researcher]

In addition to the lack of political support, it is difficult to deal with private stakeholders' disagreements on road space redistribution ($n = 4$). The cycling lanes that are situated next to private buildings need careful and time-consuming negotiation among stakeholders to reach an agreement on a plan.

“They [the citizens] want to participate more in the administration. [. . .] They want to influence the road. [. . .] Whether the tree in front of their house they want to keep, or whether there are parking spaces which they believed to be their own parking space in front of their house, and so on, so this is very complex.”

[H2 Cycling planner]

It is a challenge to implement such plans not only outside private buildings, but also in public spaces due to landscape conflicts ($n = 3$). For example, there are debates over whether installing cycle parking infrastructure outside some historical buildings would block or destroy the historical landscape.

Furthermore, several barriers are related to the cycling strategy. First, there is a lack of regular travel behavior surveys ($n = 6$). When the cycling strategy “Alliance for Cycling” set a new aim in 2016 (to increase the modal share of cycling to 25% by the 2020s), it remained unclear whether the previous aim set in 2007 (to increase the modal share of cycling to 18% in 2015) was accomplished or not. Due to the lack of a baseline for evaluation, some newly deployed infrastructure may not fully meet the demand. One interviewee provided an example:

“You shouldn't start too small. [. . .] The [parking facilities around] Saarlandstrasse [Station] is already full after a few days or weeks, if you have good conditions, people's use may be exploding. I think sometimes Hamburg is also very careful, too careful, with the number. [. . .] And I think they also underestimated that people are willing to ride a very long distance with their bikes; that is also important.”

[H5 B + R planner]

In addition, several interviewees stated that there is a lack of consideration for a long-term and integrated plan for cycling ($n = 3$). So far, it is hard to get a full picture of the overall transport planning strategy.

“We have strategy for cycling but we have no official strategy yet for any of the other modes. It's a little bit difficult you have sort of things moving one way on the one side and the other moves the other way on the other side, and there is no strategic overlap and overview of where you want to go.”

[H1 Researcher]

4.2.3. Social and Cultural Barriers

Social and cultural barriers are related to public acceptability of policy measures. In Hamburg, the primary social and cultural barrier is that some people are reluctant to give up the on-street car parking space to add new cycling infrastructure ($n = 4$). Many people are used to travelling by car, and some shop owners believe that their customers would like to travel by car.

“They [Shop owners] are afraid if we take the car parking space away and put places for bike, they think they would get bankrupt, nobody would buy anything from them.”

[H2 Cycling planner]

“And some cyclists are also motorists and they say ‘no, I wouldn’t want to give up my parking space’.”

[H4 NGO]

Another barrier related to the public acceptability is that many people are afraid to use the newly built on-road cycling lanes ($n = 3$) (Figure 6). One interviewee (H2) stated that it is safer to use on-road lanes because at intersections, the drivers can see that some cyclists are going to turn left or right more clearly, rather than the cyclists suddenly appearing at intersections. However, many cyclists do not like to use the new lanes and they prefer to ride in a pedestrian area despite increasing conflict with pedestrians.

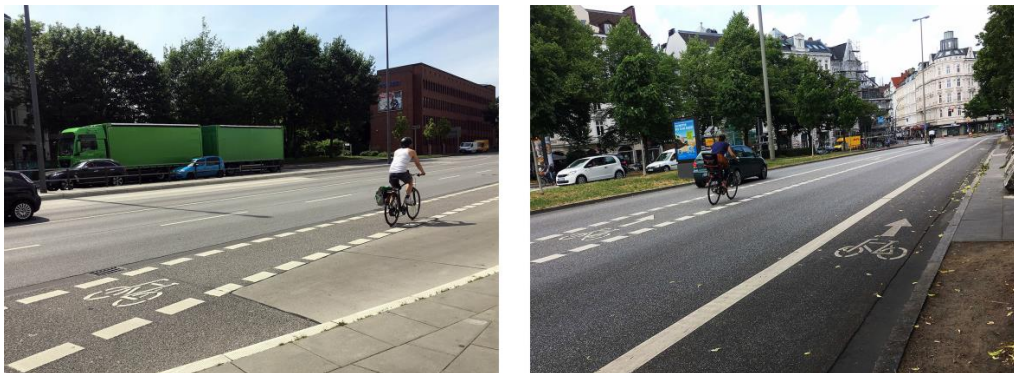


Figure 6. On-road cycling lanes. (Photos by author.)

4.2.4. Resource Barriers

In general, interviewees did not consider financial resources as a barrier; however, two of them (H2 and H5) mentioned the lack of engineers ($n = 3$). One interviewee (H2) saw this as an important barrier that slows down the process.

“I don’t think money is the problem, but we don’t have enough engineers to do the planning work. [. . .] We need more engineers. Road building companies don’t have as much engineers as we need to rebuild all the roads we want. So it takes some time.”

[H2 Cycling planner]

4.2.5. Legal Barriers

The only noted legal barrier was that at present, building new bridges for cyclists is not permitted ($n = 1$). Hamburg has about 2500 bridges. However, the traffic flow on some bridges is very high during peak hours. Cyclists have to ride through the busy bridges with massive amounts of motor traffic. Due to the existence of a large number of bridges, some of which need extensive maintenance because of lots of freight transport, it is hard for the city to build new bridges for cyclists. Therefore, it is difficult to develop a cycling network that is as connected as the motor traffic network.

4.3. Individual Level Barriers to Cycling

Although the major interview question was regarding the barriers to policy implementation, some individual level barriers emerged as well. First, some people believe cycling is not a mainstream mode of transport. They think that cycling is not safe or is used more for leisure purposes (H2). Second, for some people, cycling is impractical. It is more convenient to commute by car, especially for those who live far away from the city center (H4). Third, some new residents might not prefer to cycle. People from different countries may have experienced different mobility cultures and have different travel behaviors (H2).

5. Discussion

5.1. Summary of Findings

In summary, this research found that the frequently mentioned barriers are a lack of space ($n = 12$), lack of political support ($n = 10$), lack of evaluation of travel behavior and demand ($n = 6$), time-consuming negotiation with private stakeholders on road space redistribution ($n = 4$), and people's reluctance to give up on-street car parking space ($n = 4$).

The lack of space is highly important in implementing pro-cycling policies in Hamburg. This is different from implementing other sustainable transport policies that have no space requirement (e.g., traffic calming and adopting alternative fuels and vehicles). For historical reasons, most cycling lanes were created by taking space from sidewalks decades ago, and the city has been dominated by cars in recent decades. However, it is critical to redistribute space for cycling for sustainable and equitable mobility [60].

To redistribute the space for cycling, strong political support is essential. Although the political support for cycling in Hamburg has improved in recent years, the political courage is still not enough to take more push actions to restrict car use and facilitate cycling. In Hamburg, the transport department belongs to the Ministry of Economy, Transport and Innovation. Since the economy department and the transport department are in the same ministry, it is possible that the interests are shifted more toward the development of the economy (H1). The lack of political support was in line with existing studies on cycling and general sustainable mobility [42,61]. Politicians welcome the term "sustainable" in planning concepts; however, it is hard for practitioners to realize it in planning practice [39,40].

Case studies in England underlined the barrier of a lack of funding [42,45]. This barrier is of less importance in the Hamburg case. However, it is in accordance with British findings that the adoption and implementation of pro-cycling policies could be influenced by various stakeholders [42,45], for example, car lobby groups, shop owners, and residents. The influence of car lobby groups on transport policy echoes a case study in Freiburg where car lobby groups tend to be against the speed and emission limits [17]. The individual level barriers that emerged (safety concern, impractical, and subcultural for commuting) were in accordance with a number of studies [20–23,25].

It is obvious that some barriers are interrelated. When decision-makers are not fully committed to improving the cycling environment, practitioners can hardly acquire sufficient space, budget, and human resources [42]. The lack of evaluation of travel behavior and demand might also be due to a lack of human resources. Furthermore, time-consuming negotiation with private stakeholders on road space redistribution is closely related to people's reluctance to give up on-street car parking space. Although individual level barriers do not affect the implementation process directly, they may reinforce social and cultural barriers.

5.2. Suggestions for Overcoming Barriers

5.2.1. Cycling-Oriented Urban Design

Existing studies highlight the importance of cycling-oriented urban design, underlining that planners need to think more about cyclists' perceptions and experiences [62]. In Hamburg, the priority

of road space distribution favors motorized transport over cycling when street space is limited. To overcome the physical barrier, fundamental change of the road space is necessary, for example, removing on-street car parking, reducing motorized traffic lanes, and banning cars where streets are extremely narrow.

Reducing the space for car use may be met with resistance from private stakeholders. Lessons may also be learned from Oslo where a step-by-step measure was taken to ban car parking in the city center. For example, by establishing several pilot areas, the shop-owners (outside the pilot areas) could see the change of the flow of customers before and after the reuse of car parking areas [63]. Having opportunities for experimental measures is helpful to implement new measures [33].

Cycling-oriented urban design could also help overcome people's reluctance to use on-road cycling lanes by enhancing the visibility of cycling infrastructure to increase perceived safety [62,64,65]. From a cyclist's perspective, the same cycling infrastructure is not suitable for cyclists with a different level of skills [62]. In Hamburg, the street space might not be enough to add green belts protection for on-street cycling lanes. However, some informal separation could be added, for example, using a small strip of cobbles to separate the motorized traffic lanes [65] and coloring of the on-street cycling lanes to form a distinct demarcation [62]. These types of separation should also be complemented by a reduction of motor traffic speed, which could increase people's reaction time and increase perceived safety [66].

One more urban design solution is to combine the cycling planning with landscape planning and design. Street trees have been considered as one factor that leads to space scarcity for cycling. For cycling-oriented urban design, a full use of existing trees should be made to increase the amenities and comforts of cycling routes. In some areas with historical buildings, bicycle parking facilities should be designed to better adapt to the local historical landscape. Attractive designs can also encourage cycling use (H5).

5.2.2. Strategic and Integrated Planning for Cycling

Planners have to deal with various conflicts of interest in developing a sustainable city. A strategic and integrated cycling action plan should be able to mitigate the conflict of interests and design practical and innovative solutions [19]. To achieve these abilities, a strong planning system with high-skilled planners is critical [67,68]. Studies in Copenhagen highlight that successful cycling infrastructure planning needs a group of experts with various expertise [11]. With the development of spatial data science, more advanced planning tools should be brought to cycling network planning, for example, spatial analysis, modelling [69], and big data [70]. Training of planners and practitioners could help to refine the planning works [68].

Cycling should be integrated with other modes of transport to create a multi-modal network ([47]; also suggested by H1) and should further be integrated with wider urban plans and policies [19]. Exploring the full potential of cycling in the overall transport system and urban planning could help increase transport efficiency and could even increase financial resources for cycling [47]. For big cities like Hamburg, the B + R integration is essential. A high-quality B + R service with more programs to advertise the services could be helpful (H5).

Moreover, regular travel behavior surveys and spatial analysis are essential for measuring and adjusting the implementation progress. Cycling use in Hamburg continues to increase; it is necessary to have a more accurate estimate of the demands before planning and deploying new cycle parking facilities at different locations. The cycling use might boom with the adequate provision of cycling infrastructure (H5).

5.2.3. Strong Political Support

To ensure the implementation of pro-cycling policies, a strong political commitment has been considered of high importance by all the interviewees and many researchers [33,42,45]. In Hamburg, political courage and cross-party political support should be enhanced to facilitate long-term and

consistent planning and implementation. As suggested by one interviewee (H1), politicians should make more concrete and measurable political goals and should allow for greater visibility of cycling infrastructure. Regarding current pro-cycling policies, most are pull measures, for example, providing high quality parking infrastructure where space permits. It would be more efficient if pull measures were complemented by more push measures to restrict car use.

5.2.4. Communication

Efforts to overcome barriers could also be made by communication, in particular to overcome social and cultural barriers. It is necessary to have targeted group-oriented communication with training and educational programs according to the type of (potential) cyclists (e.g., novice cyclists, new residents, older adults, car drivers) [19,71]. Communication with private stakeholders is critical in achieving agreement on road space redistribution. The planners in Hamburg emphasized the importance of on-road cycling lanes that could make cyclists more visible to drivers. Knowledge on the advantages of on-road cycling lanes over off-road cycling lanes should be explained with empirical evidence, and education on how to use the on-road cycling lanes should also be provided.

5.3. Limitations

This research has several limitations. First, although frequency (number of times mentioned) is used to evaluate the importance of different barriers, the frequency should be treated with caution because only five interviews were conducted. This means that the frequency in this study can only decide which several types of barriers are more important and is not able to decide which barrier is the most important one. Although the major barriers are consistent across interviewees, it would be better if more interviews could be conducted, for example, more interviews with people from different political parties and urban planning authorities. There is also a potential for subconscious bias in interviews. The interviewees' opinions might not be able to fully represent the organizations.

Second, the interviewees mentioned some residents' opinions on reallocating road space for cycling. For example, one interviewee (H4) noted that some people are reluctant to give up their car parking space. The author finds it difficult to quantify the percentage of residents sharing the same opinion due to a lack of data. It would be better to have more data on local residents' attitudes to clarify how difficult it is to manage barriers related to local residents.

6. Conclusions

For effective pro-cycling policy implementation, identifying major barriers and removing them is critical. This study identified different types of barriers according to in-depth interviews with cycling experts in Hamburg. By using the barrier framework of Banister [41], this research found that the major barriers are physical, political and institutional, and social and cultural. Specifically, the city lacks enough physical space, political support, and evaluation of travel behavior and demand. Also, some private stakeholders are reluctant to give up on-street car parking space for cycling lanes, and the negotiation process is difficult and time-consuming.

Some barriers are more manageable, for example, it is feasible to enhance the evaluation of travel behavior and demand for a more accurate plan. Some barriers are more entrenched, for example, it is not easy to gain strong political support for cycling when facing the embedded car culture. To overcome the barriers, Hamburg needs multifaceted and integrated approaches, specifically, cycling-oriented urban design, a strategic and integrated cycling action plan, strong political support, and target group-oriented communication.

It should also be noted that several measures to promote cycling in Hamburg can be learned by other cities, for instance, an "Alliance for Cycling" to reach a basic consensus and commitment; a bicycle coordinator who can oversee the whole implementation procedure and ensure a sense of leadership for cyclists; high quality parking infrastructure where space allows; and public participation. These measures can be helpful for cities where cycling planning is still in its infancy.

For future studies, follow-up research is necessary to examine the implementation process and the effectiveness of different interventions in Hamburg. More research is necessary to refine the measures to gain stronger political support, for example, using cost-benefit analysis and conflict analysis. It is possible that the major barriers to promoting cycling differ from city to city. Therefore, more research on barriers that appear in cities at different stages of development is necessary. Planners can promote cycling more efficiently with a better understanding of potential barriers.

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Appendix

Table A1. List of coding categories of barriers and examples of coding passages.

Category of Barriers	Subcategory of Barriers	Example of Coding Passages
Physical	Lack of space	"This city is finished, that means we have no free spaces available to use for bike transport, we have to take some of the area which is now used for something else." [H2]
		"We don't have place, we always have houses next to the roads and we have a lot of trees next to the roads." [H4] "In Dammtor [Station] it is really difficult because there is no space anywhere, there are so many bikes because the university is close to it, and it is so important to improve the facilities." [H5]
Political and institutional	Lack of political support	"The economic cars the trucks. [. . .] The politicians always say 'we can't stop it, it's important for Hamburg.' [. . .] Many points [when] there are not enough space, always the cars are the winners, but not the bikes." [H4] "At the moment, the competition is not fair, because the privilege of car is not accessible to the bike." [H2]
	Lack of evaluation of travel behavior and demand	"Actually, if everything that is written in there is actually implemented, it would be great. But the problem is they haven't assigned definite resources on a year-by-year basis. [. . .] If you say you are going towards some kind of goal but you didn't measure where you are, obviously it's difficult to say whether you have actually made some progress." [H1]
	Time-consuming negotiation with private stakeholders on road space redistribution	"Every road is special so you have to discuss every road, it is a hard process and it takes a long time to think how we can do it here. Sometimes there is also a problem, the first part of the road we have one solution for bikes and it changed for the next part, [. . .] and that for both cars and bicycles is difficult." [H4]
	Lack of long-term and integrated planning	"We always say you have to think about the plan; you have to think about the cycling for the next ten years, or 15 years." [H4]
	Landscape conflicts between cycling infrastructure and local landscape	"Some stations are very old, there are monument conservation. [. . .] Because many people would like to leave their bikes under roofs to keep it dry, and especially these roofs at the main station, the city planning authority does not want any roofs around there, [. . .] they want to protect the view of the old buildings." [H5]

Table A1. Cont.

Category of Barriers	Subcategory of Barriers	Example of Coding Passages
Social and cultural	People's reluctance to give up on-street car parking space	"There are also some people who are very critical to this new idea of ride a bike. [...] Some people are afraid that someone would take their privilege of using cars away. [...] So they try to stop it and they don't like bikes to win the city and to get more space on the roads" [H2]
	People's reluctance to use on-road cycling lanes	"The people in Hamburg are used to use this very small bicycle ways next to the pedestrian. [...] The cyclists are afraid to ride near the car traffic. So they don't like this new bike lane. [...] This is a challenge as well to convince these people who are afraid of using the modern infrastructure." [H2]
Resource	Lack of engineers	"[...] they can't realize the concept for all the stations at the same time because there are too less people" [H5]
Legal	Not permitted to build new bridges for cyclists	"We want to improve the quality [of cycling infrastructure] and we don't want to drive [ride] with trucks on the same road. [...] So we need to increase the bridge or to add a new part for pedestrian and the bike traffic, it's always said no, it's not possible because our rule is no new bridges for no one and at no circumstances." [H2]

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