CONTRIBUTING FACTORS FOR THE UNDERUTILIZATION OF MOBILITY STATIONS: THE CASE OF THE "WIEN MOBIL STATION" IN VIENNA

Luiza Maciel Costa da Silva (https://orcid.org/0000-0003-0978-1248) [1*]
Julius Uhlmann (https://orcid.org/0000-0002-9654-412X) [1]
1 Bauhaus-Universität Weimar, Geschwister-Scholl-Straße, 99423, Weimar, Germany

*luizamacielcs@gmail.com

ABSTRACT
Purpose: Mobility stations are locations in which various mobility options are offered enabling multimodality and intermodality. In Vienna, three public mobility stations were implemented as part of the project "Wien Mobil". After observing the existing mobility stations and talking to different experts, the system was diagnosed as underutilized. Consequently, this paper aims to point out the reasons why the public mobility stations in Vienna have so far not attracted as many users as expected.

Methodology/Approach: The research question is answered with the support of explorative expert interviews, observational research and literature review.

Findings: The identified contributing factors for the underutilization of the mobility stations in Vienna are location, weather, lack of interoperability, low affordability, lack of reliability, and lack of publicity and educational campaigns.

Research Limitation/implication: The research lacks the perspective and data from the car sharing provider. Moreover, it was conducted during winter, which certainly increased the perception of an underutilized system.

Originality/Value of paper: This work is expected to contribute to urban mobility planning by identifying and reaffirming important factors to take into account when planning, implementing and operating mobility stations and by providing a thorough understanding of the reasons for the underutilization of mobility stations.

KEYWORD: mobility hubs, transport, intermodality, smart cities, MaaS.

FATORES QUE CONTRIBUEM PARA A SUBUTILIZAÇÃO DAS ESTAÇÕES DE MOBILIDADE: O CASO DA "WIEN MOBIL STATION" EM VIENA

RESUMO
Objetivo: As estações de mobilidade são locais nos quais várias opções de mobilidade são oferecidas, permitindo a multimodalidade e a intermodalidade. Em Viena, três estações públicas de mobilidade foram implementadas como parte do projeto "Wien Mobil". Depois de observar as estações de mobilidade existentes e conversar com diferentes especialistas, o sistema foi diagnosticado como subutilizado. Consequentemente, este documento visa apontar as razões pelas quais as estações públicas de mobilidade em Viena não atraíram, até agora, tantos usuários quanto o esperado.

Metodologia/Abordagem: A questão da pesquisa é respondida com o apoio de entrevistas exploratórias de especialistas, pesquisa observacional e revisão de literatura.

Conclusões: Os fatores que contribuem para a subutilização das estações de mobilidade em Viena são a localização, o clima, a falta de interoperabilidade, o baixo custo, a falta de confiabilidade e a falta de publicidade e campanhas educativas.

Limitações da pesquisa: A pesquisa carece da perspectiva e dos dados da operadora de compartilhamento de carros. Além disso, ela foi realizada durante o inverno, o que certamente aumentou a percepção de um sistema subutilizado.

Originalidade/Valor do artigo: Espera-se que este trabalho contribua para o planejamento da mobilidade urbana ao identificar e reafirmar fatores importantes a serem levados em consideração ao planejar, implementar e operar estações de mobilidade e ao proporcionar uma compreensão completa das razões para a subutilização das estações de mobilidade.

PALAVRAS-CHAVE: hubs de mobilidade, transporte, intermodalidade, cidades inteligentes, MaaS.

1. INTRODUCTION

Nowadays cities worldwide are facing a large range of problems due to the absence of coordinated planning and the rapid increase in urban population. They are dealing with the lack of space within their city centers as well as with the resulting traffic congestion. In this scenario, some new development strategies and urban practices aim at tackling those problems through the use of Information and Communication Technology (ICT), which resulted in the emergence of the smart mobility strategies within the smart cities concept. Among smart mobility strategies, there is shared mobility and the implementation of mobility stations.

Mobility stations are places or locations where different mobility offers and services are available. According to Miramontes (2018) they can be defined as "transport nodes where different mobility options are spatially concentrated, thus, enabling multimodality and intermodality". Multimodality is a travel behavior in which different modes of transport are used within a certain period of time according to an open and subjective decision of the most optimal available option; intermodality is the ability and possibility to combine different modes within a single trip (Miramontes, 2018, p. 42). Mobility stations usually include a shared mobility alternative, such as shared bikes, scooters and cars, and they aim at promoting the integration between those and the public transport in order to change travel patterns.

In Vienna, public mobility stations are being implemented and tested as part of the project "Wien Mobil". In September 2018, the first public station was implemented at "Simmeringer Platz" as a result of the European Union (EU) funded project "Smarter together". Later, in 2019, two other stations were implemented: one at "Rochusmarkt" and another in "Richard-Wagner-Platz". (Smarter Together, 2019) After observing the existing mobility stations and talking to different experts in the field during the research process for writing this scientific paper, the "Wien Mobil Station" in Vienna was recognized as a system that is still not being as much used as expected. Consequently, this paper aims to point out the reasons why the public mobility stations in Vienna have so far not attracted as many users as expected.

The main goal of this study is to find out the reasons for the current low utilization rate of the existing public mobility stations in Vienna. It consists in a mixed-method research. The research question is answered with the support of explorative expert interviews, observational research and literature review. The main methods are qualitative, however quantitative data was also considered, when available. The expected contributions are: 1) to identify important factors to take into account when planning, implementing and operating mobility stations; and 2) to provide a thorough understanding of the reasons for the underutilization of mobility stations.

This paper is composed of five parts. The first one, this introduction, presented the motivations, goals and research questions. The second part presents the state of the art of shared mobility and mobility stations. Part three describes the case study, the "Wien Mobil Station" system, by briefly presenting information about urban mobility in Vienna and useful information about the system. Part four is the core of this work and presents the findings of this research by listing and explaining the identified contributing factors for the underutilization of the "Wien Mobil Station". Finally, part five synthesizes the main findings of this study and provides recommendation for further research and for the municipality.

2. LITERATURE REVIEW

This part of the paper presents the state of the art of a few concepts deriving from the term smart cities - such as smart mobility, shared mobility, and mobility stations.

2.1 Smart Mobility

The terms smart mobility and smart cities appeared both at the beginning of the Nineties (Albino et al., 2015; Papa and Lauwers 2015). At that time, the name stated a city with systems dependent on technology and on innovation (Karlsson et al., 2020; Miramontes et al., 2017; Behrendt, 2019; Suresh et al., 2020). Nowadays, within the "smart city", studies have defined it in many other different ways, considering it as a strategy to promote better cities.

According to Albino et al. (2015, p. 9), smart mobility "refers to the use of ICT in modern transport technologies to improve urban traffic." Benevolo et al. (2016, p. 24), states that the ICT applications are "an attractive solution to many of the problems of the transport sector". Though ICT plays a central role in smart mobility, it is important consider the citizens in its planning. Albino et al. (2015, p. 6) affirms that some authors criticize smart mobility, because corporate-designed cities "eschew actual knowledge about how cities function and represent empty spaces that disregard the value of complexity, unplanned scenarios, and the mixed uses of urban spaces". In this sense, the author affirms that "the smart city concept is no longer limited to the diffusion of ICT, but it looks at people and community needs." (Albino et al., 2015, p. 3)

2.2 Shared Mobility

One of the smart mobility strategies is shared mobility, which includes sharing bicycles, automobiles, scooters, among others. According to Cohen and Shaheen (2016, p. 4) "it is an innovative transportation strategy that enables users to have short-term access to a mode of transportation on an as-needed basis". These systems bring several advantages to its users, among them the discouragement of car ownership and the incentive to the use of sustainable modes of transportation. However, with its emergence, city planners are now facing new challenges. These systems require decisions on "locating stations, choosing the number of vehicles per station, moving vehicles between stations, inciting users to change their destination" (Laporte et al., 2015, p. 342). Several cities already suffer from the massive implementation of these models and policies (Laa & Emberger, 2020). Some cities have banned or strictly regulated such sharing systems, once they can cause various disorders to the population, such as incorrect parking and sidewalk obstruction, mainly due to the lack of information to users and of places for adequate parking.

Castro Fernández (2011, p. 200) points out the main benefits that can be achieved through the use of bike-sharing: "1) making intermodal trips with public transport more attractive, 2) increasing bicycle use and 3) increasing traffic safety." Concerning the increase in bike use, bike-sharing can serve as the gateway to the adoption of more sustainable modes of transport. Fulton et al. (2017, p. 13) affirm that these systems can "introduce many new people to urban cycling, who eventually acquire their own bicycle". Some municipalities consider the implementation of bike-sharing systems as a strategy to reduce car traffic and congestion. However, as stated by Castro Fernández (2011, p. 197) the impact of bike-sharing to this goal is, actually, low. On the other hand, the influence of bike-sharing reducing public transport vehicle occupancy seems to be more significant. According to Castro Fernández (2011, p. 197), though only a few trips were transferred from public transport to bike-sharing, "a synergy with public transport through intermodality has been observed". Castro Fernández (2011, p. 198) and Link et al. (2020) also affirms that "intermodality between bike-sharing and public transport is one the main potentials" of bike-sharing to improve mobility.

Concerning car-sharing systems, its primary benefit is the more efficient vehicle use. Moreover, "environmental benefits can be achieved if the car share vehicles on average have lower emissions by being of the newer model year" (Fulton et al., 2017, p. 13) or even if the fleet is composed of electric vehicles, as in many cities worldwide.

2.3 Mobility Stations and similar concepts

A mobility station is a place or a location where different mobility offers, and services are available. They usually include at least one shared mobility alternative, enabling intermodality and multimodality. While in Germany the most used term is mobility station ("Mobilitätsstation") they are often also referred to as mobility points, especially in Austria, and as mobility hubs, especially in North America. According to Miramontes (2018, p. 55), the different terms "refer to practically the same idea". However, the author highlights that in North America there is a stronger focus on the integration of land use and transport in comparison to the concepts adopted in Germany and Austria.

In Vienna, the term used in the documents written in English is mobility point. The Urban Mobility Plan Vienna STEP2025 presents a description of them:

> "A mobility point is meant to give uncomplicated and fast access to low-emission mobility around the clock. It can be a central facility in a new urban development area or strengthen structures in existing neighborhoods. A variety of vehicles and services can be booked and used. This way, mobility services can be bundled in a well-structured way in one place, which is particularly important in new urban development areas." (Magistrat der Stadt Wien, 2015, p. 66)

3. CASE STUDY: "WIEN MOBIL STATION"

This chapter describes the three existing mobility stations in Vienna and the context in which they were implemented. Moreover, in order to provide a better understanding of the city of Vienna, a brief description of its urban mobility system is presented.

3.1 Urban Mobility in Vienna

Vienna is Austria's capital and most populous city, with about 1,897,491 inhabitants. It has an average population density of 46 people per hectare. (Magistrat der Stadt Wien, 2019a)

In 2018, the modal split would show that the share of public transport was 38%, whereas by car only 29%. Concerning the non-motorized modes, the modal split share of walking was 26% and by cycling 7%. In relation to the year of 1993, the modal split share of public transport has risen by nine percentage points and the share of cycling has risen by four percentage points. In comparison with other major cities in Germany and Austria, the modal split share of public transport is significantly higher. (Magistrat der Stadt Wien, 2019a; Ahrens, 2015, p. 86; BMVIT, 2016, p. 101)

The numbers above demonstrate the results of several policies that have prioritized public transport and cycling during the last years in the City of Vienna. Offering an annual public transport pass for 365 €, the number of passes issued in 2018 was 822,174. The bike-sharing system "Citybike Wien" has over 120 stations and offers free rides (for the 1st hour ride) with only a single subscription fee of 1 €. (Magistrat der Stadt Wien, 2019a; Citybike Wien, n.d.)

Nonetheless, the municipality wishes to improve even more this scenario, by targeting that by 2025, "the citizens of Vienna shall use public transport, cycle or walk to cover 80% of the trips they need to make, whilst the share of car transport should decrease to 20%". (Magistrat der Stadt Wien, 2015, p. 16)

3.2 Smart Mobility Approaches in Vienna

The initiative "Smart City Wien" was first announced in March 2011. Since June 2014, after some forums and a multi-stakeholder process, the "Smart City Wien Framework Strategy" has been adopted aiming at providing the best quality of life for all inhabitants while minimizing the consumption of resources and through innovation. (Magistrat der Stadt Wien, n.d.)

This strategy framework has influenced the long-term strategy of the City of Vienna defined in the Urban Mobility Plan, a thematic concept of the Urban Development Plan STEP 2025. The

main goal is to shift the largest possible share of automobiles to public transport and non-motorized modes. In order to achieve this goal, the Urban Mobility Plan proposes concrete targets as well as fields of actions, which are: Sharing instead of owning; Together in the region; Transport infrastructure: the backbone of the city; Mobility needs innovation; Efficient mobility through mobility management; Transport organization: a smarter way to of managing mobility; Business in motion; Governance: responsibilities and resources; and, Public Space: sharing streets in a fair way. For each of these fields of actions, several near-term steps and measures are proposed. (Magistrat der Stadt Wien, 2015)

In line with the Urban Mobility Plan, several smart mobility initiatives are currently being conducted in Vienna:

- "Wien Mobil": Mobility as a Service (MaaS) app, offering real-time information and ticketing possibilities to support multimodal and intermodal mobility. Through this app, Wiener Linien is aiming today at being an integrated mobility service provider, offering car-sharing, bike-sharing and e-scooter-sharing through the Wien Mobil app, a system that also supports public transport.
- "WienBot": a platform/app that enables a person to ask for advice and to get tips, directions and information through artificial intelligence. Currently available both in German and English.
- "Grätzlrad Wien": a public cargo bike-sharing system.
- Many e-scooter providers: "Bird", "Lime", "Circ", "Tier", "Arolla", "Hive", "Kiwi", among others. Some of the companies work in partnership with Wiener Linien, offering 20 min ride for free for those that own the annual public transport ticket. Recently, some spaces specifically designed for e-scooter parking have been implemented in place of some car parking spots throughout the city.
- Bike-sharing systems: "Citybike Wien", a dock station system offering conventional bicycles; "Sim Bike", a dock station system offering electric bicycles; and, "Donkey Bike", a free floating or dockless system, offering conventional bicycles.
- Around 150 charging stations for electric cars provided by "Wien Energie".
- E-car-sharing providers: a site-based system, named as "Stadtauto", and a few free-flowing systems, such as "Car2go", "DriveNow", "Eloop" and "UFODRIVE".

Nowadays mobility providers are not charged from the municipality, on the other hand, those that are in partnership with Wiener Linien need to provide data, which can be valuable for transport planning. Despite all the several smart mobility possibilities being offered, public transport is the backbone of the city and the new services are complementary. This explains the importance of the public sector keeping the lead over infrastructure, coordinating the strategies and maintaining public transport at the forefront.

Besides all the smart mobility initiatives mentioned above, both public and private mobility station are being operated in the City of Vienna. The public mobility stations system is called "Wien Mobil Station" and is the main topic of this work; however, it is also important to mention the private mobility stations, which have been implemented as part of real estate and urban developments. They were implemented both inside social housing projects, as in "Perfektrasse 58", and inside commercial and business centers, as in the "DC Tower". In Vienna, "MO.Point" is the main operator of the private mobility stations and is the one currently providing a bigger variety of services, such as e-car-sharing, e-bike-sharing, e-scooters and e-cargo bikes. The real estate pays for the station inside the buildings; however, it would also be important to provide infrastructure nearby the public transport, enabling intermodality. The motivation to provide a mobility station in real estate developments can vary, as it can be a mitigating measure to offer fewer parking spaces than required in the urban regulations, as well as a strategy to make a real estate venture more attractive and modern. In some cases, according to the contract with the municipality, providing mobility stations is binding. (Wiltschko, 2019; Franz, 2020; Kirchberger, 2020)

3.3 The mobility stations currently integrating the system "Wien Mobil Station"

There are currently three mobility stations composing the "Wien Mobil Station" system. The stations are located in different neighborhoods and the infrastructure and the services available vary.
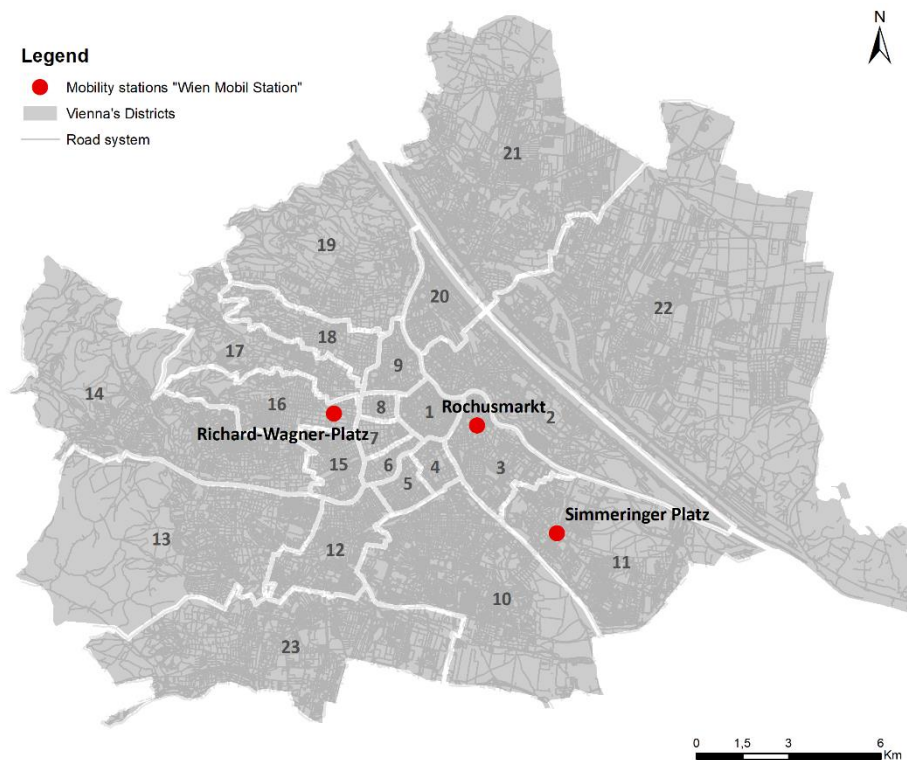

Fig. 1 – Location of the existing mobility stations in the "Wien Mobil Station"

According to Neumayer (2019), a GIS analysis was developed with 9 criteria for implementation of the mobility stations in Vienna. The criteria are:

- Type of stop: places having a subway stop are graded higher than places with tramway or buses stops, respectively;
- Connection to cycle traffic: the existence of a bikeway or a segregated cycle trail is graded higher than a cycle lane or a shared path, respectively;
- Existence of a charging station for electric cars;
- Existence of a "Stadtauto" station;
- Existence of "Citybike Wien" or "Sim Bike" station;
- Existence of a taxi stop;
- Population coverage: places adjacent to building blocks or counting areas ("Zählsprengel", the smallest area in official Austrian statistics) with more than 1,999 residents are graded higher than places adjacent to building blocks or counting areas with less residents;
- Public transport user/day: locations with more than 5,000 users/ day are graded higher than places where the public transport is less used;
- Existence of an urban development or industry/commerce area with over than 10.000m².

Unfortunately, the above criteria have not determined the locations of the existing public mobility stations. In fact, the interviewees, in general, reported the difficulty faced by "Wiener Linien" in obtaining authorization to use the public spaces for implementing the mobility stations. Thus, the availability of space has been the main criterion for the installation of the public mobility stations in Vienna so far.

3.3.1 Simmeringer Platz

The first station was implemented in September 2018 as part of the "Smarter Together" project in the 11th District of Vienna, which is also known as Simmering. Together with Lyon and Munich, Vienna is, since 2015, part of the "Smarter Together", a project funded through the EU program "Horizon 2020". Approximately 7 million euros were funded for Vienna and this triggered a total investment of over 80 million euros. Besides the mobility station, several other projects were implemented in the area, such as housing refurbishment and school constructions, all of them targeting smart city strategies. (Magistrat der Stadt Wien, 2019b)

The 11th district is in a peripheral location and it is "characterized by its working class history, a diverse building stock with a high share of municipal and subsidized housing." (Magistrat der Stadt Wien, 2019b, p. 11) The population density is 44.3 inhabitants/ hectare, which is below the average for Vienna. Concerning the motorization rate, there are 363.1 automobiles/1,000 inhabitants. This rate is also below the average for the City of Vienna, in which there are 373.8 automobiles/1,000 inhabitants. (Magistrat der Stadt Wien, 2019c, p. 302)

The location at "Simmeringer Platz 1" was not chosen by "Wiener Linien". In fact, the area was already defined, due to political reasons, for the "Smarter Together" project. The aim was to develop Simmering as a smart neighborhood. Considering the neighborhood was already defined, "Wiener Linien" then searched for available space. (Neumayer, 2019) This mobility station is located near the last subway station of the line U3, also named as Simmering, and has tram connections. It offers the following infrastructure and services: e-bike-sharing (six), e-cargo bike-sharing (one), lockable bike boxes with electricity (three), electric car charging station (two parking spots), car sharing (one parking spot), an info screen, an air pump and a public bench. It is an all-season public mobility station.

"Wiener Linien" is the main operator and it is responsible for planning and managing the mobility stations, as well as general maintenance (e.g. cleaning snow). The mobility station at "Simmeringer Platz" is co-operated with four different sub-operators, which are responsible for the operation and for their specific infrastructure. The sub-operators are: "Stadtauto", the e-car-sharing provider; "Sim Bike", the e-bike-sharing provider; "Safety Dock", the provider of the lockable bicycle boxes; and, "Wien Energie", the provider of the charging stations for electric vehicles. Unfortunately, there is no interoperability between services and it is not possible to register for all of them at once, meaning that each service requires it is own app. (Magistrat der Stadt Wien, 2019a, p. 31; Neumayer, 2019)

"Stadtauto" is available at 15 different locations and, due to a partnership with Wiener Linien, offers discounts and free rides for users that own an annual transport ticket. Franz (2019) explained that "Stadtauto" was selected to operate in the mobility stations because it already had a contract with the City of Vienna, a decision made when this was the only company accepting a short-term contract (3 years).

The e-bike-sharing system from "Sim Bike" works with a dock scheme, meaning that the bikes always need to return to a station after utilization in order to be available to someone else. There is currently only another e-bike station in this system, located in the cemetery "Zentralfriedhof", which is approximately 3.5 km from "Simmeringer Platz". According to Einwögerer (2019), there is almost no integration between the two existing stations, as the distance between the stations is quite big. Recently some rides between the stations were registered, but it is not something regular. The distance between stations, as well as the number and the density of stations are, according to Castro Fernández (2011, p. 50), some of the driving forces in bike-sharing systems. As explained by Dechant (2020), when "Citybike Wien" was first implemented, in a period in which no similar system existed worldwide, it was assumed that 800 m was a reasonable distance between stations. More recently, however, cities like Paris, Lyon and Barcelona implemented bike-sharing systems with only 300 m between stations. (Castro Fernández, 2011, p. 212-213) Although "Citybike Wien" is a consolidated bike-sharing system in Vienna, with an increasing number of members and users, it could not be implemented in the mobility station at "Simmeringer Platz" because the existing network currently does not reach the area and creating

more stations would be out of the scope of the project. (Neumayer, 2019) There are no plans and no budget at the moment for expanding the "Citybike Wien" system. (Dechant, 2020) The fact that there is only one station in the project area and the only other station in the system is relatively distant is one of the main negative points of the "Sim Bike". There is no network and, therefore, the users have no real alternatives for last or first mile transportation. This also explains why, according to Neumayer (2019), the main trips are for leisure purposes, with the average duration of the trips of approx. 2 hours. According to data available online at the "Smart Data Wien" website, only 81 trips departed from the "Sim Bike" station at "Simmeringer Platz" during the period between September 2019 and January 2020, which results in an average of 0.52 trips/ day. However, 70% of the trips registered took place in September, whereas in November 2019 only four trips were registered and in December 2019 there were no trips registered at all. Concerning the duration of the trips, among all trips registered in the analyzed period, 55% lasted longer than 1 hour. (Smart Data Wien, n.d.)

The implementation process included some community engagement activities with residents, which gave them the opportunity to share opinions and test the e-bike-sharing system. In July 2016 there was an event, which had a contribution from a total of 105 visitors. This event took place in front of the public library and lasted 15 days, for four hours per day. In the location, e-bikes were available for testing, however only eight people among all visitors tried it. Later, on October 2016 another action was held for nine days. It consisted on a special workshop for children, providing bike repair for free. In 2017, a workshop called "Geh-café" was held with a guided tour focused on mobility. In 2018, an event in front of the subway station was held, providing information about the mobility station. Finally, during the first weeks after the mobility station was implemented, in September 2018, there were people at the mobility station informing about it and helping people on how to use it. (Magistrat der Stadt Wien, 2019b, p. 19; Breitfuss, 2019)

According to the report developed by AIT (2016, pp. 5-6), the first mobility survey in the "Smarter Together" project took place between August and December 2016. The survey was carried out both as face-to-face and as an online survey. Only 241 questionnaires were fully completed and therefore considered in the evaluation. Among the participants, 81% live in a household with at least one bicycle, among which 4% have at least one e-bike available. 41% of them stated that that they would like to cycle more often if they were able to choose. In this sense, "infrastructure improvement is therefore needed since the surrounding structure does not encourage them to do so." Concerning public transport, 88% of them have a public transport stop in 5-7 minutes walking distance from their residence and 77% own a season ticket for public transport (annual passes or student tickets). The automobile, on the other hand, was not the main mean of transport of the participants, as only 59% of the participants live in a household with one or more vehicles, whereas 75% own a driving license. As for smart mobility, not so many participants stated that would like to travel more frequently with an electric car or with electric bike in the future (29% and 20%, respectively). Only 9% of respondents stated that they actually already use car sharing.

3.3.2 Richard-Wagner-Platz

The "Wien Mobil Station Richard-Wagner-Platz" is located in the 16th District, also known as Ottakring. The population density in the district is 119.7 inhabitants/ hectare, which is above the population density of the entire city of Vienna even though this district is located a little further from the Inner City. Concerning the motorization rate, there are 310.8 automobiles/1,000 inhabitants, which is below the average for Vienna. (Magistrat der Stadt Wien, 2019c, p. 312)

This mobility station was implemented in September 2019 and it is positioned in the corner of a big square with the same name, which is on "Thaliastraße" Street, the busiest and most commercially important street in the neighborhood. It offers good connection to the tram line and is approximately 1 km away from the closest subway station. The configuration of the station is a little bit different from the one in "Simmeringer Platz", because the services offered are not concentrated in a single location, but rather are spread in the corner of the square. This is partly explained because the strategy adopted for this mobility station was to use the existing infrastructure, such as the bike-sharing system "Citybike Wien" and the existing charging stations

for electric cars from "Wien Energie". The e-bikes "Sim Bike" are not available at the station, but the e-car-sharing system is the one from "Stadtauto". In order to make the stations more similar to the infrastructure offered in the first mobility station, in "Simmeringer Platz", the same visual identity was adopted, with informative signage in the same colors and style. In this location, however, it was not possible to add the bench. On the other hand, a shared cargo van is available, as well as bike racks and space for parking e-scooters. Moreover, as the bike-sharing is the "Citybike", a lot more bicycles and docks are available. The integration of the bike-sharing "Citybike" with the "Wien Mobil Station" was an initiative from "Wiener Linien" that resulted in an agreement between both. According to Dechant (2020), the utilization rate of the "Richard-Wagner-Platz" bike-sharing station in 2019 was 10,890 riders/ year and there was no observed difference after the implementation of the Wien Mobil Station.

3.3.3 Rochusmarkt

The "Wien Mobil Station Rochusmarkt" is located in the in the 3rd district, also known as Landstraße. The population density in the district is 124 inhabitants/ hectare, which is far above the population density of the whole city of Vienna, but still much lower than other districts around Vienna's Inner City. Concerning the motorization rate, there are 419.0 automobiles/1,000 inhabitants, which is also above the average for Vienna. (Magistrat der Stadt Wien, 2019c, p. 286)

This mobility station was implemented in September 2019 and it is surrounded by many stores, a big market square and some residential buildings. It is close to the subway station Rochusmarkt (line U3) and tram connections. The configuration of this station is similar to the one in "Richard Wagner Platz"; however, the bike-sharing station "CitybikeWien" is not completely connected to the mobility station because it is located across the street and a few meters further, but it is included on the mobility station map and it's reachable by foot. As stated by Franz (2020), the station is less attractive because it is dislocated and nobody sees that its many parts belong together. According to Dechant (2020), the utilization rate of the bike-sharing station "Salmgasse" operated by "Citybike Wien" during 2019 was 5,431 riders/ year and there was no observed difference in the utilization rate after the implementation of the Wien Mobil Station.

4. CONTRIBUTING FACTORS FOR THE UNDERUTILIZATION OF THE "WIEN MOBIL STATION"

The following aspects are the core of this work. With the support of the expert's opinions, they have been identified as the contributing factors for the underutilization of the "Wien Mobil Station" system.

This work was developed between October 2019 and January 2020. During the process of research, the research questions have changed, as the more the system was understood, the more the questions were identified as not appropriate. In the beginning, this work aimed at answering if mobility stations contribute to changes in travel patterns and how they are perceived by users. However, after observing the existing mobility stations and talking to different experts in the field, the "Wien Mobil Station" in Vienna was recognized as a system that is still not being as much used as expected. Consequently, the former research question had to be changed and some of the activities previously planned (such as carrying out surveys with users) were not fully conducted, as they were not reasonable and applicable anymore. The process of pursuing to answer the previous targeted research questions was, on the other hand, very important and it provided a better understanding of the mobility stations system in Vienna. By trying to answer the previous questions, it was possible to come up with a better understanding of the system, the challenges to successfully implement and operate it and the experts' criticism on it.

The activities conducted in order to develop this work were: literature review; analysis of the existing urban plans and projects for Vienna; explorative expert interviews; and field observations in the existing mobility stations.

4.1 Location

The locations of the mobility station at "Simmeringer Platz" and "Richard-Wagner-Platz" stand out for being in the outskirts of the city. This demonstrates an intention to cover peripheral areas, which do not offer as good public transport connections as the central areas, providing a new possibility for first and last mile transportation. Certainly, this is a positive characteristic, as it demonstrates the intention to better distribute the supply of urban infrastructure in the municipality. In case of "Simmeringer Platz", however, this was a challenge because the existing bike-sharing system of the city is not yet available in the area, and creating a new system and a new network requires a lot of investment, which the "Smarter Together" project did not cover. As previously mentioned, a single station, as the one being offered in "Simmeringer Platz", provides no network and it results in a bike-sharing alternative used mostly for leisure and very specific purposes. Moreover, the population density is an important aspect to have in mind when planning mobility stations, as to ensure a sufficient number of potential users. (Luginger, 2016, p. 94) As previously mentioned, the population density in Simmering is lower than the average of the City of Vienna and this might be one of the reasons why the station is underutilized.

Another important aspect concerning the location of the stations is the decision on where to place them within the neighborhoods, surrounding public transport. Luginger (2016, p. 94) states that the "intermodal change from public transport to sharing offers and vice versa is one key aspect of the provision of mobility stations. Thus, an attractive public transport offer is one basic requirement for station locations". Indeed, the mobility stations in Vienna, especially the ones in "Simmeringer Platz" and "Rochusmarkt", are installed in locations close to major public transport hubs, however the chosen locations do not offer visibility and it is likely that many public transport users have not even noticed them. According to Franz (2020), the most important aspects to be considered when planning mobility stations in the public space is to make them visible, reachable and connected to public transport. Einwögerer (2019), explained that there was a lot of discussion about the location of the station at "Simmeringer Platz" and said that he personally believes that the current location is not the best, and that it would have been better if the mobility station had been placed in front of the subway station instead of on the side and across the street – where it currently is.

4.2 Weather

Although the weather is an issue beyond technical and political decisions, it is important to approach it, as this work was conducted during the winter period, which can influence the utilization rate of bike-sharing and e-scooter systems. According to Dechant (2020), the utilization rate of the "Citybike Wien" during the winter represents around only 20% of the usage of June and the number of bikes provided during winter is around 8% less than during summer. Moreover, he explained that the weekends are highly influenced by the weather, whereas the weekdays have more stable utilization rates. In this sense, it is also possible to assume that systems mainly used for leisure purposes, as the "Sim Bike", are even higher impacted by the weather than systems used for work and study purposes.

4.3 Interoperability

According to Luginger (2016, p. 99), "the provision of an integrated registration process may reduce entry barriers for potential users. As previously explained, the public mobility stations in Vienna are operated by "Wiener Linien" and different sub-operators. In order to use a certain system, the user needs to register for each specific mobility offer. Franz (2020) sees the lack of interoperability as a negative aspect in the "Wien Mobil Station". There is, however, the app "Wien Mobil", which may provide such possibilities in the future. Nowadays it only offers a section called "Mobility services", from which it is possible to be redirected to the provider's website. Although this is still not perfect, "the provision of good redirections to the partner's applications is a cost-

efficient alternative to direct integration of access into the smartphone application." (Luginger, 2016, p. 101)

4.4 Affordability and Attractiveness

Miramontes (2018, p. 41) defines affordability as one of the indicators to assess sustainable urban mobility. According to the author, "it must be assured that mobility stations and their services are accessible and affordable to everyone." (Miramontes, 2018, p. 337) Moreover, the low attractiveness of the services offered at mobility stations in relation to other modes of transport is also relevant. Franz (2020) affirms that the main competitor for the shared mobility systems in Vienna is public transport, because it is currently good and affordable enough that public transport users might see no reason to use other options. Of course, this is a positive aspect of the urban mobility in Vienna and must be acknowledged. One of the concrete targets of the Urban Mobility Plan Vienna is to keep public transport as the backbone of the city. However, the shared mobility alternatives and the mobility stations are possibilities to improve the way people currently use public transport, complementing it and discouraging users from switching from public transport to private cars in the future. While this is an important and necessary strategy, it is challenging, and its results are often not immediately visible.

4.5 Reliability and Availability

The bike-sharing system at "Simmeringer Platz" has dealt with several cases of vandalism, resulting in the need of maintenance and bicycle repair, which resulted in the scenario in which there was only one bike available at the station during the whole month of January 2020, instead of the originally six. Previously, the cargo bike was stolen, and it took the operator company "Sycube" a few months to replace it. Vandalism occurs frequently, almost every week. One of the reasons might be that the e-bikes attract criminals for its components, such as board computer and battery. It was not possible to identify the criminals as they have damaged or stolen the bikes without registering in the system and no video surveillance is allowed on the streets of Vienna. Most probably is that the vandalism occurs during the night, as the station is quite bright, open and visible during the day. (Einwögerer, 2019) Not offering the bicycles regularly makes the system not reliable. Someone wanting to use this system on a daily basis to go to work or to school would never choose to use it, as the bikes might not be available when they most need it.

4.6 Publicity and Education

According to Luginger (2016, p. 97), "the development of an own branding and a corresponding corporate design play a key role for the implementation of multimodal mobility services". Indeed, the public mobility stations in Vienna have a branding, the "Wien Mobil", and a unique design in red color, which is the same used by "Wiener Linien". The mobility offers, on the other hand, are offered with the provider's colors and branding. However, the design of the mobility station and the branding of the system is not the main aspect that is contributing to the underutilization of the mobility stations. As demonstrated by the survey conducted with residents in Simmering, most of the interviewees have never used a shared mobility alternative and, moreover, only a few stated that they would like to do it. Therefore, it is possible to assume that the population in the district cannot be considered as "early adopters" and that they need more input in order to be interested in the smart mobility services. Furthermore, whereas the implementation of the mobility station at "Simmeringer Platz" involved the population through community engagement activities and had plenty of media coverage, this did not happen during the implementation of the two new mobility stations. In addition, advertising actions must take place on a continuous basis instead of being restricted to the implementation phase.

5. CONCLUSIONS

This paper aimed at understanding the reasons behind the currently underutilization of the public mobility stations in Vienna. The results presented in this work demonstrate the relevance of aspects previously covered by the literature - location, weather, interoperability, affordability, attractiveness, reliability, availability, publicity and education, while reinforcing the importance of taking them into account when planning mobility stations. Vienna's mobility stations are not underused for only one reason, but for the combination of different factors that have been and are being neglected during all stages - planning, implementation and operation. As demonstrated by the literature review, the knowledge on the importance of considering such aspects is not something new; however, it is still being left aside, for different reasons, mainly due to decisions that disregard technical knowledge. The public mobility stations in Vienna are different from each other in many aspects and the contributing factors presented do not apply to all of them in the same degree, yet the study shows that the three existing mobility stations have the potential for higher utilization rates.

The intention to set up mobility stations in the peripheral districts is positive; nonetheless, for it to take place in the desired way, it requires greater investment. Areas with low population density and where residents show no or low interest in shared mobility alternatives require greater effort in advertising and educational campaigns. It also requires political will to allocate certain public spaces to serve the purpose of the mobility station. Moreover, the deployment of a single mobility station in isolation does not make the system attractive as an intermodal mobility provider.

Moreover, the simple implementation of mobility stations is unable to transform cities and neighborhoods into smart. Often, the deployment of ICT is taken as a solution for urban transformation, leaving aside citizens and their real needs. Several authors have criticized the concept of smart mobility because it is often seen just as propaganda. The primary concern when planning smart mobility solutions must be the users. Due to the findings during the research process and the difficulties in contacting users of the mobility stations, the results of this project are now focused on the experts' opinion and on the infrastructure that is being offered instead of the perception of residents. However, this does not mean that the users' opinion is not relevant. On the contrary, given the scenario of underutilization of urban infrastructure, it is important to attract potential users and better understand their motivations.

Concerning the limitations of this work, unfortunately, it was not possible to organize an interview with anyone responsible at the car-sharing provider and no data on this system was available; however, field observation has shown that the car-sharing system is underutilized. Another limitation was the period of research, since conducting this study during winter has certainly increased the perception of an underutilized system. In this sense, the expert's opinions were important because they demonstrated that this scenario is not only happening during winter, but, in different degrees, during all seasons.

The recommendation for policymakers and operators when planning future mobility stations - both in Vienna and in other cities worldwide – is to involve citizens from the beginning and understand their real needs in order to develop and implement an attractive system. It is important to deeply consider the location of the mobility stations, both considering the demographic characteristics of the neighborhoods as well as the visibility of the mobility stations. Finally, it is essential to provide a dense network of stations, enabling real intermodality and multimodality.

Public mobility stations have the potential to encourage intermodality and multimodality and, for this reason, it is outstanding the initiative to deploy these stations in a context where a lower share of the automobile in the modal split is sought. The fact that the public mobility stations are not being used as much as planned should, in no way, be understood as a failure of the system, but rather as an opportunity to promote improvements. In addition, other municipalities worldwide can learn from the Viennese experience.

6. ACKNOWLEDGEMENTS

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DECLARATION OF CONTRIBUTIONS TO THE ARTICLE - CRediT

ROLE	LSilva	JUhlmann
Conceptualization – Ideas; formulation or evolution of overarching research goals and aims.	X	X
Data curation – Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use.	X	
Formal analysis – Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data.	X	
Funding acquisition - Acquisition of the financial support for the project leading to this publication.	X	
Investigation – Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection.	X	
Methodology – Development or design of methodology; creation of models.	X	X
Project administration – Management and coordination responsibility for the research activity planning and execution.	X	X
Resources – Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools.	X	X
Software – Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.		
Supervision – Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.		X
Validation – Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.		X
Visualization – Preparation, creation and/or presentation of the published work, specifically visualization/data presentation.	X	
Writing – original draft – Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation).	X	
Writing – review & editing – Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages.		X