PREDICTING THE WILLINGNESS TO CARRY LIGHTWEIGHT GOODS BY BIKE AND KICK-SCOOTER: A DESCRIPTIVE ANALYSIS

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ABSTRACT

The social transformation caused by the COVID-19 pandemic may contribute to make cities healthier and more sustainable, with more space available for active modes of transport. This paper addresses people's willingness to go shopping by bike or kick-scooter and to transport lightweight goods in cities with low maturity for cycling and scooting. Data collection was based on a survey, applied in the two main urban areas of Brazil (São Paulo and Rio de Janeiro) and Portugal (Lisbon and Porto). The dataset was processed considering only two categories of respondents, that is, potential users and regular users. The results indicate that people are willing to transport lightweight goods by bike or kick-scooter, as long as the infrastructure is safe and comfortable. This research contributes to understanding mobility behavior changes and to identifying barriers to shopping by bike or kick-scooter. It also presents some recommendations for improving cycling and scooting use for shopping, which can be carried out by public authorities.

1. INTRODUCTION

The world is currently facing a new mobility paradigm driven by the impact of artificial intelligence, new cleaner energy sources and public health problems caused by the COVID-19 pandemic. These trends are changing the way people work, travel and purchase goods and services. Furthermore, the definition of sustainable mobility is broad and should cover the three pillars (social, environmental and economic), based on people's need to have access to activities that facilitate their individual and societal development (Banister, 2008).

The reasons for using the car include convenience, time constraints, transporting heavy goods, picking up or bringing people, needing the car for the following trip and facing bad weather (Beckx et al., 2013; Mackett, 2001). The high car ownership rates, combined with a high percentage of short trips by car, has a negative influence not only on air quality, but also on living conditions in several cities (Soria-Lara et al., 2019).

The use of active modes of transport for this purpose becomes more difficult not only because of the weight of the load itself, but also because of the lack of safe and comfortable infrastructure (Félix et al., 2020), in addition to the lack of implementation of a public e-bike and e-scooter sharing systems in many places.

On the other hand, the COVID-19 pandemic is accelerating new lifestyles and the emergence of a new mobility scenario, in which public health and social distancing have become crucial challenges in transport policy and planning. In addition to mobility restrictions, the use of public transport has been limited and even discouraged in some places (Tian et al., 2020), having been identified as a vector for the spread of infection in dense populated areas (Buja et al., 2020). As demonstrated by the previous SARS pandemic, the fear of infection also discourages the use of public transport (Wang, 2014). As a consequence of that, the use of active modes of transport has also increased according to some studies (Abdullah et al., 2020; Bucsky, 2020; Haas et al., 2020).

Despite the ongoing vaccination for COVID-19, physical distancing may be necessary until 2022 (Kissler et al., 2020). Cities must adjust to that situation and compensate for some of the most negative long-term effects of the pandemic. The social changes prompted by the pandemic could be used to make cities healthier and more sustainable, with more space available for active modes of transport (Gutiérrez et al., 2020), which facilitates journeys by walking, cycling or scooting (Young & Whyte, 2020). In that scenario, this paper deals with the following research question: “are people willing to transport lightweight goods by bike or kick-scooter?”.

The paper focuses on the use of all types of bikes and kick-scooters (i.e., folding, electric, shared, rental, etc.) for personal shopping purposes by regular people (those working for a delivery company are not included). By actively promoting shopping by bike or kick-scooter, a new impetus can be given to improving and reinforcing sustainable shopping in cities. One possible contributor towards more efficient and environmentally friendly commercial transport is the use of bikes, especially cargo bikes (Nascimento et al., 2020; Schliwa et al., 2015), however, this paper does not deal with the feasibility of urban freight and city logistics. It also considers the hypothesis that part of the population can ride a bike and/or kick-scooter carrying some lightweight goods during their trips.

On the basis of a survey, a methodology was developed with the aim of characterizing the use of bike or kick-scooter for moving lightweight goods. The survey was applied to people of different age groups in the two main urban areas of Brazil (São Paulo and Rio de Janeiro) and Portugal (Lisbon and Porto). All those cities have low maturity for cycling (and also for scooting), meaning that they have: few cyclists (and even kick-scooter users), little infrastructure, no cycling (and/or scooting) culture (being considered unsafe and not respected), a car-oriented road design and a small modal share for active modes (Félix et al., 2017; Santos & Torres, 2020).

The main objectives of this paper are: (i) understand people's willingness to go shopping by bike or kick-scooter and to transport lightweight goods in cities with low cycling and scooting maturity, during the COVID-19 pandemic; and (ii) compare the results of the survey between regular users and potential users of bikes and kick-scooters.

The content of this paper is made up of this introduction plus other five sections. The second section presents the background and literature review. The third section deals with data collection and the fourth section presents the case study cities. The fifth section presents the results of the descriptive analysis, following the last section with the conclusions and future recommendations.

2. BACKGROUND AND LITERATURE REVIEW

Behavioral changes caused by the COVID-19 pandemic could be used to make cities healthier and more sustainable, with more space available for active modes of transport. Although it may not be easy to keep those habits over time, there is a clear window of opportunity available whereby temporary actions may inspire future policies (Gutiérrez et al., 2020).

Policy decision-makers, as well as the society in general, have a commitment to improve the quality of life in cities, air quality and public space, while ensuring equal accessibility in the urban context (Banister, 2008). The paradigm shift towards sustainable mobility is largely due to the transfer of fossil fuel-powered travel to electric vehicles; and from individual to collective transportation means and active modes, thus allowing short distances to be covered in the respective infrastructures (Moura et al., 2017; Santos & Torres, 2020).

Urban planning and transportation management policies must also be critically reviewed. The first actions taken during the COVID-19 pandemic sought to promote active modes and reduce the space allocated to private vehicles (Gutiérrez et al., 2020). However, the policies that will be implemented in the medium and long term are uncertain, as well as their impacts on active modes.

The benefits of active modes for urban mobility are well known for cities, including sustainability, equity, health, and quality of life. Increasing active mobility behavior, could help to address increasing rates of obesity, benefit physical and mental health, and reduce serious health problems associated with lack of exercise and air quality (Pérez et al., 2017; Sallis et al., 2004). However, changing the behavior of the population is a major challenge.

Planners and policymakers benefit from a greater understanding of available interventions to effectively promote cycling and scooting. In cities where cycling or scooting is starting to grow, as it is the case of the cities of this paper (i.e., São Paulo, Rio de Janeiro, Lisbon and Porto), little is known about who is cycling or scooting. Usually, in these cities, the attention

of transportation agencies and mobility managers is not focused on active modes, so cyclists and kick-scooters users are not a priority. The resulting lack of useful data is also a problem because there is no basis upon which governments could justify investments in effective cycling and scooting infrastructure. Cities with low cycling maturity do not have historical experience with cycling, so it is necessary to better understand and inform urban planners about which strategic infrastructure investments should be made and programs to be implemented in order to leverage their participation and mature the culture of cycling (Félix et al., 2020).

The implementation and extension of segregated cycling networks and facilities are interventions that have a high chance to successfully induce cycling (Buehler & Pucher, 2012; Carr & Dill, 2003; Pucher & Buehler, 2006; Santos et al., 2013), and can also induce scooting. However, it was found that changes in travel behavior can also be associated with a change in life circumstances rather than a change in the external environment (Chatterjee et al., 2013), such as health problems, a job change, school or residence, etc. The built environment influences a lot the use of active modes, enabling or hindering cycling and scooting. Several authors have concentrated mainly on perceptions of risk in cycling and the provision of cycling facilities to overcome this barrier (Chataway et al., 2014; Götschi et al., 2018; McClintock & Cleary, 1996; Swiers et al., 2017; Vanparijs et al., 2015), and the perception of safety is possibly one of the most important factors influencing the decision to ride a bike or not (Félix et al., 2019; Fowler et al., 2017; Muñoz et al., 2016), and probably a kick-scooter as well.

In the case of bikes, for example, other barriers are related to the physical effort of cycling, which is related to the slope and cycling maturity of the city (Stinson & Bhat, 2003; Winters et al., 2010) and sweating (Engbers & Hendriksen, 2010). In order to overcome these common barriers, electric bicycles and kick-scooters, requiring less physical effort, have been promoted worldwide (Dill & Rose, 2012; Popovich et al., 2014). Enabling active modes through basic infrastructure may be a necessary first step for numerous cities with little or no infrastructure, but such an approach is likely to have only modest impacts on travel behavior. Furthermore, significant travel behavior changes may not be possible without policies and infrastructure levers that deter people from car driving, in order to increase active travel (Piatkowski et al., 2019).

In cities with few regular users of active modes, such as the case study cities, there is a large share of the population that prefer other commuting modes. Among them it is possible to distinguish potential users of active modes from those who are not able or willing to ride a bike (Félix et al., 2017) or a kick-scooter. There is a need to appropriately measure the relevant factors that determine whether people choose to ride (or not) a bike or kick-scooter, especially for shopping purpose.

The general assumption is that the factors that prevent people from cycling or scooting are caused by a combination of personal and external factors, which together constitute the perceived barriers to cycling or scooting and influence the expectations of potential users.

Some of these factors are subjective and others are objective. Some of the objective factors (for example, distance or slope) may be perceived differently among potential users, being a strong or irrelevant barrier to cycling or scooting. These factors vary over time and can potentially lead to a change in behavior in relation to the adoption of cycling or scooting.

Another assumption is that the paradigm shift reflects the behavioral change, in which perceived barriers are outweighed by perceived benefits (Kahneman & Tversky, 1979) and the resulting motivators and expectations lead to effective results. The influence of personal or external factors on decisions to ride a bike or a kick-scooter more often can change over time, especially during pandemic periods.

The current literature points out some recommendations for public authorities to improve cycling or scooting use for shopping, such as: (i) incite active modes by means of street design interventions (Barbarossa, 2020; De Vos, 2020); (ii) reduce the number of lanes on multi-lane streets to homogeneously expand the walking and cycling (or scooting) infrastructure in central business districts (Soria-Lara et al., 2019); (iii) define the total traffic restriction on selected streets with high retail activity in order to build an infrastructure for walking and cycling (or scooting) covering the entire traffic space (Soria-Lara et al., 2019); (iv) limit (free) car parking, as it is associated with a lower likelihood for cycling (Bueno et al., 2017) or scooting; and (v) provision of showers, lockers and parking for bikes (Bueno et al., 2017) and kick-scooters.

Based on the literature review, the main reason why people do not ride a bike or kick-scooter is the possibility of using the private vehicle for the same objective. Bike and kick-scooter sharing schemes, which are rapidly spreading in many cities, are also considered essential elements of urban transport policy. However, there may not be a significant cycling increase without dedicated cycling infrastructure (Félix et al., 2019; Pucher et al., 2010). Anyway, for those who do not have bike storage at home and thus are less likely to cycle (Fernández-Heredia et al., 2016), bike (or kick-scooter) sharing systems can be a practical option.

The literature points to many studies of urban freight and city logistics (mainly cargo bikes), considering mainly those people who work for a delivery company, which is not the focus of this paper. There are even fewer research studies focused on cities with low cycling and scooting development and maturity, which typically have sizeable non-users' population, and also potential users of bikes and kick-scooters. This is precisely the research gap that this paper intends to cover.

3. DATA COLLECTION

Data collection was based on a survey aimed at understanding respondents' current mobility patterns, attitudes towards urban cycling and scooting, willingness to change behavior, and some socio-demographic data. The survey is applicable to any city regardless of the level of maturity of cycling and scooting. All questions were closed-ended and are listed in the flowchart displayed in Figure 1.

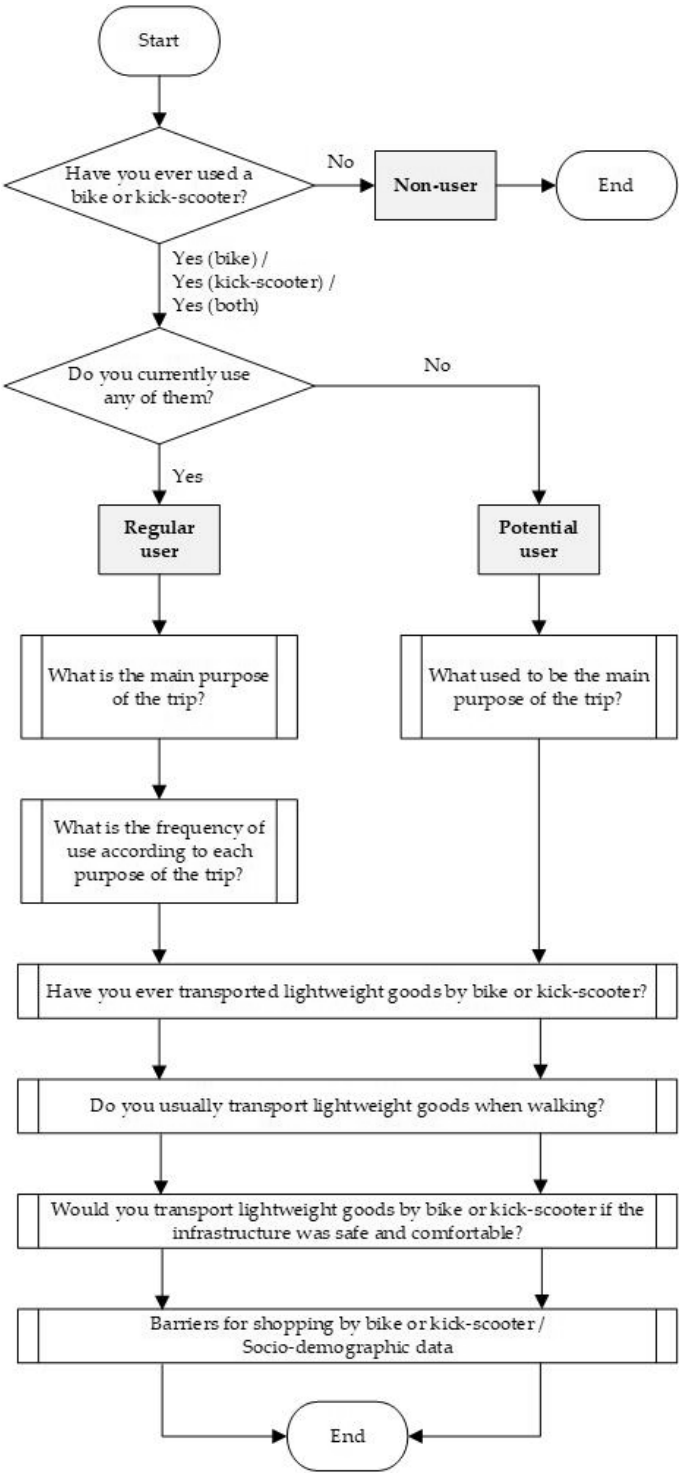

Figure 1 – Flowchart of data collection

It is worth mentioning that urban cyclists and kick-scooter users are not all the same, do not travel for the same reason or with the same frequency, or have the same needs (Christmas et al., 2010). Market segmentation has been used in transportation engineering for many years (Beirão & Sarsfield Cabral, 2007; Dallen, 2007; Jacques et al., 2013; Kassirer & Lagarde, 2010). To this end, the flowchart in this paper presents a categorization of the survey into smaller groups of similar individuals based on how they would likely respond to a particular marketing mix.

Respondents were categorized as “Non-users”, “Potential users” and “Regular users”, adapted after reviewing the literature (Kroesen & Handy, 2014; Bergström & Magnusson, 2003; Dill & McNeil, 2013; Félix et al., 2017), as follows: (i) Non-users: someone who has never ridden a bike or kick-scooter and has no particular interest in doing it; (ii) Potential users: someone who has ever ridden a bike or kick-scooter and would ride it again (or is willing to do so) if some conditions happen; and (iii) Regular users: someone who currently rides a bike or kick-scooter and should do so within the next month.

Different lines of inquiry were addressed to each group. The survey asked “Potential users” to recall their previous experiences when they used to ride a bike or kick-scooter, and “Regular users” to respond based on their current experience. The category of “Non-users” was not considered in the final dataset, as they have no particular interest in riding a bike or kick-scooter.

All questions were closed-ended, and all features were categorical. Regarding trip purpose, "Regular users" answered it for their current trips, while "Potential users" did it for the trips they would have made. Only "Regular users" had to answer what is the current frequency of use (i.e., “Sometimes”, “Once a week”, “2 to 3 times a week”, “Daily”), having to answer this question for each of the following four trip purposes: “Work or Study”, “Leisure”, “Shopping” and “Other”.

The next three questions were asked to the two categories of respondents in order to have a reference to test and validate the research question addressed in this paper (namely, are people willing to transport lightweight goods by bike or kick-scooter?). These three questions were “Yes/No” questions, involving: (i) “Have you ever transported lightweight goods by bike or kick-scooter?”; (ii) “Do you usually transport lightweight goods when walking?”; and (iii) “Would you transport lightweight goods by bike or kick-scooter if the infrastructure was safe and comfortable?”.

Finally, respondents had to answer a question to identify barriers for shopping by bike or kick-scooter in cities with low maturity for cycling and scooting (including the volume or cargo itself, etc.). They were also asked about some socio-demographic data (including gender and age).

4. CASE STUDY CITIES

The survey was applied to people of different age groups in the two main urban areas of Brazil (São Paulo and Rio de Janeiro) and Portugal (Lisbon and Porto). The two countries continue to be linked by a common language (Portuguese) and Portuguese-Brazilian ancestry, which facilitated the common application of the survey. These cities have important employment centers in their regions and have some differences related to urban morphology, transport infrastructure, modal share, etc. However, these cities have a low modal share for cycling (see Table 1) and scooting, as well as scarce infrastructure for active modes.

City	Cycling modal share	Reference
São Paulo (Brazil)	2.0%	Brand et al. (2019)
Rio de Janeiro (Brazil)	2.4%	Souza et al. (2017)
Lisbon (Portugal)	< 1%	Martinez & Viegas (2017)
Porto (Portugal)	< 1%	Costa et al. (2012)

Table 1 – Modal share for cycling in the case study cities

Cycling accounts for about 27% of trips in The Netherlands (Félix et al., 2019), unlike all cities in the case study that account for less than 3% of the participation in the cycling modal. Although information on the percentage of kick-scooter trips has not been found, it can be assumed that all cities have low development and maturity for the use of bikes and kick-scooters.

All cities in the case study face difficult challenges in adopting active modes for urban mobility: (i) low culture of cycling and scooting; (ii) little interest in collecting data on cycling or scooting; (iii) the general perception that cycling or scooting is neither safe nor respected; and (iv) car-oriented road projects.

On the one hand, the political choices that were made at the level of transport systems in these cities, were based on a bet on road infrastructure and the use of the car, in recent decades, with little significant investment in infrastructure and public transport services. The road infrastructure sector in these cities directly affects the accessibility of regions and the mobility of people and goods, contributing to access to work and income (Santos & Ribeiro, 2015, 2016a, 2018a) and road concessions have been the most strategic alternative feasible for maintaining roads at an appropriate level for traffic volumes (Santos, 2017; Santos et al., 2019; Santos & Picado-Santos, 2018, 2019; Santos & Ribeiro, 2018b). Traffic impact analysis is the key means to harmonize transport and land use planning (Santos & Gouvêa, 2012; Santos & Ribeiro, 2016b), but in these case study cities, such studies have only been used since the last few decades.

On the other hand, the conditions offered in these types of cities contribute to the individual's decision to ride (or not) a bike or kick-scooter, in a transitional way. Given that these cities do not have historical experience with cycling or scooting, it is necessary to better understand and inform city planners about what strategic infrastructure investments should be made and programs to be implemented in order to increase their participation in active modes, mature its culture, as well as encourage its use for shopping, which is the main objective of this paper.

5. DESCRIPTIVE ANALYSIS

Descriptive analysis was used to illustrate the basic characteristics of the dataset in this paper, providing simple graphical analysis and measurements. The survey was addressed to the residents, workers, students and visitors of the four cities already mentioned. As the survey was launched in different cities at the same time, no specific sampling methodology was used. The survey was distributed on social media and by university press advisory, with the title "Shopping by bike or kick-scooter in times of pandemic", and conducted in an online-only format, using the Google Forms. The survey was online in April and May 2020 and collected 294 responses. The representativeness of respondents and the three categories of population segmentation is shown in Figure 2.

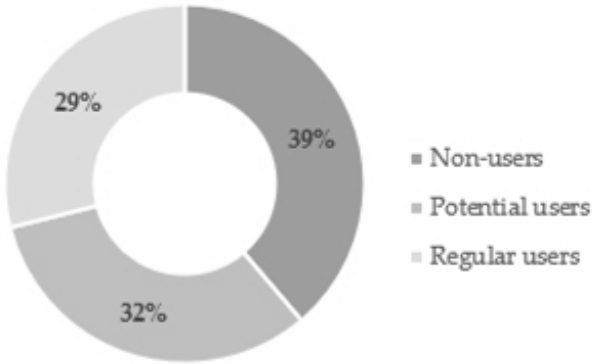

Figure 2 – Representativeness and categories of respondents (Note: 294 responses)

According to the representativeness and categories of the respondents, the category "Regular users" corresponds to 29%, which was expected in cities with low maturity for cycling and scooting. Then in second place it comes the category "Potential users" (32%), followed by the category "Non-users" (39%). In a low cycling and scooting maturity city, more non-users and potential users are expected, whereas in a high cycling and scooting maturity city, more regular users are expected (Félix et al., 2017). After the data cleaning process, the final dataset included only the categories "Regular users", as they are typically more proficient users, and also "Potential users", as they are willing but not convinced to ride a bike or a kick-scooter again if a number of conditions were fulfilled. The content of this dataset also confirms the initial hypothesis that part of the population can ride a bike and/or kick-scooter (around 61%).

Thus, the entire analysis from now on is based on the remaining 180 respondents, with almost half of them (53%) being “Potential users” and the remaining portion (47%) being “Regular users”.

The gender of respondents is shown in Figure 3, according to the category of respondents, as well as the grouping of these two categories.

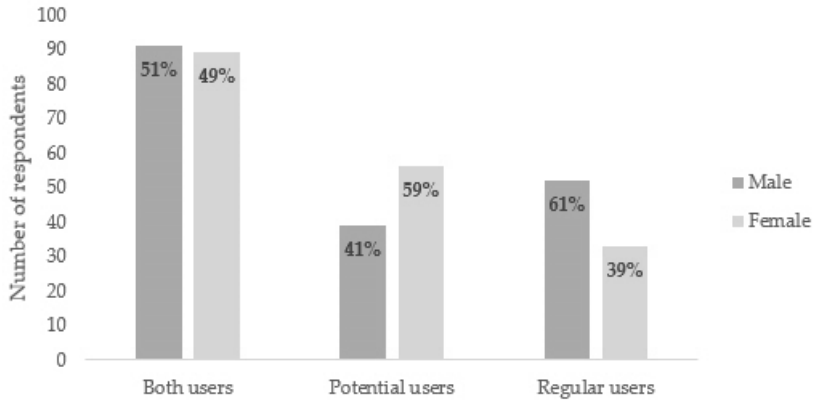

Figure 3 – Gender of the respondents

The gender of the respondents is well distributed among the sample (i.e., both users), in a total of 91 men (51%) and 89 women (49%). However, this distribution is not the same when analyzing the two categories of respondents. In the "Potential users" category, women represent the majority of the responses (59%), while in the "Regular users" category it was men who represented the majority of the responses (61%). These results are in line with the literature review, since among regular users, a higher percentage of men in countries with low maturity in cycling (and scooting) was expected (Garrard et al., 2008). The distribution of the age group of these respondents, as well as the grouping of these two categories, is shown in Figure 4.

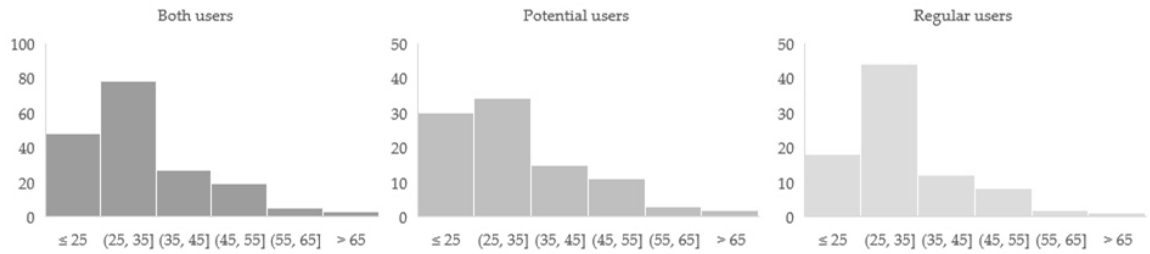

Figure 4 – Distribution of the age group

The distribution of the age group was similar in the two categories of respondents ("Potential users" and "Regular users"), as well as in the grouping of these categories (i.e., both users). In general, most respondents are between 25 and 35 years old, while a minority of respondents are over 55 years old.

The modal split is shown in Figure 5, according to the two categories of respondents.

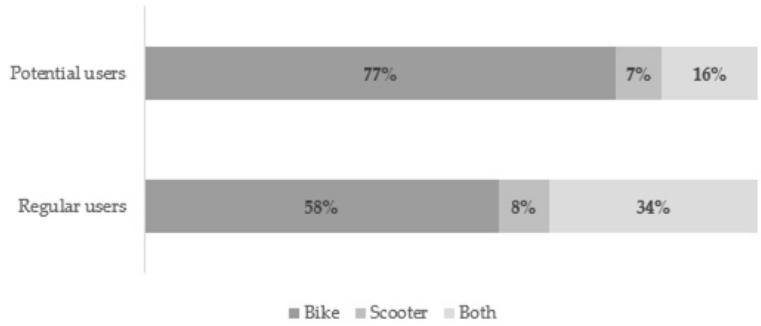

Figure 5 – Modal split according to the two categories of respondents

In the two categories of respondents considered, the modal split graph shows that the bike is the most used active means of transport, while the kick-scooter remains between 7% and 8%. However, it is observed that the use of both means (i.e., bike and kick-scooter) increases for the category “Regular users”, which shows a better acceptance of these two means of transport.

The main travel purposes are shown in Figure 6, according to the two categories of respondents. As mentioned before, "Regular users" answered it for their current trips, while "Potential users" did it for the trips they would have made.

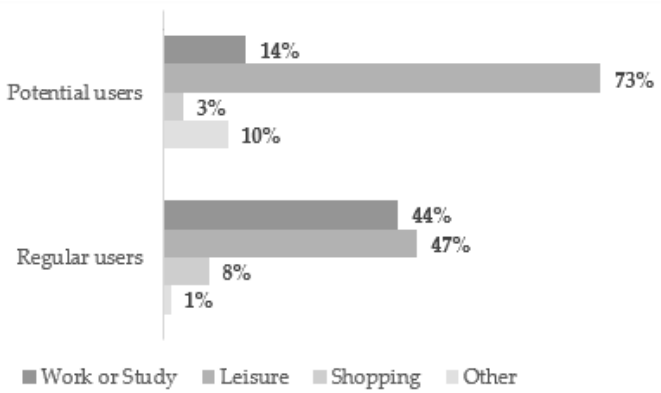

Figure 6 – Main travel purposes according to the two categories of respondents

According to the travel purposes graph, leisure was the most cited reason when analyzing the two categories of respondents. This reason is very high (73%) when analyzing the category “Potential users”, followed by work or study (14%), shopping (3%), and other reasons (10%). On the other hand, the reason for leisure was the most cited among the category “Regular users” (47%), being very close to the reason for work or study (44%), which shows that these means of transport (bike and/or kick-scooter) are no longer used just for entertainment. In addition, its use for shopping is still relatively low (8%) but it also represents a growth trend (which meets the main objective of this paper).

Only "Regular users" had to answer what is the current frequency of use, having to answer this question for each of the four purposes of trip (“Work or Study”, “Leisure”, “Shopping” and “Other”), as shown in Figure 7.

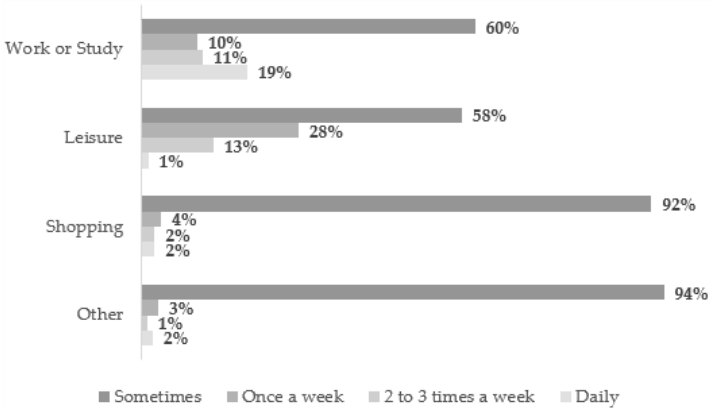

Figure 7 – Frequency of use according to each of the four purposes of trip (Note: applied only to the “Regular users” category)

The graph of the frequency of use according to each of the four purposes of trip shows that the “Regular users” often use active modes only sometimes, regardless of the four purposes of trip. It is worth mentioning that the reason for shopping is still not in use quite often, although a growth trend is expected in times of pandemic (especially in the medium- and long-term).

Some “Yes/No” questions were asked to the two categories to test and validate the research question addressed by this paper (namely, are people willing to transport lightweight goods by bike or kick-scooter?), as follows: (i) Q.1: “Have you ever transported lightweight goods by bike or kick-scooter?”; (ii) Q.2: “Do you usually transport lightweight goods when walking?”; and (iii) Q.3: “Would you transport lightweight goods by bike or kick-scooter if the infrastructure was safe and comfortable?”. The general results of these 3 questions are shown in Figure 8.

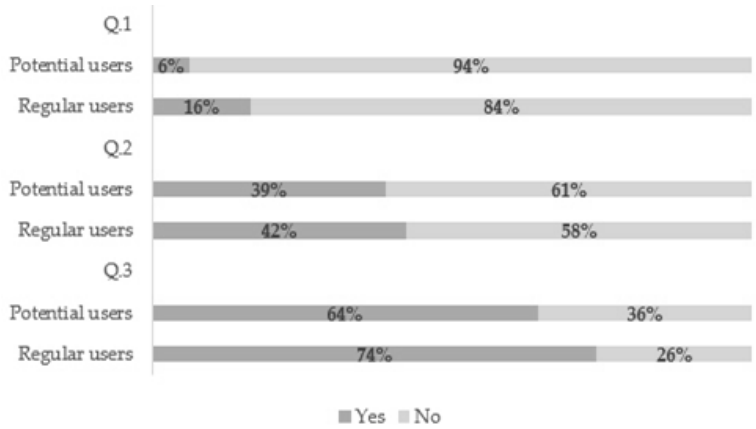

Figure 8 – General results of 3 questions to test and validate the research question

The general results of the 3 questions to test and validate the research question provide interesting results. When asked whether respondents have already transported lightweight goods by bike or kick-scooter (Q.1), both categories of respondents have mostly said "no", representing 94% for the category “Potential users” and 84% for the category “Regular users”. These results show that there is still a lot of work to be done to effectively promote active modes for shopping.

Then, when asked whether respondents usually transport lightweight goods when they walk (Q.2), the two categories of respondents have similar opinions, presenting an increase in the answers "yes" in relation to the previous question (Q.1). That is, 39% for the “Potential users” category and 42% for the “Regular users” category. It is worth mentioning that the figures are quite similar, even considering the “Potential users” (people who are willing but not convinced to ride a bike or a kick-scooter again), but who are willing to carry lightweights when walking.

Finally, when asked whether respondents would go shopping by bike or kick-scooter and transport lightweight goods if the infrastructure was safe and comfortable (Q.3), there was a significant share of the "yes" answer for both categories of respondents, representing 64% for the category “Potential users” and 74% for the category “Regular users”. Even “Potential users” would be willing to ride a bike or kick-scooter again (also for shopping purposes), if they had a safe and comfortable infrastructure, which is not common in cities with low cycling and scooting maturity. These results are in line with the literature review, indicating a high likelihood of changing mobility behavior (especially in times of pandemic). However, the change is conditioned to government interventions, such as the expansion of the cycling and scooting network and the implementation of public e-bike and e-scooter sharing systems.

Overall, the answer to the research question is “yes”, that is, people are willing to transport lightweight goods by bike or kick-scooter. Thus, the government interventions are a game-changer to start a city's progression towards higher levels of cycling and scooting maturity, and to meet the objectives of this paper, to transport lightweight goods by bike and kick-scooter if the infrastructure was safe and comfortable. This is essential, especially if they are implemented in cities with almost no cycling and scooting modal share, such as the case study cities.

To conclude, respondents answered a question to identify barriers for shopping by bike or kick-scooter in cities with low maturity for cycling and scooting. The main barrier declared by respondents was the volume or cargo itself. Other perceived barriers were: cycling or scooting in the traffic, living too far, motorists do not respect, not own a bike or kick-scooter, slope, arrive sweat, no safe route, no cycling or scooting network, taking more time, theft when parked outside, too hot or rainy, afraid of having an accident, do not ride for years, like driving a car, too dangerous, afraid of being robbed and physically unable.

6. CONCLUSIONS

This paper contributes to the understanding of the changing mobility behavior and the identification of barriers to go shopping by bike or kick-scooter in cities with low maturity in the use of these modes. In addition, it provides insight to the planning and definition of local policies and actions (hard and soft measures) that can potentially promote a modal shift for cycling and scooting in cities with low share of those modes.

The paper shows that people are willing to transport lightweight goods by bike or kick-scooter as long as the infrastructure is safe and comfortable enough. The main barrier for going shopping by bike or kick-scooter declared by respondents was the volume or cargo itself, while other perceived barriers include: cycling or scooting in the traffic, living too far, motorists do not respect, not own a bike or kick-scooter, etc.

Based on the literature review and the results of the descriptive analysis, the authors suggest additional recommendations to public authorities, with the aim to improve the use of bikes or kick-scooters for shopping purposes (especially in times of the COVID-19 pandemic), such as: (i) producing campaign to encourage car drivers for short shopping trips through active modes, especially bikes and kick-scooters; (ii) reducing distances and barriers for cyclists and kick-scooter users; (iii) fostering short travel policies; (iv) stimulating small- and medium-sized malls; and (v) avoiding planning large malls outside cities.

As a proposal for future studies, the research can be applied in different regions, for comparison purposes. In addition, the use of different machine learning techniques is expected to classify the use of active modes of transport to carry lightweight goods.

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