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Evaluation of Urban Mobility Problems and Freight Solutions from Residents' Perspectives: A Comparison of Belo Horizonte (Brazil) and Szczecin (Poland)

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Abstract: An efficient urban freight transport (UFT) system is crucial for sustainable city development. However, implementing city logistics measures still seems challenging for municipalities and decision-makers. Moreover, city authorities' decisions depend on politics and social issues, and the city residents' opinions seem to be very important in this context. Therefore, the primary objective of this paper was to assess the perception of urban mobility problems and freight solutions from the perspective of city users, considering the point of view of Brazilian and Polish city dwellers. The work was based on a survey realised in Belo Horizonte (Brazil) and Szczecin (Poland). The analysis identified the similarities and differences between the perceptions of different resident groups in both cities. The practical advantage of this research is the establishment of a set of recommendations for city decision-makers in the context of residents' perceptions and their expectations regarding the implementation of urban freight measures.

Keywords: urban mobility; urban freight transport; sustainable transportation; stakeholders; residents; Plackett-Luce model

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1. Introduction

Urban freight transport (UFT) is an essential element of urban mobility due to its externalities [1,2]. City logistics measures are a way to reduce the UFT externalities and contribute to achieving sustainable transportation. Nevertheless, transportation planning is generally focused on passenger transport [3,4].

In recent years, the perception of transport problems of municipalities has changed. Thanks to many international projects, the authorities often include some issues related to UFT in the action plans. The critical challenge for these plans is to address the expectations and needs of different UFT stakeholder groups. The main stakeholders involved in UFT are the shippers, freight operators, administrators, and residents. Shippers include both the senders and recipients of goods, usually retailers (small shops independent of large chains), wholesalers and manufacturers. Freight operators include external professional transport operators, logistics service providers, courier services, private providers, urban managers of supply centres and dispatchers. Administrators cover regional authorities, municipalities, municipal managers of supply centres, and other administrators, providing inputs to the system. Finally, residents include the citizens as well as its other city users, such as commuters and visitors [5]. Nowadays, UFT stakeholders are more often considered in the transportation planning process [6–8]. The inclusion of UFT in transportation planning and the involvement of the stakeholders are crucial for general urban planning [3,9,10] and could create awareness of the importance of UFT to achieve sustainable transportation [11]. On the other hand, two crucial issues must be considered in that context [12]:

- active policymaking on the part of the city authorities about goods deliveries in urban areas contributes to activating various stakeholder groups, and enables dynamic cooperation towards a consensus
- reaching a high usability level of any adapted solutions is determined by complementary synergistic measures underlying the possibility of full implementation of the resultant bundle of goals of the stakeholders.

Due to the significant effect of successful implementation of good practices in urban delivery transport, the implementation environment needs to involve the stakeholders at every stage of the process; this involves searching for compromises to the diverse problems and needs voiced by them, and considering the adaptability level of the city.

Considering the consensus and compromise mentioned above, it must be underlined that the perspective of city users is highly essential for municipality decision-makers; this is especially true in the context of public acceptance of the local authorities and political influences on the decision processes. However, this perspective is not often considered. Mostly, the expectations of the business actors and city administration are addressed. As a result of this, city users' awareness of city logistics problems and measures/solutions is low. This is an essential gap in the UFT research.

This paper focuses on residents' perspectives concerning urban mobility problems and city logistics measures. The literature concerning the residents' perspectives on UFT is limited [13]. Oliveira and Oliveira [7] compared stakeholders' perceptions concerning the UFT problems in Belo Horizonte (Brazil), including the residents' perceptions, and results showed a divergence in perceptions among the stakeholders. The residents perceived that trucks and cars contributed to congestion, trucks contributed to noise, and restriction of the movement of trucks in the inner cities could contribute to urban mobility [7]. Amaya et al. [13] analysed the perception of some stakeholders (carriers, receivers, and residents) concerning sustainable urban freight transportation policies in Barranquilla and Cartagena (Colombia). The residents indicated that off-street parking was the most efficient freight policy. Amaya et al. [6] analysed the relationship between infrastructure, externalities, and the UFT from the residents' perspectives in three regions in Cartagena (Colombia). They concluded that the problems are heterogeneous, and that infrastructure perception influences the perception of externalities [6]. In addition, the negative perception of externalities reduced UFT-performance awareness [6]. Finally, the residents negatively perceived UFT in their daily activities. The residents' awareness about the impacts of UFT on their daily activities gave a more rigorous evaluation of UFT [6].

Amaya et al. [6] highlighted that perception varies between areas with different socioeconomic characteristics. Based on these issues, this paper evaluates the urban mobility problems and freight solutions, comparing residents' perceptions in Belo Horizonte (Brazil) and Szczecin (Poland). The contribution of this paper is twofold. First, we compared the residents' perceptions of respondents from two cities in different countries (Brazil and Poland) of specificities regarding the planning process. Second, we showed residents' awareness for low-energy consumption problems and solutions, such as age, income, education level, and the vehicle used for work/school trip purposes, considering the opinions of fourfold residents' groups. The comparison addressed in this paper allows identification of the fact that perception varies depending on the characteristics of each city. Belo Horizonte (Brazil) and Szczecin (Poland) are in different continents and have different planning processes. However, the observed mobility problems seem similar in cities: high congestion and air pollution levels, poor quality of public transport, dependence on private vehicles for longer trips, and little use of micromobility. The similarities of the problems could indicate similar perception of the residents in relation to mobility problems and freight solutions. Furthermore, we will show that the problem perspective is different in different localities, despite them having similar problems. Thus, the stakeholders' perspectives are influenced by local context and by local problems. Consequently, solutions need to be addressed for the local context and local problems. However, successful cases may not always be successful in all locations. Finally, analysis of residents' perceptions concerning urban mobility problems and freight solutions is not common in the literature. As presented, few scholars have addressed analyses involving residents or citizens. However, the population can play a decisive role depending on the participatory process of urban and transport planning. In addition to these issues, comparing different contexts shows that conclusions involving behaviour and perception cannot be generalised. The comparison carried out in this paper also contributes to solving this issue.

Findings provided by this paper evidence the heterogeneity among the respondents in different places and with different socioeconomic characteristics. Thus, the UFT planning procedure requires the participation of residents, and UFT needs to be included as an essential activity for economic and social development. Moreover, UFT solutions are a way to achieve sustainable cities, reduce energy consumption, and fight climate change.

2. Data and Research Approach

A questionnaire was developed to obtain the data. The questionnaire was designed to address three blocks as presented in Table 1: socioeconomic information of respondents, urban mobility problems, and freight solutions. We requested that the respondents rank the urban mobility problems and freight solutions identified in the literature. Urban mobility problems and freight solutions are also usually reported by scholars in papers related to UFT. For more information about the UFT in Belo Horizonte and Szczecin, we suggest Oliveira and Oliveira [7], Oliveira et al. [9,14,15], Iwan et al. [12,16], and Kijewska et al. [11]. The authors have investigated the UFT problems and solutions from retailers, freight operators, and administrators. This paper encloses the UFT stakeholders analysis by comparing different countries perspectives, despite the data limitation, as hereunder presented.

Table 1. Problems and solutions considered in the analysis.

Block	Theme	Variable	Response Type
1	Socioeconomic information	Age	Integer number
		Income	Integer number
		ZIP Code	Text
		Education Level	Text
		The vehicle used for work/school trip purposes	Text
2	Urban Mobility Problems	P1. Congestion [9,15]	Ranking (1–8)
		P2. Low quality of public transportation [17,18]	
		P3. Lack of sidewalks [19]	
		P4. Lack of bike paths [20]	
		P5. Pollutions [6,21]	
		P6. Lack of parking areas [2,13,15]	
		P7. Accidents [21]	
		P8. Urban freight transport [22]	
3	Freight Solutions	S1. Truck restrictions [9,13–15]	Ranking (1–11)
		S2. Areas for loading/unloading goods [6,15,23]	
		S3. Circulation of green vehicles [9,13–15]	
		S4. Trucks road pricing [13,14]	
		S5. Cargo bike [14,24]	
		S6. Traffic information [25]	
		S7. Truck routes [9,15]	
		S8. E-commerce deliveries in pick-up points [15]	
		S9. Educational campaigns [11]	
		S10. Urban mobility plan [6,11,26]	
		S11. UFT discussion group [11]	

The questionnaire was divulgated by social networks to Belo Horizonte (Brazil) residents through a web-based survey, initially disseminated at the Federal Universities of Minas Gerais. Belo Horizonte has different areas with the concentration of people, income, shops spread throughout the territory. Thus, the research was focused on collecting data from all city regions.

In Szczecin, the same questionnaire was applied in person. The delimitation area was based on the analysis of the local impact of freight transport on the environment associated with the emission of chemical compounds. According to Regional Inspectorate for Environmental Protection [27], for example, NO2 concentration levels in Szczecin are focused around the downtown area; based on this, the research was focused on the residents of the downtown area.

A convenience sampling procedure was used in both Belo Horizonte and Szczecin. Additionally, a snowballing procedure was used in Belo Horizonte, since we have requested that respondents share our survey. According to Marta-Pedroso et al. [28], in-person interviews and web-based surveys produce similar results. However, obtaining a stratified sample is not always possible with a convenience sample. The most significant limitation of this sampling procedure is that our results are limited to the respondents; despite this, findings could provide insights for more in-depth analysis.

Data obtained were made compatible by adjusting Brazilian and Polish socioeconomic groups. Then, we removed incomplete or poorly ranked responses (same ranking for two categories) from the sample. After this, 828 valid responses were obtained: a total of 524 were obtained for Belo Horizonte and 304 for Szczecin.

We estimated Plackett-Luce models, a technique suitable for modelling ranking data. According to Luce's axiom of choice [29], the odds of choosing option i_1 do not depend on the other options available for selection [30]. Considering Luce's axiom, the probability of selecting the option i_j from a set S of J options is given by Equation (1) [30], where α_i is the worth of option i.

$$P(i_j|S) = \frac{\alpha_{i_j}}{\sum_{i \in S} \alpha_i} \quad (1)$$

The ranking of J options is a sequence of independent choices [30]. The Plackett-Luce model is equivalent to a log-linear model for categorical data and is detailed by [30]. The model assumes a utility Uri is modelled as Equation (2) for each option i and respondent r, [30]:

$$U_{ri} = \mu_{ri} + \epsilon_{ri} \quad (2)$$

where:

μ_{ri} is the explanatory variables, and

ϵ_{ri} is independent and identically distributed with an extreme value distribution.

The standard Plackett-Luce model is given by Equation (3) as a rank-ordered logit model [30]. Turner et al. [30] provide more details about the Plackett-Luce model.

$$U_{ri} = \log(\alpha_i) + \epsilon_{ri} \quad (3)$$

We estimated the Luce model using the Plackett-Luce package [30] in the R environment. We used the Broyden–Fletcher–Goldfarb–Shanno (BFGS) method to maximise the likelihood. The output given is the estimated coefficient, the probability of option i to be chosen and the final rank of the options.

We estimated some Plackett-Luce models based on the responses obtained for Belo Horizonte and Szczecin, both for the urban mobility problems and for the UFT solutions, as follows: the first Plackett-Luce model was global and considered all valid responses, without segregation through socioeconomic ranges; the second Plackett-Luce model considered the age groups and was estimated range by range for those that had more than 20 respondents; the other three models used the same idea as the second one, using the ranges of income, education level and usual transportation mode to estimate the residents' perceptions. These models allow the evaluation of the following research hypotheses:

(i) the perceptions of residents are heterogeneous; (ii) the worst problems are related to the urban operation, as congestion and the quality of public transport; (iii) because of the lack of experience with the theme, UFT is the least relevant problem; and (iv) the best solutions indicated by residents contribute to reducing fuel consumption and emissions.

3. Results

Belo Horizonte (Brazil) is an urban city in Brazil, with 2.5 million inhabitants distributed across 331 km^2 (7167 hab/km^2). Belo Horizonte was the first planned city in Brazil, founded in 1897, which today represents the downtown area. The service sector has an important role in Belo Horizonte's economy, and the surrounding cities concentrate on industry, agricultural and mining. According to the TomTom Traffic Index ranking, Belo Horizonte was the 74th most congested city in the world in 2020 [31].

Szczecin (Poland) is the capital and the largest city of West Pomeranian Voivodeship in Northwestern Poland. Szczecin has 0.4 million inhabitants distributed across 301 km^2 (1340 hab/km^2). Szczecin began in the eighth century and is the administrative and industrial centre of West Pomeranian Voivodeship. Szczecin was the 84th most congested city in the world in 2020 [31].

Table 2 shows the descriptions of respondents. Most respondents are younger in Belo Horizonte (less than 30 years old). In Szczecin, most respondents are between 41–50 years old. Most respondents have an income below $1000 in Szczecin and lower than $1000 in Belo Horizonte. A private car is used for work/school trip purposes in both cities. As mentioned earlier, the sampling procedure was for convenience. Thus, the groups do not represent the populations of the cities analysed. In this way, the results represent what respondents said. Furthermore, the results might provide insights for future investigations involving this important UFT stakeholder.

Table 2. Description of demographic–economic data from the respondents.

Demographic–Economic Variables		**Belo Horizonte**		**Szczecin (Downtown)**	
		Respondents	**Percentage**	**Respondents**	**Percentage**
Age	Less than 20	68	13.0%	16	5.3%
	21–30	372	71.0%	52	17.1%
	31–40	35	6.7%	52	17.1%
	41–50	16	3.1%	92	30.3%
	51–60	25	4.8%	50	16.4%
	61–70	5	1.0%	35	11.5%
	More than 70	3	0.6%	7	2.3%
Income	Less than $500	113	21.6%	96	31.6%
	$500–$1000	97	18.5%	207	68.1%
	$1000–$2000	156	29.8%	1	0.3%
	More than $2000	158	30.2%	0	0.0%
Education Level	Middle school	10	1.9%	2	0.7%
	High school	241	46.0%	206	67.8%
	Higher education	273	52.1%	96	31.6%
The vehicle used for work/school trip purposes	By bicycle	1	0.2%	9	3.0%
	By private car	273	52.1%	206	67.8%
	By public transport	194	37.0%	80	26.3%
	On foot	56	10.7%	9	3.0%

3.1. Urban Problems

Table 3 shows the estimated Plackett-Luce model for urban problems. Respondents consider congestion (P1) as the worst problem in Belo Horizonte. The second worst problem is the low quality of public transportation (P2), which could contribute to the high use of private cars in this city, as indicated by Vieira et al. [32]. These results validate hypothesis (ii). In Belo Horizonte, most bus lines move from/to neighbourhoods, necessarily passing through the downtown. This fact can negatively influence the residents' perception of the quality of public transport. The UFT is considered a minor problem in Belo Horizonte, probably due to the lack of knowledge of the problem and/or the lack of perception of this activity in the territory, validating hypothesis (iii).

Table 3. Ranking of urban mobility problems.

Problems	Belo Horizonte			Szczecin (Downtown)		
	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	25.32%	1	0.000 [a]	33.43%	1
P2	−0.057	23.93%	2	−0.352 *	23.50%	2
P3	−1.323 *	6.74%	7	−2.897 *	1.84%	8
P4	−1.070 *	8.68%	6	−1.580 *	6.89%	7
P5	−0.923 *	10.07%	4	−1.224 *	9.83%	3
P6	−0.979 *	9.52%	5	−1.359 *	8.58%	4
P7	−0.814 *	11.22%	3	−1.447 *	7.87%	6
P8	−1.723 *	4.52%	8	−1.422 *	8.06%	5

[a] reference category. Significance codes: * 0.001.

In Szczecin, we have the same ranking of the problems: congestion (P1) in first place followed by public transportation (P2), confirming hypothesis (ii). Generally, freight transport (P8) was underlined as more of a problem for Szczecin inhabitants than for those of Belo Horizonte, confirming hypothesis (iii). On the other hand, accidents (P4) were more problematic in Brazil than in Poland. An important result from this general analysis is that pollution (P5) was the middle-importance problem in both Belo Horizonte and Szczecin; this shows that the perception of this issue does not receive enough recognition from city users.

Tables 4 and 5 show the estimated rank of urban mobility problems based on age, with more respondents in Belo Horizonte and Szczecin. Figure 1 shows (in radar chart form) the "Pi" values for each of the age ranges in the cities under analysis. Residents less than 20 years old are more worried about the low quality of public transportation (P2) in Belo Horizonte. From 21 to 50 years old, the main worries are congestion (P1) and the low quality of public transportation (P2) in Belo Horizonte. The position of these problems reverses for Szczecin's interviewees. The low quality of public transportation is the principal concern of 51–60-year-olds in Belo Horizonte and Szczecin, and the main worry of respondents older than 60 years old, followed by congestion. Based on age, urban freight transport is a minor problem in Belo Horizonte and an intermediary problem in Szczecin, since the rank varies according to the age of respondents. Results indicate a low influence of age on the ranking of urban mobility problems.

Nonetheless, we observe the concern of younger people with public transportation. Literature suggests that younger people are less likely to acquire a driving licence and, consequently, a car [33]. Thus, the bus is the alternative transportation mode, and its low quality is a factor that could change their travel behaviour.

Table 4. Ranking of urban mobility problems in Belo Horizonte per age.

Problems	Age														
	Less than 20			21–30			31–40			41–50			51–60		
	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	22.17%	2	0.000 [a]	24.02%	1	0.000 [a]	34.29%	1	0.000 [a]	39.68%	1	0.000 [a]	30.18%	2
P2	0.141	25.54%	1	−0.011	23.76%	2	−0.614 ***	18.56%	2	−0.885 ***	16.38%	2	0.223	37.72%	1
P3	−0.989 *	8.25%	6	−1.282 *	6.66%	7	−1.554 *	7.25%	7	−1.786 *	6.65%	6	−2.299 *	3.02%	7
P4	−1.057 *	7.71%	7	−0.946 *	9.33%	6	−1.533 *	7.40%	6	−1.558 *	8.36%	4	−1.939 *	4.34%	6
P5	−0.720 *	10.79%	3	−0.819 *	10.58%	4	−1.459 *	7.97%	4	−1.837 *	6.32%	7	−1.697 *	5.52%	5
P6	−0.786 *	10.10%	5	−0.934 *	9.43%	5	1.483 *	7.78%	5	−1.223 **	11.68%	3	−1.219 *	8.91%	3
P7	−0.777 *	10.19%	4	−0.722 *	11.66%	3	−1.014 *	12.44%	3	−1.700 *	7.25%	5	−1.418 *	7.31%	4
P8	−1.441 *	5.25%	8	−1.663 *	4.56%	8	−2.074 *	4.31%	8	−2.378 *	3.68%	8	−2.308 *	3.00%	8

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

Table 5. Ranking of urban problems in Szczecin per age.

Problems	Age														
	21–30			31–40			41–50			51–60			61–70		
	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	40.24%	1	0.000 [a]	23.98%	1	0.000 [a]	30.36%	1	0.000 [a]	35.78%	2	0.000 [a]	42.22%	1
P2	−0.614 ***	21.78%	2	−0.002 *	23.94%	2	−0.269	23.20%	2	0.014	36.30%	1	−0.592 ***	23.36%	2
P3	−3.746 *	0.95%	8	−1.753 *	4.15%	8	−2.845 *	1.76%	8	−3.840 *	0.76%	8	−3.474 *	1.31%	8
P4	−1.366 *	10.27%	3	−0.815 *	10.61%	4	−1.577 *	6.27%	7	−2.741 *	2.31%	7	−1.932 *	6.12%	6
P5	−1.527 *	8.74%	5	−0.833 *	10.43%	5	−1.171 *	9.41%	5	−1.595 *	7.26%	4	−1.634 *	8.24%	3
P6	−1.978 *	5.57%	6	−1.114 *	7.87%	6	−1.231 *	8.87%	6	−1.522 *	7.81%	3	−1.686 *	7.82%	4
P7	−2.502 *	3.30%	7	−0.742 **	11.42%	3	−1.074 *	10.37%	3	−1.813 *	5.84%	5	−2.230 *	4.54%	7
P8	−1.481 *	9.15%	4	−1.149 *	7.60%	7	−1.135 *	9.76%	4	−2.204 *	3.94%	6	−1.887 *	6.39%	5

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

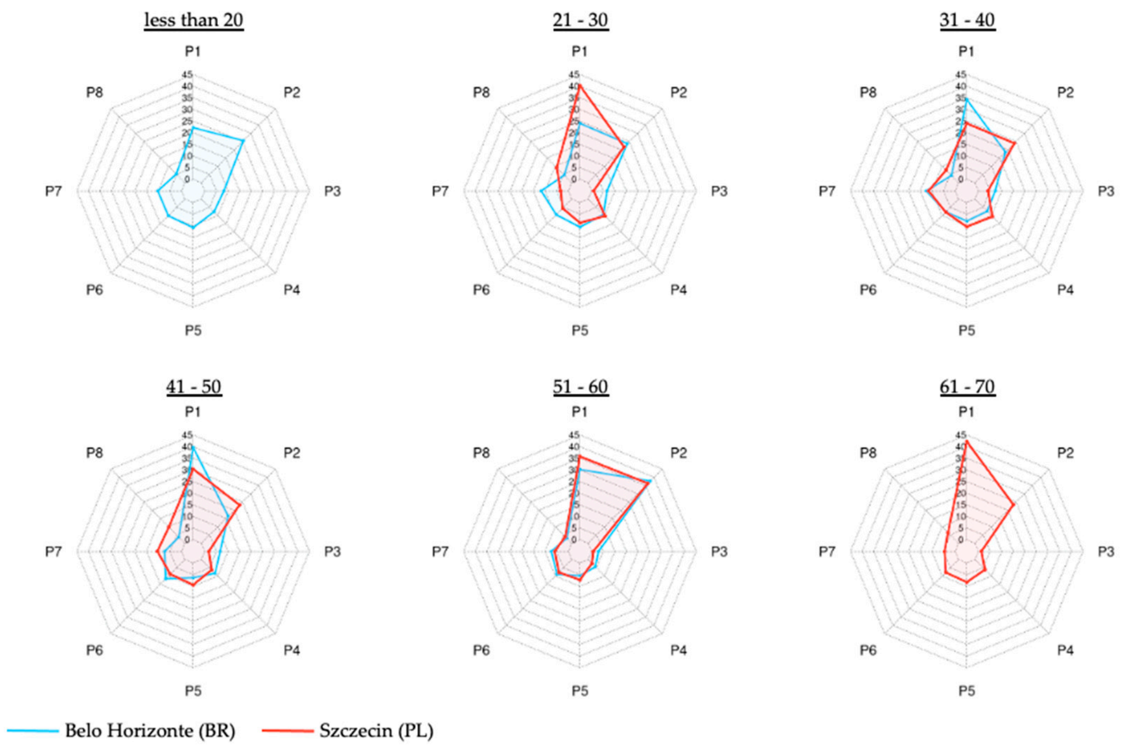

Figure 1. Radar chart of urban mobility problems per age.

Tables 6 and 7 show the estimated rank of urban mobility problems based on income, with more respondents. Figure 2 shows the chart of the "Pi" values for each range. Urban mobility problems also vary among congestion and the low quality of public transportation in Brazil. In contrast, congestion is the primary concern followed by the low quality of public transportation in Szczecin. Urban freight transport still attracts minor concerns among the respondents from Brazil and those with income less than $500 in Szczecin. Respondents with incomes of more than $500 ranked urban freight transport in fourth place. Results show that the income of respondents has little influence on the residents' perception in Brazil and Poland. These results confirm hypotheses (ii) and (iii).

Table 6. Ranking of urban mobility problems in Belo Horizonte per income.

Problems	Income											
	Less Than $500			$500–$1000			$1000–$2000			More Than $2000		
	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	22.71%	1	0.000 [a]	25.80%	2	0.000 [a]	25.60%	1	0.000 [a]	26.41%	2
P2	−0.142	19.69%	2	0.051	27.14%	1	−0.130	22.47%	2	0.036	27.37%	1
P3	−0.883 *	9.40%	6	−1.284 *	7.14%	6	−1.468 *	5.90%	7	−1.551 *	5.60%	7
P4	−0.656 *	11.77%	3	−1.285 *	7.14%	6	−1.128 *	8.29%	6	−1.205 *	7.92%	6
P5	−0.753 *	10.69%	5	−1.090 *	8.68%	5	−0.937 *	10.03%	5	−0.956 *	10.15%	3
P6	−0.967 *	8.63%	7	−1.028 *	9.23%	4	−0.850 *	10.94%	4	−1.106 *	8.73%	5
P7	−0.674 *	11.57%	4	−0.861 *	10.91%	3	−0.775 *	11.79%	3	−0.957 *	10.14%	4
P8	−1.411 *	5.54%	8	−1.875 *	3.96%	8	−1.638 *	4.98%	8	−1.972 *	3.68%	8

[a] reference category. Significance codes: * 0.001.

Table 7. Ranking of urban problems in Szczecin per income.

Problems	Income					
	Less Than $500			$500–$1000		
	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	34.32%	1	0.000 [a]	32.66%	1
P2	−0.624 *	18.40%	2	−0.210	26.48%	2
P3	−2.963 *	1.77%	8	−2.895 *	1.81%	8
P4	−1.296 *	9.39%	5	−1.709 *	5.91%	7
P5	−1.184 *	10.51%	3	−1.251 *	9.35%	3
P6	−1.256 *	9.77%	4	−1.411 *	7.96%	5
P7	−1.459 *	7.98%	6	−1.432 *	7.80%	6
P8	−1.475 *	7.86%	7	−1.403 *	8.03%	4

[a] reference category. Significance codes: * 0.001.

Tables 8 and 9 show the estimated rank of urban mobility problems based on the education level of respondents, and Figure 3 shows the radar graph. Based on the education level of respondents, the main concern is congestion followed by the low quality of public transportation in both Belo Horizonte and Szczecin. On the other hand, urban freight transport is a minor concern for the Belo Horizonte respondents based on their education level. At the same time, this problem is in the fifth and sixth positions for the high school and higher education levels, respectively, in Szczecin. Therefore, the education level has a minor influence on urban mobility problems.

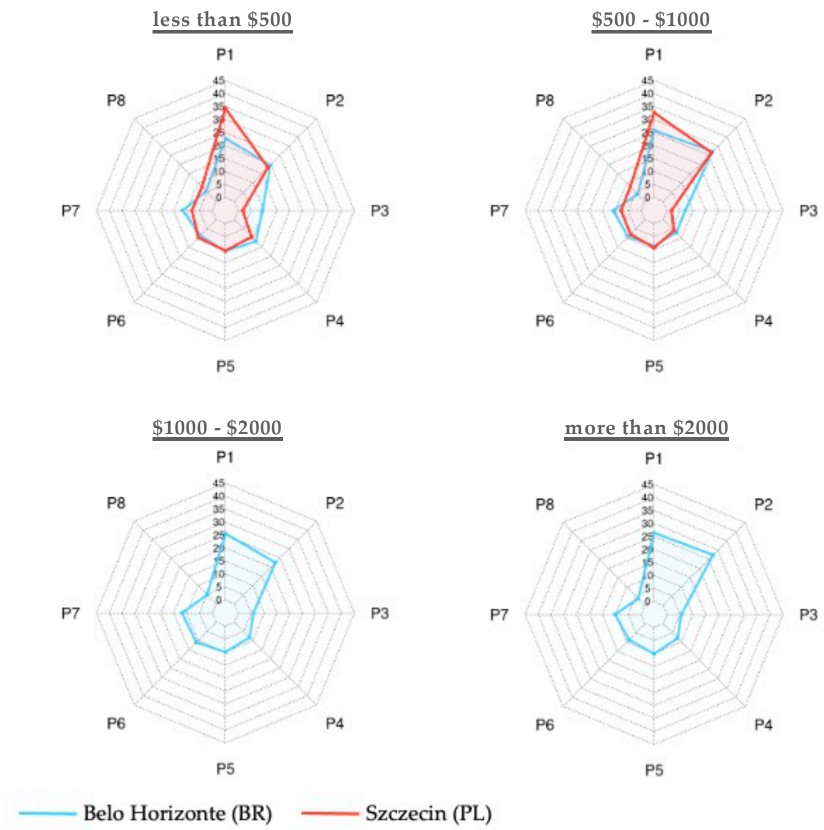

Figure 2. Radar chart of urban problems per income.

Table 8. Ranking of urban mobility problems in Belo Horizonte per education level.

Problems	Education Level					
	High School			Higher Education		
	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	23.69%	1	0.000 [a]	26.68%	1
P2	−0.035	22.88%	2	−0.048	25.42%	2
P3	−1.159 *	7.43%	7	−1.485 *	6.04%	7
P4	−0.939 *	9.26%	6	−1.176 *	8.23%	5
P5	−0.895 *	9.69%	5	−0.961 *	10.20%	4
P6	−0.775 *	10.92%	4	−1.183 *	8.18%	6
P7	−0.726 *	11.46%	3	−0.889 *	10.97%	3
P8	−1.626 *	4.67%	8	−1.830 *	4.28%	8

[a] reference category. Significance codes: * 0.001.

Tables 10 and 11 show the estimated rank of urban mobility problems based on the transportation mode used for trips (work and school). Figure 4 shows a chart of the "Pi" values. Congestion and the low quality of public transportation are the two main problems for all transportation modes in both cities. In Belo Horizonte, urban freight transport is still a minor concern, while it is an intermediary concern in Szczecin. Results indicate that transportation mode creates awareness among the respondents concerning congestion as an urban mobility problem, corroborating hypothesis (iii).

Table 9. Ranking of urban mobility problems in Szczecin per education level.

Problems	Education Level					
	High School			Higher Education		
	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	30.66%	1	0.000 [a]	40.02%	1
P2	−0.208	24.91%	2	−0.638 *	21.14%	2
P3	−2.894 *	1.70%	8	−3.154 *	1.71%	8
P4	−1.688 *	5.67%	7	−1.394 *	9.93%	3
P5	−1.136 *	9.84%	3	−1.505 *	8.88%	4
P6	−1.171 *	9.51%	5	−1.855 *	6.26%	6
P7	−1.139 *	9.82%	4	−2.177 *	4.53%	7
P8	−1.358 *	7.89%	6	−1.671 *	7.53%	5

[a] reference category. Significance codes: * 0.001.

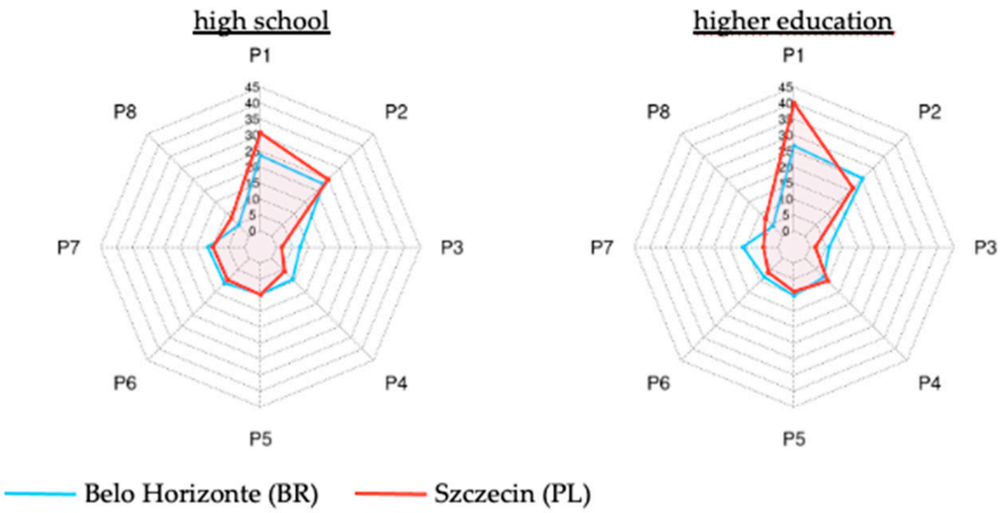

Figure 3. Radar chart of urban problems per education level.

Table 10. Ranking of urban mobility problems in Belo Horizonte per transportation mode.

Problems	Transportation Mode								
	Private Car			Public Transport			On Foot		
	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	24.75%	1	0.000 [a]	26.01%	1	0.000 [a]	24.71%	1
P2	−0.130	24.43%	2	−0.026	25.34%	2	−0.336	17.67%	2
P3	−1.362 *	6.33%	7	−1.272 *	7.29%	7	−1.303 *	6.71%	7
P4	−1.115 *	8.12%	6	−1.124 *	8.45%	6	−0.651 **	12.88%	3
P5	−0.852 *	10.56%	4	−1.030 *	9.28%	4	−0.837 *	10.70%	5
P6	−0.887 *	10.20%	5	−1.095 *	8.70%	5	−1.031 *	8.81%	6
P7	−0.797 *	11.16%	3	−0.888 *	10.70%	3	−0.657 **	12.81%	4
P8	−1.715 *	4.45%	8	−1.817 *	4.23%	8	−1.467 *	5.71%	8

[a] the reference category. Significance codes: * 0.001; ** 0.01.

Table 11. Ranking of urban mobility problems in Szczecin per transportation mode.

Problems	Transportation Mode					
	Private Car			Public Transport		
	Estimate	Pi	Rank	Estimate	Pi	Rank
P1	0.000 [a]	37.68%	1	0.000 [a]	27.58%	1
P2	−0.441 *	24.26%	2	−0.331	19.82%	2
P3	−3.261 *	1.45%	8	−2.270 *	2.85%	8
P4	−1.939 *	5.42%	7	−1.025 *	9.90%	6
P5	−1.412 *	9.19%	3	−1.023 *	9.92%	5
P6	−1.496 *	8.44%	4	−1.291 *	7.59%	7
P7	−1.741 *	6.61%	6	−0.823 *	12.11%	3
P8	−1.690 *	6.95%	5	−0.992 *	10.23%	4

[a] reference category. Significance codes: * 0.001.

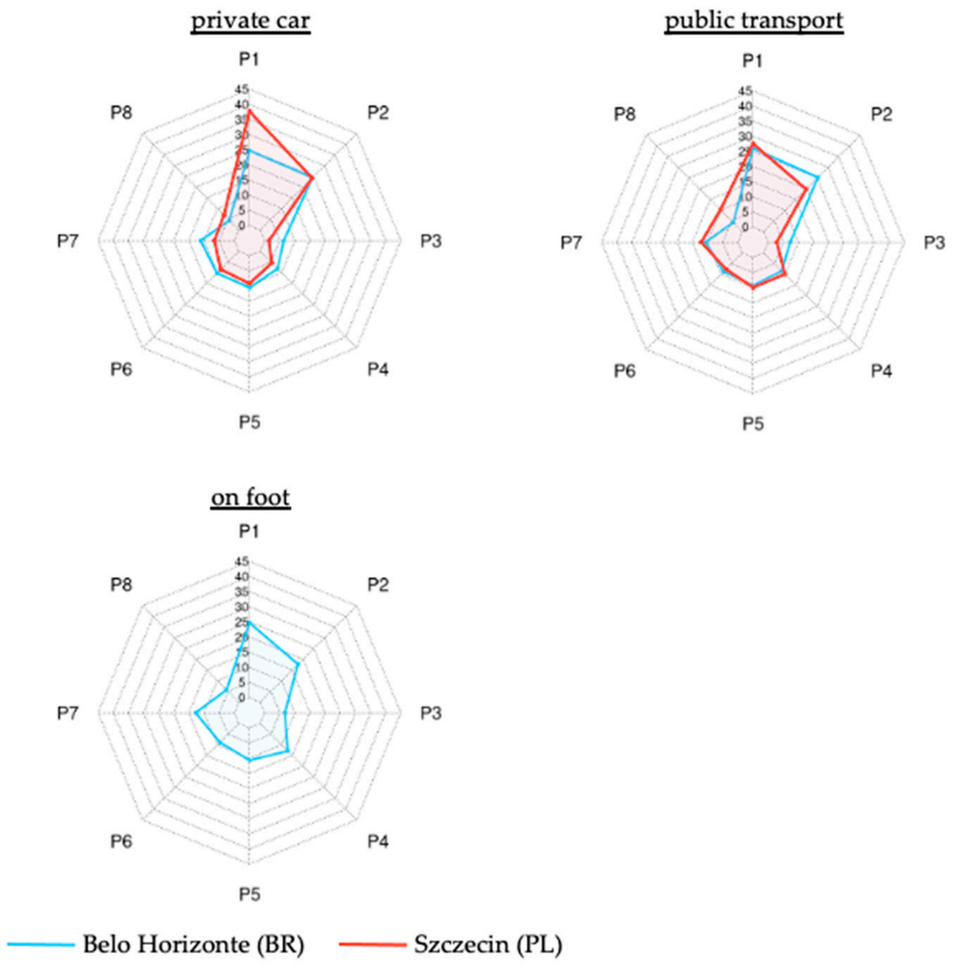

Figure 4. Radar chart of urban problems per transportation mode.

Findings show that the respondents have heterogeneous awareness of urban mobility problems, validating hypothesis (i). However, regardless of age, income, educational level, and transportation mode used, congestion is the main problem, followed by the low quality of public transportation.

3.2. Urban Freight Solutions

Despite urban freight transport having low awareness from the residents, this activity contributes directly to energy consumption. Thus, making it essential to identify strategies for developing freight policies to achieve sustainable urban freight transport and, consequently, contribute to fighting climate change.

Table 12 shows the ranking of UFT solutions. The respondents from Belo Horizonte consider the urban mobility plan (S10) and truck routes (S7) as the best solutions for sustainable transportation. The residents and experts evaluated the congestion charge positively as an urban mobility solution in Belo Horizonte, and this finding highlights the potential to extend this for freight vehicles. The least efficient solution was the use of green vehicles (S3). Despite the wide use of electric vehicles in Europe, this vehicle engine is limited in Brazil and has an expensive price. In Szczecin, delivering goods by bike (S5) is considered the best solution for the respondents. The cargo bike reduces congestion, emission and fuel consumption, and creates a better environment for the residents [34], confirming hypothesis (iv). Thus, it appears that the general perception of residents is heterogeneous about UFT solutions, ratifying hypothesis (i).

Table 12. Ranking of UFT solutions.

Problems	Belo Horizonte			Szczecin (Downtown)		
	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	5.87%	8	0.000 [a]	12.24%	2
S2	0.588 *	10.57%	3	−0.072	11.39%	4
S3	−0.424 *	3.84%	11	−0.369 *	8.46%	5
S4	−0.340 *	4.18%	10	−0.685 *	6.17%	10
S5	0.312 *	8.01%	5	−0.410 *	18.45%	1
S6	0.580 *	10.48%	4	−0.616 *	6.61%	9
S7	0.879 *	14.14%	2	−0.554 *	7.04%	7
S8	0.120	6.61%	7	−0.545 *	7.10%	6
S9	0.171 ***	6.96%	6	−0.011	12.10%	3
S10	1.435 *	24.64%	1	−1.173 *	3.79%	11
S11	−0.223 *	4.70%	9	−0.610 *	6.65%	8

[a] reference category. Significance codes: * 0.001; *** 0.05.

Tables 13 and 14 show the estimated rank of UFT solutions based on age with more respondents in Belo Horizonte and Szczecin. Figure 5 shows the “Pi” values for each age range in the cities. The urban mobility plan is more important for all age ranges in Belo Horizonte, followed by truck routes, the most suitable solution for those under 20 years. The ranking of UFT solutions is heterogeneous among the age range. In Szczecin, a cargo bike is the most suitable solution for all ages. Other UFT solutions were ranked in an assorted way. Results show the rank convergence for the first ranked solutions from age range and ad heterogeneity in the other solutions for both cities, as hypothesised (i).

Tables 15 and 16 show the estimated rank of UFT solutions based on income with more respondents, and Figure 6 shows the chart of the “Pi” values for each range. A similar trend to that of age was observed by analysing the income. An urban mobility plan is the most suitable solution for the respondents in Belo Horizonte, while the cargo bike is the solution preferred by the respondents in Szczecin.

Tables 17 and 18 show the estimated rank of UFT solutions based on the education level of respondents, and Figure 7 shows the radar graph of the “Pi” values. An urban mobility plan is indicated in Belo Horizonte, and the cargo bike is indicated by the respondents in

Belo Horizonte and Szczecin. Thus, the ranking of UFT solution has convergence regarding the education level in both Brazil and Belo Horizonte.

Tables 19 and 20 show the estimated rank of UFT solutions based on the transportation mode, and Figure 8 shows the chart of the "Pi" values. An urban mobility plan is the most suitable solution from the resident's perspective in Belo Horizonte, followed by truck routes, independently from the transportation mode. Finally, the cargo bike is indicated independently from the transportation mode in Szczecin.

Regarding UFT solutions, respondents from Belo Horizonte are concerned about public policy, while Szczecin's respondents are concerned about the cargo bike, a UFT-solution that contributes to climate change.

Table 13. Ranking of UFT solutions in Belo Horizonte per age.

Problems	Age														
	Less than 20			21–30			31–40			41–50			51–60		
	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	5.56%	8	0.000 [a]	5.52%	8	0.000 [a]	8.31%	5	0.000 [a]	6.70%	7	0.000 [a]	5.20%	6
S2	0.678 *	10.95%	4	0.617 *	10.23%	4	0.096	9.15%	3	0.613	12.36%	2	0.809 ***	11.68%	3
S3	−0.162	4.73%	10	−0.409 *	3.67%	11	−0.617 ***	4.48%	11	−0.237	5.28%	10	−0.881 **	2.16%	11
S4	−0.092	5.07%	9	−0.338 *	3.94%	10	−0.332	5.97%	9	−0.678	3.40%	11	−0.628	2.78%	10
S5	0.577 **	9.89%	5	0.375 *	8.03%	5	−0.202	6.79%	7	0.222	8.36%	5	−0.100	4.71%	7
S6	0.781 *	12.14%	3	0.656 *	10.64%	3	0.043	8.68%	4	0.428	10.28%	3	0.114	5.83%	5
S7	1.013 *	15.30%	1	0.897 *	13.53%	2	0.690 ***	16.57%	2	0.426	10.25%	4	1.238 *	17.94%	2
S8	0.547 **	9.60%	6	0.147	6.40%	7	−0.191	6.87%	6	−0.217	5.39%	9	−0.314	3.80%	8
S9	0.347	7.86%	7	0.191 ***	6.69%	6	−0.204	6.78%	8	−0.096	6.08%	8	0.468	8.31%	4
S10	0.987 *	14.92%	2	1.571 *	26.56%	1	0.970 **	21.92%	1	1.300 **	24.57%	1	1.887 *	34.31%	1
S11	−0.332	3.98%	11	−0.140	4.80%	9	−0.617 ***	4.48%	10	0.091	7.33%	6	−0.461	3.28%	9

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

Table 14. Ranking of UFT solutions in Szczecin per age.

Problems	Age														
	21–30			31–40			41–50			51–60			61–70		
	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	12.33%	3	0.000 [a]	15.47%	2	0.000 [a]	14.49%	2	0.000 [a]	11.67%	3	0.000 [a]	9.62%	4
S2	−0.320	8.95%	4	−0.469 ***	9.68%	4	−0.133	12.69%	3	−0.111	10.44%	5	0.054	10.16%	3
S3	−0.559 *	7.05%	5	−0.822 *	6.80%	7	−0.439 **	9.34%	4	−0.027	11.36%	4	−0.986 *	3.59%	9
S4	−0.961 *	4.72%	10	−0.919 *	6.17%	8	−0.846 *	6.21%	9	−0.941 *	4.56%	10	−0.460	6.07%	7
S5	0.723 **	25.55%	1	0.066	16.53%	1	0.044	15.14%	1	0.287	15.55%	1	1.164 *	30.82%	1
S6	−0.696 **	6.15%	7	−1.052 *	5.41%	10	−0.839 *	6.26%	8	−0.637 **	6.17%	8	−0.244	7.54%	6
S7	−0.810 *	5.48%	8	−0.928 *	6.11%	9	−0.529 **	8.53%	7	−0.278	8.84%	6	−1.040 *	3.40%	10
S8	−0.902 *	5.00%	9	−0.728 **	7.47%	6	−0.499 **	8.79%	5	−0.455 ***	7.41%	7	−0.676 ***	4.90%	8
S9	0.195	14.99%	2	−0.077	14.32%	3	−0.499 **	8.79%	6	0.186	14.05%	2	0.390	14.20%	2
S10	−1.474 *	2.82%	11	−1.445 *	3.65%	11	−1.076 **	4.94%	10	−0.957 *	4.48%	11	−2.060 *	1.23%	11
S11	−0.573 **	6.96%	6	−0.611 **	8.39%	5	−1.102 *	4.81%	11	−0.759 **	5.47%	9	−0.126	8.48%	5

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

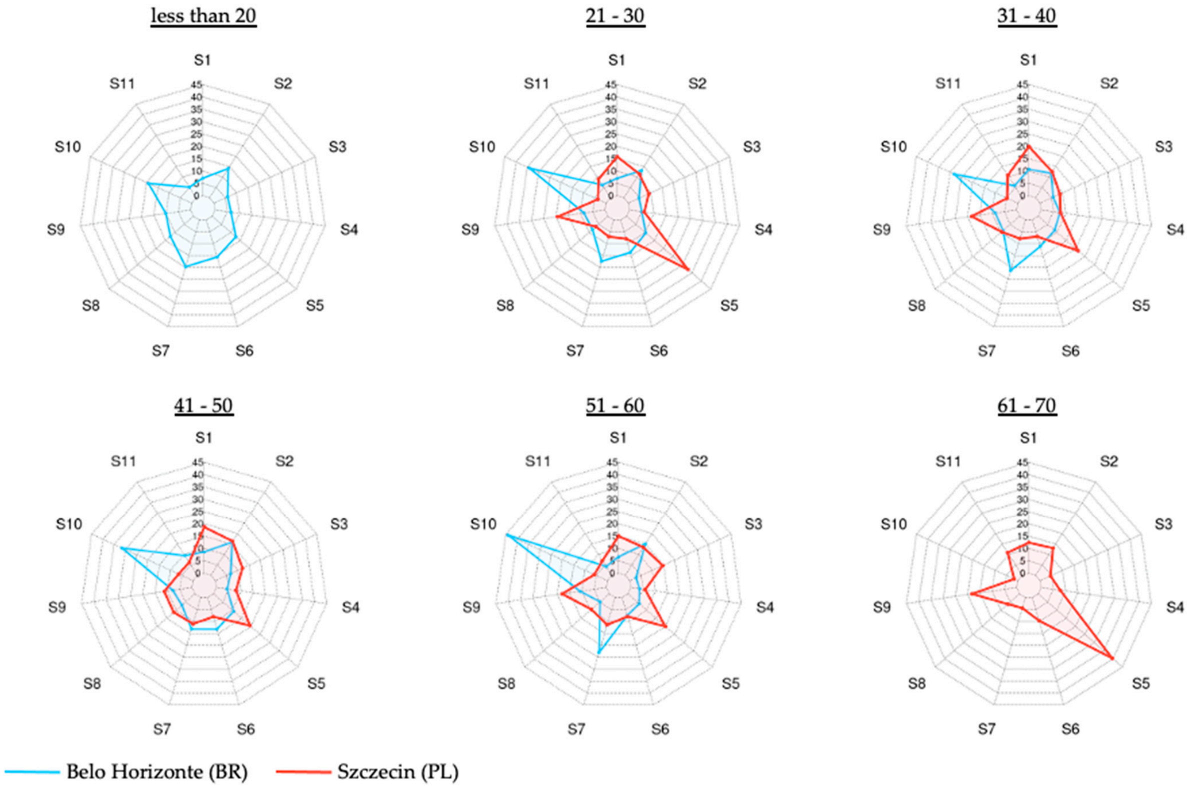

Figure 5. Chart of UFT solutions per age.

Table 15. Ranking of UFT solutions in Belo Horizonte per income.

Problems	Income											
	Less Than $500			$500–$1000			$1000–$2000			More Than $2000		
	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	4.67%	10	0.000 [a]	4.90%	9	0.000 [a]	7.00%	6	0.000 [a]	6.32%	8
S2	0.644 *	8.89%	4	0.597 *	8.91%	3	0.521 *	11.79%	3	0.600 *	11.51%	3
S3	−0.069	4.35%	11	−0.400 ***	3.29%	10	−0.692 *	3.49%	11	−0.466 *	3.96%	10
S4	0.115	5.24%	9	−0.412 ***	3.24%	11	−0.651 *	3.65%	10	−0.326 ***	4.56%	9
S5	0.550 *	8.09%	6	0.441 **	7.62%	5	0.214	8.67%	5	0.153	7.36%	5
S6	0.932 *	11.84%	3	0.545 **	8.45%	4	0.361 ***	10.04%	4	0.568 *	11.15%	4
S7	1.173 *	15.07%	2	1.018 *	13.57%	2	0.688 *	13.92%	2	0.772 *	13.67%	2
S8	0.482 **	7.56%	7	0.289	6.55%	7	−0.175	5.88%	8	0.036	6.55%	7
S9	0.563 *	8.19%	5	0.416 ***	7.43%	6	−0.128	6.16%	7	0.041	6.58%	6
S10	1.470 *	20.29%	1	1.844 *	30.96%	1	1.259 *	24.63%	1	1.361 *	24.64%	1
S11	0.220	5.81%	8	0.037	5.08%	8	−0.384 **	4.77%	9	−0.533 *	3.70%	11

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

Table 16. Ranking of UFT solutions in Szczecin per income.

Problems	Income					
	Less Than $500			$500–$1000		
	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	10.63%	4	0.000 [a]	12.97%	2
S2	0.042	11.09%	3	−0.136	11.32%	4
S3	−0.319	7.72%	5	−0.403 *	8.67%	5
S4	−0.380 ***	7.27%	7	−0.828 *	5.67%	10
S5	0.721 *	21.86%	1	0.296 **	17.46%	1
S6	−0.362 ***	7.40%	6	−0.732 *	6.24%	9
S7	−0.558 *	6.09%	10	−0.555 *	7.45%	6
S8	−0.510 **	6.38%	9	−0.571 *	7.33%	7
S9	0.103	11.78%	2	−0.058	12.25%	3
S10	−1.204 *	3.19%	11	−1.171 *	4.02%	11
S11	−0.478 **	6.59%	8	−0.673 *	6.62%	8

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

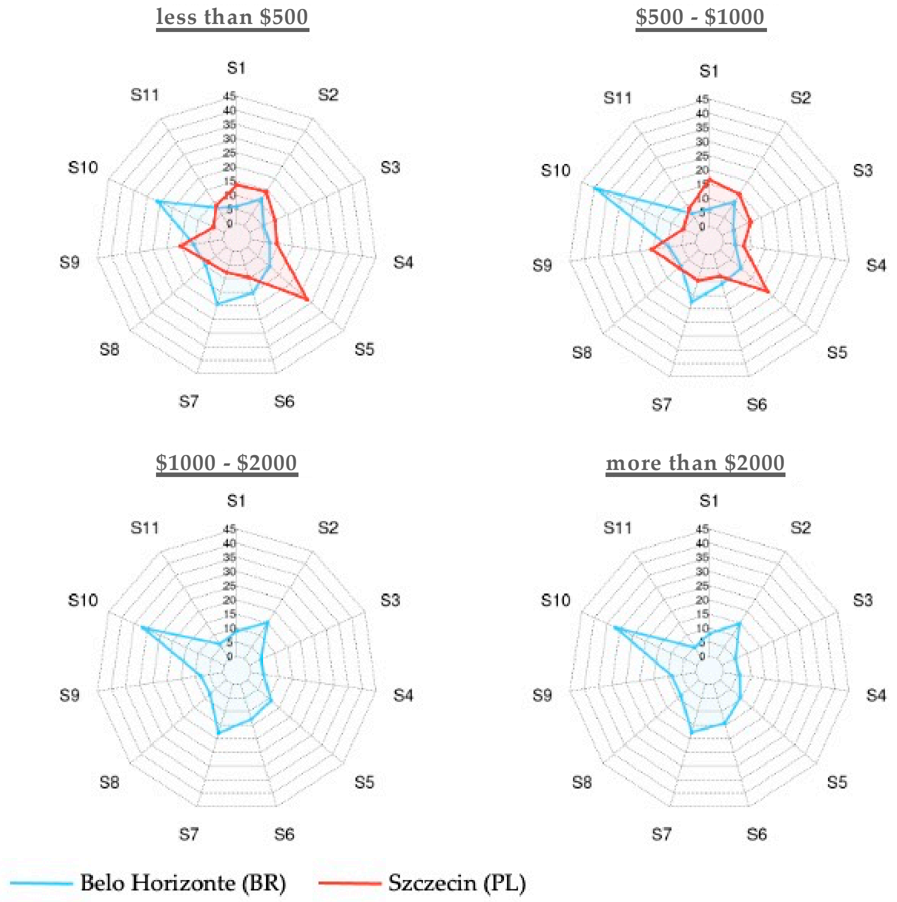

Figure 6. Chart of UFT solutions per income.

Table 17. Ranking of UFT solutions in Belo Horizonte per education level.

Problems	Education Level					
	High School			Higher Education		
	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	5.71%	8	0.000 [a]	6.14%	8
S2	0.660 *	11.05%	4	0.501 *	10.14%	3
S3	−0.474 *	3.56%	11	−0.397 *	4.12%	11
S4	−0.335 **	4.09%	10	−0.362 *	4.30%	10
S5	0.389 *	8.43%	5	0.236 ***	7.78%	5
S6	0.673 *	11.19%	3	0.478 *	9.91%	4
S7	0.932 *	14.51%	2	0.809 *	13.80%	2
S8	0.170	6.77%	6	0.053	6.48%	7
S9	0.120	6.44%	7	0.174	7.31%	6
S10	1.398 *	23.11%	1	1.426 *	25.56%	1
S11	0.106	5.14%	9	−0.320 **	4.46%	9

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

Table 18. Ranking of UFT solutions in Szczecin per education level.

Problems	Education Level					
	High School			Higher Education		
	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	12.38%	2	0.000 [a]	11.29%	3
S2	−0.070	11.55%	3	−0.118	10.04%	4
S3	−0.230 ***	9.84%	5	−0.808 *	5.03%	8
S4	−0.764 *	5.77%	10	−0.588 *	6.27%	7
S5	0.253 ***	15.95%	1	0.831 *	25.93%	1
S6	−0.706 *	6.11%	9	−0.400 *	7.57%	5
S7	−0.374 *	8.52%	6	−0.982 *	4.23%	10
S8	−0.445 *	7.94%	7	−0.815 *	5.00%	9
S9	−0.145	10.71%	4	0.355 ***	16.10%	2
S10	−0.934 *	4.87%	11	−1.815 *	1.84%	11
S11	−0.666 *	6.36%	8	−0.522 **	6.70%	6

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

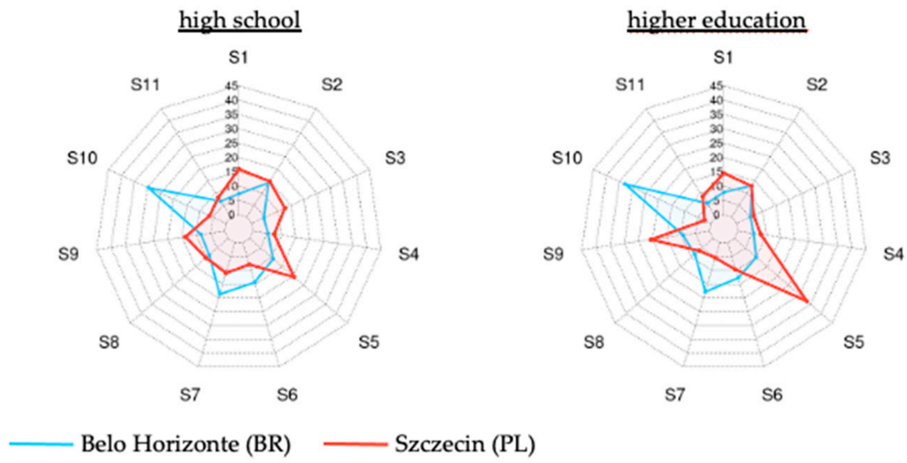

Figure 7. Chart of UFT solutions per education level.

Table 19. Ranking of UFT solutions in Belo Horizonte per transportation mode.

Problems	Transportation Mode in Belo Horizonte								
	Private Car			Public Transport			On Foot		
	Estimate	Pi	Rank	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	6.69%	7	0.000 [a]	4.76%	9	0.000 [a]	6.48%	6
S2	0.474 *	10.75%	3	0.716 *	9.73%	4	0.646 **	12.36%	3
S3	−0.476 *	4.16%	11	−0.334 **	3.41%	11	−0.539 ***	3.78%	11
S4	−0.449 *	4.27%	9	−0.187	3.95%	10	−0.445 ***	4.15%	9
S5	0.149	7.77%	5	0.512 *	7.93%	5	0.362	9.31%	4
S6	0.372 *	9.70%	4	0.934 *	12.11%	3	0.307	8.80%	5
S7	0.694 *	13.39%	2	1.163 *	15.23%	2	0.745 *	13.65%	2
S8	−0.001	6.68%	8	0.347 **	6.73%	7	−0.168	5.48%	8
S9	0.018	6.81%	6	0.423 *	7.27%	6	−0.044	6.20%	7
S10	1.338 *	25.52%	1	1.587 *	23.26%	1	1.386 *	25.90%	1
S11	−0.453 *	4.26%	10	0.167	5.62%	8	−0.509 ***	3.89%	10

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

Table 20. Ranking of UFT solutions in Szczecin per transportation mode.

Problems	Transportation Mode					
	Private Car			Public Transport		
	Estimate	Pi	Rank	Estimate	Pi	Rank
S1	0.000 [a]	11.58%	3	0.000 [a]	12.85%	2
S2	−0.013	11.43%	4	−0.186	10.67%	4
S3	−0.369 *	8.01%	5	−0.374 ***	8.84%	5
S4	−0.651 *	6.04%	10	−0.736 *	6.15%	10
S5	0.568 *	20.43%	1	0.131	14.65%	1
S6	−0.564 *	6.59%	7	−0.703 *	6.36%	9
S7	−0.564 *	6.58%	8	−0.543 **	7.47%	7
S8	−0.546 *	6.71%	6	−0.411 ***	8.52%	6
S9	0.115	12.99%	2	−0.065	12.05%	3
S10	−1.288 *	3.20%	11	−0.935 *	5.04%	11
S11	−0.586 *	6.44%	9	−0.552 **	7.40%	8

[a] reference category. Significance codes: * 0.001; ** 0.01; *** 0.05.

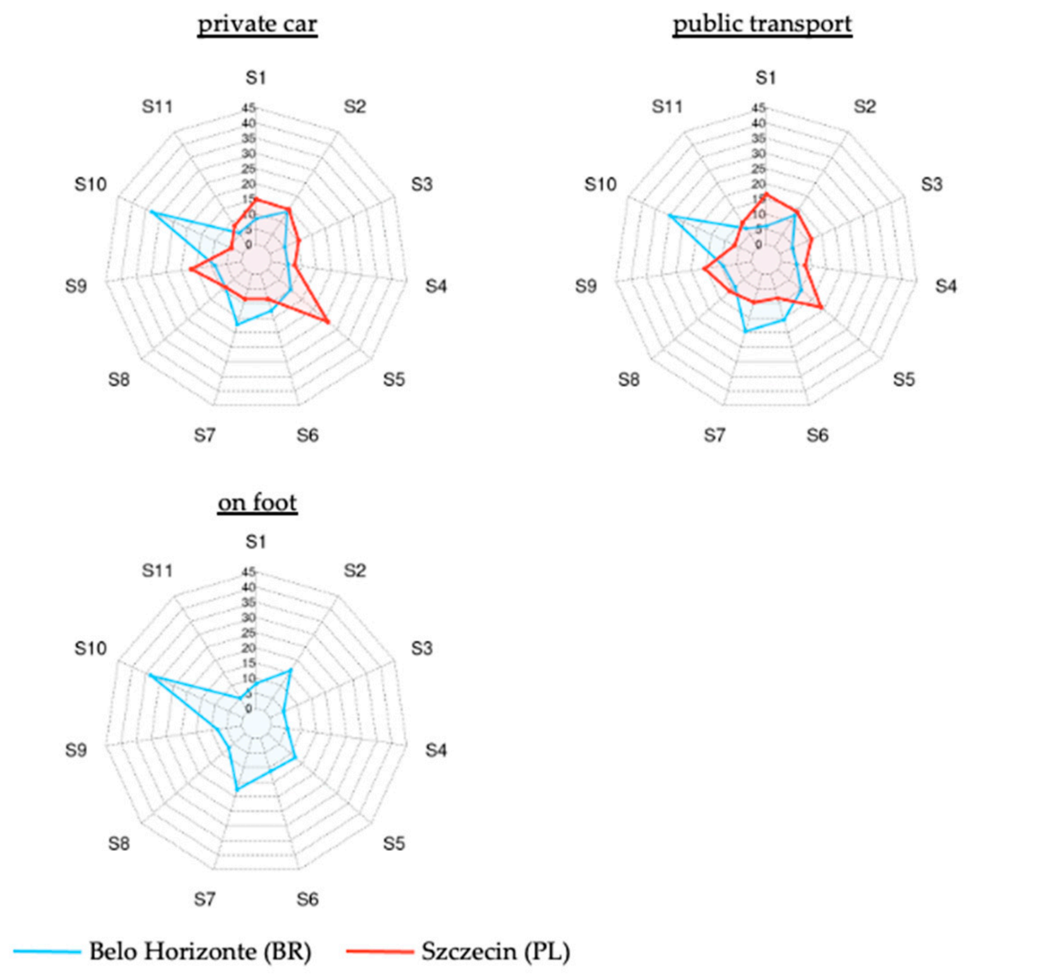

Figure 8. Chart of UFT solutions per transportation model.

4. Discussion and Conclusions

Residents' perceptions are essential to public authorities. In addition, considering the opinion of residents in public transport policies is a way to achieve greater acceptability of them. The findings of this paper indicate an awareness of respondents regarding the congestion and low quality of public transportation. Regarding UFT solutions, urban mobility plans and cargo bikes are the most prominent solutions for Belo Horizonte and Szczecin, respectively. Figure 9 compares the global results from each city.

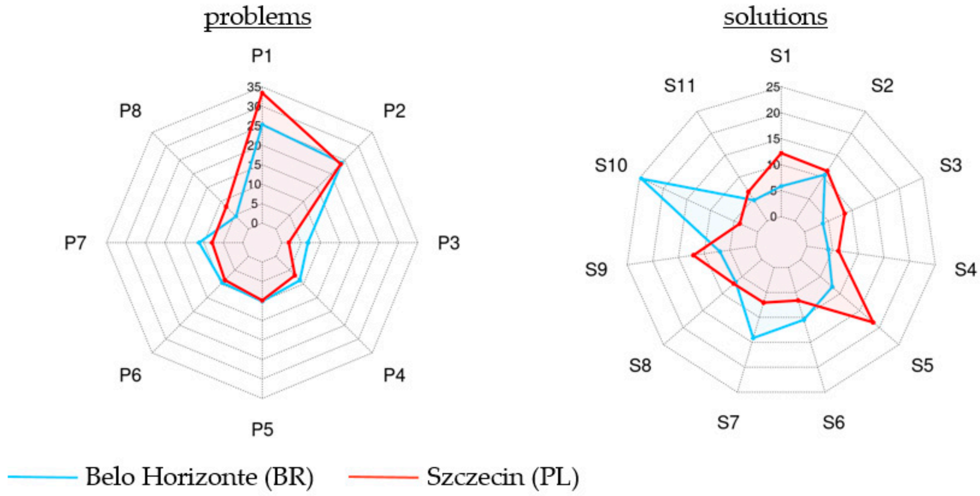

Figure 9. Chart of urban mobility problems and UFT solutions.

Congestion is a global concern, and it is related to the fight against climate change. Solutions to reducing congestion include reducing car usage, improving public transportation, and micro-mobility networks. However, some solutions to reduce congestion are not related to improving energy efficiency. For example, the contribution of electric mobility to improving energy efficiency is not clear [35], despite reducing energy consumption [17]. On the other hand, green supply chain management could reduce emissions and energy consumption [36].

Moreover, literature reports that the micro-mobility network has a role in developing sustainable cities [37]. The micro-mobility network could improve the safety of crown shipping deliveries. Thus, based on the residents' concerns, the public authorities have information about the main urban mobility problems; this can help them to address public policies to reduce urban mobility problems and, mainly, to fight climate change, contributing to the 2030 Agenda.

Urban mobility planning (or sustainable transportation) is still incipient in Brazilian municipalities. Urban freight transport is considered superficially in Brazilian cities' urban mobility plans [11]. Moreover, most of the UFT solutions included in the mobility plans are related to traffic management, as freight restriction by time, truck routes or parking management [11]. From this, truck routes have convergency to the residents' opinion in Belo Horizonte; however, it is not a solution proposed in its mobility plan. Moreover, the municipality designed the mobility plan of Belo Horizonte from 2007–2010, revised in 2016. Since 2017, an annual mobility report has been published, with non-included data related to urban freight transport. Thus, there is a mobility plan to ensure compliance with national legislation and receive investments, without any practical effectiveness in improving urban mobility, including freight transport in Belo Horizonte. The lack of effectiveness of the plan proposed by the municipality is the likely explanation for the respondents identifying this as an effective UFT solution.

The main benefits of truck routes are the reduction of truck movements in some streets and the reduction of pavement damage [38]. The electrification of trucks could be more effective for energy consumption [39] than the truck routes. Nevertheless, the electrification of freight vehicles is a challenge in Brazil. The first electrical trucks made in Brazil started to run in 2021, mainly delivering beverages in São Paulo. The electricity cost, the production cost (+300% of diesel truck), and the production capacity are challenges to spreading this solution over Brazilian territory. In Poland, the development of electric freight vehicles (EFVs) has increased step by step. Many transportation companies have implemented electric vans and trucks in their fleets in recent years. In addition, some optimistic results related to EFV efficiency have been achieved in the EUFAL project, including research realised in Szczecin [16].

On the other hand, the cargo bike is suitable for last-mile deliveries and reducing emissions [40,41]. Therefore, it is one of the most promising solutions for last-mile delivery systems; this also arises from the opinions of Szczecin dwellers. Besides improving the efficiency of freight transport, swapping trucks for cargo bikes has other benefits such as fuel savings, and reduction of emissions, noise, and congestion; in addition, it presents a positive image, and contributes to the improvement of employees' health conditions and quality of life [42]. This solution was experimentally analysed in Szczecin and Stargard, another Polish city [43]. The results show the potential of cargo bikes, especially considering their electric engine support. In summary, the cargo bike promotes sustainable freight transportation.

Findings confirm the hypotheses developed for this study: (i) the perceptions of residents are heterogeneous; (ii) the worst problems are related to urban operations, as congestion and the quality of public transport; (iii) UFT is the least relevant problem due to the lack of experience and/or knowledge regarding this theme; and (iv) the best solutions pointed by residents contribute to reducing fuel consumption and emissions.

Furthermore, the heterogeneity of perception among residents from different cities converges with the results of Amaya et al. [6]. Based on these converging results, we conclude that no single solution can be optimal for any city. The local context must always be considered in the planning process, and the residents' perceptions become essential for the acceptability of public policies. Municipalities could use these results to develop sustainable urban freight transport policies, to reduce congestion and increase the quality of public transportation.

The analysis introduced in this paper is the part of broader city logistics' stakeholders' perception assessment made by authors. Oliveira et al. [14] identified congestion as one of the main problems reported by Brazilian carriers [14] and retailers [9]. In addition, carriers prefer urban mobility plans as a freight policy [14]. Cargo bikes, truck lines and electrical vehicles are other freight solutions evaluated by authors, with less preference for carriers [14,16,24,34,43]. Other scholars evaluated operational freight solutions, such as street parking, road pricing, vehicle restriction, and off-hour deliveries, among others [7,9,13], not included in this paper. A common point in all of the studies is the divergent opinions among UFT stakeholders. Moreover, these analyses were realised considering the carriers, drivers or logistics operators perceptions only. In addition, the experiences and needs of this stakeholder group are most often considered, and influence the perception of problems and best practices for UFT. Nevertheless, knowing the other stakeholders' opinions is fundamental for a better understanding of UFT functioning and to achieve a balanced and more sustainable development of these systems. Thus, studies of this nature, which contemplate local characteristics, are essential and must be developed to support UFT planning.

Finally, the most critical challenge in this area is increasing the city users' awareness of sustainable UFT development. In many cities worldwide, activities focusing on this are successfully realised. However, it is challenging, especially considering the minimal engagement of city authorities in Brazil and Poland. To support this, the development of Freight Quality Partnerships (FPQ) seems to be a promising direction. However, the first FPQ was established ten years ago in Poland, and has not started in Brazil.

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References

1. Ewbank, H.; Vidal Vieira, J.G.; Fransoo, J.; Ferreira, M.A. The Impact of Urban Freight Transport and Mobility on Transport Externalities in the SPMR. *Transp. Res. Procedia* **2020**, *46*, 101–108. [CrossRef]
2. Lindholm, M.; Behrends, S. Challenges in Urban Freight Transport Planning—A Review in the Baltic Sea Region. *J. Transp. Geogr.* **2012**, *22*, 129–136. [CrossRef]
3. Ballantyne, E.E.F.; Lindholm, M.; Whiteing, A. A Comparative Study of Urban Freight Transport Planning: Addressing Stakeholder Needs. *J. Transp. Geogr.* **2013**, *32*, 93–101. [CrossRef]
4. Akgün, E.Z.; Monios, J.; Rye, T.; Fonzone, A. Influences on Urban Freight Transport Policy Choice by Local Authorities. *Transp. Policy* **2019**, *75*, 88–98. [CrossRef]
5. Taniguchi, E.; Thompson, R.G.; Yamada, T.; Duin, R. *City Logistics: Network Modelling and Intelligent Transport System*; Emerald Group Publishing Limited: Bingley, UK, 2001.
6. Amaya, J.; Delgado-Lindeman, M.; Arellana, J.; Allen, J. Urban Freight Logistics: What Do Citizens Perceive? *Transp. Res. Part E Logist. Transp. Rev.* **2021**, *152*, 102390. [CrossRef]
7. Oliveira, G.F.; Oliveira, L.K. Stakeholder's Perception about Urban Goods Distribution Solution: Exploratory Study in Belo Horizonte (Brazil). *Transp. Res. Procedia* **2017**, *25*, 942–953. [CrossRef]
8. Marcucci, E.; Le Pira, M.; Gatta, V.; Inturri, G.; Ignaccolo, M.; Pluchino, A. Simulating Participatory Urban Freight Transport Policy-Making: Accounting for Heterogeneous Stakeholders' Preferences and Interaction Effects. *Transp. Res. Part E Logist. Transp. Rev.* **2017**, *103*, 69–86. [CrossRef]
9. Oliveira, L.K.; Barraza, B.; Bertoncini, B.V.; Isler, C.A.; Pires, D.R.; Madalon, E.C.N.; Lima, J.; Vieira, J.G.V.; Meira, L.H.; Bracarense, L.S.F.P.; et al. An Overview of Problems and Solutions for Urban Freight Transport in Brazilian Cities. *Sustainability* **2018**, *10*, 1233. [CrossRef]
10. Comi, A.; Persia, L.; Polimeni, A.; Campagna, A.; Mezzavilla, L. A Methodology to Design and Assess Scenarios within SULPs: The Case of Bologna. *Transp. Res. Procedia* **2020**, *46*, 269–276. [CrossRef]
11. Kijewska, K.; de Oliveira, L.K.; dos Santos, O.R.; Bertoncini, B.V.; Iwan, S.; Eidhammer, O. Proposing a Tool for Assessing the Level of Maturity for the Engagement of Urban Freight Transport Stakeholders: A Comparison between Brazil, Norway, and Poland. *Sustain. Cities Soc.* **2021**, *72*, 103047. [CrossRef]
12. Iwan, S. *Implementation of Good Practices in the Area of Urban Delivery Transport*; Maritime University of Szczecin: Szczecin, Poland, 2013.
13. Amaya, J.; Arellana, J.; Delgado-Lindeman, M. Stakeholders Perceptions to Sustainable Urban Freight Policies in Emerging Markets. *Transp. Res. Part A Policy Pract.* **2020**, *132*, 329–348. [CrossRef]
14. Oliveira, L.K.; Nascimento, C.O.L.; Sousa, P.R.; Resende, P.T.V.; Silva, F.G.F. Transport Service Provider Perception of Barriers and Urban Freight Policies in Brazil. *Sustainability* **2019**, *11*, 6890. [CrossRef]
15. Oliveira, L.K.; França, J.G.C.B.; Nascimento, C.O.L.; Oliveira, I.K.; Meira, L.H.; Rabay, L. Evaluating Problems and Measures for a Sustainable Urban Freight Transport in Brazilian Historical Cities. *Sustain. Cities Soc.* **2021**, *69*, 102806. [CrossRef]
16. Iwan, S.; Nürnberg, M.; Jedliński, M.; Kijewska, K. Efficiency of Light Electric Vehicles in Last Mile Deliveries—Szczecin Case Study. *Sustain. Cities Soc.* **2021**, *74*, 103167. [CrossRef]
17. Mugion, R.G.; Toni, M.; Raharjo, H.; Di Pietro, L.; Sebathu, S.P. Does the Service Quality of Urban Public Transport Enhance Sustainable Mobility? *J. Clean. Prod.* **2018**, *174*, 1566–1587. [CrossRef]
18. Paudel, J. Bus Ridership and Service Reliability: The Case of Public Transportation in Western Massachusetts. *Transp. Policy* **2021**, *100*, 98–107. [CrossRef]
19. Ismail, N.I.N.; Rahman, N.A.A.; Muhamad, N.S.; Yaccob, A.A.; Mohtar, N.H. Pedestrian's Perception toward Quality of Sidewalk Facilities Case Study: UiTM Pulau Pinang. *IOP Conf. Ser. Mater. Sci. Eng.* **2020**, *849*, 012057. [CrossRef]

20. Oliveira, F.; Costa, D.G.; Duran-Faundez, C.; Dias, A. BikeWay: A Multi-Sensory Fuzzy-Based Quality Metric for Bike Paths and Tracks in Urban Areas. *IEEE Access* **2020**, *8*, 227313–227326. [CrossRef]
21. Dexheimer, L.; Larrañaga, A.M.; Lindau, L.A. Society's Perception to the Presence of Urban Distribution Trucks. *J. Traffic Logist. Eng.* **2013**, *1*, 111–115. [CrossRef]
22. Kiba-Janiak, M. Urban Freight Transport in City Strategic Planning. *Res. Transp. Bus. Manag.* **2017**, *24*, 4–16. [CrossRef]
23. Comi, A.; Schiraldi, M.M.; Buttarazzi, B. Smart Urban Freight Transport: Tools for Planning and Optimising Delivery Operations. *Simul. Model. Pract. Theory* **2018**, *88*, 48–61. [CrossRef]
24. Nocerino, R.; Colorni, A.; Lia, F.; Luè, A. E-Bikes and E-Scooters for Smart Logistics: Environmental and Economic Sustainability in Pro-E-Bike Italian Pilots. *Transp. Res. Procedia* **2016**, *14*, 2362–2371. [CrossRef]
25. Karakikes, I.; Nathanail, E. Using the Delphi Method to Evaluate the Appropriateness of Urban Freight Transport Solutions. *Smart Cities* **2020**, *3*, 1428–1447. [CrossRef]
26. Buldeo Rai, H.; van Lier, T.; Meers, D.; Macharis, C. An Indicator Approach to Sustainable Urban Freight Transport. *J. Urban. Int. Res. Placemaking Urban Sustain.* **2018**, *11*, 81–102. [CrossRef]
27. Pałyska, R.; Bursztynowicz, M.; Bykowszczenko, N. *Annual Assessment of Air Quality in the West Pomeranian Voivodeship*; Voivodship Report for 2020; RWMŚ in Szczecin: Szczecin, Poland, 2021.
28. Marta-Pedroso, C.; Freitas, H.; Domingos, T. Testing for the Survey Mode Effect on Contingent Valuation Data Quality: A Case Study of Web-Based versus in-Person Interviews. *Ecol. Econ.* **2007**, *62*, 388–398. [CrossRef]
29. Luce, R.D.; Suppes, P. Preference, Utility, and Subjective Probability. In *Handbook of Mathematical Psychology*; Luce, R.D., Bush, R.R., Galanter, E.H., Eds.; John Wiley and Sons: New York, NY, USA, 1965; Volume 3, pp. 249–410.
30. Turner, H.L.; van Etten, J.; Firth, D.; Kosmidis, I. Modelling Rankings in R: The PlackettLuce Package. *Comput. Stat.* **2020**, *35*, 1027–1057. [CrossRef]
31. TomTom. TomTom Traffic Index. 2021. Available online: https://www.tomtom.com/en_gb/traffic-index/ (accessed on 18 January 2022).
32. Vieira, T.; Almeida, P.; Meireles, M.; Ribeiro, R. Public Transport Occupancy Estimation Using WLAN Probing and Mathematical Modeling. *Transp. Res. Procedia* **2020**, *48*, 3299–3309. [CrossRef]
33. Bayart, C.; Havet, N.; Bonnel, P.; Bouzouina, L. Young People and the Private Car: A Love-Hate Relationship. *Transp. Res. Part D Transp. Environ.* **2020**, *80*, 102235. [CrossRef]
34. Aiello, G.; Quaranta, S.; Certa, A.; Inguanta, R. Optimization of Urban Delivery Systems Based on Electric Assisted Cargo Bikes with Modular Battery Size, Taking into Account the Service Requirements and the Specific Operational Context. *Energies* **2021**, *14*, 4672. [CrossRef]
35. Fiori, C.; Arcidiacono, V.; Fontaras, G.; Makridis, M.; Mattas, K.; Marzano, V.; Thiel, C.; Ciuffo, B. The Effect of Electrified Mobility on the Relationship between Traffic Conditions and Energy Consumption. *Transp. Res. Part D Transp. Environ.* **2019**, *67*, 275–290. [CrossRef]
36. Aziziankohan, A.; Jolai, F.; Khalilzadeh, M.; Soltani, R.; Tavakkoli-Moghaddam, R. Green Supply Chain Management Using the Queuing Theory to Handle Congestion and Reduce Energy Consumption and Emissions from Supply Chain Transportation Fleet. *J. Ind. Eng. Manag. JIEM* **2017**, *10*, 213–236. [CrossRef]
37. Abduljabbar, R.L.; Liyanage, S.; Dia, H. The Role of Micro-Mobility in Shaping Sustainable Cities: A Systematic Literature Review. *Transp. Res. Part D Transp. Environ.* **2021**, *92*, 102734. [CrossRef]
38. Titi, H.H.; Coley, N.; Latifi, V.; Matar, M. Characterization of Overweight Permitted Truck Routes and Loads in Wisconsin. *Transp. Res. Rec.* **2014**, *2411*, 72–81. [CrossRef]
39. Gao, Z.; Lin, Z.; Franzese, O. Energy Consumption and Cost Savings of Truck Electrification for Heavy-Duty Vehicle Applications. *Transp. Res. Rec.* **2017**, *2628*, 99–109. [CrossRef]
40. Hess, A.-K.; Schubert, I. Functional Perceptions, Barriers, and Demographics Concerning E-Cargo Bike Sharing in Switzerland. *Transp. Res. Part D Transp. Environ.* **2019**, *71*, 153–168. [CrossRef]
41. Assmann, T.; Lang, S.; Müller, F.; Schenk, M. Impact Assessment Model for the Implementation of Cargo Bike Transshipment Points in Urban Districts. *Sustainability* **2020**, *12*, 4082. [CrossRef]
42. Heinrich, L.; Schulz, W.H.; Geis, I. The Impact of Product Failure on Innovation Diffusion: The Example of the Cargo Bike as Alternative Vehicle for Urban Transport. *Transp. Res. Procedia* **2016**, *19*, 269–271. [CrossRef]
43. Nürnberg, M. Analysis of Using Cargo Bikes in Urban Logistics on the Example of Stargard. *Transp. Res. Procedia* **2019**, *39*, 360–369. [CrossRef]