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Opinion of Residents about the Freight Transport and Its Influence on the Quality of Life: An Analysis for Brasília (Brazil)

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Abstract: Urban Freight Transport (UFT) is responsible for moving goods in urban areas to meet citizens' demands, which makes it essential for economic development. Simultaneously, UFT contributes to adverse impacts on society and the environment, including congestion and pollution. This paper assesses how the urban infrastructure and UFT externalities influence the residents' quality of life. Three major assumptions were considered: (i) Public managers are responsible for the urban infrastructure, which is also influenced by businesses; (ii) UFT leads to negative externalities, which are influenced by government actions; and (iii) both infrastructure and externalities influence the residents' quality of life. The analysis is based on a web-based survey conducted with residents of Brasília, Brazil. Structural Equation Modelling with Partial Least Squares was used to analyze the data. Findings showed that the residents' quality of life is negatively influenced by UFT externalities and positively influenced by the urban infrastructure. Furthermore, both public and private management have more influence on externalities when compared to urban infrastructure. Finally, road capacity, proper loading and unloading, and supervision should be prioritized to improve citizens' quality of life in Brasília.

Keywords: urban freight transport; externalities; urban infrastructure; stakeholders; residents; quality of life; structural equation modelling

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Citation: Leite, C.E.; Granemann, S.R.; Mariano, A.M.; de Oliveira, L.K. Opinion of Residents about the Freight Transport and Its Influence on the Quality of Life: An Analysis for Brasília (Brazil). *Sustainability* **2022**, *14*, 5255. https://doi.org/10.3390/su14095255

Academic Editors: Eiichi Taniguchi and Russell Thompson

Received: 7 March 2022
Accepted: 25 April 2022
Published: 27 April 2022

1. Introduction

Urban freight transport (UFT) is important for cities' operation as it enables products to reach the final consumer, guarantees the delivery of goods and their returns, or removes waste in the last mile [1,2]. Cities have grown rapidly, which has led to increased demands to adequately supply urban centers. This situation resulted in significantly increasing the movement of goods, which also increased carriers' travel times and traffic congestion, among other externalities [3,4]. UFT is responsible for numerous negative impacts, such as noise, safety, obstructions for pedestrians, damaging and invading urban infrastructure, loss of time and energy, emission of greenhouse gases, and congestion [5,6]. Still, despite the UFT's importance to economic development [7,8], the growing volume of transported goods negatively impacts the urban environment and the quality of life [2,9]. Furthermore, UFT is simultaneously responsible for maintaining the quality of life and generating UFT externalities [10]. Therefore, a proper understanding of UFT is essential to minimize its effects without harming the economy and the quality of life [11]. Currently, practices to reduce externalities are focused on (1) changing the delivery system, (2) reducing freight traffic in critical areas, and (3) encouraging the use of smaller and more environmentally friendly vehicles [12].

Given the complexity of UFT [13], sustainable solutions need to be based on three pillars: Sustainability, mobility, and quality of life [5,6]. These pillars represent the concept of sustainability, which arose from urban environmental, social, and economic concerns. This occurred as a result of the population increase, which decreased the citizens' quality of life [14].

Despite UFT externalities, cities seek to improve the quality of life and achieve socio-economic well-being by using Information and Communication Technologies (ICT) [15]. For example, ICT reduces the delivery time and distance travelled, decreasing the congestion level and accidents [16]. Similarly, reducing the movement of motorized vehicles or urban consolidation centers provides the effectiveness and efficiency of logistics flows and reduces the negative externalities they generate [17]. Still, parking policies can be used to promote sustainable development [5]. While retailers, carriers, and the government are well-known for these measures, few studies have investigated the opinions of city residents [1,2,7,18,19].

Public managers and the population consider UFT effects as disturbances [20], and freight transportation providers understand that the population may support restrictions on these activities. Thus, there are conflicts between urban activities and UFT. To minimize these conflicts, several initiatives have been proposed in terms of vehicle restrictions, which increase congestion and alter the number of shipments by replacing large freight vehicles with small freight vehicles [11]. Moreover, reducing shipment sizes generates financial losses for local, regional, and global economies, and also disrupts the flows of goods [21]. While public management policies aim to mitigate UFT-related problems [4], e-commerce deliveries increase UFT externalities [22].

Urban infrastructure drives cities' development and is responsible for increasing residents' quality of life in terms of both social and economic aspects [23]. The urban infrastructure concept is multidimensional and can be divided into three parts: (1) Public facilities (e.g., water, electricity, telecommunications), (2) public services (e.g., education, health, sanitation, waste collection, etc.), and (3) transport systems (e.g., roads, airports, railways) [24]. The lack of integration between urban infrastructure and freight vehicle flow often results in congestion [8,25], a lack of parking spaces [3,7], and inadequate loading and unloading areas [4].

The application of information technologies and proper urban planning enables the efficient use of the urban infrastructure [26,27]. Furthermore, the use of intelligent transport systems (ITS) and information and communication technologies (ICT) contribute to the better use of urban infrastructure [28]. Moreover, urban infrastructure planning should consider that a resident of a modern city may choose the transportation modes to be used, breathe fresh air, enjoy pleasant views, receive preferential information, and frequently sightsee. Proper urban infrastructure is then required for bicycles, scooters, skates, segways, electric unicycles, or any other alternatives [29]. The use of electric vehicles (e.g., cars, scooters, bikes) has increased recently [30], which leads to the need for new urban infrastructure to charge batteries [31] and support green-energy-based cargo logistics services [32]. This urban transportation infrastructure is critical for cities not only in terms of urban planning and economic activity, but also for quick and safe evacuations in the case of natural disasters, such as earthquakes, floods, and forest fires [23].

UFT negatively influences residents' quality of life, and the quality of life can be interpreted from several different perspectives, such as health [1,33], social [21,34], or economic [9,15] aspects. Improving the quality of life requires improvements in liveability, mobility, accessibility, and community [26].

As people moved to urban centers, business operators started to concentrate on cities, which also resulted in freight increases [34]. As a result, UFT directly impacts the environment and the lives of the city residents by increasing greenhouse gas emissions, air pollution, water pollution, and environmental degradation. In addition, it leads to inadequate management of the urban space, urban mobility and accessibility issues, increased transport needs, and traffic congestion. Finally, UFT may also harm public safety and health [35]. In the long-term, heavy freight vehicle movements lead to dissatisfaction among city residents [34] due to externalities such as noise [1,34], congestion [22,36], and pollution [31,37]. These factors tend to reduce the residents' quality of life.

This paper is based on the concepts of urban infrastructure, UFT externalities, and residents' quality of life. This research evaluates the influence of urban infrastructure and UFT externalities on the residents' quality of life. Few scholars have addressed the residents' perspective related to UFT [18,19]. This study analyzes residents' perspectives in Brasília, the capital of Brazil. Despite being a planned city that is recognized worldwide, Brasília was mainly designed for cars and faces urban mobility problems related to congestion, noise, and pollution [38]. Data were obtained from a web-based survey of Brasília residents. Structural Equation Modelling (SEM) was then used to describe the relationship between observable and unobservable variables. The results showed that residents' quality of life is negatively influenced by UFT externalities and positively influenced by urban infrastructure. Furthermore, findings show that public and private management have more influence on externalities when compared to the influence of the urban infrastructure. Moreover, road capacity, proper loading and unloading, and supervision should be prioritized to improve citizens' quality of life in Brasília.

The remainder of the paper is organized as follows. Section 2 presents the hypotheses considered in this paper based on the existing literature. Section 3 depicts the research method. The results are presented in Section 4. Section 5 closes this paper with the conclusion.

2. Hypotheses and Conceptual Model

Previous research shows the importance of UFT to meet the population's needs [9,26]. This paper analyzes how UFT externalities influence residents' quality of life. Urban planning seeks to improve cities' quality of life [34,36]; however, UFT externalities impact the quality of life [26]. An inverse relationship may be observed between UFT externalities and the quality of life. Therefore, the first hypothesis (H1) is related to the inverse relationship between UFT externalities and the perception of the quality of life.

Likewise, urban planning is also related to urban infrastructure in order to provide a quality of life [1]. Consequently, urban infrastructure contributes to the quality of life. This relationship postulates hypothesis H2a: Urban infrastructure directly influences the perception of quality of life. Furthermore, investments in urban mobility contribute to mitigating UFT externalities [4,39], which suggests an inverse relationship between them. Thus, hypothesis H2b is related to the potential inverse relationship between infrastructure and the population's perception of UFT externalities.

Public management is responsible for managing land use and occupation, and it should provide adequate urban infrastructure to support UFT [12,26]. Thus, hypothesis H3a considers that public management directly influences urban infrastructure. Since urban infrastructure improvements by public management reduce UFT externalities, hypothesis H3b investigates the influence of public management on UFT externalities.

Finally, urban infrastructure imposes difficulties for UFT companies in terms of performing deliveries, which causes them to seek alternatives to improve their efficiency [15,21]. Hypothesis H4a is related to the contribution of private management in improving urban infrastructure, i.e., private management directly influences urban infrastructure. In addition, private management also seeks delivery alternatives to reduce UFT externalities [10,18,22,40]. Thus, hypothesis H4b is related to the inverse influence of private management on UFT externalities. Table 1 summarizes the literature review related to the hypotheses.

Table 1. The literature related to the hypotheses.

Variables		Reference																												
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[13]	[14]	[18]	[21]	[24]	[25]	[34]	[35]	[39]	[40]	[36]	[41]	[42]	[43]	[44]	[45]	[46]	[47]
Quality of Life	Lack of essential UFT services	X	X	X				X		X	X	X		X	X		X		X	X	X	X	X			X			X	
	UFT reduces quality of life	X	X	X				X		X	X	X		X	X		X		X	X	X	X	X			X			X	
	UFT provides essential goods for daily activities	X	X	X				X		X	X	X		X	X		X		X	X	X	X	X			X			X	
UFT Externalities	Pollution	X	X	X	X	X	X		X	X	X				X	X	X	X	X		X		X		X	X	X	X		X
	Noise	X	X	X		X	X		X	X	X		X	X	X	X			X		X	X		X	X	X	X	X	X	X
	Congestion	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X		X	X	X
	Safety	X	X	X	X	X	X		X	X	X			X	X	X		X	X	X						X	X			X
	Unloading delivery time	X			X	X	X	X	X	X	X	X	X		X				X				X	X		X				
	Waste collection			X	X	X							X		X	X	X						X			X				X
Urban Infrastructure	Road capacity					X		X				X	X																	X
	Unloading areas						X	X			X	X	X		X								X							
	Supervision of unloading areas							X			X	X	X		X								X							
Private Management	Home delivery as a UFT solution		X					X			X	X							X		X									X
	Pick-up points as a UFT solution							X			X	X							X		X									
	On-demand delivery services							X			X	X							X											
	Last-mile delivery by motorcycles					X		X	X	X		X		X		X			X			X	X		X					
	Last-mile delivery by bicycles	X	X					X			X	X		X					X	X		X	X							X
Public Management	Circulation of new freight vehicles			X		X	X	X			X	X							X			X						X		X
	Stimulating the renewal of the freight fleet							X			X	X							X			X								X
	Electrical vehicles	X						X			X	X			X	X			X		X	X	X	X				X		X
	Urban mobility plans						X	X				X			X								X							X
	Freight policies to support UFT							X			X	X			X									X						

The conceptual model shown in Figure 1 was used to verify the hypotheses. It suggests that the urban infrastructure contributes to the quality of life. Moreover, UFT externalities related to the urban environment reduce the quality of life. Finally, local governments and private managers directly influence the urban environment. Thus, UFT externalities influence the quality of life, while the urban infrastructure improves UFT operations and promotes the quality of life. To minimize UFT externalities, freight flows and the urban infrastructure should have an equilibrium. However, UFT is managed by private companies, whereas the urban infrastructure is managed by public companies. Therefore, public and private companies influence the urban infrastructure and UFT externalities. Public management and private management are independent latent variables, urban infrastructure and UFT externalities are intervening latent variables, and the quality of life is the dependent latent variable.

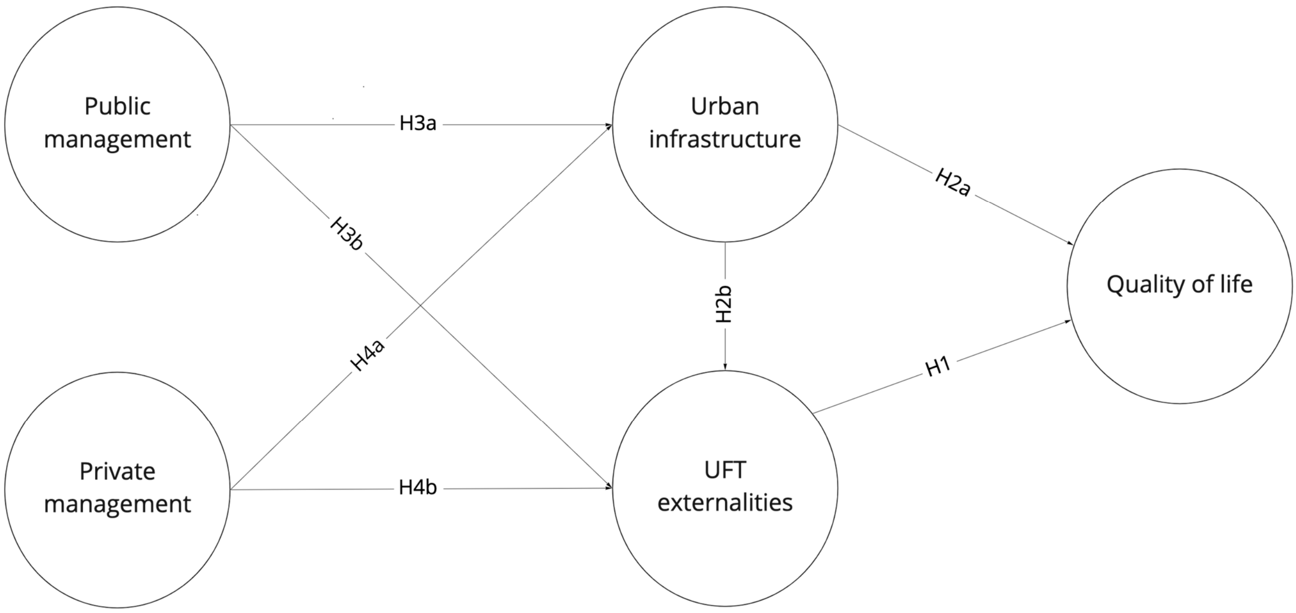

Figure 1. Conceptual model.

The conceptual model was analyzed using structural equations modelling (SEM), as described in the next section.

3. Research Method

A questionnaire was designed to obtain data for the analysis. The conceptual model described in the previous section was considered. Thus, the variables were translated into statements to be evaluated on a 5-Point Likert scale. These statements composed the questionnaire, which was validated by 24 experts. Data were collected using a web-based survey with the residents in the study area, as described in Section 4. The sample was calculated based on Hair et al. [48], where the effect size defines the sample size. An average effect size (0.15) was adopted for the most complex relationship with eight predictors. In addition, the error probability was set at a 5% confidence level ($\alpha = 0.05$), and a power of 0.95 was defined. Thus, the sample required at least 160 respondents.

The data were analyzed using a structural equations model (SEM). SEM is a multivariate technique used to evaluate multivariate causal relationships. The Partial Least Square SEM (PLS-SEM) is recommended when the theoretical basis is not well developed or small datasets are employed [49,50]. An SEM includes observed and latent variables. Latent variables are not observed or measured. Based on the conceptual model (Figure 1), the path diagram (Figure 2) was designed. Figure 2 shows a graphical representation of the relationships, where the impacts of one construct on others are represented by arrows. The constructs are defined as exogenous or endogenous variables [49]. For the latent variables, the following variables were considered: Quality of life, UFT externalities, urban infrastructure, public management, and private management. In addition, quality of life is assumed as a multidimensional construct, which evaluates the conditions for achieving happiness and satisfying people's needs [37].

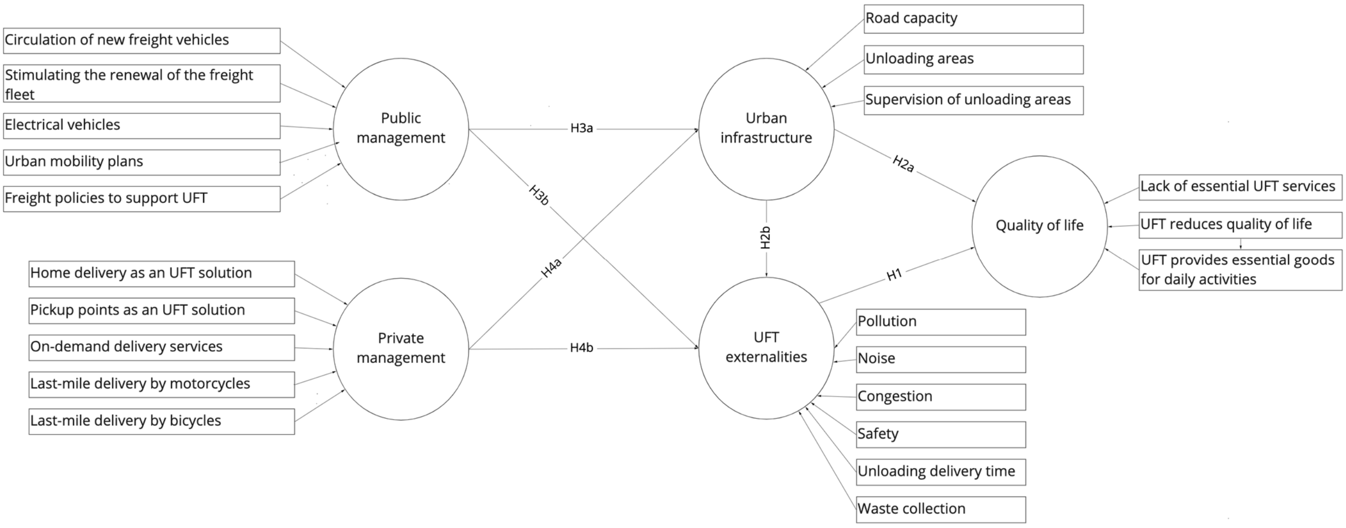

Figure 2. Path model.

A formative measurement scale [51–53] was used to construct the composites. The composite constructions are artifacts of human creation, which are created from the researcher's perception of the research problem. In this case, the researcher takes the designer role and designs the construct [53]. In composite measurement, the relationships between the indicators and the construct are not cause-effect relationships. Instead, they show how the different ingredients were organized to form a new entity. In composite models, eliminating an indicator changes the meaning of the construct. Constructing this artifact is closely associated with the researcher's experience (or with the literature review), and the same researcher can assign different weights to different constructs.

Variance-based structural equations were chosen because the model consisted of a composite-formative model of experimental order with an initial design. The structural equation model was estimated with the SmartPLS 3.3.3 software. It includes an importance-versus-performance analysis [54] to understand the main actions to be taken from the results.

The reliability and the validity of the model were assessed considering the method used by Ramírez et al. [55], which consists of evaluating the measurement model. Two tests were applied in the composite-formative models [56–58]:

i. External collinearity.
ii. Significance of the structural weights of the variables' indicators.

Unlike reflective models, indicators are not eliminated in composite-formative models due to low relevance. In this case, they are eliminated because of high collinearity. The Variance Inflation Factor (VIF) was calculated to identify the collinearity between the variables. Values lower or equal to five were expected [48,59].

After evaluating the reliability and the validity of the model, the structural model aims to verify how much the dependent variable is explained by the other variables (i.e., the coefficient of determination) and which variable exerts greater influence (i.e., magnitude of the path coefficient) [55]. An SEM mixes econometrics and psychometry, and these models tend to have low coefficients of determination. Falk and Miller [60] suggest a value of at least 10% to consider the model significant. The significance of the structural weights of the variables' indicators was evaluated using a two-tailed bootstrapping test with a significance of 0.05. Evaluating the path coefficient using beta values enables the identification of the most important variables. These beta values vary from −1 to 1, and the relationship between variables is supported by values greater than or equal to 0.2 (or lower than or equal to −0.2). Additionally, a significance test must be conducted using bootstrapping in a two-tailed relationship of 5% [55].

Practical implications were extracted using the importance-performance map analysis (IPMA). The performance-importance map is widely used for initiative management so that actions can be implemented based on the results from the calculated model [61–63]. An IPMA guarantees the step prioritization to be taken in an action roadmap.

4. Study Area and Results

This paper focuses on residents living in Brasília's Plano Piloto, which is the center of the city and has an airplane shape, as shown in Figure 3. This region is composed of the intersection between two axes in a strict geometry. Due to design constructive adjustments made by Lúcio Costa, Plano Piloto is divided into two regions: Asa Norte and Asa Sul (North Wing and South Wing, respectively). The central region (i.e., the body of the plane) consists of public administration buildings and is the hub of many job opportunities for the residents who live in the wings. The wings are organized into superblocks (e.g., similarly to Barcelona, Spain), which are designed so that people can move on foot, to/from residences, and between local businesses [64]. These local businesses are located between the superblocks. In addition, these superblocks may also present churches, schools, clubs, movie theatres, and sports courts [65,66].

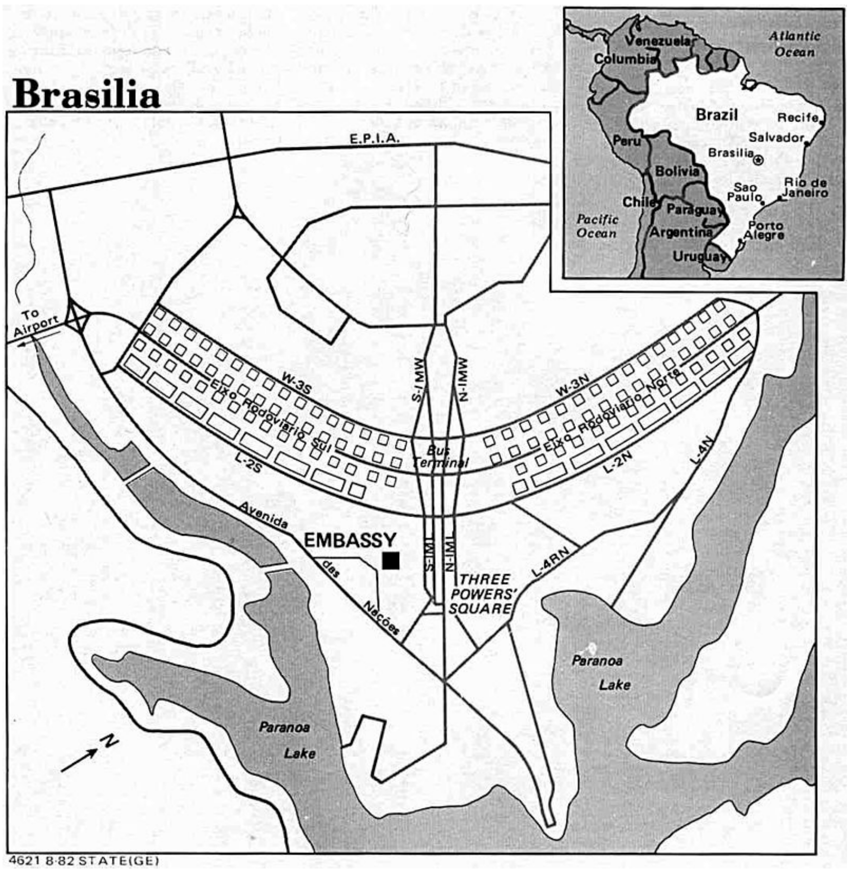

Figure 3. Brasília Plano Piloto (Source: www.dominiopublico.com.br, accessed on 5 March 2022).

Brasília's Plano Piloto was declared a World Heritage Site by UNESCO in 1987. Lúcio Costa was then praised for his urban design, which integrated zoning, architecture, and road infrastructure. Brasília zoning characteristics provide areas for different land-use patterns, such as residential, governmental, commercial, industrial, leisure, and culture, among others. However, these zoning characteristics resulted in intense, long, diverse, and random movements. Brasília's zoning stimulates the use of the car, which causes many residents to say that "Brasília was designed for cars" [65,67].

Brasília's Plano Piloto, simply referred to as Brasília for the remainder of the paper, has approximately 185,290 residents, of which 58% live in the North Wing and 42% in the South Wing. Residents are, on average, 39.2 years old. The Central area is exclusively for non-residential purposes. Moreover, 56.4% of residents use a car for daily trips and 58.2% have an average commute time of 15 min. In addition, 86.2% of the total number of households consist of apartments, with an occupation of 2.6 residents per household, and the average household income is BRL15,021.20 [67].

The data for this study were obtained from a web survey, which was published on social networks. This survey was exclusively intended for those who live, work, or regularly visit the study region, in this case, the Plano Piloto of Brasília. The survey received 458 responses between 27 August and 13 October 2021. After processing the data and eliminating respondents with more than 15% of blank responses, 403 responses remained, and this sample was used in the research. The 5-Point Likert scale responses measured the respondents' level of agreement with the influence of these factors on the quality of life, as shown in Figure 4.

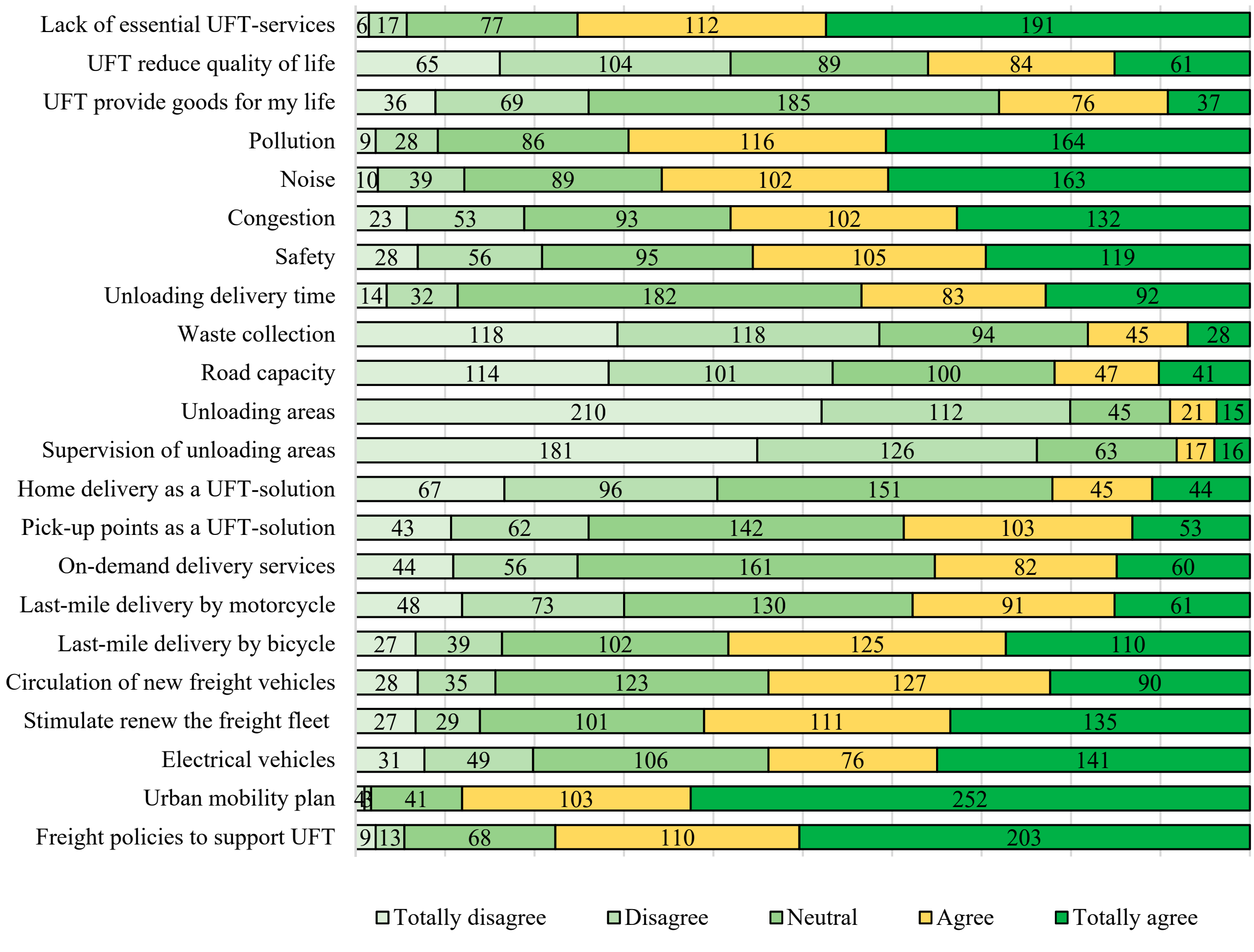

Figure 4. Level of agreement of the variables concerning the importance to the quality of life.

Low levels of agreement were observed for the variables related to unloading areas, the supervision of unloading areas, waste collection, and road capacity. On the other hand, residents have a high level of agreement concerning urban mobility plans, freight policies, and the lack of essential UFT services. Table 2 shows the significance of the formative measures, and seven formative measurements have statistical significance (p-value < 0.05).

Table 2. Significance of formative measurements.

Formative Measurement	Path	t-Value	*p*-Value
Lack of essential UFT services → Quality of life	0.199	0.896	0.371
UFT reduces quality of life → Quality of life	0.612	4.828	0.000
UFT provides essential goods for daily activities → Quality of life	0.582	3.836	0.000
Pollution → Externalities	0.582	3.252	0.001
Noise → Externalities	0.092	0.517	0.605
Congestion → Externalities	0.097	0.561	0.575
Safety → Externalities	0.086	0.535	0.592
Unloading delivery time → Externalities	0.235	2.156	0.031
Waste collection → Externalities	0.211	1.371	0.170
Road capacity → Infrastructure	0.722	2.242	0.025
Unloading areas → Infrastructure	0.341	1.270	0.204
Supervision of unloading areas → Infrastructure	0.198	0.599	0.549
Home delivery as a UFT solution → Private Management	0.407	1.415	0.157
Pick-up points as a UFT solution → Private Management	0.809	1.722	0.085
On-demand delivery services → Private Management	−0.225	0.676	0.499
Last-mile delivery by motorcycles → Private Management	−0.250	0.636	0.525
Last-mile delivery by bicycles → Private Management	0.154	0.646	0.519
Allow circulation of new freight vehicles → Public Management	0.445	2.238	0.025
Stimulate the renewal of the freight fleet → Public Management	0.168	0.746	0.456
Electrical vehicles → Public Management	−0.015	0.074	0.941
Urban mobility plans → Public Management	0.690	3.310	0.001
Freight policies to support UFT → Public Management	−0.096	0.432	0.666

Table 3 shows the latent variables' formative measurement, which had a VIF lower than 5. It indicates no collinearity between the variables.

Table 3. VIF results.

Formative Measurement from Latent Variables	VIF
Externalities → Quality of life	1.027
Public Management → Externalities	1.069
Public Management → Urban infrastructure	1.062
Private Management → Externalities	1.064
Private Management → Urban infrastructure	1.062
Urban infrastructure → Externalities	1.011
Urban infrastructure → Quality of life	1.027

The measurement tests ensured the reliability and validity of the model. Then, Figure 5 shows the estimated coefficients of the SEM. The values inside the circles are the coefficients of determination, which show how each variable is explained, directly or indirectly, by the variables coming from the arrows. The coefficient of determination values shows that 19.5% of the UFT externalities variable is explained by public management, private management, and urban infrastructure. Moreover, 18.4% of the quality of life is explained by urban infrastructure and UFT externalities. Finally, 0.1% of the urban infrastructure is explained by public and private management.

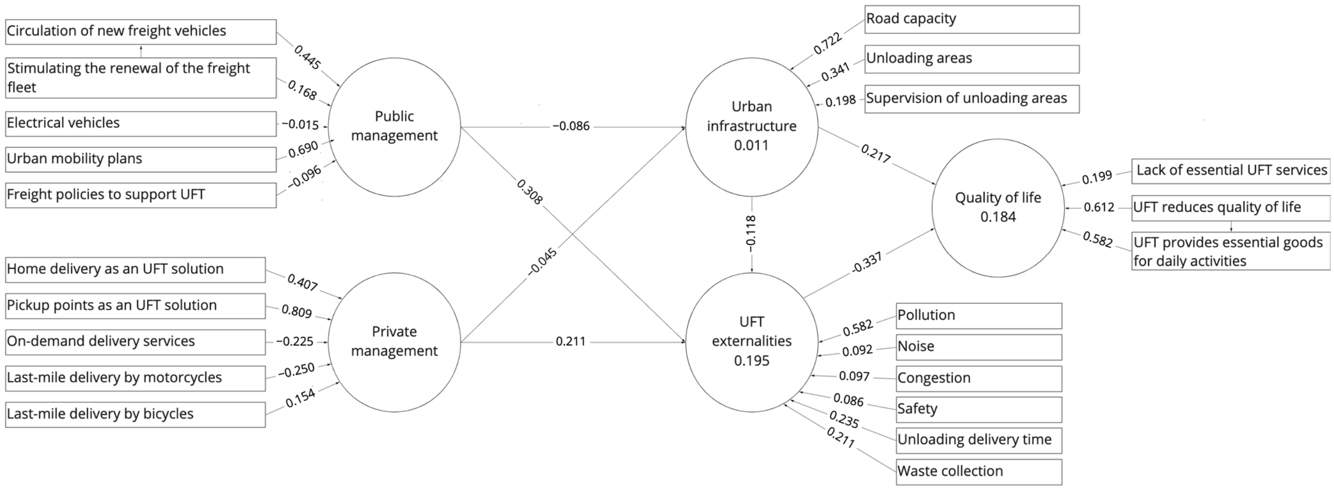

Figure 5. Estimated coefficients of SEM.

Table 4 shows the evaluation of the path coefficients. Results indicate that UFT externalities influence the quality of life by 12.9%, which confirms hypothesis H1 and is consistent with the existing literature [21,31]. Furthermore, the urban infrastructure influences the quality of life by 5.9%, which confirms hypothesis H2b and corroborates research related to advocating urban planning to provide adequate freight transport urban infrastructure [3]. Public management influences UFT externalities by 11.4%, which confirms hypothesis H3b. This result is also supported by other scholars who show that public management could reduce UFT externalities [3,8].

Table 4. Evaluation of path coefficients.

Hypotheses	Beta	Percentage	t-Value	*p*-Value	Supported?
H1: UFT-Externalities → Quality of life	−0.337	12.54%	5.059	0.000	Yes
H2a: Urban infrastructure → UFT-Externalities	−0.118	1.91%	1.853	0.064	No
H2b: Urban infrastructure → Quality of life	0.217	5.90%	2.599	0.009	Yes
H3a: Public Management → Urban infrastructure	−0.086	0.83%	1.237	0.216	No
H3b: Public Management → UFT-Externalities	0.308	11.40%	5.195	0.000	Yes
H4a: Private Management → UFT-Externalities	0.211	6.18%	1.498	0.134	No
H4b Private Management → Urban infrastructure	−0.045	0.30%	0.313	0.754	No

Figure 6 shows the importance-versus-performance map. Quadrant 1 (bottom-right) is concentrated on the priority variables (the most important variables as well as the variables with the lowest performance). Three infrastructure variables are observed: Road capacity (D_21), unloading areas (D_22), and the supervision of unloading areas (D_23). This shows the importance of investing in UFT infrastructure to improve the population's quality of life. In addition, this result reinforces the results of the structural model, where urban infrastructure was behind UFT externalities in terms of influencing the quality of life.

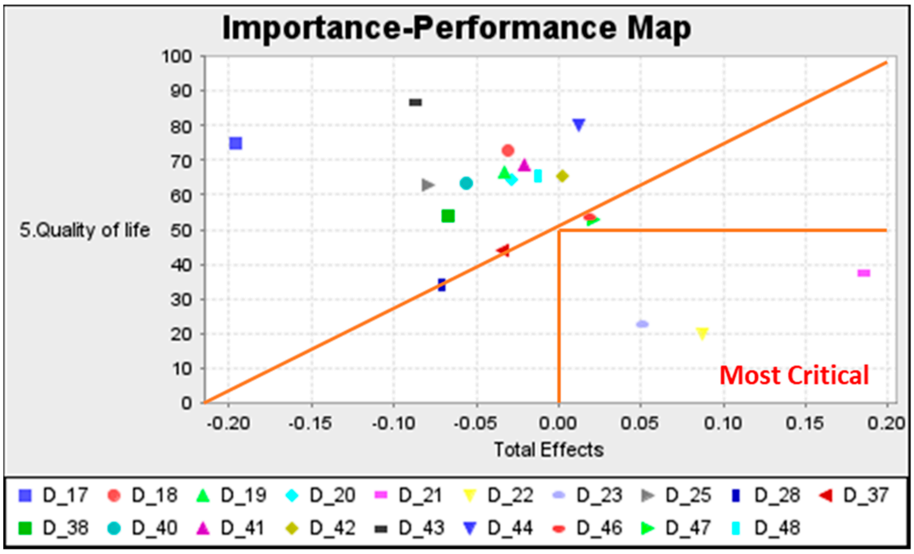

Figure 6. Importance versus performance map.

Road capacity is a major urban planning problem that is directly linked to the most voted item in the questionnaire, which is the urban mobility plan. This confirms this issue in achieving a better quality of life for the population. Conversely, activities related to unloading products, including availability and inspection, presented the least votes in the questionnaire. This casts doubt on the population's awareness of the UFT's importance.

5. Conclusions

The research achieved its objective of evaluating the influence of both urban infrastructure and negative UFT externalities on the residents' quality of life. The database was obtained from a survey of residents of Brasília's Plano Piloto. The Structural Equation Modeling (SEM) presented consistent results, which confirm the two hypotheses related to the quality of life and the hypotheses concerning public management and negative UFT externalities.

The area chosen for study is a planned city, which was conceived to be practical and pleasant for its residents. However, the research showed that the urban infrastructure of Brasília's Plano Piloto does not meet the residents' needs. In addition, investing in urban infrastructure is a strategic point for improving the residents' quality of life.

The negative influence of UFT externalities and the positive influence of urban infrastructure on maintaining the residents' quality of life were clear. This shows that businesses should invest in new technologies for UFT and also that public administration should invest in mobility-oriented policies.

The research has its limitations; however, the results obtained were significant and enable future research to address the residents' quality of life. For further works, we suggest analyzing the impact of UFT on quality of life using multi-criteria methods. Moreover, the assessment of traffic impacts using traffic data can evolve the concept of the quality of life and be explored in further studies.

Author Contributions: Conceptualization, C.E.L., S.R.G. and L.K.d.O.; methodology, C.E.L., A.M.M. and L.K.d.O.; software, C.E.L., validation, C.E.L., S.R.G., A.M.M. and L.K.d.O.; formal analysis, C.E.L.; investigation, C.E.L.; data curation, C.E.L.; writing—original draft preparation, C.E.L.; writing—review and editing, C.E.L., S.R.G., A.M.M. and L.K.d.O.; supervision, S.R.G., A.M.M. and L.K.d.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Brasília University.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Pietrzak, K.; Pietrzak, O.; Montwiłł, A. Light Freight Railway (LFR) as an Innovative Solution for Sustainable Urban Freight Transport. *Sustain. Cities Soc.* **2021**, *66*, 102663. [CrossRef]
2. Jiang, Y.; Lai, P.; Chang, C.-H.; Yuen, K.F.; Li, S.; Wang, X. Sustainable Management for Fresh Food E-Commerce Logistics Services. *Sustainability* **2021**, *13*, 3456. [CrossRef]
3. Tanco, M.; Escuder, M. A Multi-Perspective Analysis for the Better Understanding of Urban Freight Transport Challenges and Opportunities in Montevideo. *Case Stud. Transp. Policy* **2021**, *9*, 405–417. [CrossRef]
4. Muñoz-Villamizar, A.; Santos, J.; Montoya-Torres, J.R.; Velázquez-Martínez, J.C. Measuring Environmental Performance of Urban Freight Transport Systems: A Case Study. *Sustain. Cities Soc.* **2020**, *52*, 101844. [CrossRef]
5. García-Gallego, J.M.; Kang, T.; Lacoba, S.R.; Genovese, A. Lorry Park Selection Criteria and Drivers' Preferences: A Study from the UK. *Sustainability* **2019**, *11*, 5214. [CrossRef]
6. de Gusmão, A.C.S.; Ribeiro, P.C.M. Guidelines for the Efficiency of Urban Goods Distribution: The Brazilian Case. *Case Stud. Transp. Policy* **2020**, *8*, 1478–1488. [CrossRef]
7. de Oliveira, L.K.; França, J.G.d.C.B.; Nascimento, C.D.O.L.; de 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]
8. Holguín-Veras, J.; Leal, J.A.; Sanchez-Diaz, I.; Browne, M.; Wojtowicz, J. State of the Art and Practice of Urban Freight Management Part II: Financial Approaches, Logistics, and Demand Management. *Transp. Res. Part A Policy Pract.* **2020**, *137*, 383–410. [CrossRef]
9. Holguín-Veras, J.; Encarnación, T.; Ramírez-Ríos, D.; He, X.; Kalahasthi, L.; Pérez-Guzmán, S.; Sanchez-Díaz, I.; González-Calderón, C.A. A Multiclass Tour Flow Model and Its Role in Multiclass Freight Tour Synthesis. *Transp. Sci.* **2020**, *54*, 631–650. [CrossRef]
10. Cassiano, D.R.; Bertoncini, B.V.; de Oliveira, L.K. A Conceptual Model Based on the Activity System and Transportation System for Sustainable Urban Freight Transport. *Sustainability* **2021**, *13*, 5642. [CrossRef]
11. Oliveira, L.K.; Nascimento, C.D.O.L.; de Sousa, P.R.; de Resende, P.T.V.; da Silva, F.G.F. Transport Service Provider Perception of Barriers and Urban Freight Policies in Brazil. *Sustainability* **2019**, *11*, 6890. [CrossRef]
12. Holguín-Veras, J.; Leal, J.A.; Sánchez-Diaz, I.; Browne, M.; Wojtowicz, J. State of the Art and Practice of Urban Freight Management: Part I: Infrastructure, Vehicle-Related, and Traffic Operations. *Transp. Res. Part A Policy Pract.* **2020**, *137*, 360–382. [CrossRef]
13. Diana, M.; Pirra, M.; Woodcock, A. Freight Distribution in Urban Areas: A Method to Select the Most Important Loading and Unloading Areas and a Survey Tool to Investigate Related Demand Patterns. *Eur. Transp. Res. Rev.* **2020**, *12*, 40. [CrossRef]
14. Bebber, S.; Libardi, B.; Moschen, S.D.A.; da Silva, M.B.C.; Fachinelli, A.C.; Nogueira, M.L. Sustainable Mobility Scale: A Contribution for Sustainability Assessment Systems in Urban Mobility. *Clean. Eng. Technol.* **2021**, *5*, 100271. [CrossRef]
15. Shee, H.K.; Miah, S.J.; De Vass, T. Impact of Smart Logistics on Smart City Sustainable Performance: An Empirical Investigation. *Int. J. Logist. Manag.* **2021**, *32*, 821–845. [CrossRef]
16. Russo, F.; Comi, A. Sustainable Urban Delivery: The Learning Process of Path Costs Enhanced by Information and Communication Technologies. *Sustainability* **2021**, *13*, 13103. [CrossRef]
17. Russo, F.; Comi, A. Investigating the Effects of City Logistics Measures on the Economy of the City. *Sustainability* **2020**, *12*, 1439. [CrossRef]
18. 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]
19. Kijewska, K.; França, J.G.; de Oliveira, L.K.; Iwan, S. Evaluation of Urban Mobility Problems and Freight Solutions from Residents' Perspectives: A Comparison of Belo Horizonte (Brazil) and Szczecin (Poland). *Energies* **2022**, *15*, 710. [CrossRef]
20. Rose, W.J.; Ralston, P.M.; Autry, C.W. Urbanness and Its Implications for Logistics Strategy: A Revised Perspective. *Transp. J.* **2020**, *59*, 165–199. [CrossRef]
21. Montwiłł, A.; Pietrzak, O.; Pietrzak, K. The Role of Integrated Logistics Centers (ILCs) in Modelling the Flows of Goods in Urban Areas Based on the Example of Italy. *Sustain. Cities Soc.* **2021**, *69*, 102851. [CrossRef]
22. Oliveira, L.K.; Oliveira, R.L.M.; Sousa, L.T.M.; Caliari, I.P.; Nascimento, C.O.L. Analysis of Accessibility from Collection and Delivery Points: Towards the Sustainability of the e-Commerce Delivery. *Urbe Rev. Bras. Gest.* **2019**, *11*, e20190048. [CrossRef]
23. Erdogan, S. Analyzing the Environmental Kuznets Curve Hypothesis: The Role of Disaggregated Transport Infrastructure Investments. *Sustain. Cities Soc.* **2020**, *61*, 102338. [CrossRef]
24. Chen, H.-K.; Chou, H.-W.; Hung, S.-C. Interrelationships between Behaviour Intention and Its Influential Factors for Consumers of Motorcycle Express Cargo Delivery Service. *Transp. A Transp. Sci.* **2019**, *15*, 526–555. [CrossRef]
25. Ewbank, H.; Vieira, J.G.V.; 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]
26. Yildirim, Y.; Allen, D.J.; Albright, A. The Relationship between Sound and Amenities of Transit-Oriented Developments. *Int. J. Environ. Res. Public Health* **2019**, *16*, 2413. [CrossRef]

27. 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]
28. Croce, A.I.; Musolino, G.; Rindone, C.; Vitetta, A. Route and Path Choices of Freight Vehicles: A Case Study with Floating Car Data. *Sustainability* **2020**, *12*, 8557. [CrossRef]
29. Seliverstov, S.; Seliverstov, Y.; Gavkalyk, B.; Fahmi, S. Development of Transport Infrastructure Organization Model for Modern Cities with Growing Effectiveness. *Transp. Res. Procedia* **2020**, *50*, 614–625. [CrossRef]
30. Hou, R.; Lei, L.; Jin, K.; Lin, X.; Xiao, L. Introducing Electric Vehicles? Impact of Network Effect on Profits and Social Welfare. *Energy* **2022**, *243*, 123002. [CrossRef]
31. Zhang, X.; Li, Z.; Luo, L.; Fan, Y.; Du, Z. A Review on Thermal Management of Lithium-Ion Batteries for Electric Vehicles. *Energy* **2022**, *238*, 121652. [CrossRef]
32. Musolino, G.; Rindone, C.; Vitetta, A. Passengers and Freight Mobility with Electric Vehicles: A Methodology to Plan Green Transport and Logistic Services near Port Areas. *Transp. Res. Procedia* **2019**, *37*, 393–400. [CrossRef]
33. Pašalić, I.N.; Ćukušić, M.; Jadrić, M. Smart City Research Advances in Southeast Europe. *Int. J. Inf. Manag.* **2021**, *58*, 102127. [CrossRef]
34. Jardas, M.; Hadžić, A.P.; Tijan, E. Defining and Measuring the Relevance of Criteria for the Evaluation of the Inflow of Goods in City Centers. *Logistics* **2021**, *5*, 44. [CrossRef]
35. Davidich, N.; Galkin, A.; Iwan, S.; Kijewska, K.; Chumachenko, I.; Davidich, Y. Monitoring of Urban Freight Flows Distribution Considering the Human Factor. *Sustain. Cities Soc.* **2021**, *75*, 103168. [CrossRef]
36. 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]
37. Serrano-Hernandez, A.; Ballano, A.; Faulin, J. Selecting Freight Transportation Modes in Last-Mile Urban Distribution in Pamplona (Spain): An Option for Drone Delivery in Smart Cities. *Energies* **2021**, *14*, 4748. [CrossRef]
38. Siqueira, A.J.; Almo, P.M.; Cicerelli, R.E.; Machado, R.F.C.; Almeida, T.d. Mapping the Usability and Quality of Bicycle Paths Using a Terrain-Inclination-Based Classification, Study Case: Darcy Ribeiro Campus, University Of Brasília, Brazil. In Proceedings of the 2020 IEEE Latin American GRSS & ISPRS Remote Sensing Conference (LAGIRS), Santiago, Chile, 21–26 March 2020; pp. 78–81.
39. Mucowska, M. Trends of Environmentally Sustainable Solutions of Urban Last-Mile Deliveries on the E-Commerce Market—A Literature Review. *Sustainability* **2021**, *13*, 5894. [CrossRef]
40. Oliveira, C.M.; Albergaria De Mello Bandeira, R.; Vasconcelos Goes, G.; Schmitz Gonçalves, D.N.; D'Agosto, M.D. Sustainable Vehicles-Based Alternatives in Last Mile Distribution of Urban Freight Transport: A Systematic Literature Review. *Sustainability* **2017**, *9*, 1324. [CrossRef]
41. Akyol, D.E.; Koster, R.B.M. Determining Time Windows in Urban Freight Transport: A City Cooperative Approach. *Transp. Res. Part E Logist. Transp. Rev.* **2018**, *118*, 34–50. [CrossRef]
42. Alam, P.; Ahmad, K.; Afsar, S.; Akhter, N. Noise Monitoring, Mapping, and Modelling Studies—A Review. *J. Ecol. Eng.* **2020**, *21*, 82–93. [CrossRef]
43. 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]
44. Dong, X.; Wu, Y.; Chen, X.; Li, H.; Cao, B.; Zhang, X.; Yan, X.; Li, Z.; Long, Y.; Li, X. Effect of Thermal, Acoustic, and Lighting Environment in Underground Space on Human Comfort and Work Efficiency: A Review. *Sci. Total Environ.* **2021**, *786*, 147537. [CrossRef]
45. He, Z.; Haasis, H.-D. A Theoretical Research Framework of Future Sustainable Urban Freight Transport for Smart Cities. *Sustainability* **2020**, *12*, 1975. [CrossRef]
46. Holguín-Veras, J.; Wang, C.; Browne, M.; Hodge, S.D.; Wojtowicz, J. The New York City Off-Hour Delivery Project: Lessons for City Logistics. *Procedia-Soc. Behav. Sci.* **2014**, *125*, 36–48. [CrossRef]
47. Ranieri, L.; Digiesi, S.; Silvestri, B.; Roccotelli, M. A Review of Last Mile Logistics Innovations in an Externalities Cost Reduction Vision. *Sustainability* **2018**, *10*, 782. [CrossRef]
48. Hair, F.J.; Hult, G.T.M.; Ringle, C.M.; Sarstedt, M. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*; Sage Publications, Inc.: Thousand Oaks, CA, USA, 2017.
49. Thakkar, J.J. Procedural Steps in Structural Equation Modelling. In *Structural Equation Modelling: Application for Research and Practice (with AMOS and R)*; Thakkar, J.J., Ed.; Springer: Singapore, 2020; pp. 29–34. ISBN 978-981-15-3793-6.
50. Hair, F.J.; Sarstedt, M.; Hopkins, L.; Kuppelwieser, V.G. Partial Least Squares Structural Equation Modeling (PLS-SEM). *Eur. Bus. Rev.* **2014**, *26*, 106–121. [CrossRef]
51. Hair, J.F.; Black, W.C.; Babin, B.J.; Anderson, R.E.; Tatham, R.L. *Multivariate Data Analysis*; Cengage: Hampshire, UK, 2019.
52. Henseler, J.; Ringle, C.M.; Sarstedt, M. Testing Measurement Invariance of Composites Using Partial Least Squares. *Int. Mark. Rev.* **2016**, *33*, 405–431. [CrossRef]
53. Henseler, J. Bridging Design and Behavioral Research With Variance-Based Structural Equation Modeling. *J. Advert.* **2017**, *46*, 178–192. [CrossRef]
54. Ringle, C.M.; Sarstedt, M. Gain More Insight from Your PLS-SEM Results. *Ind. Manag. Data Syst.* **2016**, *116*, 1865–1886. [CrossRef]

55. Ramírez, P.E.; Mariano, A.M.; Salazar, E.A. Propuesta Metodológica Para Aplicar Modelos de Ecuaciones Estructurales Con PLS: El Caso Del Uso de Las Bases de Datos Científicas En Estudiantes Universitarios. *Rev. ADMPG* **2014**, *7*, 133–139.
56. Becker, J.-M.; Klein, K.; Wetzels, M. Hierarchical Latent Variable Models in PLS-SEM: Guidelines for Using Reflective-Formative Type Models. *Long Range Plan.* **2012**, *45*, 359–394. [CrossRef]
57. Cenfetelli, R.T.; Bassellier, G. Interpretation of Formative Measurement in Information Systems Research. *MIS Q.* **2009**, *33*, 689–707. [CrossRef]
58. Cenfetelli, R.T.; Bassellier, G.; Posey, C. The Analysis of Formative Measurement in IS Research: Choosing between Component- and Covariance-Based Techniques. *SIGMIS Database* **2013**, *44*, 66–79. [CrossRef]
59. Hair, J.F.; Ringle, C.M.; Gudergan, S.P.; Fischer, A.; Nitzl, C.; Menictas, C. Partial Least Squares Structural Equation Modeling-Based Discrete Choice Modeling: An Illustration in Modeling Retailer Choice. *Bus. Res.* **2019**, *12*, 115–142. [CrossRef]
60. Falk, R.F.; Miller, N.B. *A Primer for Soft Modeling*; University of Akron Press: Akron, OH, USA, 1992.
61. Ramayah, T.; Chiun, L.M.; Rouibah, K.; May, O.S. Identifying Priority Using an Importance-Performance Matrix Analysis (IPMA): The Case of Internet Banking in Malaysia. *Int. J. E-Adopt. IJEA* **2014**, *6*, 1–15. [CrossRef]
62. Ahmad, S.; Afthanorhan, W.M.A.B.W. The Importance-Performance Matrix Analysis in Partial Least Square Structural Equation Modeling (PLS-SEM) with Smartpls 2.0 M3. *Int. J. Math. Res.* **2014**, *3*, 1–14. [CrossRef]
63. Shafaei, A.; Razak, N.A. Importance-Performance Matrix Analysis of the Factors Influencing International Students' Psychological and Sociocultural Adaptations Using SmartPLS. In Proceedings of the 2nd International Symposium on Partial Least Squares Path Modeling—The Conference for PLS Users, Seville, Spain, 16–19 June 2015.
64. Silva, A.L.; Silva, M.G.J.P.V.; Pantoja, J.C. Levantamento Patológico Das Calçadas Que Interligas as Superquadras 300 Sul. *Rev. Arquitetura Cid. Habitaç.* **2021**, *1*, 152–170. [CrossRef]
65. Souza, A.C.S.; Bittencourt, L.; Taco, P.W.G. Women's Perspective in Pedestrian Mobility Planning: The Case of Brasília. *Transp. Res. Procedia* **2018**, *33*, 131–138. [CrossRef]
66. Kallas, L.M.E.; da Silva, E.A.S.; Guillen-Salas, J.C. O Patrimônio Edificado e Urbanístico Do Plano Piloto de Brasília [DF]: Documentação, Valorização e Resgate Por Meio Dos 'Sketches'. *Labor Eng.* **2020**, *14*, e020014.
67. Derntl, M.F. O Plano Piloto e Os Planos Regionais Para Brasília Entre Fins Da Década de 1940 e Início Dos Anos 60. *Rev. Bras. Estud. Urbanos Reg.* **2019**, *21*, 26–44. [CrossRef]