Investigating Stakeholders in the Field of Sustainable Mobility in Curitiba, Brazil

A Case Study Research

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31.08.2017

Abstract

This research report aims to provide an analysis of the goals and inhibiting factors of prominent stakeholders in the field of sustainable mobility in Curitiba, and aims to find mutually beneficial interventions to improve Curitiba's urban transport system. Interviews were held to discover the stakeholders' aims and inhibiting factors and empirical data of several means of transportation were gathered, to get an overview of the current mobility system. It was concluded that the sustainable mobility stakeholders in Curitiba aim to create a culture of sustainable mobility through, improving the public transportation system; integrating means of transportation and mobility regions; promoting cycling and walking; and improving the safety of commuting. In realising their sustainable mobility goals, the stakeholders are mainly inhibited by a lack of money, the current political and/or social climate; a lack of security on sustainable means of transportation and a poor execution of projects. To decrease these inhibiting factors and help the stakeholders realise their goals, future mobility plans should aim to increase (1) civil engagement, (2) the convenience, comfort and affordability of the BRT system, and (3) the safety of cyclists through education, collaboration and integration of means of transport. As this research was limited in scale, we suggest performing a more elaborate research into the stakeholders' aims and inhibiting factors, especially regarding the citizens. Furthermore, we suggest performing a feasibility study regarding the interventions that were found, followed by possible pilot studies in the city.

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Introduction

This research entails a case study of stakeholders in the field of sustainable mobility[1] in the City of Curitiba, Brazil, and is conducted on the basis of a Memorandum of Understanding between the University of Twente and various other Dutch and Brazilian organisations, including the Prefecture of Curitiba, and local universities in Curitiba (Universidade Tecnológica Federal do Paraná (UTFPR), and Pontifícia Universidade Católica do Paraná (PUCPR)). This research was also endorsed by the University of Twente's DesignLab, who provided a creative environment and trained the researchers in the use of design thinking methods (see Appendix 1).

Before initiating this research project, the research project group conducted an in-depth research into the mobility sector of Curitiba. This in-depth research consisted of writing an explanatory socio-technical scenario, which aimed to outline a plausible chain of events leading up to a more sustainable mobility network (Elzen & Hofman, 2007). The main promoted solution in achieving this was the creation of a cycling culture in Curitiba, which is said to bring economic, social and environmental benefits to the city (World Bank, 1996). Furthermore, to achieve a sustainable mobility network, it was predicted that the main means of transit - the Bus Rapid Transit (BRT) system - will transition from diesel to electricity, and become more efficient and responsive through autonomous technology (Kienteka, Lopes & Reis, 2015).

The scenario also shed light on how the contemporary state of affairs developed over time (Birari et al., 2017). The rapid urbanisation of Curitiba led to road congestion and air pollution (Miranda & Da Silva, 2013). Besides this, the saturation and deterioration of the BRT system resulted in less citizens using this means of transport (URBS, 2017). As the Prefecture of Curitiba searched for another means of reducing the road congestion (Macedo, 2004), the goal to innovate the mobility system using bicycles was established. Government and citizen initiatives related to improving the cycling experience in the city started around 2012 (Costa Nascimento, 2013; Duarte, Procopiuck & Fujioka, 2014; CycloMobility, 2016). However, inhibiting factors existed, such as security and safety issues while cycling, and the status of the bicycle as a means of transport for the lower class. Besides this, other impedances to cycling were found in the city, such as the poor cycling infrastructure and a lack of public bicycle storage facilities (Miranda & Da Silva, 2012; Schilte, 2016; Motta, 2017; Kesteren & Bradley, 2017).

There are pressing issues with the mobility system and hence various organisations invested in the city's mass-transit have established aims to improve this. However, it seems as little has been achieved. Therefore, a more in-depth analysis of the aims and perceived inhibiting factors was deemed valuable for further developments in the City of Curitiba. This research aims to analyse stakeholders and find mutually beneficial interventions related to sustainable mobility. The analysis investigates the various stakeholders independently and determines their desired outcomes related to urban mobility. The results of this research are combined into a holistic view of the various stakeholders active in this field in Curitiba. This creates a foundation on which possible interventions can be explored. These interventions aim

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[1] In the interviews, the stakeholders' definitions of sustainable mobility were inquired upon. Therefore, this research report does not provide such a definition.

to increase the potential for sustainable mobility in Curitiba. Therefore, this case study aims to answer the following questions:
1. To what extent are there similarities and differences in the sustainable mobility goals of the various stakeholders?
2. What inhibits the stakeholders from achieving their aims?
3. Which kinds of interventions could reduce these inhibiting factors?

Methodology

As this research outlines various stakeholders' attitudes towards sustainable mobility, with the aim of creating possible interventions, this research requires substantial flexibility in methods used to collect data. Therefore, this study includes qualitative research (Kvale, 1996; Cassell & Symon, 1999). Also, as this study focuses on contemporary structures in a real-life context, it is justified to approach this as a case study. Various case studies regarding mobility have been conducted in Curitiba (Cavalcanti, Limont, Dziedzic & Fernandes, 2017; Zannin, Diniz & Barbosa, 2002), however, little is known about the topic this research will consider. The way in which data was collected and analysed needed a detailed guideline. Therefore various protocols were set up. These protocols could be altered during the research depending on whether the data showed that an alteration would be beneficial. This research spanned over two months and was performed in four phases. The time frames for the different stages are indicated in the Gantt chart in Appendix 2.

In the first phase, it was determined which stakeholders would be analysed. To determine the relevance of the different stakeholders, digital data were collected (see protocol in Appendix 3). This collected data is presented as a stakeholder analysis. During this phase, stakeholders were also contacted for an initial meeting, which was used to introduce the project to the stakeholder and to clarify the stakeholder's role in the mobility system to the researchers.

In the second phase, information was collected about the sustainable mobility goals of the stakeholders and the inhibiting factors experienced in reaching these goals. This information was gathered through semi-structured interviews. The interview protocol with the interview questions can be found in Appendix 4. After each interview, a reflective memo was written, which contained a summary of the key findings, an evaluation of the interview, and — if necessary — suggestions to improve the protocol. A fundamental aspect of qualitative research is the approach used to analyse data. For the interview analysis, a constant comparison approach, as developed in the grounded theory devised by Wester (1995), was followed (see Appendix 5).

In addition to the stakeholder interviews, surveys among the citizens of Curitiba were conducted. In this research, the participants were asked to fill out a form in writing or, if possible, answer the questions in an interview setting. The questions that were asked and an outline of the structure of the group meetings can be found in Appendix 7. Severe limitations need to be considered when approaching this group, namely the sample size and group type: The data might not accurately portray the general attitude of the citizens due to the small sample size and the sample group

mainly consisting of university students and staff, as approaching these citizens was within the researcher's capacity. However, it was believed that valuable insights could be acquired by interviewing a small sample group in-depth.

Besides this, empirical data about the current mobility system were collected in the second phase. Five means of transportation were considered for empirical data collection: taking a bus, taking a taxi, taking an Uber, cycling and walking. Walking was excluded, because this does not entail a service and is therefore not linked to any stakeholder directly. The protocol for empirical data collection can be found in Appendix 8.

The third phase was focused on mapping the various goals and inhibiting factors with respect to the different stakeholders. This mapping included contrasting the goals and inhibiting factors, seeing where they align, and how they relate. This provided a holistic overview of the stakeholders and their opportunities and goals. A precise explanation of how the stakeholders were mapped can be found in Appendix 9.

In the fourth phase, the results and preliminary interventions were discussed at a stakeholder brainstorm session. The stakeholder brainstorm session was held at the Renault Experience classroom at the Pontifical Catholic University of Paraná's Innovation Agency. The stakeholders present at this meeting were representatives of the City Hall, COMEC, Agência Curitiba, PUC-PR, UTFPR, the former MoU representative and a number of students from PUC-PR's English-taught Urban Planning master's degree. After the initial icebreaker, three groups went to work on three cases related to the following questions: (1) How might we create collaboration between the Prefecture and citizens, to more actively involve citizens in government projects? (2) How might we educate and incentivise citizens to make sustainable mobility choices? and (3) How might we improve the overall efficiency of the integrated bus system BRT? A more detailed description of how these meetings were organised according to the DesignLab method can be found in Appendix 10.

Results

Stakeholder Analysis

For this research, eighteen organisations were investigated as possible stakeholders. Each of these stakeholders is involved in the mobility system in Curitiba or sustainable mobility in general. The decision to include or exclude certain organisations was based on the nature of these respective organisations, their current and previous pursuits and their influence in Curitiba. The following sections give an overview of the information that was used to decide which stakeholders are most relevant.

Agência Curitiba. The Agência Curitiba is an innovation hub in the industrial area Vale do Pinhão of Curitiba. It houses numerous organisations trying to further develop their ideas into start-ups, preferably related to sustainability (Histórico, n.d.). Essentially, the Agência Curitiba is an innovation ecosystem in the city. It tries to provide a platform in the city for entrepreneurial initiatives by universities, incubators, investment funds, research and development centres (Histórico, n.d). The Agência Curitiba also holds an annual event called Conecta Engenho: An event where people can present their ideas and discuss approaches in technological development, and an enhanced future reality can be achieved for all parties involved (F. Augusto Munhoz da Rocha Lacerda, *personal communication*, 2017). Furthermore, the Agência Curitiba is supports the MaaS (Mobility as a Service) project. The MaaS project aims to integrate different means of transportation and combine the main transport providers into one mobile service.

The Agência Curitiba is socially integrated and aims to keep an up-to-date overview of the projects they are hosting, which could make it vital in determining to what extent and in which setting an intervention is implementable (Historico, n.d.). This integration and overview, combined with its aim to create sustainable innovations in Curitiba, has led to the Agência Curitiba to be considered as a stakeholder in this research.

COMEC (Coordenação da Região Metropolitana de Curitiba)**.** COMEC aims to improve the connectivity within the metropolitan area of Curitiba by integrating the mobility systems of the city's 29 municipalities and increasing availability of different means of transport(COMEC, n.d.). It is ultimately responsible for the wholesale integration of Paraná's transportation networks and for the formulation and execution of legal and public policy in the interest of metropolitan citizens and the municipalities (COMEC, n.d.).

COMEC does not publicise any projects directly related to environmental sustainability. Nevertheless, as COMEC is an important player in the mobility system in Curitiba, it has been considered a stakeholder in this research.

Prefecture/City Hall As not all councilmen would be equally willing to discuss sustainable mobility, one was selected specifically: Goura Nataraj. This section gives an overview of the information and reasoning that was used to determine whether Mr. Nataraj could represent the Prefecture and shed light on the Prefecture's sustainable mobility goals. Mr. Nataraj is known for being a bicycle activist within

Curitiba, and for being one of the founders of CicloIguaçu (Santana, 2014). He has carried out discussions with the board of directors of the Association of Environmental Engineers, on topics such as environmental issues, mobility, and urban planning; the association was invited to participate in the discussions of the Commission on Environment and Sustainable Development and the Committee on Urban Planning Public Works and IT.

As a councilman within Curitiba, Mr. Nataraj initiates and completes mobility and sustainability projects and has influence on various sectors of the city (I. Reck Neto, *personal communication*, 2017). Therefore, it was decided that he could represent the Prefecture in this research. Although Mr. Nataraj's personal level of influence within the government may be debatable(I. Reck Neto, *personal communication*, 2017), he can be assumed to have significant influence over citizens, companies and organisations.

Guarda Municipal The Guarda Municipal is not necessarily active in the field of sustainable mobility. However, it plays an active role in ensuring the correct use of public spaces and transportation, and thus has a large impact on the mobility of citizens (Defesa Social, 2017). The Guarda Municipal operates in municipal schools, day care centers, health centers, parks, squares, woods, family warehouses, public transportation and other services of the Municipality of Curitiba, aiming at the protection of the population, goods, services and facilities (Defesa Social, 2017). The guarda municipal aims to further expand the good care, protection and safety of the population; the lack of which are major inhibiting factors for citizens using bicycles.

The guards which patrol the parks use bicycles as their mode of transport, which is a very interesting link with sustainable mobility (Defesa Social, 2017). However, as an entity working under policy set by the government, it is unclear how much change the Guarda Municipal can carry out on its own actions. The Guarda Municipal will be considered a stakeholder in this research, because of its possible influence on safety in the mobility system, specifically with regards to cycling.

IPPUC (Instituto de Planejamento e Pesquisa de Curitiba). IPPUC is the urban planning institute of Curitiba, and was created to develop and monitor the Plano Diretor de Curitiba, or the 'Master Plan of Curitiba' (IPPUC, n.d.). This master plan is a plan for the future urban development of Curitiba over the next 50 years. IPPUC advises the government and subsidiary organisations on which parts of the city's infrastructure demand revisiting or maintenance, and where improvements can be made. It makes the actions of the municipality compatible with those of the metropolitan region, through the formulation of urban plans and projects that follow this "Master Plan of Curitiba" (IPPUC, n.d.). IPPUC is also working together with URBS to ensure feasibility and efficiency of Curitiba's transportation networks. In early 2017, IPPUC organised an urban planning and management event,similar to a think tank, where senior students were involved in the thought processes behind urban planning, transport and the environment (IPPUC, 2017).

IPPUC will be considered a stakeholder in this research, because it is a key player in the field of planning future mobility in Curitiba.

IBQP (Instituto Brasileiro de Qualidade e Produtividade). IBQP aims to continually improve productivity, quality and innovation in Brazil, through unified

management-oriented processes in the commercialisation, development and operational sectors of Curitiba (IBQP, n.d.). It is also a consultancy office for smart city-related projects in Brazil (Zilli, 2014). IBQP wants to improve city life in Curitiba using technology and other developments (F. Chiesse Espinola, *personal communication*, 2017). IBQP works with Renault and other organisations on safe mobility projects in Curitiba. For instance, it has a model park in its offices where school children can learn about traffic and sustainable mobility. (F. Chiesse Espinola, *personal communication*, 2017). IBQP also has direct access to a network of mobility-related experts in the city (F. Chiesse Espinola, *personal communication*, 2017).

IBQP will not be considered a stakeholder in this research because it focuses on enabling other parties and organisations to execute their plans, and is thus more a facilitator than a stakeholder. Furthermore, sustainable mobility is only one of the many interests of the organisation.

URBS (Urbanização de Curitiba) When URBS was created in 1963, it was a company for urbanization and sanitation with activities in urban infrastructure, construction, landscaping, lighting and housing (URBS, n.d. a). Nowadays, it is a corporation that is responsible for operating and managing the transportation system in Curitiba, including public transport, taxis and public and commercial logistics (URBS, n.d. a). 99.99% of URBS' capital belongs to the municipality (Marchiori, 2016). In terms of environmentally sustainable mobility, URBS is involved in the implementation of a bicycle sharing system in Curitiba. This system is aimed to be in place by 2018 (P. H. Scherner Romanel, *personal communication*, 2017).

As URBS fulfils an essential role in the organisation of Curitiba's transport systems, and has the power to affect change on the private stakeholders involved in the organisation of the transport system (Escavador, 2017), it will be considered a stakeholder in this research.

SETRAN (Secretaria Municipal de Trânsito) SETRAN is the municipal secretary of transit. It is part of the public administration of Curitiba and has close contact with the mayor (SETRAN, n.d.). Its main activities are related to legislation, electronic surveillance, fines, removal and storage of vehicles, traffic safety and traffic education (SETRAN, n.d.). SETRAN aims for the population to participate in the traffic management of Curitiba (Prefeitura de Curitiba, 2013). Joel Krüger, a former Secretary of Transit in Paraná, was famous for seeking to balance the focus on investment and education, as he found that a large part of the problems with urban transport in the city originated from a lack of knowledge (Prefeitura de Curitiba, 2013).

As SETRAN is part of the administration of transit, it will be considered as a stakeholder in this research.

ITDP (Institute for Transportation and Development Policy). ITDP is a non-profit international organization that designs and implements transport systems and policy solutions. It aims to make cities worldwide more livable, equitable and sustainable (ITDP, n.d. a). ITDP is active in transport projects, policy advocacy and research publications. Its efforts focus mainly on reducing carbon emissions and air pollution, and on creating social equality (ITDP, n.d. a). In Brazil, ITDP aims to integrate pedestrians and cyclists into the mobility network once again, since they

have been sidelined over the years by the strong focus on cars (ITDP, n.d. a). ITDP has multiple ongoing projects centered on sustainable cities, bicycle sharing and the current unequal distribution of transport systems, employment, and education in Brazil (ITDP, n.d. a). Furthermore, URBS is trying to stimulate ITDP to place specific focus on Curitiba (Fabio Duarte, *personal communication*, 2017).

ITDP will not be considered a stakeholder in this research, because although it is a global organisation with a separate department in Brazil, there seems to be no direct influence in the city of Curitiba yet.

Radio Táxi Curitiba. Curitiba has a fleet of around 3000 taxis, which are regulated by the government, of which about 70% operate through Radio Táxi (URBS, n.d. b). In 2015, Curitiba's taxi fleet aimed to implement the first electric cars (Ciclovivo, 2015). According to the mayor at the time, Gustavo Fruet, this was a step towards the use of clean and cheaper energy and reduced costs in providing service to the public (Ciclovivo, 2015). According to Mr. Fruet, if deemed technically feasible, the electric taxis could represent a new form of business (Ciclovivo, 2015). However, the programme was cancelled in three months because Curitiban law required the electric cars to be as quiet as possible, which made licensing them more expensive (Tribuna, 2017). Until cheaper electric vehicles are available, taxis will continue to be combustion-engine driven. The taxi service is currently being threatened by Uber, even though "ride hailing" is technically prohibited in Paraná because it allows one to work without a formal contract (Tribuna, 2017). The government is working on legislation that would significantly impede the operability of Uber in a less radical way (Tribuna, 2017).

In this research, Radio Táxi will be considered a stakeholder, because it is a part of the transportation network and they are already involved in creating a sustainable future for the city.

Renault Institute. In Curitiba, Renault is very active in electric vehicle integration and traffic education. Together with partner companies, Renault Institute has implemented the largest traffic safety education program in Curitiba (Renault Brazil, 2016). Renault-Nissan Alliance also takes part in zero emission mobility projects (Renault Brazil, 2014). Furthermore, the Renault-Nissan Alliance is part of Curitiba's Eco Elétrico project (Renault Brazil, 2014) which aims to implement new generation technologies with low environmental impact, taking into account the municipality's Sustainable Urban Mobility policy (Renault Brazil, 2014). Renault has also created an electric microbus which could replace some of the buses in the ônibus network (Renault Brazil, 2014).

As Renault is a key stakeholder in the field of electric vehicles and the company is quite active in the city of Curitiba, it has been considered a stakeholder in this research.

Volvo Group. Volvo has an important role in the bus system in Curitiba, because most of the city's public buses are produced in Volvo's production centre in Curitiba (A. do Amaral, *personal communication* 2017). Because of the "special" chassis design, Volvo claimed the market for bi-articulated buses — in Curitiba and Rio de Janeiro, Brazil specifically — in urban transport (Piva, 2016). Volvo is also aiming to

create a sustainable mobility system where every new Volvo engine will eventually at least be supported by an electric engine (Piva, 2016). In the past, as an attempt to somewhat alleviate the city's congestion problems, Volvo proposed to enlarge the bus schemes in Curitiba by adding [blue] buses that would travel between outskirts of the city and the countryside (A. do Amaral, *personal interview*, 2017). Furthermore, Volvo has a plan to revitalize and expand the city's BRT system, through the installment of interconnected tube stations, progressive replacement of current vehicles with hybrid electric models, underground stations and the use of big data (Piva, 2016).

Volvo has been considered a stakeholder in this research, because the company can give a unique perspective on the thinking behind the design of the BRT system.

Bike Fácil. Bike Fácil is a company in Curitiba specialized in designing infrastructure for bicycle sharing and bicycle parking (Bike Fácil, n.d. a). Its projects prioritize ergonomics and the safety and comfort of cyclists (Bike Fácil, n.d. a). It produces bicycle stands and parklets, is involved in architectural projects and advises on sustainable mobility (Bike Fácil, n.d. a). In the past few years, Bike Fácil has installed bicycle stands in multiple locations in the city and parklets, with the aim of creating an environment that meets all the needs of cyclists (Bike Fácil, n.d. b). Currently, the company is in charge of implementing a bicycle sharing system in the city. Accomplishing this will have a large impact on the number of people who cycle in Curitiba, as bicycles will be more easily accessible for the public. Interestingly, in 2015, 40% of Bike Facil employees cycled to work (Bike Fácil, 2015).

Bike Fácil has been considered a stakeholder, because it plays an important role in creating cycling infrastructure, and cycling is one of the forms of sustainable mobility that is considered in this research.

CEiiA, Portugal. CEiiA is a company that offers complete solutions for the deployment and management of smart mobility services (CEiiA, n.d. a). It aims to connect vehicles and infrastructures, integrate different information systems and promote sustainability (CEiiA, n.d. a). In order to do so, CEiiA is developing a platform, called 'mobi.me', that provides information in real-time about the duration, the cost and the ecological footprint of all the existing transportation alternatives (CEiiA, n.d. a). Mobi.me was recognized by the UN as the first mobility management system that allowed the user to access sustainability indicators and mobility services of the future (ITP, n.d.). CEiiA completes projects across Brazil and Europe (UK, Ireland, Netherlands, Spain, Portugal, Italy) including integrated mobility solutions on electric vehicles charging, car sharing, bicycle sharing, scooter sharing, parking, bus and public transportation, taxi and transport on demand, urban logistics, traffic and fleets (CEiiA, n.d. a). In Curitiba, CEiia takes part in the earlier mentioned Eco Elétrico project. This project aims to establish a smart mobility network, providing a integrated and sustainable transport system in Curitiba (CEiiA, n.d. b). For this project, CEiiA collaborates with Itaipu Binacional, the Municipality of Curitiba and the Renault-Nissan Alliance (CEiiA, n.d. b).

CEiiA has been considered a stakeholder in this research, because its goals directly relate to sustainable mobility and the company has started to become more active in Curitiba.

Itaipu Binacional. Itaipu Binacional owns the Itaipu hydroelectric dam on the border of Brazil and Paraguay and is the world's largest generator of renewable energy (Harris, 2017). Itaipu Binacional has an electric vehicle program, called 'EV', together with KWO (Oberhasli Kraftwerke AG), which owns hydroelectric plants in Switzerland. The goal of this program is to find technically and economically feasible electric mobility solutions that can minimize the environmental impact of mobility in cities (Itaipu Binacional, n.d. b). Among others, the EV project has been working on electric buses and trucks, recyclable batteries and energy storage systems (Itaipu Binacional, n.d. b). In Curitiba, Itaipu Binacional is a part of the earlier mentioned Eco Elétrico project (Renault Brazil, 2014).

Itaipu Binacional has not been considered a stakeholder in this research, because the company is aimed at energy and is not based in Curitiba, and its influence on the mobility system in Curitiba seems limited.

BYD (Build Your Dreams), China. BYD is a company specialized in rechargeable battery technologies and one of the world's largest manufacturers of electric vehicles (Grigg, 2017). BYD was the first factory to produce and sell 100% electric buses in Brazil and its electric cars are also used in corporate fleets, taxis, and the logistics industry (Xiaoying, 2016). Furthermore, the company is aiming to invest in engineering localization and infrastructure construction in the near future and it is planning to expand the electric bus assembly chassis that was established in 2015 in the Brazilian city Campinas (Xiaoying, 2016). BYD is also involved in C40, which helps cities, including Curitiba, replicate, improve and accelerate climate action (C40, n.d.).

BYD has not been considered a stakeholder in this research, because of its limited influence in Curitiba specifically.

CicloIguaçu. CicloIguaçu is an organisation that was created by cycling activists in 2011 to effectively communicate the public's cycling wishes to councils, such as the Conselho de Trânsito de Curitiba (Traffic Council), and Cicloparaná, a working group of the State Government that aims to encourage cycling through policies (CicloIguaçu, n.d. a). In practice, CicloIguaçu works in many areas, such as urban mobility, public transportation, urban planning, education and public health. The organisation is run by volunteers and well known in the cycling community (CicloIguaçu, n.d. b). CicloIguaçu is currently working on several projects with different aims and partnerships.

CicloIguaçu has been considered a stakeholder, because cycling is a promising form of sustainable mobility and CicloIguaçu is very active in Curitiba. In this research, they have been used as a representative of the cycling community.

Bike Anjo. Bike Anjo promotes, mobilizes and helps people getting started with cycling as a means of transportation in cities. Its members are volunteers who believe that cycling is a tool for social change and the more people ride bicycles, the better cities will become (Bike Anjo, n.d. a). There is a network of people called 'bike angels' in several cities, including Curitiba, who teach citizens how to cycle, as well as which routes and practices are safest within the city (G. Prado, *personal communication*, 2017). Besides this, Bike Anjo organizes and co-organizes campaigns and events, such as the Bike to Work Day on the second Friday of May (Bike Anjo, n.d. b).

The organisation does not seem to have a centralized form that has significant control over the mobility in the city. They mainly seem to be individual volunteers who independently teach people how to cycle, but are not really involved in any political activities. Furthermore, based on personal communication with several stakeholders in the mobility sector in Curitiba, Bike Anjo has seemingly limited connections in the city. Therefore, Bike Anjo has not been considered a stakeholder in this research.

Stakeholder Interviews

In the first phase, it was decided that thirteen organisations would be eligible to be considered as stakeholders in our research. However, we were unable to organise interviews with the following six stakeholders: Guarda Municipal, SETRAN, Radio Táxi Curitiba, Renault Institute, Bike Fácil and CEiiA. Most of these six stakeholders had been contacted by email and did not get back to us, and with the rest we ran out of time while trying to schedule an interview. The conclusions of the interviews with the seven remaining stakeholders are described in the following sections.

Agência Curitiba. The Agência Curitiba aims to function as a catalyst for innovation for the city, in an attempt to turn Curitiba into a Smart City with the help of established and interested stakeholders in the city, and attract potential foreign investors to Curitiba (These stakeholders include both private and public corporations as well as the general public of the city). The mobility within the city is only one of the many areas that it aims to innovate, and within this sphere, it does provide and investigate varied perspectives from which to approach the current mobility system. Its main focus in this regard is the Mobility as a Service (MaaS) system, that it is working on together with IBQP. Another one if its mobility related aims is to integrate and improve the different means of transportation, to allow people to move around the city in a more efficient manner, as well as getting more people to use the public transportation system. The Agência also works closely with other government agencies such as URBS and IPPUC.

 Alongside its ambitious dreams, the Agência Curitiba also faces a lot of hurdles. One of its main challenges is presenting and convincing citizens to think about new and innovative ideas that can be incorporated into the citizens' daily lives. Another challenge is the future integration of the municipalities around Curitiba with the expanding city, which the Agência Curitiba is working on together with COMEC. The growing population and size of the city strains the systems that are already in place, meaning that the current mobility system of the city needs to be rethought. This rethinking includes the realignment of the different mindsets that the citizens have about mobility, which is already an enormous challenge, and getting more people to use the rapidly aging public transport system is also difficult. Convincing the people and the organizations in charge to change their current practices to match the vision that the Agência has for the city is no simple task, and the bureaucracy involved is cumbersome at best. New stakeholders entering the market for mobility, such as UBER and Cabify, need to be cooperated with to find an optimal solution, and any progress in those sectors will be difficult until some of the ongoing projects of the transport department are completed.

The main intervention that the Agência is aiming to use, with regards to its mobility challenges, is the MaaS system. Within this scheme, it would want to make sure to incorporate the ride-hailing services that have appeared in the city, and encourage more car sharing systems to join the city's mobility ecosystem. The Agência believes that a rewards system will be highly effective in helping the implementation of this system. The Agência Curitiba focuses its efforts on innovating the city, and the MaaS project is the main mobility related project that it is currently working on.

The Agência is aware of the return on the investment of focussing on the younger generations that reside in the city, and encouraging them to change their behaviours in ways that are better for the city's development. While this younger generation will eventually inherit the city, the older generations are also targeted by the Agência, in an attempt to create a large-scale change in the use of mobility systems.

COMEC (Coordenação da Região Metropolitana de Curitiba). COMEC's main infrastructure aim is about integration. In the mobility and transportation sector, COMEC ensures infrastructure and system integration between all 29 municipalities around Curitiba as well as within Curitiba. However, although positive about bicycle mobility, COMEC's stance on the implementation of cycling infrastructure is uncertain, as we received representative gave contrasting arguments. COMEC's current role in government processes is to carry out projects which are approved by the administration. Furthermore, various government secretaries enlist COMEC for infrastructure planning. COMEC makes the suggestions and the secretary, for example of construction, takes care of the budget. COMEC works to promote public transport usage further and works with URBS for various policies and subsidies currently in place regarding the transport system. For pricing of the public transport system, each year there is a review of the price for the ticket, which includes URBS and COMEC, however, it is predominantly URBS who decides the public transport fee for Curitiba. The COMEC representative we spoke to also divulged that there is a social law in Brazil, that says that the company has to pay 6% surplus of the salary of an employee for the use of transportation.

On a side note, the COMEC representative believes that it is against Brazilian culture to buy long term subscriptions to something and that is why there is no long term transport card offered by URBS and COMEC.

COMEC experiences many societal inhibiting factors regarding cycling in Brazil and Curitiba, mainly referring to the use of bicycles as a means of transport that does not seem suitable for the local culture. Besides climatic and topographic characteristics that deter citizens from cycling, some common routines among citizens also cannot be carried out on a bicycle. Cycling remains a leisure activity and a sport, rather than being respected as a complete means of transportation. COMEC also noticed issues related to security and personal safety while cycling.

Yet another inhibiting factor for COMEC relates to the fares for the public transportation. The present situation in Curitiba can be described as follows: It costs R$4.25 to get from one place to another using busses, anywhere in the system, but if you swap buses outside of an enclosed terminal, one has to pay again. To optimise the journey, one must know how to alter their route to their destination based on their wishes. One must weigh their preference of a shorter bus journey over a cheaper one,

or vice versa.

COMEC is building new terminals to aid transport integration, as well as other projects related to topics it works on, such as water and urban occupation. It is also building a new ring road around Curitiba, due to the growth of the city encompassing the previous one. Furthermore, it is working on the integration between downtown and the airport by making a transport axle. Finally, COMEC is still working on road and bridge construction projects that were planned for the Olympics in 2014, but got delayed.

One must keep in mind that transportation and mobility are only one out of nine sectors that COMEC deals with, and therefore, COMEC has a less focussed view on the situation.

Prefecture/City Hall. The representative of the Prefecture with whom the interview was done, is very active in the cycling community, and could be seen as being a cycling activist. Due to his stance towards cycling, his projects are focused on cyclists, which does not necessarily represent the projects undertaken by the Prefecture as a whole. This stakeholder believes that there is a misconception that a citizen is only connected to one means of transport. There should be an awareness that people should be able to use different means of transport based on the desired convenience. In the concept of sharing the road, cars, cyclists, and pedestrians should have policies directed towards them with equal importance, creating the possibility of multiple modalities using the same space on the road.

However, there should be a prioritisation by the Prefecture of collective transport over individual transport, and non-motorised transport over motorised transport. Education is important to achieve this collective responsibility, as many road users lack awareness of the rights and duties of cyclists. While the risk is much greater for cyclists than for car drivers when on the road, it should be everyone's responsibility to ensure that all road users are safe.

Throughout the city it can be seen that car drivers and cars have a priority over other road users such as cyclists and pedestrians. Car drivers are seen as citizens of a higher class, whereas others who do not have a car seem poor. The car one drives shows their societal status. Cars are also prioritised due to the car lobby which car manufacturers undertake with the government. Car manufacturers sponsor the government financially to ensure support for the car industry, in terms of infrastructure and policies, which ensures that the market for cars remains large in the city. Policies created by the administration often support car drivers over other means of transportation, this also relates to politicians and other influential members of the community being car drivers who do not want to give up their luxury.

The city also has low quality bicycle paths and sidewalks, and these are not always situated in parts of the city where it is necessary. Across the city some attempts have been made to improve cycling infrastructure, however, although the cycling routes connecting the city's parks are good and so are some of the main bicycle paths, many are non-existent or in very dangerous condition. Main transit routes still lack the bicycle paths needed, resulting in cyclists on BRT lanes which is very dangerous and decreases the efficiency of the system. Sidewalks are often not well maintained for pedestrians, however, to increase safety, a street light project is underway in a

small area of the city.

During this interview, it became clear that the mayor has a lot of influence in what happens in the city. As this mayor is elected every four years, this results in many policy changes due to differences in opinion from the previous to the current administration. If projects from the previous administration are ongoing during this change in administration, there is often uncertainty if these projects are allowed to continue. A consequence of this is that a lot of projects are left unfinished.

In conclusion, all the sustainable mobility discussion points are either politically or socially oriented. The Prefecture representative believes that the main inhibiting factor is bureaucracy, but also believes that there is a societal responsibility to consider the sustainability of Curitiba's transport more frequently, and aims to improve this with projects that promote cycling, such as improving infrastructure or increasing the safety of the cyclists by educating drivers.

IPPUC (Instituto de Planejamento e Pesquisa de Curitiba). According to IPPUC, projects should be set up in a social manner, which means that they should create benefits for the largest number of people possible. In its mobility plans for the city, IPPUC considers social, economic and environmental sustainability. However, it perceives social and economic sustainability as crucial, whereas environmental sustainability is optional. Furthermore, mobility projects should aim to decrease social problems, such as the differences between classes and flooding in certain seasons, even if they are not related to mobility. IPPUC also emphasizes that public transportation should be prioritised over any form of individual transportation, so cars, bicycles, motorcycles, etc. Curitiba needs to offer large-scale public transportation, but the city should facilitate any type of mobility. Therefore, there should also be infrastructure for walking and cycling.

IPPUC sees the difficulty in financing projects as a major barrier to sustainable mobility, both for the company itself and for the entire city. Arranging funding takes a lot time, which delays projects. Furthermore, most funding has to be arranged with international companies, because there are barely any local financial sources. This also means that the projects are bound to the wishes of external investors, which is another inhibiting factor, as external parties may not always be working towards the best interests of the city. Another inhibiting factor is that none of the stakeholders are legally accountable or responsible for executing the plans that they make. They might have a 50-year Master plan, but do not have an action plan for what should be done in the upcoming 20 years.

Additionally, IPPUC mentioned that projects from partners are often short-term instead of long-term. Lastly, IPPUC thinks that Curitiba's hilly landscape and climate is not suitable for just any type of transportation. For example, massive transportation is not possible in the North and the city is not optimal for cycling.

Currently, IPPUC's largest project is a proposal to transform the public transportation network, that is based around axes, to a network that is based around nets. This would create more connection points and allow citizens to travel to their destination more directly. These connection points should be linked to other means of transportation. In this project, IPPUC wants to promote locally offered services, so that

citizens' movements would be more concentrated and displacement would be reduced.

In conclusion, when creating projects, IPPUC mainly thinks in terms of social responsibility and long-term investments. It believes the future mobility system in Curitiba should be based around public transportation, which is what most of its projects relate to. IPPUC believes environmental sustainability is important, but does not seem to involve it in its projects explicitly. This might be due to the financial barrier. During the interview, it became clear that IPPUC has a lot of mobility partnerships, in which knowledge and facilities are shared. IPPUC values these collaborations, and therefore seems willing to work with other organizations in a possible intervention. Besides that, IPPUC is strictly limited to planning, so a partnership always has to involve a facilitator.

URBS (Urbanização de Curitiba). URBS is the organisation behind urban management and urbanisation in Curitiba: It allocates government funding to public transportation, road maintenance and commissions new infrastructure projects in the city. As URBS is a key player in the mobility sector of Curitiba, and the company is involved in many different projects, interviews were held with two of its divisions: the Bicycle Sharing division and the Architecture division.

URBS aims to make Curitiba's mobility system more environmentally and economically sustainable by encouraging the use of public transportation. Together with other stakeholders, URBS is responsible for making high-density land use work, by reserving exclusive lanes for public transport, increasing the speed and hence the efficacy of the bus fleet and reducing congestion.

URBS's Bicycle Sharing division believes that you can only work in the mobility industry if you create economically and socially sustainable systems. The price for these systems needs to be affordable for the citizens and be sufficient for the system's upkeep. Furthermore, any system should be comfortable for the citizens. The Bicycle Sharing division defines environmental sustainability as ensuring that the environment is taken care of. This division thinks that integrating different means of transportation is the eventual target. During this interview, URBS seemed very willing to cooperate with other companies, though they would also be relying on these partners for the funding of possible projects. The Bicycle Sharing division understands that, in order to create a sustainable mobility system, you have to think in the long term. However, it is presently working only on goals that are for the short term.

For URBS's Bicycle Sharing division, the main barrier in the implementation of environmentally sustainable mobility is the lack of monetary resources available for investment and the need to find willing collaborators to help finance the execution. Furthermore, because it is a public company, URBS is significantly affected by the instability of the government. Every time the government changes, the people in charge of the different projects change as well, and the ideas and vision about what needs to be done change with them. The bureaucratic problems accompanying this are the reason for URBS's current approach to planning, ie. maintaining the system is a priority compared to long term planning. Lastly, the current laws are outdated and now create barriers rather than facilitate change. Due to these laws, URBS takes longer than necessary to execute projects. With better laws, changing and creating new systems would go faster.

URBS's Architectural division aims to facilitate the construction of a public transport system in which various means of transport can be integrated. The Architectural division thinks that the work-related travel costs of people from lower-income households should be subsidized to encourage the use of public transport. Furthermore, it believes that citizens must consciously choose public transport over private vehicles. Based on this, the system can be further improved to serve the growing population. In creating this sustainable system, URBS experiences inhibiting factors such as a shortage of financial resources, the relatively higher price of sustainability-oriented technologies and a lack of knowledge among the technical staff about these technologies. URBS Architectural division also explained that as URBS is a part of the government, its structure is overhauled every time there is a government shift. In spite of these hurdles, major investments in new technologies, that facilitate telemation of the system, have recently been deployed. Generally, these developments are well-received by the population.

Volvo Group. Volvo's chief aim is to renovate Curitiba's transport system in such a way as to adopt a new mode of transport that is focused on the functionality and comfort of the service provided, i.e., the service must satisfy the needs of all layers of the population. Its endeavours are mostly centred around finding creative ways to bypass the hurdles Brazil's current political system poses in renovating Curitiba's public transportation system. Volvo is a commerce-oriented company, that designs solutions for the city that could potentially be executed in its envisioned CiVi project. The demands of the citizens, the ultimate users of its products, are the main driving force behind its choices, and government's demands are a part of the implementation process, but not so much of the design process. Volvo has many aspirations for future transportation solutions — e.g., telematic opportunities. It believes that money should be invested adequately, wherein the focus must be on massive public transportation. Ultimately, public transportation must become more accessible to the lower classes.

On the other hand, Volvo believes that innovation is being impeded by several cultural and politico-economic inhibiting factors, such as misconceptions regarding alternative systems and multimodality. The representative of Volvo mentioned that in Latin America, travelling by car is akin to showing that you are wealthy. If one does not have much money, their only option is to use the bus. The problem here is that the wealthier a city becomes, the more cars there are on the roads. Car infrastructure has been long prioritised over collective transportation in the city, and this tendency affects city policies because the administration is strongly influenced by the preferences of car owners. Volvo believes that if there is a lack of road space for both car and bus lanes, the buses should be given the street, as they are a form of massive public transport. Volvo also said that Latin American cities are much more densely populated than in Europe, and hence other mass transport solutions are required. European or American solutions might not always be the best solutions for the situation in Latin America. Volvo believes that university teachers teach the population about the great solutions in Europe, rather than the realistic solutions for Latin America. Some companies even take on academics as consultants to help them sell their European product in Latin America, fuelling these misconceptions.

According to Volvo, there is a lack of investment because public administration takes up the majority of tax funds. Bus fares are increasing because the average velocity of the city's infrastructure is going down due to the age of the system. The decreasing reliability and increasing fares result in low usage rates. Because of these high maintenance costs and low usage rates, cities do not have enough money to subsidise maintenance and renovations. Conversely, solutions such as ride hailing or car sharing are temporary and do not address the root issue, these types of solutions only invite people to leave public transport.

Instead, citizens and administrations must be educated on the advantages of public transport or at least collaborative transport. Mass transport such as the BRT is more environmentally friendly, and takes up less road space as compared to other means of transportation with equivalent capacities. Volvo thinks that, as the public transportation system often stops several blocks away from workers' final destinations, cycling would be a good option for the beginning or the end segments of your journey, to facilitate connections between work, home, and public transport routes. However, the restrictions of the network generally result in the public choosing the car as their main mode of transport rather than resorting to a bicycle for the last mile.

In terms of interventions, Volvo believes that the ideal system must be managed through telematics. The new project would provide real-time information, through telematics systems, regarding arrival and departure times of buses, making the system reliable for those on a tight schedule. Besides that, moving more buses onto exclusive lanes would help increase the average velocity of the buses and improve punctuality. Volvo has pitched a project, called CiVi, to the new administration which requires additional funds to be put in place. CiVi aims to incorporate the telematic system into the buses e.g. by adding WiFi functionality. This service would aid in trying to increase usage from the wealthier members of the population. CiVi includes constructing underground bus lanes in places where traffic lights are frequent and buses cannot be granted priority, hence ensuring that the punctuality can be maintained. Current projects focusing on telematics are working to improve the overall functionality of the system such that it may be adopted by more users, possibly also reaching out to higher classes.

CicloIguaçu. The themes that reoccured in the interview with CicloIguaçu were the great focus that CicloIguaçu put on the cultural and economic aspects of sustainable mobility; its societal and infrastructural aspirations for mobility; the lack of infrastructure encompassing multimodality in the current system and the great disparity between the government and citizens. It became clear that CicloIguaçu aims to not only increase the number of cyclists actively commuting by bicycle in Curitiba, but also congregate different means of transport in the city; diminish the disparity between the government and citizens; improve the safety of cyclists on the roads; increase and improve the cycling infrastructure; educate citizens to repair and provide service for bicycle-holders and educate children about cycling. All above-mentioned aspects are united principally on the basis of CicloIguaçu's ideologies: Chiefly, these associations aim to unite people with similar mindsets to create a more sustainable future for Brazil's mobility. Through its various educational

programmes, CicloIguaçu endeavours to achieve this. On the one hand, the citizens must learn to understand the language used by government representatives; on the other hand, government agencies must adapt their efforts to envision what the citizens require, rather than what decades of conventional political and cultural tradition dictates. Besides this, its ideology differs substantially from the mainstream, as it is focused on new ways of thinking to improve the lives of people.

In trying to realise these aims, the main inhibiting factors CicloIguaçu experiences are insufficient funds to subsidise renovation of urban infrastructure; the infrastructural development being automobile-oriented due to the car industry and people using different, separate vocabularies.

As possible interventions, CicloIguaçu suggested that interested parties can be invited to discuss the topic of raising economic revenue and permaculture projects can be used to improve urban thinking.

Citizens Survey

After all the information found in the qualitative surveys and interviews was synthesised, the following observations were made: Firstly, most working-class citizens prefer to commute by car over public transport. Due to the rising cost of public transport, many families opt to commute by car, because it is often more affordable than multiple bus tickets. Anecdotal evidence also suggests that bus journeys take longer because of bus saturation and lowered velocities to accommodate on-board safety. More concretely, due to Brazil's car-oriented society, proper alternative infrastructure has not yet been implemented. The car is not only more time-efficient, in many cases, it is also the only option considered by many working- and middle-class citizens. Additionally, car-sharing and ride hailing technologies such as Uber and Cabify are being used increasingly frequently. Students, although having this same preference for cars, are often forced to travel by bus due to monetary constraints. When asked about cycling, it became clear that bicycles are generally considered to be a means of transportation used only for leisure purposes. Furthermore, citizens do not feel comfortable using the bicycle, because of safety- and security-related concerns, including muggings and road injuries. Only the "fanatics", as one of the interviewees called them, use bicycles to commute.

Secondly, most citizens have a fairly thorough understanding of the implications of sustainable mobility. Most interviewees specified sustainable mobility to be means of transportation that do not inflict significant harm on the environment. However, due to the distance the lived from their place of work or study, they often cannot travel using public transport because of time constraints. Also, for the ones who live closer to their work, they often fail to consider the sustainability of their journey due to force of habit.

Thirdly, when asked what various means of sustainable mobility the citizens had used, the majority of our sample indicated they had ridden bicycles before, and some of them had been transported using one of the City Hall's Hibribus. Most citizens indicated that they had tried using a bicycle multiple times, but eventually gave up on the endeavour because of the city's uneven landscape and the car-oriented infrastructure, which magnifies the risks of cycling. The use of another sustainable means of transportation, the electric car, is not supported by the city, as there are only two charging stations in the whole of Curitiba. One charging station is at the Jardim Botânico, and the other in the Prefecture's private car park.

Fourthly, when posed the question how sustainable mobility could be more effective, many participants indicated that a lack of opportunity is the main deterrent. Most alternative means of transportation that would maintain their personal preferences, such as electric cars, are simply unavailable. Most participants suggested that the government should work on providing education and institute campaigns to help change the culture to adopt a more collective approach to urban transportation. Furthermore, the infrastructure should be improved; many citizens indicated more lighting was necessary to encompass safer streets at night, and a more well-maintained infrastructure [for bicycles] would also help to render this option more attractive.

In conclusion, citizens mostly use the car because of economic considerations, including the excessively pricey cost of using public transport for a whole family. Other more convenient and not much more expensive alternatives, such as Uber and Cabify are also increasingly used. The citizens ask to promote using public transport, for instance by making it cheaper than it currently is.

Empirical Data

The empirical data that was collected can be found in Appendix 11. Based on our data, we have drawn the following conclusions: There are significant differences between taking a bus, taking a taxi, taking an Uber and cycling, in terms of costs, comfort, safety and efficiency. Cycling is the cheapest option, but it is also the most labour-intensive and feels less safe than the other means of transportation. Taking a bus is relatively cheap if long distances are travelled, but is relatively expensive for short distances. The buses are quite comfortable, except during the rush hours when the buses are very full and you will most likely have to stand. Furthermore, the buses are unreliable in when they will arrive. Taking a taxi is very comfortable and reliable, but it is also the most expensive option by far. The taxi business is being threatened by Uber: Uber provides a degree of comfort and reliability that comes very close to what taxis offer, for a price that, when sharing the ride, can be lower than that of taking a bus.

Mapping Stakeholders

The process of mapping stakeholders resulted in the two tables and visualisations displayed below. The first table shows common aims as discovered during the interviews. Each aim is explained and it is shown which stakeholders have this aim. The common aims are visualised in the circular graph below the tables. The second table and second graph show the same information, but for the inhibiting factors as experienced by the stakeholders.

Table 1. Aims of the stakeholders

	Expanding, modernizing and promoting the public transportation system	Improving cycling and pedestrian infrastructure, promoting cycling and walking	Integrating different means of transportation and different mobility regions	Reducing population displacement	Improving commuting safety, through e.g. education	Reducing number of cars, discouraging car usage
Volvo	X					
URBS	X	X				
IPPUC	X	X	X	X		
Councilman/ bicycle activist		X	X		X	
COMEC			X			
CicloIguaçu		X	X		X	
Agência Curitiba	X		X			
Citizens	X	X	X			X

Table 2. Inhibiting factors experienced by the stakeholders

	There is a lack of money to invest in sustainable mobility/investing in sustainable mobility it too expensive	The political and/or social climate is not supportive of sustainable means of transportation (e.g. public transportation, cycling)	There is a lack of security on sustainable means of transportation (public transportation, cycling, walking)	There is a lack of knowledge about sustainable means of transportation (how to interact with them, why to use them)	Sustainable mobility projects are not planned/executed properly (e.g. short-term instead of long-term, legislation issues, bureaucracy)	The city's topography and climate is not suitable for all types of transportation (e.g. cycling)
Volvo		X		X		X
URBS	X			X	X	
IPPUC	X	X			X	X
Councilman/ bicycle activist		X	X	X	X	
COMEC		X	X		X	X
CicloIguaçu	X	X	X	X		
Agência Curitiba		X			X	
Citizens	X	X	X	X		X

In the circular graphs, each goal and each inhibiting factor has its own circle. If a stakeholder has mentioned a certain goal or inhibiting factor in its interview, its circle segment is coloured. So, for example, URBS aims to expand, modernize and promote the public transportation system and improve cycling and pedestrian infrastructure.
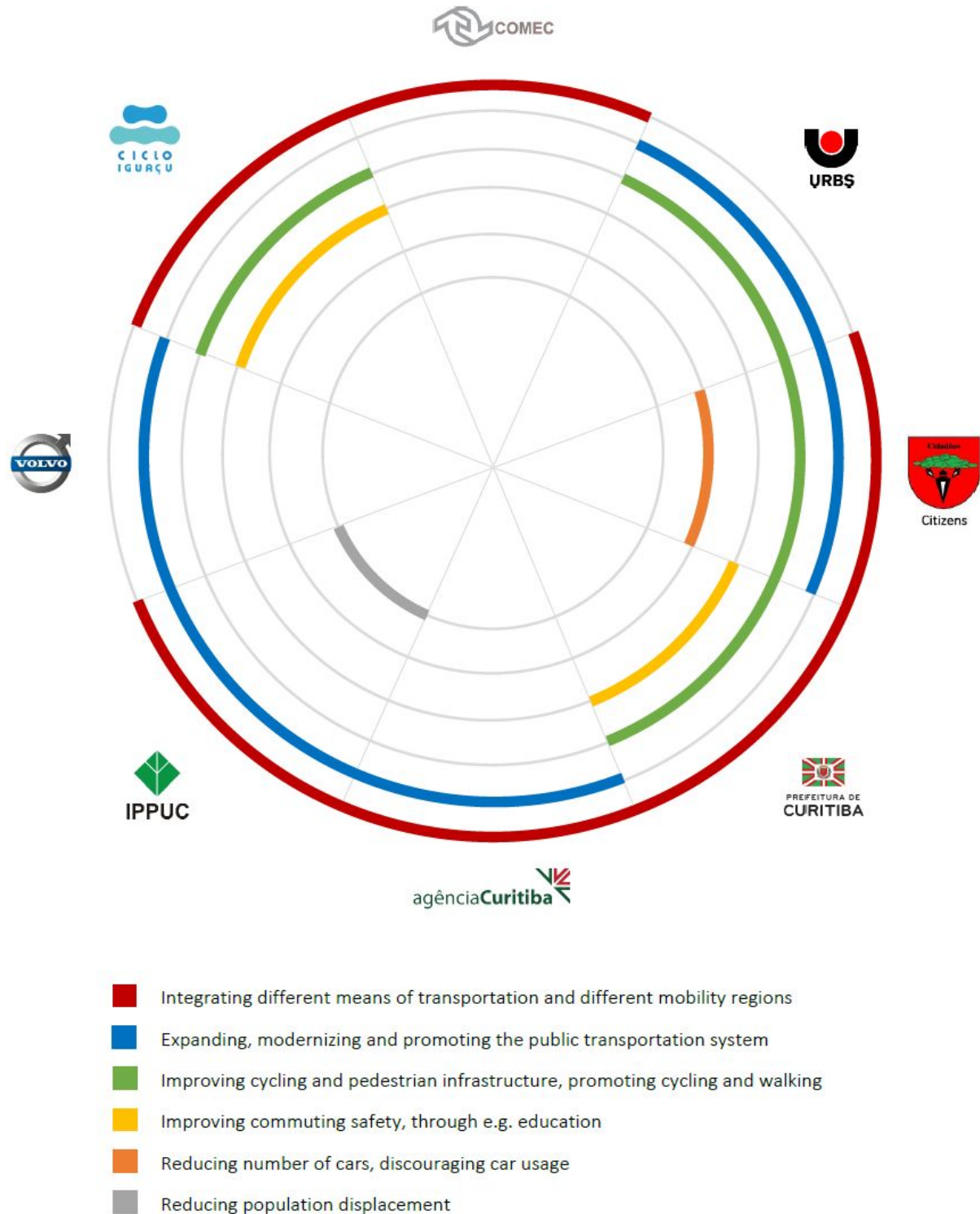

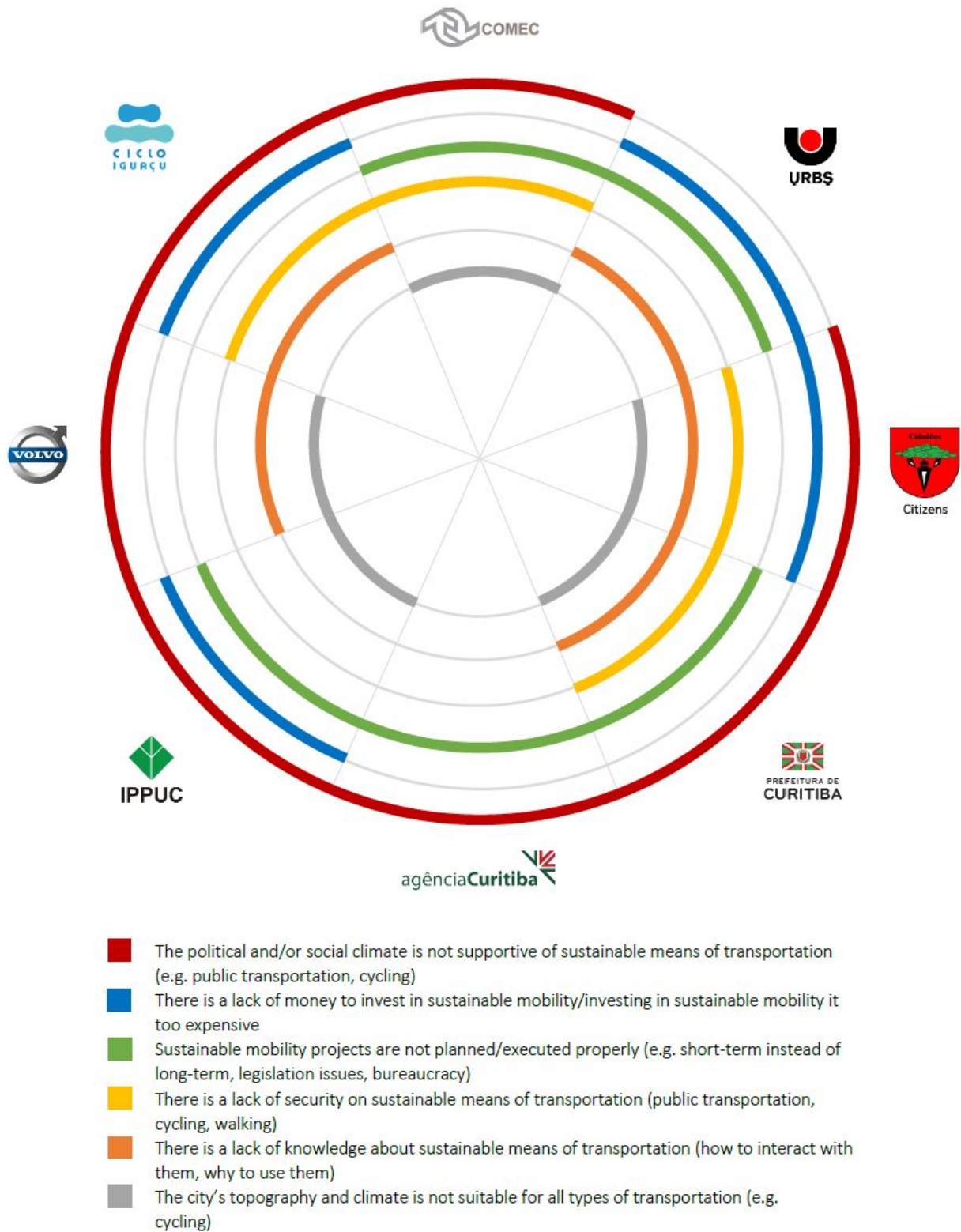Figure 1. Visualisation of the aims of the stakeholders

Figure 2. Visualisation of the inhibiting factors experienced by the stakeholders

Interventions

After the process of mapping stakeholders, interventions that would encompass the stakeholders' aims and anticipate the inhibiting factors were envisioned by the researchers. The first intervention is related to telematics: A large issue with the current bus system concerns its reliability. Citizens who need to be somewhere at a set time cannot reliably plan their schedule around the bus system. They would either need to plan a large safety margin when taking the bus or use a different means of transport. A telematics system would connect all bus stops with the buses, to give passengers accurate information about when the next bus will arrive. It would also rely on bus drivers being given set schedules that they have to stick to, and the telematics would let passengers know if this is no longer the case. This ensures that passengers can stay informed and rely on the bus system, hopefully resulting in more people choosing to travel by bus.

The researchers also envisioned a complex intervention regarding the current payment system of the buses. URBS already provides subsidies for its employees to alleviate the economic burden public transportation imposed on citizens in the lower income scales. For citizens with incomes of up to three times the legal minimum wage in Brazil, half the transportation fees to and from their workplaces should be subsidized. However, government subsidies are difficult to control, therefore, the researchers focused on more manageable interventions. To increase the number of passengers on the buses, including increasing passenger loyalty and convenience, a subscription concept could be implemented. These subscriptions would lower the price for some passengers buying the packages offered, but overall the use and therefore income of the bus system would increase. These subscriptions would be purchased online and loaded onto the passengers' travel cards. There would be many packages to choose from. To increase the comfort of using the bus, one package could offer WiFi for the journey. As currently traveling in a group is less expensive if you take an Uber than if you take a bus, to compete with the Uber market, a family-friends package could be offered for those travelling in a group. To solve the issue of changing buses during the journey and having to pay again, a package that lets your ticket last for various durations would be available for those regularly changing buses. Finally, to target the regular passengers who are unhappy with the expensive fares, there would be full- or multi-day, week, month, and year packages to encourage long-term loyalty at a discount. Another intervention would be a loyalty card, where, for every ten or twenty bus rides, the passenger is entitled to one free ride. To further lower prices, more advertisements could be added to the buses' interior and exterior. However, the researchers are unsure whether there is national or city legislation against this.

The researchers also saw opportunities for implementing a park and ride system next to the inner city bus terminals. This would be a good intervention to reduce the number of cars in the city centre, however, it is necessary to offer some reward to ensure it is used. The researchers considered making the parking free and provide points that can add up to getting a voucher for a partner shop or service, or getting a free bus ticket. However, the researchers would leave it up to the Prefecture to choose what reward they wish to provide.

There were further discussions about interventions that discourage car usage. These interventions included congestion charges and increased parking fares. In many other large cities, congestion charges are put in place to have less cars in the city centre, and there are many different policy strategies that have been implemented worldwide. These include measures such as zonal and duration-based charging policies. Increasing parking fares in the city centre of Curitiba would increase the Prefecture's income, while discouraging car usage in the city centre. Another intervention is a larger plan of pedestrianising more of the city centre. This, as well as congestion charges, would also make the city centre safer and more secure for citizens. The lack of cars would not affect the commerce as was shown in Curitiba in 1972, when R. XV de Novembro was pedestrianised and footfall of the businesses increased ("Streetfilms | Jaime Lerner on Making Curitiba's First Pedestrian Street", 2009). This pedestrianised area could be used not only by pedestrians, but also by buses, bicycles and property owners, to ensure continued ease of access. The government could also choose to allow all traffic but then reduce the speed limits drastically, and the surrounding area could also accommodate for an expansion of the Vias Calmas. For Curitiba, it may also be interesting to further connect squares in the city centre with pedestrianised streets. The implementation of pedestrianised areas would also improve safety for cyclists, and so bicycle lanes and bicycle parking should also be implemented in these areas. Finally, as a promotional campaign, to discourage citizens from buying cars, the researchers feel that it is important to bring some clarity to how expensive it is to buy, own, and maintain a car. This could be in the form of financial comparators such as the total amount saved per year by taking the bus or cycling, or more attractive comparisons like the number of holidays they could take out of the country.

Regarding politics, the researchers explored interventions that were feasible within the current political framework of Curitiba and Brazil. One issue with the administration changing every four years, is the completion of various projects. One administration may start a project, investing a substantial amount of government funds in its planning and in beginning its implementation. However, when the next administration takes over, a process commonly known as *Gestão*, the project might be dropped, resulting in a waste of funds. The researchers suggest to implement new legislation that ensures that — if any given project has had, for example, over R$5 million of already invested funding — subsequent administrations must complete or continue the project. An intervention to reward the use of sustainable vehicles would also be an interesting consideration for the Prefecture. For instance, this could be present in the form of subsidies for sustainable vehicle use or ownership.

Another means to achieving the goals of some stakeholders is by involving citizens more actively in the political process. A more passive, but still increased, form of involvement would be with citizen surveys and constant citizen feedback. The issue of the lack of communication between IPPUC and URBS could be tackled with citizen participation in the mobility planning of the city. As IPPUC creates 50-year mobility plans and URBS does not know what to try and implement when, a citizen jury, who gets to vote on various implementation schedules of the 50-year plan could be very helpful. This would also ensure that citizens have a voice in the implementation schedule but not entirely in what projects are implemented. Another issue the

researchers discovered was that, due to rules and protocols within the government, projects take a long time to pass from ideation to implementation. To circumvent this issue, the researchers believe that citizens should play a more active role. As start-ups may disrupt or disregard government legislation, which impedes certain government maneuverability , an intervention should be implemented to guide citizen initiatives and start-ups to provide benefits for the city, and have the government supporting them rather than fighting them. The organisation Agência Curitiba could play an interesting role in this intervention as an intermediary between government legislation and citizen innovation. Agência Curitiba could also determine what projects cannot progress within the government system, and suggest them as projects for citizens or other organisations to carry out instead. There would also be a possibility of giving these projects to university students to research. Regarding current implementation projects from the government or proposed projects such as CiVi, the researchers suggest incremental implementation to reduce the need for large initial investments of money and time by the government. For example if the proposed telematics system for CiVi was implemented on the current bus system, that would already increase reliability of the system. Similarly, if the government completed more pilot programmes, such as for the bicycle sharing system, that might reduce the risk of wasted funds if the system is not successful.

 The use of educational interventions was also explored by the researchers. Primarily, having cycling lessons as part of all children's education would not only be a fundamental skill to learn for many, but would also teach them about road safety practices. The schools could also ask for help from Escola Bike Anjo to provide these lessons. Secondly, like in some European countries, these lessons could finish with a cycling exam, which would have children doing a small cycling circuit in a quiet neighbourhood while being constantly supervised. This process of allowing children to cycle in public would also act as an effective promotion for safe cycling within the city and make car drivers more vigilant when they see cyclists, as the cyclists might be children. Furthermore, a lot of rush hour traffic is made up of parents driving their children to school. This could be improved by initiatives that encourage children to walk or cycle to school if they live close enough. Some examples of initiatives for schools and the Prefecture to consider are walking school buses in the United Kingdom (Smith et al., 2015), and teenagers walking younger children to school in Japan (Hendry, 1987).

Stakeholder brainstorm session

 The complete result of the stakeholder brainstorm session can be found in Appendix 12. The main goal of this session was to find interventions that could potentially be implemented by the stakeholders that were present. During the session, the stakeholders proposed to incentivise citizens to partake in governance decisions. This could be done by asking citizens to provide feedback in the form of thumbs up or down on an app. Furthermore, to encourage the use of the BRT, the stakeholders wish to tackle the difficulties of switching buses. This includes linking bus timetables to ensure that your connecting bus leaves shortly after you arrive at a terminal. Lastly, the stakeholders believe that the citizens should be introduced to sustainable means of

urban transportation from a young age. Overall, future mobility plans must have three central goals. They should aim to (1) increase civil engagement, (2) increase the convenience, comfort and affordability of the BRT system, and (3) implement educational activities directed at sustainable mobility. Achieving these three aims should bring together education, collaboration and integration of means of transport.

Conclusion

In the field of sustainable mobility in Curitiba, the Prefecture, URBS, COMEC, IPPUC, Volvo, Renault, Radio Táxi Curitiba, Bike Fácil, Agência Curitiba, CEiiA, CicloIguaçu, Guarda Municipal and the citizens seem to be the main players. The stakeholders involved in this research aim to create sustainable mobility, through expanding, modernizing and promoting the public transportation system; integrating different means of transportation and different mobility regions; improving cycling and pedestrian infrastructure and promoting cycling and walking; and improving the commuting safety on sustainable means of transportation. The main inhibiting factors that these stakeholders experience are a lack of money; a restrictive political and/or social climate; the lack of security on sustainable means of transportation; the poor planning and execution of sustainable mobility projects; and the city's difficult topography and climate for cycling.

To decrease these inhibiting factors and help the stakeholders realise their aims, several interventions were suggested. These suggested interventions were mentioned during the stakeholder brainstorm sessions, which resulted in the conclusion that future mobility plans, as defined by these brainstorms, must have three central goals. They should aim for an increment in (1) civil engagement, (2) convenience, comfort and affordability of the BRT system, and (3) the safety of cyclists. Ultimately, achieving these three main aims should integrate education, collaboration and integration of means of transport.

Discussion

This research has some severe limitations, but we believe the conclusions are valid nonetheless. Firstly, not all stakeholders, that were deemed relevant in Curitiba's sustainable mobility sector, were interviewed. All of the thirteen stakeholders were contacted, but we were unable to arrange interviews with seven of them. Therefore, this research does not present a full overview of all the stakeholders, their goals and inhibiting factors. Furthermore, each organisation was only represented by one representative. This representative might not always have been able to give a complete outline of their organisation's point of view. The data would have been more complete if multiple representatives had been interviewed. With regards to the citizen surveys, only a very small group of citizens was reached, partly due to the language barrier, and this group consisted mainly of students and professors. As this group is not representative for the complete population of Curitiba, the found aims and inhibiting factors for the citizens are most likely distorted. Regarding the empirical data collection, due to time and financial constraints, only a few rides could be taken with each vehicle. Hence, the conclusions can be incomplete or even incorrect. However, as only a global overview of the different means of transportation was needed, this is not seen as a significant limitation to the research.

The stakeholder meeting went largely according to plan. However, during the introductory stages of the presentation, a lot of Portuguese had to be translated. These translations took up significantly more time than expected, therefore, we removed the second brainstorm phase from the meeting's schedule. The groups were made fairly and collaboration was productive. Participants seemed to encourage each other to take each other's input and take it a step further. Sometimes it was difficult for participants to grant each other the stage and let others speak, but this did not seem to be a significant impedance in the overall creative process.

As this research was limited in scale, we suggest performing a more elaborate research into the stakeholder's aims and inhibiting factors, especially regarding the citizens. A more quantitative survey could provide valuable information as to what the citizens need from their City's mobility system. Furthermore, we suggest performing a feasibility study regarding the interventions that were found in this research. The interventions that are deemed feasible can be tested in a pilot study. As most stakeholders agree that different means of transportation and different regions should be integrated, it would also be interesting to further explore the possibilities for integrated mobility in Curitiba.

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Appendices

Appendix 1: DesignLab thinking
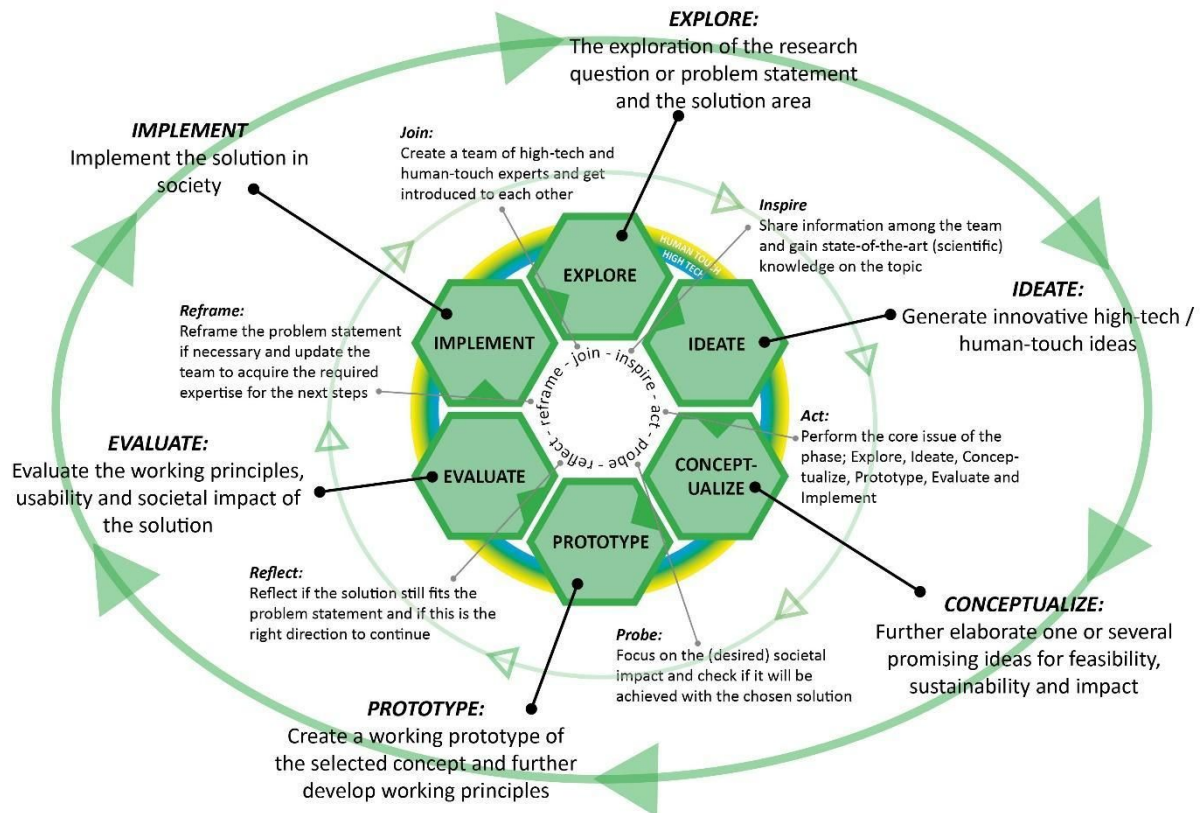
The Science2Design4Society approach

The Science2Design4Society (S2D4S) approach is the design and research approach developed by and used in the DesignLab of the University of Twente. The spaces of the DesignLab are directly linked to the phases of the approach. In the core, the DesignLab is a physical place in which the designing character of the University of Twente is shown explicitly. Design forms, together with working in multidisciplinary teams and focus on relationships between technology and society, the basis for the DesignLab and the S2D4S approach. This makes the DesignLab is a platform for multidisciplinary collaboration, innovation and creativity, for which 'design research' is taught, studied and practiced based on a clearly distinctive profile: Science2Design4Society. Key-values of the S2D4S approach

Multidisciplinary: The teams working with the S2D4S approach consist of participants with a high tech/technology/things-oriented background and human touch/human/behavior-oriented background. For the problems that are addressed with the S2D4S approach, both viewpoints are required to come to promising solutions.

Empowering: the DesignLab does not solve the problem, but offers the problem owner an approach, connections to university staff and a place to work on the problem. The DesignLab facilitates the process and moderates specific workshops to enable the problem owner and the project team to come up with innovative solutions with high impact on society.

Iterative: The S2D4S approach follows an iterative approach. This is visible as the steps in each phase are the same steps, even though they are customised for each phase. Moreover, the approach also leaves room to return to a previous phase or go through a phase again when the results of the phase are not as sufficient.

Reflective: In the S2D4S approach there is a continue focus on the problem that you want to solve and reflection on whether you are still solving the right problem. Also, there is time to reflect on the team and the expertise needed to solve the problem.

Reframing: In the end of each phase, when newly obtained insight show that the previously set problem definition is incorrect or partly incorrect, there is room to reframe the problem statement. This is not to change the project, but to focus the project in the right direction. By keeping an open and reflective focus, the S2D4S approach will solve real issues and as a result will truly have an impact on society.

Tangible: Important for the S2D4S approach is to create 3D models of first ideas, concepts and detailed solutions to communicate the ideas participants have in mind. Because the aim is to have a multidisciplinary team collaborating, this might lead to miscommunication as all experts use their own language or jargon. By creating tangible representations of the ideas or concepts, the team can talk about and point towards something, which allows the team to talk about one and the same thing.

Explanation of the 6 phases:

Explore. At the start of a development process, it is important to verify if the problem statement and solution area are the ones that should be focused on. Therefore, the explore-phase starts with defining the solution area and as a result reframing the problem statement if needed. Important in this phase is to explore the desirable impact of possible solutions on society to create an understanding of the current situation and areas that might be improved with a high tech-human touch solution. The explore-phase can be run as workshop. Outcome of the explore-phase is a clear problem statement and definition of the solution area to aim for.

Ideate. To come to effective and innovative ideas, it is useful to start with generating a lot of ideas to choose from (e.g., ideate). In the ideate-phase the focus is on specific high-tech/human-touch solutions that fit in the solution area and will solve the problem statement as determined in the explore-phase. In this phase experts/specialists from relevant expertise fields join to inspire, create and steer to solutions. Specifically through the mix of disciplines/expertise in the team surprising and unexpected outcomes will be generated. The ideate-phase can be run as workshop. Outcome of the ideate-phases are several innovative and high-tech/human-touch solutions.

Conceptualise. During the conceptualise-phase, a few selected promising and innovative ideas created during the ideate-phase are elaborated further. During this phase, the ideas are explored and further elaborated non-feasibility to be able to

deliver a feasible and realistic product, service or system in the end of the S2D4S approach. To elaborate on the ideas, research and design actions are needed as well in the high-tech as in the human-touch part of the project. By exploring more options, adaptations, modifications etc. the idea will crystallise into a final idea that will be tested more extensively. Outcomes of the conceptualise-phase are one or several further elaborated innovative ideas that are feasible to go on with.

Prototype. In the prototype-phase one or more simple, quick and dirty prototypes are created. These prototypes are to find out and create insights in specific aspects, technical and behavioral, of the product, service or system. Finally, one final prototype will be created that shows the general working principles, interaction flow and appearance. In each iteration in this phase the prototype becomes more "real". Outcome of the prototype-phase is a (working) prototype that is elaborated enough to do several evaluations in real society.

Evaluate. The previous phases of the S2D4S approach led to a concept and prototype of a final product, service or system. However, still should be evaluated whether the product indeed will function as anticipated.Therefore, the use of the product, or technical aspects will be tested in the evaluate-phase. Important in this phase is to check whether these results meet the desired impact on society. So, the team should look back and reflect to the desired impact they composed during explore-phase and the ideate-phase. Outcomes of the evaluate-phase are insights in the use of the solution and the actual impact the solution will have on society. Implement A product, service or system is developed and based on information gained in the evaluate-phase lead to the desired societal impact. Then it is time to roll out the production and implement the product, service or system on society. Important in this phase is to be reflective on what happens and understand where adjustments might be needed to be able to come with the best solution possible. Outcome of this phase is a solution to a societal issue that is implemented in society.

Explanation of the 6 steps

Join. The team comes together. As the team might change over time in the different phases, it is important to get to know each other. Especially when phases are performed as workshops, the join-step is the right moment to start with a warming-up and ice-breaker.

Inspire. In the inspire-step, experts of the team inspire each other with their state-of-the-art knowledge to inform the development of the solution. Also, experts can be invited to inspire. Even though the inspire step is placed as second step, inspirations comes and information is shared through the entire phase. For the flow of workshops, the steps inspire and join (warming-up) might be switched.

Act. The core step of the phase. Explore, Ideate, Conceptualise, Prototype, Evaluate and Implement. For each of these steps are specific methods to perform, customised to the wished and requirements of the project.

Probe. The impact of the solution is evaluated. Where in the first phases the focus is on desired impact, in later phases the actual impact on society is evaluated via various methods.

Reflect. In each phase the team should take the time to reflect if the problem they are working on still is the right problem. As a lot of new knowledge about the

problem and possible solutions is collected and shared, the team should decide if they follow the right path.

Reframe. Before going to the first step of the next phase, the team reframes the problem statement, if necessary, based on the results of the reflect-step. By reframing the problem statement or research question, also a reframe of the team might be necessary to make sure the right experts join the team

Appendix 2: Gantt-chart of time frames and stages of the study
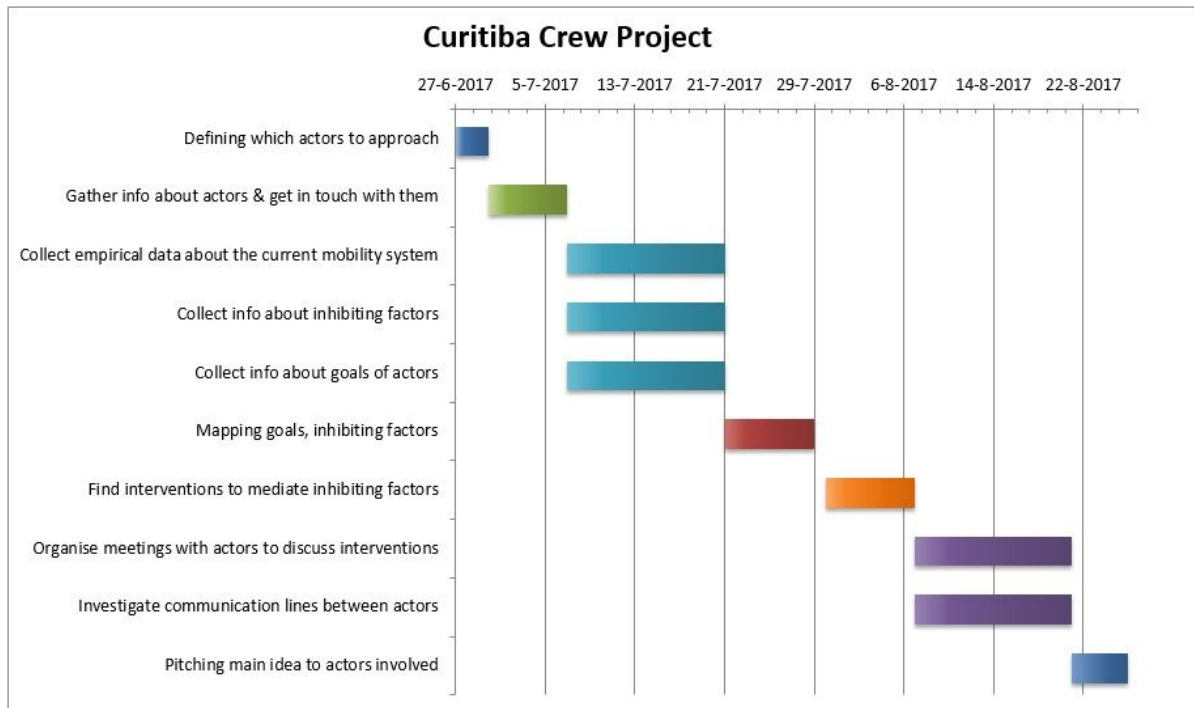
Appendix 3: Information collection protocol

Information Collection Protocol

In the first phase, digital data collection will be important. Therefore, a data collection protocol was formed. Every read document should be listed for future reference. This listing should include who published the document, which date the document was accessed and who the author(s) is/are. In another document, it should be stated if the found data provides valuable information, and what that information was.

Generally, we aim to answer these questions with this data collection:
1. How active is the stakeholder in the field of sustainable mobility?
2. What is its role in the City of Curitiba?
3. How is this role important, related to sustainable mobility?

To finalise the list of stakeholders we will approach first, a simple report of the findings should provide an overview of the collected data, which then will be discussed with Agência Curitiba for affirmation.

Appendix 4: Interview protocol

Interview Protocol

As the aim of the second phase interviews is to collect information about the stakeholder's attitude is towards sustainable mobility (what they want), and why the stakeholder might not be achieving their goals, we will use a semi-structured interview method. This means that unplanned follow-up questions can occur to get more in-depth information about the stakeholders' opinions and aims. The interview will be a one-on-one interview with one additional researcher to take notes without actively participating in the interview. The collected data will have the form of digital notes made by the observer or recordings if the stakeholder agrees with this. The following list of questions are to be posed during the interview, in this order:

1. How would you define for your organisation or company sustainable mobility?
a. Follow-up specifically ask about environmental, economic, and societal sustainability related to mobility.
2. How would you describe the company's or organisation's attitude towards sustainable mobility?
3. To what extent has your company or organisation implemented policies that addresses sustainable mobility?
a. Follow up: what challenges did you encounter by implementing policy that addresses sustainable mobility?
2. To what extent is your company or organisation involved in the organisation or implementation of projects related to sustainable mobility within Curitiba?
a. What are the inhibiting factors for these projects?
2. Has your company or organisation ever collaborated with other companies or organisations to establish sustainable mobility?
3. What initiatives does your company or organisation undertake to promote sustainable mobility among employees? E.g., provided information to employees about sustainable mobility or company practices such as a 'Bike to work day' or car-sharing.
4. What do you think are the inhibiting factors limiting sustainable mobility in Curitiba?
5. Introduction to Mobility as a Service: Mobility as a Service approaches mobility from a service perspective. It is an ongoing project between IBQP (Instituto Brasileiro da Qualidade e Produtividade) and CBlume consultancy that aims to integrate various means of transport into one system. This system should provide a complete mobility service for the citizens of Curitiba. One system where different means of transport are compared on criteria such as costs and time, but also environmental criteria will be considered. In this system sustainable mobility choices can be incentivised by awarding sustainable mobility choices with for example discounts on cultural events.
a. Question: Would you be willing to implement such a system?
i. If no, What would need to change?
ii. If yes, Why do you think this system could work?
iii. In your opinion, what kind of issues related to mobility would such a service resolve?

The collected data from these interviews will be analysed. This means making a summary report of the collected responses.

Appendix 5: Data analysis protocol

Data Analysis Protocol

A fundamental aspect of qualitative research is the approach used to analyse data. We will follow a constant comparison approach as developed in the grounded theory and the stages devised by Wester (1995). This approach consists of:

1. Exploration: discovery of concepts;
2. Specification: development of concepts;
3. Reduction: determining the core concept;
4. Integration: developing the final theory.

These steps translate into the following approach. As our data will consist of interview notes, empirical data notes and qualitative surveys notes, we will first need to prepare the data. Therefore, we will use the spiral of analysis described by Boeije (2014). This spiral uses coding, which means segment the data, categorise the interview/survey data into the different themes. This process of coding is described by Lewins and Silver (2007: 81) as "Qualitative coding is the process by which segments of data are identified as relating to, or being an example of, a more general idea, instance, theme or category. Segments of data from across the whole dataset are placed together in order to be retrieved together at a later stage.". The spiral described by Boeije (2014) consist of three steps, which start after having a complete raw data set up till a certain point in the research. These three main steps are represented by the following descriptions:

1. Open coding:
   a. "Breaking down, examining, comparing, conceptualizing and categorizing data" (Strauss & Corbin, 2007: 61). All data is read carefully and divided into fragments. These fragments are compared, grouped into categories (themes) dealing with the same subject and labeled with a code.
   b. Look at Appendix 6 for example of descriptive codes for observational notes.
   c. Open coding consist of the following steps:
      i. Read the whole document;
      ii. Re-read the text line by line and determine the beginning and end of a fragment;
      iii. Determine why this fragment is meaningful;
      iv. Judge whether the fragment is relevant to the research;
      v. Make up an appropriate label for the fragment;
      vi. Assign this code to text fragment;
      vii. Read the document and code all relevant fragments;
      viii. Compare the different fragments as similar fragments should get the same code.
2. Axial coding:
   a. "Axial coding relates categories to subcategories, specifies the properties and dimensions of a category, and reassembles the data you have fractured during initial coding to give coherence to the emerging analysis" (Charmaz, 2006: 60).
   b. Axial coding consist of the following steps:
      i. Determine whether the codes developed so far cover the data sufficiently;
      ii. Check if every fragment has received the appropriate code;
      iii. Decide which code is most suitable if synonyms have been used;

iv. Look at one code and consider the similarities/differences of the fragments belonging to that code;

v. Subdivide categories if required;

vi. Look for evidence for distinguishing main codes and subcodes;

vii. Determine whether or not sufficient data had been collected to give a detailed description of a category based on the fragments in that category, if not to collect more data.

2. Selective coding:

    a.   "Selecting the core category, systematically relating it to other categories and filling in categories that need further refinement and development." (Strauss & Corbin, 2007:116)

    b.   Selective coding aims to answer these questions:

      i. Which themes have recurred in the observations?

      ii. What is the main message that the stakeholders have tried to bring across?

      iii. How are the various relevant themes related?

      iv. What is important for the description, and understanding of the stakeholder's perspective and behaviour?

Appendix 6: Code tree, a method to code by Fayard & Weeks (2007)

Appendix (coding tree)

Affordances
- Propinquity
- Privacy
- Social designation

Environmental elements
- Geography
  - Centrality
    - Physical
    - Functional
      - Proximity to elevator
      - Proximity to stairway
      - Proximity to entrance
      - Proximity to lavatories
      - Proximity to mailroom
      - Proximity to kitchen
      - Proximity to meeting room
      - Proximity to intersecting hallways
  - Locality
- Architecture
  - Enclosure
    - Doors
      - Kept open
      - Kept open
    - Walls
    - Partitions
    - Windows
      - Internal
      - External
  - Ease of ingress
  - Ease of egress
  - Size
  - Visibility
    - Inward
    - Outward
- Function
  - Number of Resources
  - Type of Resources
    - Photocopier
    - Fax
    - Printer
    - Supply Cabinet
    - Bulletin Board
    - Mailboxes
    - Water-cooler

Appendix 7: Citizens survey protocol

Citizens Survey Protocol

The lion's share of the surveys were done by handing out paper or digital surveys to students present at student stakeholder meetings. These stakeholder meetings were intended to be trials of the exact methodology we planned on using for the final stakeholder meetings. Essentially, the sessions were initiated using a short presentation about the University of Twente, the project in Curitiba, the DesignLab methodology being used, an individual and group brainstorm, pitches and eventually a final discussion on what interventions could actually be implemented, per the citizens (i.e., students). After this was done, the citizens were offered the opportunity to ask questions concerning the methodology, give feedback and fill out the survey questions cited below.

General questions to ask will be:

1. What are your most used means of transport?
   a. Why do you use these means of transport?
2. How would you define sustainable mobility?
3. How would you characterise your attitude towards sustainable mobility?
4. Do you consider sustainable mobility when you pick your means of transportation?
   a. Why do you [not] take sustainable mobility into account?
5. What experience do you have with sustainable mobility? E.g., using bicycles, electric cars, etc.
   a. Why did you chose this means of transport, or why not?
   b. What is limiting you from using sustainable means of transport?
6. What challenges do you think are presently limiting sustainable mobility in Curitiba?
   a. (Why do you think these limitations exist?)
   b. Has anything changed in your use of transportation in the last few years?
      i. Why [not]?
7. How could sustainable mobility be more successful in Curitiba?
   a. What kind of interventions/activities would you suggest or what kind of interventions would you like to see to improve sustainable mobility in Curitiba?

The collected data is analysed as described in the data analysis protocol, and afterwards the found themes are summarised in a report.

Appendix 8: Empirical data collection protocol

Empirical Data Collection Protocol

As our study aims to evaluate various mobility services in the City of Curitiba, we will collect empirical data, which will be done in the following way:

1. Describe the service in detail, including the following aspects:
a. costs;
b. ease of use;
 i. What aspects of the service contribute to its convenience?
ii. How does this enhance the service (what is it used for)?
b. learning curve;
c. availability;
d. safety:
 i. psychological;
ii. physical.
b. security:
 i. psychological;
ii. physical.
b. comfort.
 i. What forms of comfort are found in the service?
ii. How does this enhance the service (what is it used for)?
2. Describe what infrastructure is generally present for this specific service;

3. Observe for whom the service is designed and who uses the service;

Our method of analysis of this data will be a selective approach, first we will code the important and relevant observations to answer the questions. After this we will categorize these fragments into the used means of transport, and further develop subcategories that directly relate to the questions we posed. We will deduce from this an overview of all the services, and document this in a small report.

Appendix 9: Mapping stakeholders

To begin the mapping process, the researchers referred back to the selective coding answers at the end of the data analysis of each of the interviews. The inhibiting factors and aims of the stakeholders, that were interpreted as most important from the analysis, were then transferred to a mindmap. This was followed by adding the interventions that the stakeholders mentioned, and then completing a group brainstorm on what other interventions could solve their inhibiting factors or help them complete their aims. Once the mindmap was full of ideas, the researchers moved on to the next stakeholders. This process was completed for all eight stakeholders that were interviewed, before extracting similar data from the citizen interviews and qualitative surveys. This completed the mapping of the stakeholders. After this, the info was taken from the board and typed up into an excel document. Within this document, the aims, inhibiting factors, and interventions were initially placed next to the respective stakeholder. This was followed by all aims, inhibiting factors and interventions being compared and grouped by similarities between stakeholders and topic area. The data visualisation was then designed off these groupings. In the final stage, the researchers looked at the grouped interventions and individually brainstormed what other interventions were possible. When looking at the already gathered list of interventions and when forming new interventions, preference was given to feasible, unique or quickly implementable interventions. This was followed by a group discussion and brainstorm of all individually chosen interventions, to end up at the final interventions. To classify and evaluate the intervention, the methods described by Tromp, Hekkert & Verbeek (2011) were used. Their paper that describes a way to classify behavioural change interventions based on how persuasive, decisive, coercive or seductive these interventions are to the target group.

Appendix 10: Stakeholder meeting approaches

Stakeholder Meeting Approaches

Overall, a lack of engagement is present in the design and renovation processes of Curitiba's public transport systems. Hence, in order to facilitate the public debate, we might consider **extending the invitation** for PUC-PR's (*Pontifícia Universidade Católica do Paraná*) brainstorm session next Monday **to outside sources** such as stakeholders. Considering, however, that inviting stakeholders active in the field might **adversely affect the hierarchy of the design process**. To alleviate this issue, brainstorm facilitators could preliminarily join the meeting to mitigate the effects of a difference in knowledge on the topic in question. In addition, for the stakeholder

meeting later in August, it's important to have **one person**, potentially a dominant moderator who can call people out, at the table **who can polarise the dialogue** between stakeholders. However, before we can establish such dynamics, it must be pondered how we can **encompass the needs of all stakeholders not currently involved**. Once the brainstorm has passed, small solutions that might eventually contribute to the dialogue, including the conventional stakeholder approach, can be distilled.

The next step is prototyping a meeting. Prototyping and conceptualising can be done through a variety of different events provoking continuous engagement, which is currently the troublesome factor in Curitiba's approach. Chiefly, it must be realised that **different complementary approaches are required to transform the culture**. For instance, "random drinks" events such as at the University of Twente's UIF DesignLab division could be an option; students, staff, professionals and government representatives would be invited to engage in the discussion on an equal basis. The following schedule was decided upon, integrating the above-mentioned input into the DesignLab method as originally envisioned by the University of Twente.

1. **Icebreaker** – 15 to 20 minutes

During the initial trial session at PUC-PR, the icebreaker will consists of every participant briefly introducing themselves by stating their name and their professional and academic backgrounds. A random word stated on a piece of paper will have to be incorporated in this introduction. The other participants are then invited to guess which 'random' word was not part of their original pitch.

2. **Introductions** – 10 minutes

The introductions are to establish which stakeholders in Curitiba are relevant for the problem in question, what their exact interests are, and in what areas they operate. The Curitiba Crew is invited to introduce their findings up until this point and express how they wish to proceed. In case of direct involvement and participation, any local stakeholders can introduce their perspectives as well.

3. **Individual Brainstorms** – five to seven minutes

Research has repeatedly proven that individual brainstorms are much more effective than group brainstorms. Individual brainstorms allow for unlimited thinking and permit participants not to limit their ideas based on social pressure or other participants overruling their ideas. The goals of the individual brainstorms are:

- Basic stakeholder mapping;
- Creating ideas and concepts, related to the participants academic and professional background, that would improve the sustainable mobility in Curitiba.
- **Exploring** the problem and **framing the problem statement**;
- Formulating what institutions can offer to contribute to a more sustainable city, together.

4. **Group Brainstorms** – 20 to 25 minutes

Before the Group brainstorm starts, we will group the participants in teams of 4 to 6 people. We will assign a moderator to every team, to direct the discussion. We will also introduce the solution areas (Societal, Political and Infrastructure/Technology), in which the individually created ideas should be grouped during the team brainstorm. The Curitiba Crew will introduce the main inhibiting factor of each of these solution areas, this to encourage thinking to overcome this inhibiting factor. The team brainstorming sessions are about integrating different ideas. In the newly formulated version of this phase, not all ideas must be combined into one solution, but various ideas can be grouped into a solution area. Systems design is about integrating various aspects of one problem and several solutions into one viable action plan. The session would start by **pitching the ideas resulting from the individual brainstorms** to the other members of a group. In the brainstorm, professional backgrounds, ideas and conceptions about improving sustainable mobility in the City of Curitiba will be purported and integrated.

5. **Pitching Concepts** – max. two minutes per group

Every group will pitch their discussion processes.

6. **Top-Off Conclusions and Suggestions** – 10 to 15 minutes

The groups have also reached **conclusions regarding the feasibility and implementability of their solutions**. Each group will also present the rest of their solutions and explain how these could be implemented, and on what grounds of expertise they deemed these feasible enough. As such, more people would get to presenting and active participation is automatically provoked. One question to ask would be: 'If you were (Important stakeholder in field of mobility Curitiba), which one of these ideas would you try and implement if you need to implement one and why?'

For the later sessions, e.g. with the stakeholders at the end of August, there will be a number of small adaptations to the programme mentioned above to incorporate their specific needs and what they would specifically have to add to the entire solution's implementation plans. The changes are as follows:

1. **Icebreaker**: Instead of learning about every individual's background, a stakeholder brainstorm would focus more on the role of the stakeholders in the eventual implementation plan. The Icebreaker would be focused on understanding the target stakeholders' roles through a secret word game. Every individual would be asked to use a secret word that describes one other stakeholder in their introduction; all other participants are then invited to guess to whom the secret word was referring.

2. **Introductions**: Again, the introductions are to establish which stakeholders in Curitiba are relevant for the problem in question, and what their exact interests in this operational area are.

3. **Individual Brainstorms**: Every stakeholder would be asked to provide a portfolio on the ideas that they have on the solution. In looking at the portfolios provided by each stakeholder, participants may come up with designated research questions or topics for the rest of the brainstorm session. Participants can also still individually bring in solutions and discuss their feasibility afterwards, this is commonly referred to as brain writing. The following question must be answered: **According to your research and professional background, what are the ideas and concepts involved in improving the sustainable mobility in Curitiba?** Afterwards, ideas will be shared and the group brainstorms may begin based on these pitches. The individual brainstorming phase may last up to 10 minutes longer than usual.

4. **Group Brainstorms**: In addition to the goals set in the first section on group brainstorming, one complementary aspect would be that the aim is not to create one plan, but rather to **formulate a solution area which would be a "steering factor" for the rest of the discussion**. Signups would be required to form adequately categorised groups with appropriate expertises. The eventual product of this session would be a flow chart which could be provided as a template to other stakeholders; this flow chart would display the actionable ideas shared by multiple stakeholders, and the requirements stated to put these into practice. As a preparatory phase, the facilitators could **state the major inhibiting factors as found by them for every social area**.

5. **Pitching Concepts**: The presentations should clarify concepts, rather than detailing the plans.

6. **Top-Off Conclusions and Suggestions**: Pitching what each stakeholder would concretely suggest the City Hall invest in and a joint initiative between all stakeholders endeavour.

For the stakeholder meeting, the inhibiting factors impeding the brainstorm processes as found in the second preliminary meeting at PUC-PR must be tackled. The brainstorm facilitators must focus on overcoming the societal and technical barriers in achieving a consensus. All in all, the following question must be answered through conceptualisation and prototyping: "**How might we split responsibility in an implementation agenda?**" The outcome of this workshop and the one at PUC-PR can be used as input for consecutive stakeholder meetings; putting the findings of the DesignLab group in a real dialogue, and forming a complementary subpart of the process. As a product for the totality of the workshops, an **action plan for all stakeholders involved** in this project and a **responsibility matrix** could be integral parts of the closing documentation. Whereas the initial meeting at PUC-PR should last no longer than between 1.5 and two hours, including breaks, the meeting with the

stakeholders may last longer, i.e., from three to four hours. The latter because we are aiming to go further.

Taking a bus

Curitiba has an elaborate bus system, with many different types of buses that cover many different routes. There are six categories of buses: Alimentador, Interbairros, Convencional, Expresso, Linha Direta and Circular Centro. The last one, Circular Centro, was excluded from the empirical data collection, because we were told that it is only used by a small and specific part of the population. The data of the five categories of busses that are left were gathered separately, but to avoid repetition, they were combined into two main categories in the report: the Bus Rapid Transit system and the conventional bus system.

  The price for travelling by bus is R$ 4.25, regardless of the distance that is travelled. This makes long-distance trips very cost effective compared to other means of transportation. Regardless of the type of bus, if you switch buses in a terminal, it is not required to pay again. You can either pay cash or use a public transportation chipcard, called a *cartão*. To plan your trip, you can use Google maps, which has accurate information about the bus routes. However, the times at which the buses leave according to Google maps are often incorrect. There is a quick repair service for the busses in case of a breakdown.

  Bus Rapid Transit System. The Bus Rapid Transit system (BRT) is a bus system designed to optimize capacity and reliability (ITDP, n.d.). In Curitiba, the system consists of separate lanes dedicated to buses, raised bus platforms that decrease the time needed for passengers to board or disembark and priority for the BRT busses on intersections. The system is used by two categories of buses: Expresso, including the faster Ligerão buses, and Linha Direta. The Expresso busses, except for the Ligerão buses, can be seen as the regular BRT buses and stop at every BRT station. The Expresso busses cover five axis, as can be seen in appendix 3. The Ligerão lines were created to support the the regular Expresso buses in busy areas (Ônibus de Curitiba, n.d. a). The Ligerão buses make fewer stops and can therefore take passengers from the neighbourhoods to the city center and vice versa faster. Eventually, Ligerão buses should be implemented in all the axis to complement the regular Expresso buses (Ônibus de Curitiba, n.d. a). The Ligerão buses drive on biodiesel, whereas the other BRT buses drive on regular fuel. The Linha Direta busses have appeared over the years, to connect places that are not connected by the Convencional busses (Ônibus de Curitiba, n.d. b). The BRT busses are owned by many different companies.

  Payment is done at a till by the entrance of the tube-shaped bus platforms. In terminals, it can be difficult to find your bus, as there are many different bus lines and signs only show the main bus stops. At the regular BRT stations, it is usually more clearly indicated which bus is arriving at what time and at which stations it will stop. For a visualisation of what this research considers to be terminals and regular BRT stations, see appendix 4. The Expresso buses arrive about every seven minutes and the Ligerão buses every ten to fifteen. The different Linha Direta lines have very

different frequencies, ranging from every two to three minutes to ten to fifteen minutes. This bus system covers only a part of the city and it usually does not bring you to your destination completely. Therefore, it must be used together with other means of transportation. On the buses, upcoming stops are generally announced through loudspeakers and on/ a screen, so it is easy to determine when to get off.

The BRT lanes are only shared with emergency vehicles and the occasional cyclist, so the buses are not very limited in their speed by other road users. It seems to us, that it would not be possible to drive as fast as the BRT buses do, on the regular roads. The Expresso buses use both regular bus stations and terminals and they purely drive on the BRT lanes. The Linha Direta buses have their door on the left and can only stop at terminals, or specific stations designed for that bus type. These buses use both regular roads and BRT lanes. Some of the Expresso buses have specific constructions for taking bikes, but we have not seen any passengers taking their bike on the bus during our stay in Curitiba.

There are relatively comfortable chairs on the buses, but having to stand is not an exception, especially during the morning, afternoon and evening rush hours. If there is enough space to stand, it is still relatively comfortable as there are many hand rails for stability. However, the rides are often bumpy and the buses accelerate and decelerate suddenly, so it is necessary to hold on tightly. There are good facilities for disabled passengers and priority travellers, both on the buses and at the tube stations.

Driving in the BRT buses feels relatively safe, because the buses are quite robust and their separation from regular traffic makes crashes less likely. However, there are no seatbelts and standing is quite unstable, so passengers could get hurt badly if a collision were to happen. As the entrances of the system are guarded by till people and the buses and stations are well lit when it is dark, the system feels quite secure. In terms of pickpockets, it can be difficult to keep track of your belongings when you are standing in a crowded bus during rush hour.

Before you can use the BRT, you have to learn how to pay, which entrances and exits to use and how to determine which bus to take and at which stop you need to get off. We think that this should not take more than a couple of rides to understand. The system was probably designed for any type of users, but we were told that it is rarely used by the richest part of the population, because these people use their private car. The Ligerão buses were added to the system to transport people from the suburbs to the city centre and vice-versa more efficiently than the other BRT buses, and that seems to be exactly what they are used for.

Conventional Bus System. There are four categories of busses that are part of the conventional bus system: Convencional, Alimentador, Interbairros and Circular Centro. As mentioned before, the Circular Centro buses were excluded from the empirical data collection, The Convencional buses connect neighbourhoods to the city center (Ônibus de Curitiba, n.d. c). The Alimentador buses connect neighbourhoods to terminals and neighbourhoods to neighbourhoods via terminals (Ônibus de Curitiba, n.d. d). The Interbairros buses drive in rings around the city and allow people to travel between neighbourhoods without having to pass through the city center (Ônibus de Curitiba, n.d. e).

Payment happens with a ticket collector, who sits in the bus with their own seat

and a gate in front of them. This gate means that you cannot enter the main seating area, and then leave the bus without paying. Next to the gate and ticket collector, there is also a public transportation chipcard reader. When it is busy, passengers waiting to pay will not only occupy the area before the gate in the bus, but will also be waiting outside the bus. The bus can therefore not leave until a part of the passengers has paid and all passengers are able to enter the bus.

There are different types some do not have any signs or screens with information and some provide general information about the bus lines and maps with bus schedules. For a visualisation of the different bus stops, see appendix 4. In terminals, there are signs, but they do not always provide sufficient clarity as to the correct bus stop location. At the bus stop in the terminal, there is a screen indicating bus number, direction and arrival time. The buses have a set schedule of arrival, however, there is no list in the terminal as to the schedule for the day and when that bus will arrive at each stop, also what the bus stops are along the route. Buses seem to arrive at irregular times and over inconsistent intervals of between 10 and 20 minutes. The bus itself states the line number and direction on the font. In the bus, there is often no information of the route, so there is no way of knowing how far you have travelled, what the next and previous stop were and no list of stops anywhere on the bus. However, in some busses, upcoming stops are announced through a speaker. You can indicate that you want to get of at the next station by pressing a button. Due to the general lack of information, this system has a steep learning curve.

The seats are hard, and if it is cold or hot, so is the bus due to a lack of heating/airco. Due to saturation, many people have to stand during their ride and even though there are plenty of bars to hold onto, little comfort is found on the buses. However, the buses and stations are generally clean. The buses are easily accessible for the disabled: There is a wheelchair lift, and ample space for wheelchairs or guided dogs. There are also designated seats for people with special needs.

The buses drive on public roads and on BRT lanes where possible. The infrastructure used by the buses is not great, the road is poorly maintained resulting in many bumps, which, in combination with the hard seats, again provide little comfort. Furthermore, to drive their routes, the buses take substantially longer than a car would. As driving behaviour is often considerably fierce, standing does not feel very safe, even when you are holding on to something. Furthermore, driving on public roads means being prone to collisions with other vehicles. In large crowds, pickpocketing might also go unnoticed.

Taking a taxi

Curitiba has a fleet of around 3000 taxis, which are regulated by the government (URBS, n.d.). 70% of the fleet operates with auxiliary service of a company called Radio Taxi (URBS, n.d.). Therefore, our rides were arranged via Radio Taxi. To arrange a taxi ride, you can either catch one in the streets or at specific points, or you can contact Radio Taxi or one of the smaller Taxi companies. There are about ten taxi stands located at main points in the city, such as the bus and train station and the main street in the city center. Locals will most likely know where to go to find a taxi. However, as these taxi stands are mostly concentrated around the city center, it is likely that you will have to arrange your ride via one of the taxi

companies. Radio Taxi can be contacted by phone or through their website. By phone, you can either call, send a whatsapp message or use their app. With the later two, it is possible to send a location directly using Google Maps, so the customer does not have to describe it. You always get an ETA, which, according to Radio Taxis website, should not be longer than ten minutes. Taxis are easy to recognize, because they are orange in colour. Furthermore, Radio Taxi sometimes gives you the licence plate number of the taxi you ordered.

Taking a taxi is substantially more expensive than taking a bus or an Uber. The connecting fee is R$ 4.- and you pay 40 cents every 100 meters. If the vehicle is not moving, you pay 4 cents every seven seconds. There are exceptions to these fees, such as when driving at night. In advance, there is no way to know how much you will be spending. While driving, you can see the price going up on a meter on the dashboard. You can pay for your ride with cash or credit card.

As taxis use the regular roads, you will go as fast as the regular traffic. Especially in rush hours, you might get stuck in traffic. However, taxi drivers aim to find the optimal route and avoid the city center. Driving in a cab is quite comfortable. The taxis are clean, the seats are nice, you will not be bothered by other people and you can ask for heating, air conditioning or the radio to be put on. Unlike the busses, the taxi will bring you directly to your destination and you will not to use any other means of transportation. Driving in a taxi feels secure, because the driver and vehicle are registered. The taxis number and the Prefecture's phone number are also mentioned inside the taxi. Furthermore, you do not have to be concerned about other people travelling with you. In terms of safety, the car has working seatbelts and airbags and the driver's driving skills are ensured by the taxi company.

Taxis are relatively expensive, so they are rarely used by the lower classes. The richer part of the population mostly uses their own cars. Taxis are probably used in specific situations, such as when the private car is unavailable or if a person cannot drive. There are also special taxis for people with disabilities.

Taking an Uber

Uber connects people that are looking for a ride with people that are closeby and willing to provide a ride. Uber is quite popular in Curitiba; we have heard of many people that use the system and the availability of cars is high. Taking an Uber is cheaper than taking a taxi, and, if an Uber is shared, it can also be cheaper than taking a bus. The system works through an app, which finds and organises the rides and arranges the payment. Payment can either be in cash or the expenses can be withdrawn from your credit card or PayPal account. Using the app to find a ride is usually no problem as long as you have internet in the form of mobile data or WiFi. However, special attention needs to be taken when the pick up location is close to a BRT lane, because if there is a BRT lane on the road, the app often does not realise that you cannot make a U-turn at any moment. Before you order the Uber, you get a price indication. Which is usually very close to the eventual price.

The app and internet requirement make the service readily available to almost everyone. Furthermore, because of the high availability, pick ups usually happen within ten minutes. During the night and early in the morning, rides are more expensive and pick up times are longer. Finding your ride is often easy, when given

the licence plate, car model, and driver's name. Most drivers will verify that the destination is correct when you enter the vehicle. Being in a car with locked doors makes the entire trip feel safe, secure, and overall comfortable as you are transported between destinations. However, though the drivers are screened, Uber is not responsible when something were to happen. Furthermore, it is a door to door service. Therefore, in order to reach your destination, there is no need to combine different means of transportation when taking an Uber. Uber is not designed for a specific type of user, though it is mostly used for short distances. Besides that, it seems to be used by a very broad spectrum of citizens.

Cycling

Cycling is a very different experience than the other three means of transport. It gives the user a lot of control over many aspects of the journey. However, in the city of Curitiba, it does not come without its costs. As a cyclist, you can control where you go and how fast you go, and it is practically free after the initial investment. It is exhilarating, healthy, and provides excellent freedom of mobility, as you do not have to rely on a set system to reach your destination. Besides that, some parts of the city are very conducive to cycling, with bicycle paths separated by bollards or parked cars from the rest of the road. The Vias Calmas near the center of the city are very comfortable to cycle through, even during rush hours.

The BRT lanes are often much better to bike on than the bicycle lanes themselves, and cyclists choose them over the cycling lanes even if they run parallel. They are more willing to risk the possible collisions with a bus than be as close to the cars as they would be on the cycling lanes. While cycling on BRT lanes, much care needs to be taken in regard to keeping an eye out for the busses in front and behind you, and also keeping the appropriate amount of space between yourself and the bus. This either means getting off the BRT lane when the bus is catching up to the cyclist, or following directly behind the bus as that guarantees that the cyclist will not get hit by the bus. It is not very difficult to keep up with the busses, as they need to stop at both bus stops and at red lights.

Special care also needs to be taken regarding the hills that are part of the city's topography. When biking up a hill, it is important to stay aware of the other vehicles on the road, and being apprehensive when cresting a hill. It is also hard work, going up a number of hills, and is not comfortable for the cyclist. The way down is much easier, and more fun, but the close traffic and the bad road conditions on the cycle paths, and occasionally the BRT lanes, limits the amount of speed that the cyclist can go at. The hills, as well as the rhythm of cycling in traffic, makes stopping and starting difficult, even if it is to drink some water or check a map. Extra attention must be given during rush hour as there are many cars driving very quickly, making the entire trip accident prone.

Cars do take care not to hit the cyclist on purpose, but many of the design choices of the city have made this difficult. There is little space for a car to move out of the way of a cyclist when there are many cars. At traffic lights, many of the cyclists will put themselves at the front of the line. To get to this spot they will weave through traffic, which makes it so that the cyclists needs to know where they are going before

the traffic light changes. If the cyclist is not careful, a car may just turn into their lane while trying to go into a perpendicular street.

As long as the cyclist stays in the center of the city, they can feel completely secure. There are some parts of the periphery that do not give the same feeling. During their time in Curitiba, the researchers were confronted with two victims of a robbery of their bicycles. As also mentioned several citizens, cyclists in Curitiba are quite vulnerable in terms of security. The parking spaces feel quite secure, and usually you can safely keep your bikes in those locations. With regards to planning, it is difficult to take the amount of time Google maps predicts it will take. Often Google maps is off by a significant percentages.

Appendix 12: Complete stakeholder brainstorm session results

Case 1:
How might we create collaboration between the Prefecture and citizens, to more actively involve citizens in government projects?
City for People

Collaboration between citizens is created by actively inviting them to contribute to the city's planning. This can be done by creating an app, which lets the citizens of Curitiba vote thumbs up or down to a proposed project or law. The app should also provide a space where citizens can provide written feedback. This will include citizens in governance, and give them an empowering feeling, as they have played an active role in the decision making process. Various steps for implementation of citizen involvement could include:
1. Citizens form committees, who will draft project proposals that can be delivered to a designated digital mailbox at the Prefecture;
2. The government takes the proposal into its process and organises a debate between the affected citizens, who will receive special invitations, and government representatives, concerning the feasibility of the proposal;
3. Feedback formulated by the citizen and government representatives will be incorporated and the original proposal will be amended for resubmission (the feedback phase may be repeated);
4. The final decision is made through an applet, where citizens can vote on the final proposition through public polls and questionnaires contributing to democratic implementation processes;

Case 2:
How might we educate and incentivise citizens to make sustainable mobility choices?
Master Plan on Education

This intervention is aimed on long term impact, and is called the Master Education Plan. It is based on the green exchange programme promotion method with cartoons. The children do not only need to understand maths, physics, language, history, but also how mobility in Curitiba works, a way to do this is using memory learning by using cartoons for the younger generation.
When designing education programmes concerning urban mobility, it must be kept in mind that the widespread adoption of bicycles is only a part of the solution. Sustainable urban mobility also includes mass transportation, which requires much

more in terms of a vehicle's capacity. A few key solutions were designed in the brainstorm:

- Children can be taught the rules and dangers of traffic in playful ways, i.e., appealing to "Memory Learning" and other strategic approaches;
- Cars, bicycles and buses must have separate lanes.

Case 3:
How might we improve the overall efficiency of the integrated bus system (RIT [BRT])?
Synchronising Bus Schedules

Improving the efficiency of the BRT consists of two subparts: (1) increasing inter-modality and (2) improving the efficiency of the bus system itself. For instance, one solution would be to provide parking spaces for bicycles and cars near all bus terminals. This way, the car and bicycles would become a veritable last-mile solution and, simultaneously, alleviate some of the city's congestion issues. Thirdly, the bus stations currently include either generic or no maps indicating your location and the easiest ways to continue your journey. One suggestion would be to improve the maps by adding [walking] routes to frequented places and other bus connections, facilitating a convenient journey. Adding the single-ticket, whereby a specific time spent in the system is paid for, rather than entering the system, such as in São Paulo, would further simplify the pricing system of the BRT. Offering multiple parallel bus lines, would also decrease waiting times and augment civil engagement and decrease the corporate power disparity in the city.

Another significant part of improving the BRT system would be to observe and research bus arrival patterns and, in places where buses are most often late, tarry the rest of the system to accommodate no significant loss of time in one's journey. Apart from that, separating the buses onto their own lanes would be the most efficient way to decrease the probability of tardiness.