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MOBILITY CITY LAB JOINVILLE

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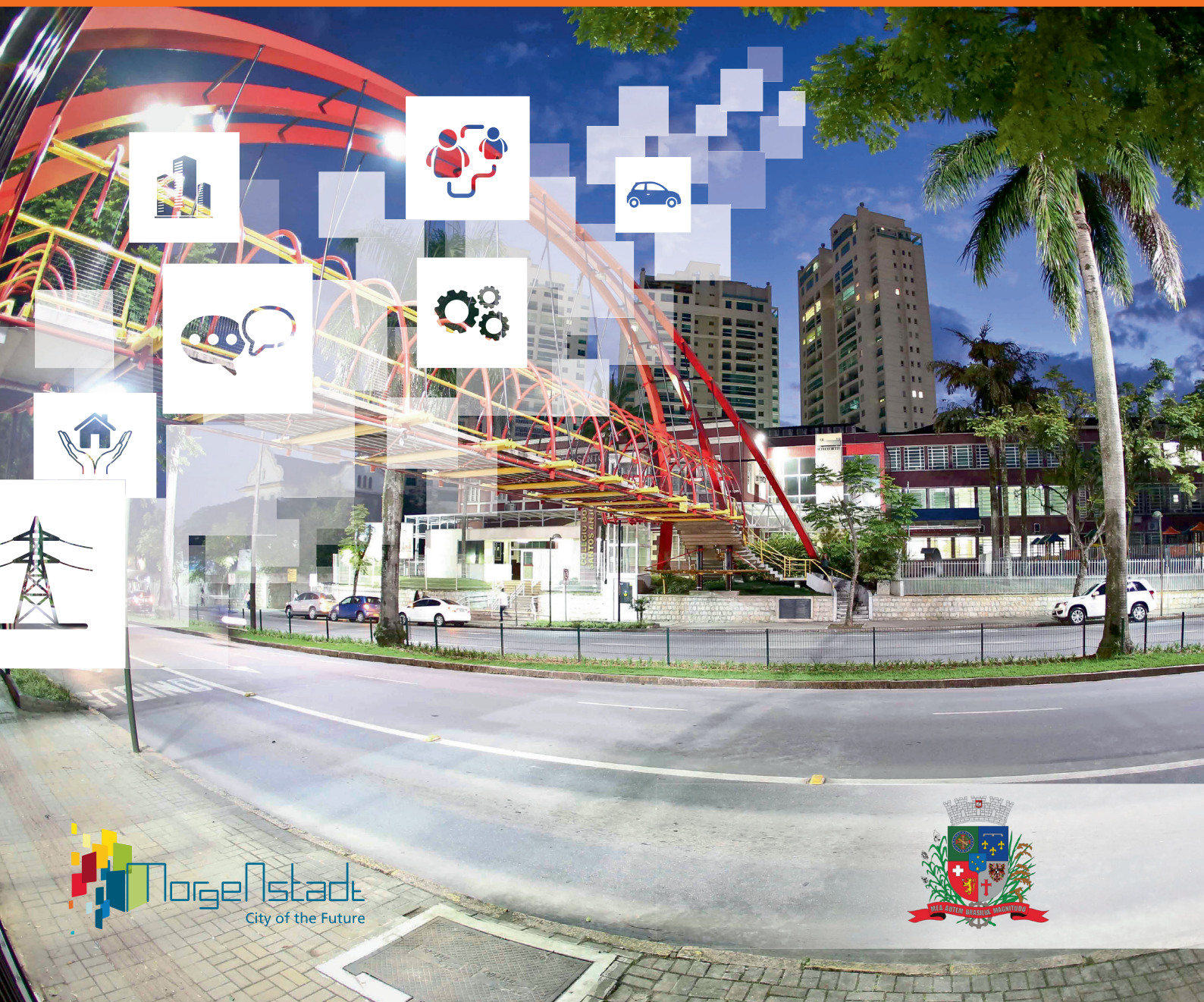

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List of abbreviations

API – Application Programming Interfaces

BRL – Brazilian real, official currency of Brazil

GDP – Gross Domestic Product

GIZ – Deutsche Gesellschaft für Internationale Zusammenarbeit - German Agency for International Cooperation

GHGs – Greenhouse Gases

GmbH – Limited Liability Company in German law

HDI – Human Development Index

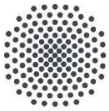
IAO – Fraunhofer Institute for Industrial Engineering and Organisation

ICT – Information and Communication Technologies

PlanMOB – Mobility Plan of Joinville

SEPUD –The Secretary of Urban Planning (Joinville)

Actors



Universität Stuttgart
Institut für Arbeitswissenschaft und Technologiemanagement IAT

The University is contractor and author of the study.The University of Stuttgart IAT has close cooperation at local level in one of Europe's strongest economic regions – Stuttgart region. Companies such as Daimler, Fischer, Bosch, IBM, Festo, Porsche, Züblin, Würth, Stihl, and Trumpf are just some of the great research partners and customers. This cooperation goes along with regular research studies consulting projects, assessments and trainings in the area of the fourth industrial revolution. Also, in the branches plant engineering, automotive and medical technologies this network provides optimal conditions to analyze regional strategies and existing implementation schemes to identify synergies and linkages among them. Exceptional laboratories and industrial insights predestine the IAT to analyze and verify the important success factors in transformation or so-called metamorphosis towards a digital factory and a holistically integrated product lifecycle management. The human factor is always in the focus of research. The IAT is involved in more than 400 international and local research and consultancy projects per annum.

Additionally the IAT has a strong cooperation with the Fraunhofer Institute of Industrial Engineering (IAO). The IAO has leading expertise in numerous fields, including industrial engineering, logistics, information and communication technology, product development, innovation and industrial R&D-management, business model and manufacturing planning – to mention just a few of them which are most relevant to the scope of this project. Moreover, Fraunhofer IAO coordinates the Innovation Network "Morgenstadt / City of the Future" is a platform of high-level first movers from cities and industry. It aims to accelerate the global transition to sustainable cities and fully supports the New Urban Agenda as set out during the UN Habitat III in Quito. Our mission is to shape sustainable cities by designing and implementing innovative urban systems solutions that solve sustainability challenges in the social, environmental and economic development of cities.

Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

The GIZ is the commissioner of this study and supported technically the City Lab Team throughout the assessment. As a provider of international cooperation services for sustainable development, GIZ is dedicated to building a future worth living around the world. GIZ has over 50 years of experience in a wide variety of areas, including economic development and employment, energy and the environment, and peace and security. The German Ministry for Economic Cooperation and Development (BMZ) is its main commissioning party but GIZ also works with businesses, civil society actors or research institutions. The priority areas for GIZ´s activities in Brazil are renewables, energy efficiency and the protection and sustainable use of tropical forests.

The projects "Energy Efficient Propulsion Systems" (PROMOB-e) of the Brazilian Ministry of Industry, Foreign Trade and Services (MDIC) and "Energy Efficiency in Urban Mobility" (EEMU) of the Ministry of Cities, are implemented in partnership with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). The project PROMOB-e aims to promote the necessary conditions for a broad use of energy-efficient propulsion systems in Brazil and focuses on electric mobility in public transport and urban delivery transport. For more information, please visit www.promobe.com.br. The project EEMU aims to improve the conditions to enhance energy efficiency in urban mobility in Brazil through better policy-making, planning and management. Therefore, the project addresses the key elements that shape urban mobility in Brazil: national policies and municipal actions.

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Preliminary remarks - Morgenstadt City Labs

The Innovation Network "Morgenstadt / City of the Future" is a platform of high-level first movers from cities and industry run by the German Fraunhofer-Society. It aims to accelerate the global transition to sustainable cities and fully supports the New Urban Agenda as set out during the UN Habitat III in Quito.

Within this innovation network "Morgenstadt / City of the Future", the Fraunhofer Society together with the University of Stuttgart and its partners from industry and municipalities has developed the Morgenstadt City Lab Approach – a holistic analytical framework that helps design individual sustainability strategies for cities that build on digital innovations, clean technologies and a broad stakeholder dialogue moderated through Fraunhofer experts. The Morgenstadt Model is a globally unique instrument, which has been developed and tested with the six globally leading cities in sustainable urban development: Copenhagen, Singapore, Freiburg, New York City, Berlin, and Tokyo.

Throughout 2015 and 2016 the Fraunhofer Innovation Network "Morgenstadt / City of the Future" has been successfully applied to cities as Prague, Lisbon, Chemnitz, Prague, Leipzig, Sabadell and Berlin TXL, boosting the sustainable development of these cities in an integrated way. The result of each Morgenstadt City Lab is an individual roadmap towards a sustainable city, integrating several

specific measures in the areas of renewable energies, energy efficiency, sustainable mobility, water infrastructures, waste management, sustainable buildings, urban resilience, environmental and urban planning, economic development, urban governance and digital innovation. Apart from creating sustainable and well-functioning cities, it also spurs local economic development and job creation by guiding investments and designing policies and strategies for a long-term development.

The city of Joinville – major industrial center in the south region of Brazil.

In Brazil, 86% of the population (180 million people) live in cities. The number of registered passenger cars has risen by 138.6% (Observatório das Metrópoles) in the last 10 years, with an increasing tendency. Public transport is considered to be inadequate, long waiting times, overcrowded buses and collapses after rainfall are not an exception.

Today in Brazil, cities as well as companies are struggling with the consequences of the ongoing changes regarding urbanization: absence of dialogs between private and public sector leads to bad investments and a missing blueprint for sustainable urban development of cities can have bad urban planning decision as a consequence. Innovative mobility concepts and technologies for the planning and implementation of sustainable urban systems, are needed not only to face diverse challenges of an urbanized world but also to open up important future markets for companies and cities.

Joinville with 577,077 inhabitants it is the most populous municipality of the state of Santa Catarina and the 37th of the country. Important to mention, there are less than 300 cities in Brazil with population more than 100.000 inhabitants. Thus, Joinville can be a replication example for them. It has a population density of 457.58 inhabitants per square kilometer and is the third largest city in the South Region of Brazil[1]. The city has a high HDI (human development index) - (0.809) holding 21st national position among Brazilian municipalities[2]. Moreover, Joinville has the largest GDP (Gross Domestic Product) of the state of Santa Catarina – EUR 11 553,54 (BRL 44 303,65)[3] per capita and produces 18.9 percent (fiscal value added) of the global gross domestic product of the state.

Joinville is the 3rd largest industrial pole of the South Region of Brazil and in spite of the progressive increase in the regions tertiary sector, industrial activity continues to be very important. Large conglomerates of the metal-mechanical, chemical, plastics, textile and software development sectors, makes it a major technological hub. For this, important economic groups such as Cipla, Buschle & Lepper S.A., Amanco, Schulz S.A., Franklin Electric, Neogrid, Docol, Döhler, Embraco, Ciser, Lepper, Tigre, Tupy, Totvs, Britania, KaVo Dental, Krona, General

[1] Instituto Brasileiro de Geografia e Estatística (IBGE) 2017
[2] Instituto Brasileiro de Geografia e Estatística (IBGE) 2010
[3] Instituto Brasileiro de Geografia e Estatística (IBGE) 2014

Motors, Whirlpool, Wetzel, Catarinense Laboratory, Siemens and BMW are present here. Joinville is for instance the first major metallurgical center of Brazil and is represented by the Tupy S.A.[4], which is one of the largest in the world.

1. Smart city activities in Joinville

This city is also known for its future oriented policies and efforts towards becoming a smart city. In February of 2016 the so-called project *Join.Valle* was launched, with the aim of co-creating the city of the future, improving, at the same time, its citizens' quality of life. The program has three main working areas: to create a creative ecosystem in Joinville, to develop an open platform and standard to facilitate the generation of new smart applications while democratizing Internet access, and promote a dialogue between the public sector, private initiatives, and universities[5].

The first area of the program seeks to stimulate the sustainable economic development by promoting creative entrepreneurship in the following strategic sectors: the pharmaceutical industry, green economy, ICT (information and communication technologies), materials, life sciences, and logistics-mobility[6].

A second area is the creation of an open platform that guarantees the access to application programming interfaces (APIs) that can help companies and the academia to develop solutions to current problems. The government also participates in this process by making public the city and citizens´ requirements and needs[7].

In the beginning of 2017 as a part of *Join.Valle* project, were launched two events:

- "Joinville, creative, intelligent and human city" - a challenge, where architects and architecture students were able to propose projects for the City Center. The aim of using the opportunities offered by new technologies to face the challenges that come with an increasing urbanization, especially the ones related to mobility, security and energy consumption.
- Joinville Project 30 years - Public Workshops to develop ideas for Joinville in 30 years. Through this project will be made a documentary that shows the city narrative that the citizen wants.

[4] Tupy S.A. 2017
[5] Prefeitura de Joinville 2016
[6] Prefeitura de Joinville 2016
[7] Prefeitura de Joinville 2016

1.1 City Lab goal

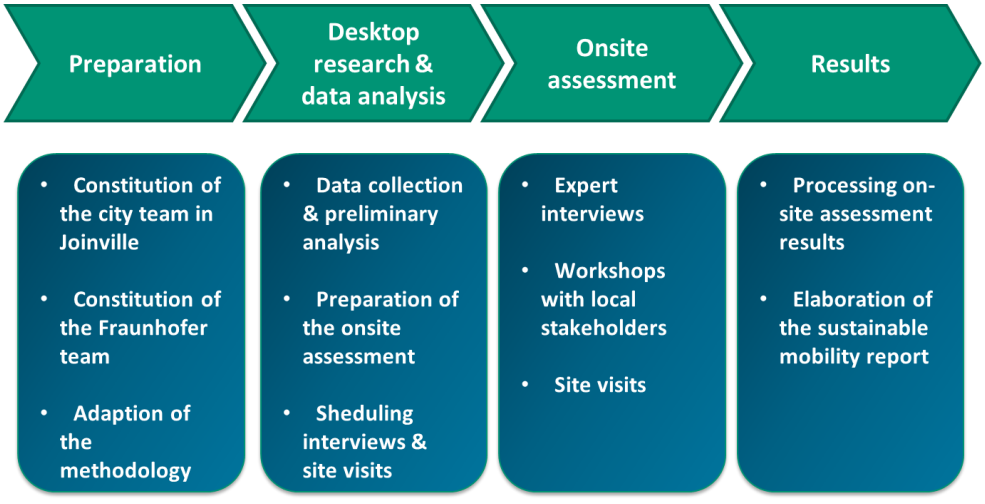
Joinville seeks further support in developing solutions in this context. The Morgenstadt Initiative in a strategic Cooperation with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH co-designed a project for supporting the city of Joinville in the development of a Roadmap for sustainable urban mobility. The goal of this City Lab is to help this city to become a model in Brazil for innovative mobility concepts and create a precedent in Latin-America on how intelligent growth and sustainable urban development can be initiated in an emerging economy.

The project was brought towards realization in a joint effort between the city, research, industry and national strategic actors and was technically supported and accompanied by the GIZ.

The results of the Mobility City Lab research shall lead to an integrated set of innovative mobility projects constituting a comprehensive roadmap going into the future. The projects have been tailored to Joinville's unique needs and are meant to support the city in addressing its specific challenges in the area of mobility. The proposed projects are combined with the already ongoing and planned activities in Joinville and aim to further strengthen its position within Brazil and make it a lighthouse city within Latin America.

2. City Lab Process

The process in the setting of CityLab is divided in four different steps.



Graph 1: Structure of the Mobility City Lab process in Joinville

The first phase comprised the preparation and with it, the constitution of the city team in Joinville as well as the assessment team. The city team in Joinville is composed of two employees of the Secretary of Urban Planning and Sustainable Development. The City Lab Leader, a Mobility Expert and a Research Assistant form the assessment team. The GIZ team throughout all phases accompanied the process. In addition, the adaption of the methodology was carried out (see described in detail below).

The second phase included the collection of documents of the city in the field of mobility and the initiation of data collection through Desktop Research and data analysis. Existing strategic papers and plans of the city were inquired and studied by the assessment team. Furthermore templates were prepared for the collection of the indicators and action fields and provided to the partners of the municipality of Joinville. Gaps in the information and data landscape received were identified. Preparations with regard to content (like the formulation of research questions for the onsite assessment) and organization for the on-site assessment were also included in the second phase. With regard to this matter, together with the city team in coordination with the GIZ and the assessment team, scanned the actor landscape in the field of mobility in Joinville, identified interview partners and defined dates for the interviews during the on-site assessment set. Special attention was paid in the selection of the interview partners, to ensure that strategic stakeholders from all kinds of action fields of mobility are represented, like pedestrian and cycling transport, public transport and logistics as well as political and planning institutions (the municipality, the region), the industry and social organizations. Besides the organization of venues for the interviews and workshops for the onsite assessment were identified.

In the third phase of the City Lab Process the realization of the onsite assessment took place. The conduction of interviews and workshops with the players as well as the site visits of relevant locations in the city were key features.

The fourth phase „Results“ includes the compilation of the results, the design of a strategic roadmap for the city and the production of the at hand report.

2.1 Adapting the City Lab Methodology to the Brazilian context

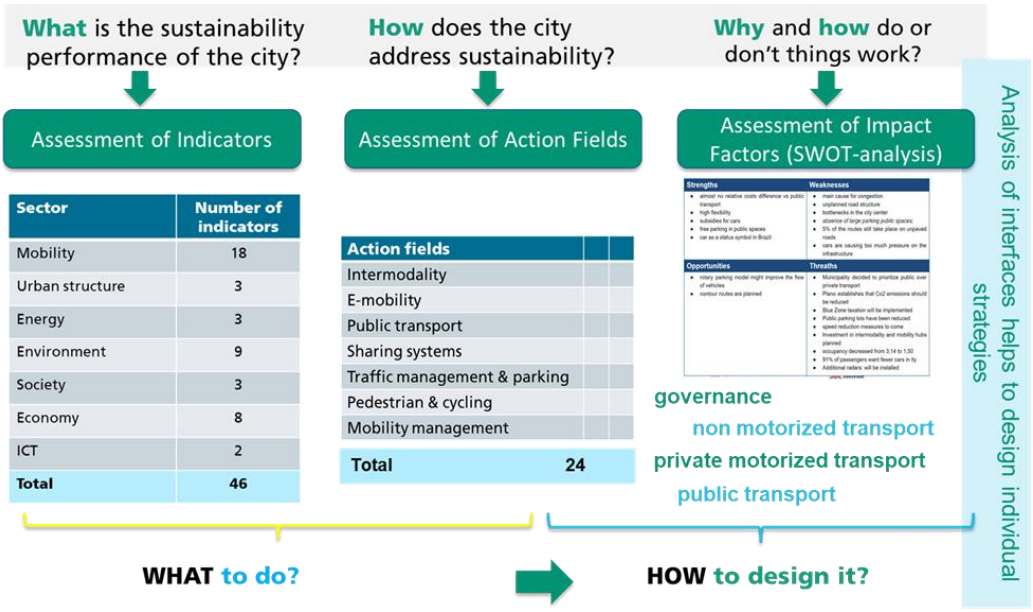
The basis for the in-depth analysis of Joinville is the Morgenstadt assessment framework for sustainable urban development. For creating the current mobility profile of Joinville, the relevant indicators and action fields from the Morgenstadt Model, developed by Fraunhofer IAO together with the University of Stuttgart within the innovation network „Morgenstadt: City Insights“ were applied. In the adaptation of the City Lab Methodology to the local context, two aspects need to be highlighted. On the one hand, the focus of the City Lab in Joinville was set on mobility and therefore, a compression of indicators and considered action fields related to this sector was required. On the other hand, there was a need of classification and evaluation of mentioned indicators and action fields in regard of the local conditions in Brazil. As the stated indicators and action fields

refer to highly developed cities with rather advanced infrastructures and technologies, the preparation phase was also used to adapt the existing framework to the local context in Brazil. This was based upon experiences made within the Urban Nexus Project (GIZ funded project in which Fraunhofer IAO adopted the Morgenstadt Framework to the analysis of 10 Asian cities e.g. Ulaan Baator, Dan Nang, Corrat, Chiangmai etc) and upon an evaluation (desktop research) of Brazilian regulations on cities and urban development. Federally-mandated import duty, for example, is a product-specific tax levied on a cost, insurance, and freight basis, and most rates range from 10 % to 35 %[8].

Adapting the existing framework will refer mainly to replacing advanced action fields & scope of analysis with more basic urban services, e.g.: intermodal and real time traffic to promote public transport quality and parking.

The framework of the Mobility City Lab in Joinville is divided into three levels of analysis:

- **Assessment of indicators**: measuring the current status quo of urban systems and showing the sustainable performance of the city with focus on the mobility sector.
- **Assessment of action fields**: measuring the degree of intervention in key areas that promote sustainability and the current activities of the city.
- **Assessment of impact factors**: identifying factors that are unique to the city based on a SWOT-analysis.

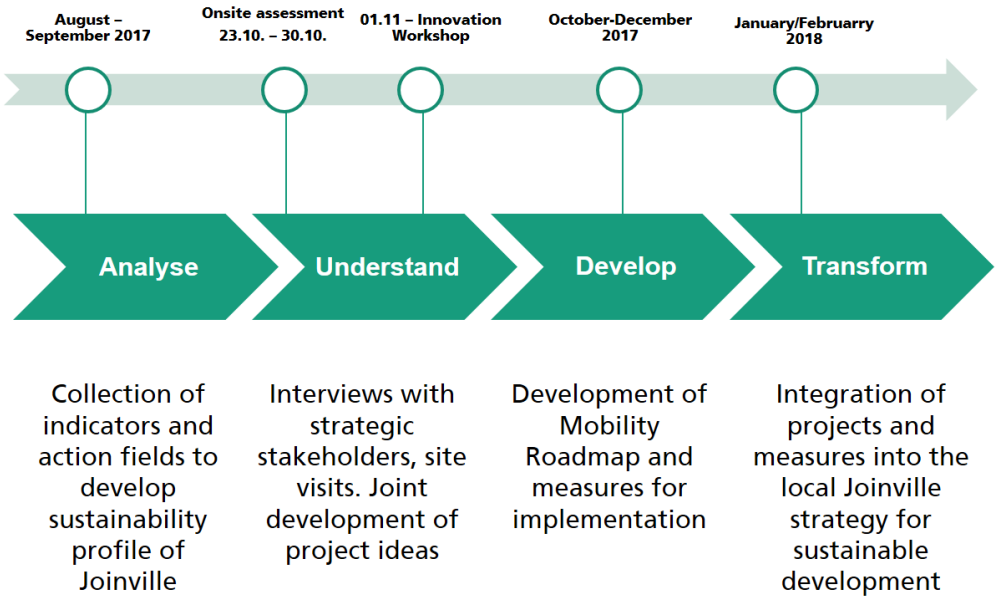


Graph 2. Morgenstadt assessment framework applied in the City Lab

[8] Export.gov 2017

The analysis of indicators and action fields addresses the question "What to do", the analysis of impact factors (SWOT-analysis) focus on the transformation process and "How to design it". The sum of all three levels allows for an understanding of the current sustainability performance of cities, assisting in the development of coherent strategies and an integrated roadmap for development while, at the same time, respecting the unique factors of the city that are conditioned by external pressures, sociocultural dynamics, geographic and historic conditions, etc. A standardized data assessment helps to identify key challenges and opportunities.

2.2 City Lab Joinville Process Timeline



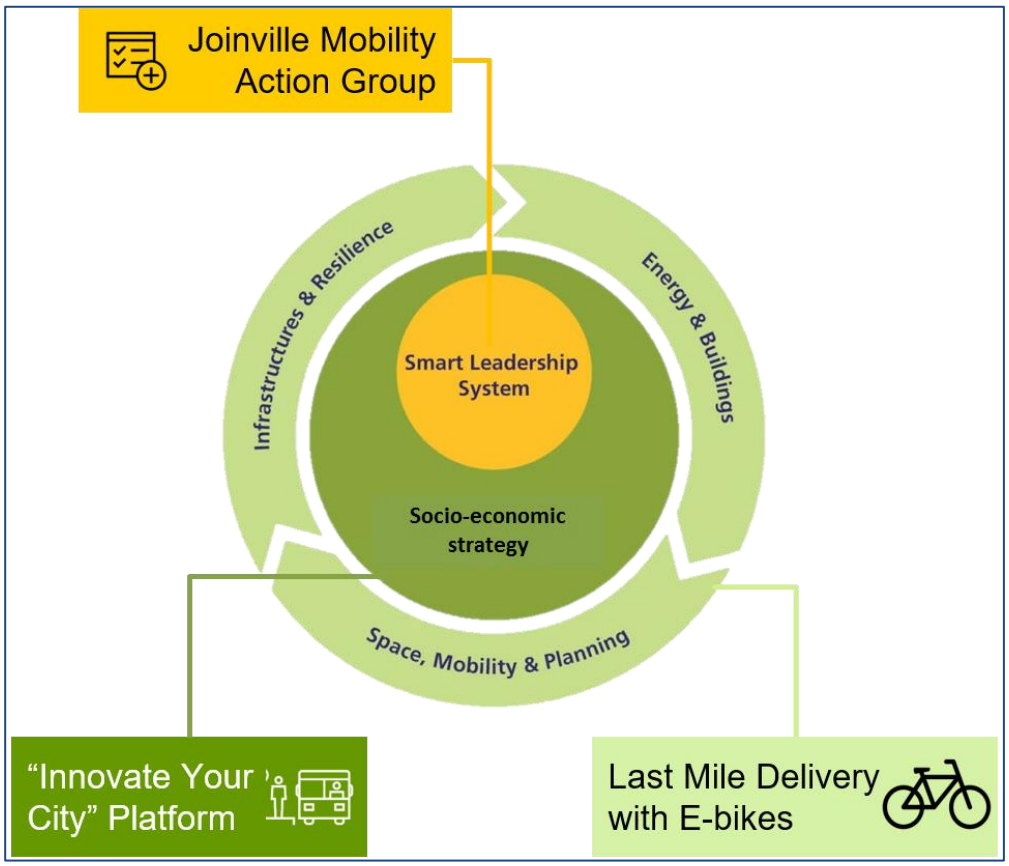
Graph 3. Mobility Lab Joinville Timeline

2.3 On-site assessment facts

The on-site assessment of the Mobility City Lab took place from the 23rd to the 1st of November 2017. 20 interviews with more than 35 interviewees, 4 site visits and 2 workshops were carried out by our Morgenstadt researchers.

The Secretary of Urban Planning (SEPUD) organized together with the GIZ interviews with representatives of different department within the city administration but also with bus and ticketing companies, cyclist associations, the regional administration, energy providers, environmental consultants and German companies such as Bosch, BMW and the start-up *Station-i* of the Zuweso GmbH (See list of interviewees). The interviews took place mainly during the morning and in the afternoon site visits to the main bus transfer stations (central station, ITAUM, Vera Cruz), the bus manufacturer BUSSCAR, and the SEPUD were organized. The assessment was done on the different strategic

layers and tackled all of the relevant aspects for transforming the mobility in Joinville: smart governance, socio-economic development, intermodality, e-mobility, and technical aspects as the restructuring of the tariff system. 25 innovative mobility project ideas were developed in the process and are presented in the sections below.



Graph 4. Mobility Lab Joinville Layers of Action
Icons: thenounproject.com

3. City Profile

Strategic plans provided by the local administration such as the mobility plan released in 2015 and a public transport user´s satisfaction research were studied and an exhaustive web research was carried to complement the analysis of the indicators and action fields collected. This information formed the basis of the sustainability profile of Joinville regarding Mobility presented below.

3.1 Overview of the mobility in Joinville

According to a survey conducted in 2010, the main means of transport used in Joinville were cars and motorbikes (41.15%), followed by public transport (24.60%), then walking (23.11%), and finally bicycles (11.13%)[9].

A survey conducted by the municipality in 2014 showed that the main reason why people use the public buses is to go to work (52%), and to go to study (24%). 54% of those using public transport, needed two buses to reach their destination, 26% used three, and 20% only one. Regarding the length of the journey, 27% of the users travel between 30 minutes to one hour while 25% travel between one and one and a half hour.

Table 1. Urban transport passenger flow
Source: adopted from Prefeitura Municipal de Joinville 2017: Cidade em dados 2017

YEAR	PASSENGERS/DAY	POPULATION	INDICATOR
2000	139.022	429.604	32,36%
2010	128.106	515.288	24,86%
2011	130.467	520.905	25,04%
2012	127.415	526.338	24,20%
2013	121.726	546.981	22,25%
2014	120.040	554.601	21,64%
2015	114.909	562.151	20,44%
2016	107.676	569.645	18,90%

According to the table above the passengers flow in the city of Joinville has a constant decreasing trend: in the last 16 years indicator of the transported passengers changed for 13,46% (from 32,36% in 2000 to 18,90% in 2016).

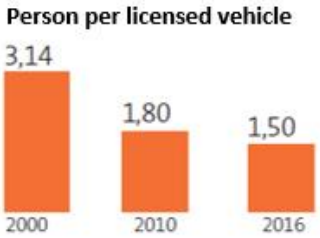
3.1.1 Private motor vehicles

Being the most used mode of transport in the city (41.15%), it is also the main cause for congestion in the main streets, especially in the city center. So far the municipality does not have any regulation or incentives establishing limitations to the use of motor vehicles. Furthermore, the payment system for parking in public parking is suspended since 2013. Nevertheless, the city has plans to implement a new parking system[10]. According to the study, the total fleet in the city increased by 32% if compared with the year 2010 (33% increase in private cars) and the number of persons per licensed vehicle decreased from 3,14 to 1,50 which pose a certain pressure on infrastructure[11].

[9] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2010
[10] ANotícia 2016
[11] Prefeitura Municipal de Joinville 2017

Table 2. Indicators of motorization and number of persons per licensed vehicle
Source: adopted from Prefeitura Municipal de Joinville 2017: Cidade em dados 2017

Indicators of motorization	2000	2010	2016
• Motorcycle and scooter	16.794	56.710	67.750
• Car	104.875	198.499	264.839
• Van	686	1.404	1.546
• Buses and minibuses	6.688	18.442	27.606
• Truck, tractor truck, pickup truck	7.949	11.107	18.421
• Others*		22.495	8.403
• Total fleet	136.992	286.162	380.162



3.1.2 Public transport

The public transport system in Joinville consists of buses. The system is organized around ten "Integration stations" (Estações de Integração) and the different bus stops along the city. It consists of 257 bus lines, which include 21 main lines, 17 inter stations lines, 184 feeder and special lines, and 4 neighborhood lines. The payment system consists of only one type of tariff, in which includes any number of connections[12]. So far two private companies are offering this public service: Transtusa and Gidion.

The Total Fleet is of 347 busses, from those 296 buses are accessible (35 from low floor). Efficient transportation: 14 minibuses (on request)[13].

Bus-only lane

The city has already implemented 21,4 kilometers of bus-only preferred lanes, which are considered by its new mobility plan as a small number for a city of its size. In addition, it has been acknowledged that 20% of the fleet is still not accessible for everybody (including persons with disabilities)[14]. Furthermore, some bus stops need refurbishment to provide a better service to customers the people, and that the Integration stations should be redesigned in a way that they become a reference point in the neighborhoods, offering services and place for shops[15].

User´s satisfaction

Public buses' users were interviewed in 2014 about a range of questions on public service satisfaction, alternatives, and preferences.

In terms of general satisfaction: 63% showed some degree of dissatisfaction with the bus stops' comfort, 61% with the public transport's costs, and 45% with the exposure to noise and pollution. When asked about if they would prefer

[12] Prefeitura Municipal de Joinville 2017
[13] Passebus 2017
[14] A federal law states that 100% of the public bus fleet should be accessible to everybody by December of 2014 (Decreto Federal 5.296/2004).
[15] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2010

to use an alternative mean of transport, 69% answered they would prefer to use a car, 26% to use a bicycle, and 19% to use a motorbike[16].

In terms of the services provided, 66% of the users surveyed expressed some degree of dissatisfaction with the service availability during the weekends, while 56% complained about the bus frequency, and 51% with the service availability during the evening. When they were asked about the waiting time, 58% said that they were unsatisfied or very unsatisfied with this aspect. Related to the ticket costs, 27% answered that they were very unsatisfied, and 46% just unsatisfied[17]. At the time of the survey in 2014, a ticket cost EUR 0,78 (BRL 3) if it was bought before taking the bus, and onboard EUR 0,88 (BRL 3,4)[18], which has increased in the last years, reaching the current cost of EUR 1,04 (BRL 4), and EUR 1,17 (BRL 4.5) onboard [19].

Regarding intermodality: 66% of those polled did a connection in the last month, mostly (83%) in the "integration stations", but 72% indicated that it is not easy to combine with the use of bicycles. Related to the use bicycles, the users were asked if they would cycle more, if there were safe and monitored bike stations, with a positive answer of 58%. With respect to the comfort in the buses, 76% of the people showed some degree of dissatisfaction with the amount of passengers in the bus (overcrowded). The exposition to noise and pollution generated by the buses was another topic where many users surveyed (55%) showed dissatisfaction. Finally, 41% of those polled were very unsatisfied with the long lines in the shops where the transport card are sold and recharged, 35% were unhappy with the opening times of those shops, and 33% with the facility of finding those shops[20].

3.1.3 Walking

Although it is an important transportation mode in Joinville, most of its citizens (66.25%) found it difficult to use the sidewalks due to a lack of them (58.09%) or because they were defective[21].

[16] WRI Brasil Cidades Sustentáveis 2014
[17] WRI Brasil Cidades Sustentáveis 2014
[18] G1 Rbs Tv 2014
[19] ANotícia 2017
[20] WRI Brasil Cidades Sustentáveis 2014
[21] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2010

3.1.4 Cycling

The city of Joinville counts with 125 kilometers of bike lanes, which are planned to be expanded. According to a survey from 2010, from the 58.03% of the people that do not usually ride a bicycle, 22.5% answered it was because they do not have one, and 17.97% because they find it dangerous. From the 41.97% of the people that usually ride a bicycle, 46.72% do not use bike lanes, as they do not exist (97.45%)[22].

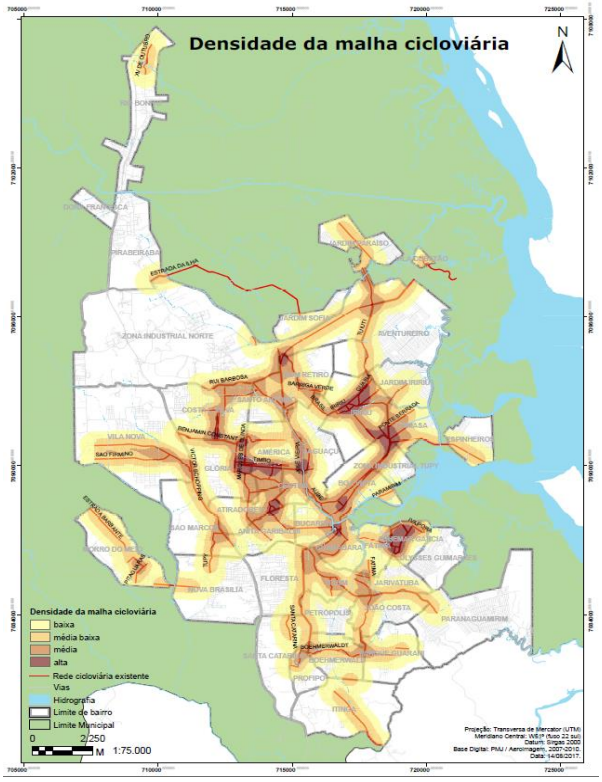


Figure 1. Map of bike lane density in Joinville.
Colours: yellow - low, orange - medium, brown – high.
Source: SEPUD, 2017

3.1.5 Rail freight transport

The freight train connects the city of São Francisco do Sul with Mafra, transporting goods from Santa Catarina (state) to the rest of the country. In average, there are 4 trips per day[23].

3.1.6 Port

The city has a port, which is closely located to other important ports in South Brazil, like Itapoá and São Francisco do Sul. The port has a railway branch line, which leads to Mafra, linking it with the national rail system[24].

3.1.7 Airport

Joinville's airport is located 13 kilometers away from the city center, with a growing presence of passengers (514,720 people in 2016, compared to 289,129 people in 2010, and 83,686 in 1990), but a decreasing amount of freight transported (986,533 kilograms in 2016 compared to 1,906,743 kilograms in 1990). In 2016 8,712 airplanes landed in the Lauro Carneiro de Loyola (Joinville) airport[25].

3.2 Mobility Plans

The process of developing a Mobility Plan started in 2012 with a primary research of the status of the mobility in the city. Defining the plan, was not an action carried unilaterally by the city, but rather a participatory process where the

[22] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2010
[23] Prefeitura Municipal de Joinville 2017
[24] Prefeitura Municipal de Joinville 2017
[25] Prefeitura Municipal de Joinville 2017

population had the opportunity to participate and comment on the plan. One of the remarked problems by the civil society was the lack of prioritization of the public transport and its inefficacy[26].

The city of Joinville developed the Mobility Plan (PlanMOB) in 2015, with the goal of establishing a priority between the different means of transport (Figure 2) and, at the same time, to tackle the negative effects associated to some of them[27] by integrating its mobility concept with a sustainable one. It also complements to the Municipal Sustainable Development Master Plan (Municipal Law No. 261 of February 28, 2008)[28] and implements the National Mobility Policy (Federal Law No. 12,587 of January 3, 2012)[29]. According to the National Policy guideline, this plan should be reviewed every ten years[30].

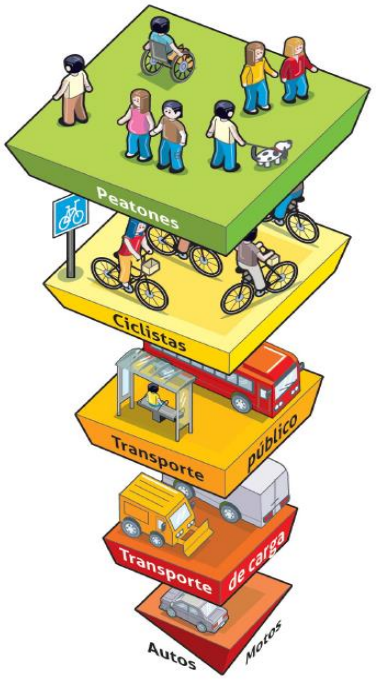


Figure 2. Prioritization levels of the transport in Joinville
Source: Planmob, Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015

One goal in the PlanMOB is to increase the number of trips in the neighborhoods, in order to revitalize them and promote the "decentralization" of the public transport. Thus, the concept of "Estações da Cidadania" (Eng. "Stations of Citizens") was proposed to transform the traditional bus stations into some kind of meeting point that also offer access to public administration services with the implementation of sub-prefectures besides access to the means of transportation inside its building[31].

The following mobility plan goals for all means of transport were defined with the aim of having a sustainable model for mobility in Joinville:

3.2.1 Walking

It has been highlighted by the city that walking will be prioritized in the first place as a mobility alternative. Therefore, the city wants to guarantee that walking is

[26] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015
[27] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015
[28] Prefeitura de Joinville 2008
[29] Presidência da República, Casa Civil 2012
[30] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015
[31] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015

attractive and safe, and that there are no major obstacles or threats to the pedestrians[32].

3.2.2 Cycling

As the second priority point, Joinville is willing to install 30 bike sharing stations, expand the bike lanes from the current 140 kilometers to 730 kilometers by 2025, and to promote the use of bicycles so the modal share should increase from 11% to 20% by 2025. However there is no exact plan on how this should be achieved, nor there is a strategic plan on where the bike stations should be installed.

3.2.3 Public transport

Joinville is attempting to reduce the use of private motor vehicles, thus the split share of buses should be increased and the goal is to reach 40% of all journeys by 2030, offering a more comfortable and efficient service, with a more accessible 'subsidized' price. By 2030 emissions generated by the public transport system are planned to be reduced by 50% and up to 100% by the year 2045. For the purpose of planning, controlling and funding of low-emission transport system Municipal Environmental Control Unit and Municipal Mobility Fund will be established[33].

3.2.4 Trains

As mentioned before, currently the city has only freight trains, but their intention is to use them also to transport people integrating them into the urban mobility system.

3.2.5 Freight transport

Regarding freight transport, it is intended to reduce its environmental impacts and increase road safety. This will be done via reorganization of areas where freight vehicles can circulate, preserving pedestrian, residential, and natural protected areas; and restraining irregular cargo transportation and extending monitoring for prevention of dangerous cargo.

3.2.6 Inland waterway transport

Similar to the use of trains, the city is willing to incorporate waterway transport to the urban sphere as an alternative for the passengers inside the municipality as well as for the displacement of the passengers at the regional level[34].

[32] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015
[33] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015
[34] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015

3.2.7 Contour routes

The execution of contour routes in the city becomes more and more urgent. They are specifically designed for the circulation of vehicles in the periphery of the urban area, in order to avoid or minimize the traffic in its interior, being able to completely surround the city and avoid urban sprawl[35].

3.2.8 Private motor vehicles

Private motor vehicles are the ones that generate the most CO2 emissions, compared to other modes of transport, and it is the most inefficient when transporting people causing traffic congestions. Hence, the Mobility Plan has as a goal to reduce the use of motor vehicles in the city by promoting other modes of transport, and a new parking system. Additionally, it is stated that 35% of the taxis' CO2 emissions should be reduced, which shall be achieved by increasing taxes (port. IPVA-Imposto sobre a Propriedade de Veículos Automotores) to cars with higher CO2 emissions.

3.2.9 Air transport

Finally, the city added a goal to promote the use of flights, for freight and people transportation, by building new roads connecting to the airport, to facilitate the access to it.

3.3 Other related plans

Municipal Bicycle and Pedestrian Plan: has been already approved and states the strategies for expanding the bike lanes network and upgrading the existing ones.

Furthermore the city is working on other plans for guiding the particular actions in each specific area, following the goals and guidelines defined in the PlanMOB:

- Master Plan of Afforestation: aims to include all the norms that guide the plantation and maintenance of flora in the city's green areas.
- Public Transport Guidelines Plan: should establish guidelines and regulations for public transport.
- Municipal Infrastructure and Urban Facilities Plan: with an integrative view, this plan considers all the mobility and infrastructure aspects, in order to plan future adaptations and expansion.

3.4 Indicator Analysis

The analysis of the indicators shows a status quo inventory of Joinville and addresses the following question: „What is the sustainable performance of the city?"

[35] Fundação Instituto de Pesquisa e Planejamento para o Desenvolvimento Sustentável de Joinville 2015

A total of 46 indicators were taken into account for the analysis. Those address different aspects concerning mobility and other sectors. The main focus of interest is on means of transport for Joinville's citizens and in some cases freight transport was also taken into account. However, the integrated point of view on the topic of mobility requires the inclusion of additional indicators of different sectors, such as urban structure, energy, environment, society, economy and ICT. The consideration of different indicators is important in order to evaluate the entire system. Mobility is an integral part of the social and economic prosperity of a city, a region or a state. As the current transportation system has an adverse impact it is important to transform the mobility in Joinville. Due to the limited availability of data, not all indicators were evaluated. Accordingly, the report only presents arguments based on the existing data.

The analysis is based on experience of „Indicators of the Emerging and Sustainable Cities Initiative" (ESCI) of the Inter-American Development Bank and the Fraunhofer "Morgenstadt City Initiative" (MCI). The scale of the benchmark is divided in three categories: green (no problem), yellow, red (critical issue). The following figure shows an overview of the mobility indicators and benchmarks.

Indicator (name and unit)	**Indicator scope**	**Value Joinville**	**Green**	**Yellow**	**Red**
Modal split in % of total traffic	share of traffic by pedestrian	23,11%	> 40%	20% - 40%	<20%
	share of traffic by bicycle	11,13%	> 25%	5% - 25%	< 5%
	share of traffic by public transport	24,60%	> 65%	50 - 65%	<50%
	share of traffic by personal vehicles (cars, motorcycles,etc)	41,15%	< 15%	15% - 40%	>40%
Level of motorisation in passenger vehicles per 1000 city inhabitant	The ratio between the total number of passenger motorized vehicles (incl. cars & taxis) within the urban agglomeration and the population.	434	< 300	300 - 400	> 400
Parking fee in $/h	average cost of parking per hour	1,74			

Special roads for public transport in km/100.000	Kilometers of roads dedicated exclusively to public transit per 100.000 population	3,7	> 40	10 - 40	< 10
Special paths and lanes for bicycle in km/100.000	Kilometers of bicycle paths and lanes per 100.000 population	24	> 25	15–25	< 15
Use of public transport rides/annum/capita	average number of annual rides per capita	69,6 (bus)	>400	200 - 400	<200
Cost of a (day) ticket in central area of the city	in €	1,02	< 6,50	6,50 - 8,50	>8,50
Modal split of freight system in % of total freight traffic volume	rail	0%	>25%	10% - 25%	<10%
	road	>95%	<70%	70% - 85%	<85%
	water	0%	>15%	5% - 15%	<5%
Electromobility in % of total number of vehicles	share of e-vehicles	0%			
Safety	number of annual fatalities per 1000 inhabitants	0,28	< 0.1	0.1–0.2	> 0.2
congestion and delays in hours per capita and year	hours spending in congestions	23,5h			

In addition to the stated benchmark, it is helpful to compare the values of the indicators with regional or national numbers and averages. In addition, several "best-practices" examples were taken into account.

The share of bicycle traffic has a value of approximately 11%. The average of the southern region is 2%[36], however, this percentage includes rural areas with fewer alternative transport modes. In comparison bicycle share in European cities

[36] M. Pochmann 2011

such as Cologne (2008) and Helsinki (2013) ranges between 11-13 %[37]. An extraordinary example is Copenhagen, where 30% of all transportation is carried out by bicycles.

In comparison to the remaining southern states, public transport is rarely used. While in the southern region the share of public transport is 46,3 %[38], about 22% of the total traffic in Joinville is only covered by public transport.

In contrast, the share of private motorised transport (car and motorbike) is much higher than in many other cities in Brazil. A high level of motorisation in Joinville is demonstrated in the number of 434 cars and taxis per 1.000 inhabitants in 2016. The development of the past 15 years shows a heavy increase of the total fleet as it almost tripled in this time range. In 2009, there were 282 registered vehicles in Recife, 250 in Fortaleza per 1.000 inhabitants. Joinville´s level of motorisation is significantly above the Brazilian average, which was about 249 passenger vehicles per 1.000 inhabitants in 2016[39]. Compared to the European level of motorisation, the value of Joinville (in 2016) is about 40 vehicles per 1.000 inhabitants less than the average of Europe in the year 2010 (477).

Furthermore, parking fees are an essential indicator to analyse the aspects of stationary traffic. The average cost of parking in Joinville is about BRL 3,16 (approx. EUR 0,80). By comparing this value with the parking fees in European cities, such low costs are most likely to be found in cities in Eastern Europe (between EUR 1-2). In terms of parking fees, London has the highest rates in Europe with an average of around 10 euros per hour[40].

With regard to the infrastructure, special paths and routes can encourage alternative modes (cycling and public transport). Some special lanes already exist, but the length of these specific lines is short and the existing network is quite fragmentary. In the context of the area-wide extension of the city, the length of 27 km of special bus lanes is relatively low. The city of Curitiba is a good example for a well-developed network with special paths and lanes for bus transport. The Curitiba Integrated Transport Network totals about 800-900 km of routes with 3 out of the 8 varying service lines running on dedicated bus lanes[41].

The length of the special cycle paths is with 147 km quite small with regard to the extent of the city, and although it is fragmentarily interrupted, it is of certain importance for the urban networks.

An example, which was designated in many of the interviews as "good-practice" in Brazil, sets the city Fortaleza. Within the program Bicicletar, it is planned to

[37] Österreichische Gesellschaft für Politikberatung und Politikentwicklung (OGPP) 2016
[38] M. Pochmann 2011
[39] Instituto Brasileiro de Geografia e Estatística (IBGE) 2013
[40] Süddeutsche Zeitung 2016
[41] Friberg 2000

achieve 524 km of asphalted paths throughout every zone of the city[42] in a period of 15 years. A good reference is Amsterdam, as it is one of the most bicycle friendly cities in Europe. The cycle path network of the city covers about 400 km[43] on an area of about 219 km², which is similar to the area of Joinville (about 210 km²).

Moreover, the benefit and costs of public transport were taken into account as well. The services in Joinville count an average of 107.676 users of public transport[44] per day, which was about 70 rides per year and inhabitant in 2016. In the Curitiba Integrated Transportation Network it was 384 rides per year and inhabitant[45]. A daily ticket in Joinville costs BRL 4, whereas in Curitiba a single trip costs BRL 3 and in Florianópolis BRL 2,90[46]. However, due to different ticketing systems it is hard to compare the costs.

Almost 100% of freight transport in Joinville is transported by road. Rail and water transport is scarcely of any importance, as over-sea transport is not taken into consideration. Brazil shows a pre-eminence in freight transport by road (61,1%), too, but in a nationwide context. Therefore, comparison to inner-city logistics is not reasonable, as it is conventionally road bounded.

In the conversion of the transport system to non-fossil fuels, electro mobility is of high importance. Joinville´s share is about 0%, as it quotes only few registrations of electric vehicles. In the EU, electric passenger vehicles represent only 1.2% of all new cars sold in 2015, as its market is quite limited to a few countries. A prominent example for a high share of electric vehicles in Europe is Norway with more than 20%[47].

The road safety in Joinville is in a critical state with 28 traffic fatalities per 100.000 inhabitants. The same situation applies for the traffic accidents counting more than five accidents per 1.000 habitants in a year. The capital of Santa Catarina, Florianópolis, counts 22,6 traffic fatalities per 100.000 inhabitants[48]. The average in Brazil is 23 traffic fatalities in 2013. In Germany, there were only 3,8 traffic fatalities per 100.000 inhabitants in 2016[49].

In terms of delays caused by traffic, Joinville´s loss of time in congestion with 23,5 hours per capita and year is far below Feira de Santana with 32,9 hours but above Cuiabá with 20,7 hours (both similar population) of waiting time in traffic.

[42] Prefeitura de Fortaleza 2014
[43] Resorti 2017
[44] Prefeitura Municipal de Joinville 2017
[45] Friberg 2000
[46] Mobilidade urbana sustentavel 2018
[47] Nils-Viktor Sorge 2017
[48] Mobilidade urbana sustentavel 2018
[49] Destatis 2016

Out of 54 investigated cities, Joinville takes place 15 beginning with the longest waiting time of 77 hours in Sao Paulo[50].

For better classification of the mobility-related values and inclusion of effects on other sectors, the examination of further topics is of relevance. Therefore, economic, spatial and urban-structural aspects as well as the development of the population were involved. The economic performance of Joinville is stronger in comparison to its state regarding the GDP per capita in Joinville with BRL 34.767 in 2012 and BRL 32.289 in Santa Catarina in 2013[51]. The monthly average household income was BRL 1126.74 in 2013 in Joinville which is more compared to Santa Catarina's average with BRL 983.90[52]. About 30% of the income flows into rental expenditures. Measuring the inequality in income, Joinville is pointing in the direction towards slightly greater equality than the rest of Brazil[53]. It has to be recorded that the population development was dynamic in the recent years and the total population development is positive (1,63% between 2010-2017). To conclude, Joinville is relatively well developed compared to other Brazilian cities. But also spatial aspects should implicitly be considered in terms of structure and expanse. The urban structure is formed by a land use of 11,94% occupied by traffic and 31,75% of undeveloped area of the total city area. The density of 2.705 inhabitants per km² in the urban center is relatively low compared to the density of cities like Recife (7133 inhabitants/km²) or Curitiba (4062 inhabitants/ km²).

There was no information available on energy and environmental indicators in Joinville such as carbon dioxide, fine dust or nitrogen oxide. To analyse the energy consumption and emissions produced by traffic, these indicators are valuable.

3.5 Action Fields Analysis

The following analysis indicates how the city addresses sustainability in existing activities and development plans. The following list gives an overview of the relevant fields of activity and related sub aspects.

Intermodality

The action field addresses subjects such as the building of mobility stations in order to combine different transport modes more easily. Moreover, the installation of park & ride spaces in selected stations of the public transport, the

[50] INRIX 2017
[51] Instituto Brasileiro de Geografia e Estatística (IBGE) 2013
[52] Research And Planning Institute Foundation For Sustainable Development In Joinville 2015
[53] International Bank for Reconstruction and Development/The World Bank 2015

combination of public transport with sharing-concepts as well as the offer of integrated ticketing systems allow the use of different mobility suppliers.

E-mobility

The action field focuses on the promotion of integrating e-mobility into cities. This includes topics like the utilisation of electric vehicles in the own fleet of a municipal administration, the promotion of electric vehicles by reducing fees (for example free parking, reduction in taxes on emissions) or the construction of charging infrastructure in public spaces.

Public transport

The action field contains themes like the privilege for busses on special lanes as well as the active use of real-time information.

Sharing systems

The action field aims to promote parking spaces for sharing-vehicles and the establishment of sharing concepts and propositions in the city.

Traffic management & parking

The action field includes subjects on environmental and low-emission zones, systematic reduction of parking lots in the inner city as well as fee models for parking and the entry in chosen areas of the inner city.

Pedestrian & cycling

The action field focuses on the special treatment of pedestrians, the bicycle transport in planning or the built environment such as the extension of pedestrian zones or cycling infrastructure.

Mobility management

The action field contains topics like the elaboration on integrated mobility strategies, the existence of organising positions and personnel capacities for the coordination and communication of mobility themes, as well as the collection and utilisation of real-time data for traffic control.

The following table shows a status quo of the action fields answered by the assessment City team.

Table 3. Joinville Action Fields

Action field intermodality	**yes**	**no**	**planed**
Does the city implement mobility hubs to combine several modes of transportation (bus, bycicls, sharing vehicles, charging stations etc.)?		X	
Has the city implemented park&ride slots around public transport nodes?		X	
Has the city implemented sharing stations (car or bike) around public transport nodes?		X	
Does the city provide one ticket for all mobility alternatives (public transport, car-sharing, parking etc.)?		X	
Action field e-mobility	**yes**	**no**	**planed**
Does the city administration have electric vehicles in their municipal fleet?		X	
Are there specific "free parking slots" in the public space reserved for electric vehicles?		X	
Does the city incentivize the purchase of EVs (e.g. by reduction on carbon tax?)		X	
Is there a plan to implement a charging infrastructure in the public space of the city?		X	
Is there a booking system in place for the charging stations?		X	
Action field public transport	**yes**	**no**	**planed**
Do buses and trams have own priority lines?	X		
Are real-time data from the public transport system used to monitor the traffic in the city?		X	
Action field sharing systems	**yes**	**no**	**planed**
Does the city provide parking spaces for shared vehicles?		X	
Does the city implement car sharing in the city?		X	
Action field road traffic management and parking	**yes**	**no**	**planed**
Has the city created low-emission zones?		X	
Is the city undertaking a systematic process of decreasing the number of car parks in the city?	X		
Has the city implemented pricing mechanisms to control commuting patterns (congestion charging, tolls, etc)?		X	
Action field pedestrian and cycling	**yes**	**no**	**planed**
Does a mobility-plan include cycling and pedestrian accessability as key elements?	X		
Does the city expand pedestrian-activities in the public space (e.g. pedestrian zones etc.)?	no information		
Does the city expand cycling-activities in the public space (e.g. cycling lines etc.)?	X		
Action field mobility management	**yes**	**no**	**planed**
Has the city developed an integrated mobility strategy?	no information		
Does the city have a single body/organization responsible for the communication and coordination of transport managers (eg parking, PT, Bike/car sharing..)?		X	
Does the city collect and utilize real time data to optimize the traffic system (eg user data to understand mobility behavior and artifact based data)?			X

Does the traffic management respond to real time data (e.g. change traffic light circuits)?	no information
Is the overall transport system being improved on the basis of real-time data measurement?	no information

In addition to the query, the levels of implementation of the action fields in the strategic documents was investigated.

According to the City team the action fields "sharing systems", "e-mobility" and "intermodality" are largely unattended. Especially the action field "intermodality" was rated important from the responsible persons of the municipality and other actors in the area of mobility for the sustainable creation of the mobility sector. In combining the promotion of cycling and public transport, there are different practical ideas and synergies. Furthermore, in the interviews with the actors, there were several debates on the topic of "e-mobility". Concepts like „freight transport over the last mile" or „integration of electric vehicles in fleets" of companies, public institutions and universities can be implemented. The installation of charging infrastructure is to be combined with "Park and Ride" spaces or big parking garages. The usage of e-bikes as electric vehicle was in debate within the scope of "e-mobility".

The existing plans and the current activities focus on the action fields "pedestrian & cycling" as well as "public transport". Most activities are stated in the action field "pedestrian & cycling". In addition, the importance of transport by bike and feet in order to achieve a more sustainable mobility has been emphasized in conversations with the various interview partners. In addition, walking is to become safer and barrier-free. The municipality is taking an important step to create a sufficient and functional infrastructure for biking in the city by extending cycling lanes and filling the gaps of the cycling network. On top of that, it is planned to build bike sharing stations to increase the share of cycling in the modal split. During interviews it was pointed out, that essential factors to make cycling more attractive are facilities to lock up the bike and ensuring safety when riding the bike.

Scope of important fields of action

With regard to the implementation of listed actions, the concrete process of expansion of the cycling network is not definite. Furthermore, the location of the construction site of bike stations is still uncertain. For this purpose, several relevant places were inspected as part of the onsite assessments. Generally, the partners throughout the dialogs mentioned, that Joinville used to stand for the capital of cycling in Brazil. It is to become the cycling capital again.

Besides "pedestrian & cycling", "public transport" is to prioritize. Some special lanes for buses exist, but the length of these specific lanes is short and the existing network is quite fragmentary. In terms of promoting public transport, the plans list „decentralisation" of public transport as well as making bus stations

more attractive as objectives. The goal to achieve 40% share of cycling and 100% less emissions in bus transport are ambitious within the scope of the mobility plans. Service has to become more comfortable and efficient and fees have to decrease. Moreover, an installation of on-board units with GPS in busses have to be part of the planning of bus operators in 2018. Thereby, an improvement of process coordination and planning is provided. The different actors in the interviews offered great receptiveness to new concepts in bus transport (like express bus lanes, initiation of a zoning system etc.) as well as investments in infrastructure (like more special lanes, intermodal bus stations, usage of real-time data). There are only a few pilot projects. The action field public transport indicated, that measures and activities are frequently related to high investments, too. This refers especially to the reconstruction or adaption of built infrastructure like roads and stations, to the provision of new vehicles as well as the implementation of technologies for example in the area of billing systems. Partially, this represents a major barrier for the implementation.

Further activities related to "traffic management & parking" and "mobility management" are planned. By creating the PlanMOB, the municipality is taking a major step in comprehensive mobility management towards strategic planning in the field of „mobility". Therefore, the PlanMOB is a central document with policy formulations. In the long-term, the concretization of implementing actions are intended to be pursued. The following measures are already taking place in the planning area of „traffic management & parking": gathering of real-time information and its specific use to improve traffic. Plans to limit parking in the inner city are existing.

Several activities in the action fields "cycling" and "public transport" are well developed. To increase the share of bicycles in the city and follow the aim of being one of the most bicycle-friendly cities of Brazil, actions have to be advanced and combined with other transport modes. Reasonable and cost-efficient measures can result in positive effects.

A range of important action fields that aim to improve the sustainability of the mobility systems of cities have not yet been addressed in Joinville, namely, „intermodality", „e-mobility" and "inner-city logistics".

Intermodality is an action field with impacts on different indicators. It offers many options to improve and increase public transport and cycling. Attractive connecting stations present high potential to facilitate the transition from private vehicle to public transport. These investments have an impact on indicators such as the transformation of the modal split. Mobility stations as well as city logistics offer potential for electro mobile concepts in the city.

3.6 SWOT Analysis

The preparatory phase composed of the adaptation of the Morgenstadt methodology, the analysis of the indicators and action fields above as well as the study of the strategic documents of the city allowed the City Lab researchers to have a global understanding of the main aspects and issues regarding mobility in Joinville. Strengths, weaknesses, threats but especially opportunities were identified in this process and deepened and completed during the interviews. This was the basis for co-developing the project ideas during the on-site assessment. During the conversations with the stakeholders, further relevant information was gathered and generated. Further opportunities for sustainable mobility were identify and developed.

The data was then classified and condensed in the SWOT tables presented below. The information was clustered in four categories: governance, public transport, non-motorized transport and motorized transport. This data on the one hand is a summary of the status quo in Joinville in terms of mobility and on the other hand is the reason and justification for the project ideas presented in chapter 4. All facts and figures provided in tables have been collected during on-site assessment, stakeholder interviews and based on such sources as Mobility Plan of Joinville (PlanMOB, 2015), QualiÔnibus Satisfaction Survey (2014), Joinville Sustentável (2015) and City in Numbers (Cidade em Dados, 2017).

Table 4. SWOT analysis of the governance regarding mobility in Joinville

Strengths	Weaknesses
● Local Government sees Mobility as one of the priorities and enabler for local development. ● PlanMOB stated goal to reduce the use of motor vehicles in the city by promoting other modes of transport, etc. ● Existence of initiative as *Joinvalle* or *Joinville 30 anos*, enhance citizen participation, engagement and awareness. ● The existing "Mobility Observatory" has been recently reactivated. ● Local Government supports co-creation and inclusive processes in the development of projects to increase public acceptance. ● High potential for local development due to the existing infrastructure: railways, airport.	● Lack of coordination between the different institutions and agencies related to mobility such as SEPUD, UDESC, Univille University, Softville, etc. ● In PlanMOB as one of the main challenges was mentioned long and complicated processes for project implementation. ● Lack of concrete strategies to achieve strategy plan goals. For example, according to the mobile diagnosis book, published on the IPPUJ website, the scenario we find in the city is not conducive to the movement of pedestrians. ● No incentives provided by the city to promote initiatives such as "car sharing" in the companies. ● Current taxation system designed to promote the private car. ● Municipality does not have any regulation or restrictions to the use of motor vehicles.
Opportunities	**Threats**
● The Mobility Observatory could be expanded and transformed and institutionalized into the proposed "Action Group". ● Valuable mobility data available at universities, city administration, public transport companies, telecommunication companies, cyclist association, and others. ● Wide openness and willingness shown by the different stakeholders to try and implement new things for improving the current system e.g.	● Uncoordinated activities can lead to inefficient use of resources. ● Uncompleted implementations block potential investment .e.g. from the Caixa Federal. ● Current taxation system discourages the transition to e-mobility. ● The state of the infrastructure pulls back economic development.

Universities and e-mobility. ● ● Existing living lab promotes innovation and co-creation. ● Public buildings currently under used or empty as potential storage for promoting last mile distribution. ● Energy provider CELESC has development programs for research on alternatives sources of energy as solar energy and their impact. ● Instruments as the "Estudo de Impacto da Vezinhanza" can be used to promote sustainable transport. ● The "Parcerías verdes" could be revised to promote/include bike infrastructure investments, etc.	

Table 5. SWOT analysis of the public transport system in Joinville

Strengths	Weaknesses
● "Joinville Sustentavel" actively promoting sustainable mobility and affordable public transportation. ● According to the QualiOnibus study 60% of passengers think that access to public transportation is good or very good. ● Free use of the public transport for several groups (e.g. age more than 60 years). ● First short- and medium-term goals have been established, such as: intermodal integration; improvement of collective transportation infrastructure; qualification of roads, public transport vehicles and bus shelters; implementation of information system for users; road segregation for collective transportation.	● Among the motorized modes, only 37.41% correspond to the collective transport, no intermodality services offered. ● Joinville has only a little more than 14 km of preferred routes for busses. ● 54% of the passengers need two busses to reach their destination, 26% of passenger need 3 or more. ● 67% of passengers think that existence of good sidewalks and crossings around bus stops and stations are bad or very bad. ● 20% of the fleet is still not accessible for everybody (including persons with disabilities). ● 63% of passenger showed some degree of dissatisfaction with the bus stops' comfort. ● Not available real time information available to end users and on users' movements for improving routes or designing new lines accordingly. ● 61% of passengers are dissatisfied with the public transport's costs, single tariff implies too high costs for short distances. ● Overcrowded buses particularly in peak times.
Opportunities	**Threats**
● The operation of the system is carried out by two concessionaire companies, with priority areas (north and south). ● City has 49% more buses and minibuses if compare to 2010. ● Goal is public transport to reach 40% of all journeys by 2030. ● More comfortable and efficient service, with a 'subsidized' price, and a 100% reduction of the buses emissions by 2045 is also aimed. ● Train transport is recognized nationally as national security. ● Existing railway infrastructure currently used only 6 times (for freight) a day can be also used for public transport. ● Plans for introducing express / direct lines exist. ● Intense cooperation between local companies and the	● The lack of prioritization of collective transport. ● Continuous population increase (in 2017, the population of Joinville reached approximately 570,000 people). ● Bottlenecks, mainly in the city center. ● There is a lack of competition in the market, since the entire operation of the system is carried out by two concessionaire companies, with priority areas (north and south). ● Number of persons per licensed vehicle decreased from 3,14 to 1,5 (if compare with 2000) which pose a pressure on infrastructure and indicates that more people prefer to travel with a private car. ● High costs for the implementation of infrastructure. ● Some companies supporting rather the use of shuttle busses. ● In the Brazilian culture, the use of public transport is

public transport sector. ● The installation of GPS in the bus fleet is planned for next year. Information can be used to improve the user experience. ● New incomes from the "blue zones" or "green/zero emission zones" can be used to partly subsidize public transport.	associated with being poor and has a bad image.

Table 6. SWOT analysis of the non-motorized transport in Joinville

Strengths	Weaknesses
● Compared to other cities in Brazil, Joinville has a high percentage (11,13%) of bike use. ● Existence of a clear vision as "Joinville Sustentavel" - promotes sustainable mobility, recognizing the interdependence between transports, health, and the environment and has specific objectives. ● City main goals are to: reduce the need for using individual motorized transport and promoting transportation on foot or by bicycle. ● City administration´s aim is to develop and maintain a good infrastructure for pedestrians and people with disabilities, with adequate sidewalks and crossings. ● City wants to guarantee that walking is attractive and safe, and that there are no major obstacles or threats to the pedestrians ● Plano Director de Transportes Ativos foresee the expansion of pedestrian zones - needs to be implemented.	● Cars still represent an average of 45% of the trips percentage vs: non-motorized trips corresponded up to 34.25%, and foot mode (23.11%). ● The city is not conducive to the movement of pedestrians: sidewalks are the sole responsibility of the owner of the lot for its execution and maintenance, present serious problems of accessibility, continuity of routes and lack of standardization. ● The existing bike routes are not connected. ● The road structure of Joinville (and for bicycles also) can be explained by the intense opening of roads that goes back to the period of foundation and development resulting in an extremely spontaneous system, without academic urbanistic criteria. ● 5% of the routes still take place on unpaved roads. ● 67% of passengers think that existence of good sidewalks and crossings around bus stops and stations are bad or very bad. ● Most of its citizens (66.25%) found it difficult to use the sidewalks due to a lack of them (58.09%) or because of being defective.
Opportunities	**Threats**
● Best practice examples on the promotion of bike sharing in Fortaleza, Malharia Princesa and other Brazilian cities can be used as reference and for knowledge exchange. ● Poll show that 58% of passengers would cycle more if safe parking would be provided; city planned to install30 bike sharing stations. ● PlanMOB foresees the expansion of bicycle roads up to 730 km (140 currently) by 2025. ● Bike stands can be included in the planned "estacionamentos azueis/rotativos". ● Caixa Federal open to finance (If well organized, agreed), bike promotion projects. ● Logistic companies openness and willingness to implement last kilometer delivery with bikes. ● The maintenance of sidewalks can be concussed/outsourced and financed via a new "Taixa da Calcada" or an increased IPTU (Property tax).	● In 2017, the population of Joinville reached approximately 570,000 people which may pose a certain pressure for the non-motorized infrastructure of the city. ● The PlanMOB should be reviewed every ten years which may be too short or too long period of time for a proper review especially in terms of non-motorized transport. ● Municipal Fund for Sustainable Mobility (FMS) may be used ineffectively for a small range of areas of action and financing. ● Extremely high taxes for bike purchasing vs cars (>70% of bike price are taxes) while cars are subsidized. ● Use of car regarded as a status symbol.

Table 7. SWOT analysis of the motorized transport in Joinville

Strengths	Weaknesses
● Relative costs of individual transport versus the costs of public transport are nearly the same.	● Being the most used mode of transport in the city (41.15%), it is the main cause for congestion.

• High flexibility. • Governmental subsidies for car purchase. • The payment system for parking in public parking is suspended since 2013. • Car seen as a status symbol in Brazil.	• The road structure of Joinville is consist of an extremely unplanned system, without academic urbanistic structure. • The road infrastructure causes bottlenecks in the city center. • Absence of large parking public spaces. • 5% of the routes still take place on unpaved roads. • The increasing amount of cars are causing too much pressure on the infrastructure. • Number of private cars has increased in 33% while their occupancy decreased from 3,14 to 1,50.
Opportunities	**Threats**
• Municipal Fund for Sustainable Mobility (FMS) may be used for a greater range of areas of action and financing of private motorized transport. • The new proposed rotary parking model aims to equalize the use of the track intended for it, to improve the flow of vehicles in the 'Blue Zone'. • The execution of contour routes in the city is part of the planned measures in the Master Plan.	• PlanMOB establishes that collective transport should be prioritized over private. • PlanMOB states that 35% of the taxis' CO2 emissions should be reduced, which will be achieved by increasing taxes (IPVA-Imposto sobre a Propriedade de Veículos Automotores) to cars with higher CO2 emissions. • Blue Zone taxation will be implemented next year. • Parking lots on public roads are being reduced. • Speed reduction measures will be implemented. • 91% of passengers think that a city with fewer cars and bikes would be nicer to live in. • Join.valle foresees the implementation of special Radars: with cameras of high definition, integrated to the system of transit.

The analysis above confirms the conclusions extracted from the strategic documents regarding the immediate need for improving the public transport, the lack of intermodality, the strong private car culture and the general discontent of the users with the services offered. Manifold opportunities have identified and they should be used to start the change and designing the roll out of the projects.

4 Project ideas for transforming the mobility in Joinville

During the 1,5 weeks of on-site assessment, a total of 25 project ideas were developed together with the interviewees and during the internal working sessions of the local and the City Lab assessment team. The assessment was conducted in a way that promoted constructive discussions and the co-creation of solutions for facing the mobility challenges in the city.

The innovation workshop organized on the 1st of November had the aim of presenting, verifying, discussing and further develop the ideas for smart city projects and measures that were generated and shaped during the on-site assessment 23-31 Oct. Given the limited time available on the innovation workshop, 10 out of the 25 project ideas were selected by city representatives

and the City Lab team, to be presented and discussed in detail on the 1st of November.

4.1 The innovation workshop of 1st November

More than 35 representatives the municipality, private companies as BOSCH, Passebus, bus companies, start-ups, research institutes, universities and GIZ experts participated in the session. As an introduction, the City Lab methodology as well the interim results and the 25 developed ideas were briefly presented. The ten ideas selected for a further discussion were then presented in more detail and the participants were divided in 5 groups according to their expertise and/or area of interest. Each of the working tables was assigned one of the ten project ideas for its validation and further developing regarding the needed components, the strategic stakeholders, next steps, possible financing options and others. For this, templates were designed and distributed and explained to the moderators in advance. The groups had 1,5 hours for the discussion and to fill in the templates (see project descriptions below). The moderation of the small groups was done by one municipal expert and one GIZ expert. The Morgenstadt team coordinated the overall procedure and intervened in the moderation when needed.

After a redistribution of the participants, a second round of 1,5 hours followed for the discussion of the 5 other projects left. Finally the results of the discussion and the filled templates were presented in plenum in the form of a market place with a short 3 minutes pitch by the table moderators.

The 25 project ideas developed throughout the City Lab are presented below. The ten projects discussed on the 1st of November are presented with more detail. Additional research work was done after the on-site assessment for finding adequate reference projects for most of the ideas. Furthermore and upon request of the GIZ, an additional assessment regarding the contribution of each of the projects to climate change mitigation was carried out.

4.2 Contribution of the project ideas to climate change mitigation

As it was mentioned in the first chapter, the main goal of the Joinville City Lab is development of a Roadmap for sustainable urban mobility. All projects proposed or generated during the final Workshop on the 1st of November have been assessed in accordance to the contribution to climate mitigation and suitability for strategic alliance.

Climate mitigation are all actions and solutions which limit the rate of climate change in the long-term perspective and generally involves reductions in anthropogenic emissions of greenhouse gases (GHGs)[54]. Assessment was conducted based on such trusted sources as United Nations Framework Convention on Climate Change (UNFCCC) and European Union Council of Ministers of Transport. The ultimate objective of the UNFCCC is to stabilize

[54] B. Metz et al. 2007

atmospheric concentrations of GHGs at a level that would prevent dangerous human interference of the climate system which is in line with Climate change mitigation[55]. Moreover, Brazil signed its intended contribution to the goals of UNFCCC as a non-annex party[56]. European Union Council of Ministers of Transport in Brussels defined characteristic features of a sustainable transportation system and they include such ones as accessibility and affordability of all means of transportation, limit GHGs generation, operation is based on the use or renewables, high level of efficiency, safe for society and ecosystem in terms of land use and other then chemical emissions generated[57].

Definitions cited above in combination with overall goal of Convention on Climate Change basically paraphrase the conditions under which transport is more "clean" and is involved in climate change mitigation process due to its characteristics. That is why, it was decided to design climate mitigation assessment tool based on such generalized factors as:

- "Emissions and waste generation";
- "Energy consumption and efficiency";
- "Consistency with ecosystem".

The main goal was to conduct a valuation which will take into consideration GHGs and any other type of possible pollution generated under "Emissions and waste generation" factor, how energy efficient is project, use of non-renewables and their levels under "Energy consumption and efficiency" factor, and whether project is in harmony with local citizens and ecosystem in general under "Consistency with ecosystem" factor. All 25 projects proposed during the City Lab Joinville were rated based on a scale that calculates a grade that gives an idea of climate mitigation scale of the project. Minimum possible grade is 1 and maximum possible grade per factor is 5. The sum of three is an overall grade for climate mitigation impact of the particular project which in turn gives maximum possible grade of 15 after each factor is rated. Scale of the mitigation is divided in 4 groups:

- 3-6 – low climate mitigation impact;
- 7-11 – moderate climate mitigation impact;
- 12-15 – high climate mitigation impact;
- Not applicable (N.A.) – impossible to measure climate mitigation impact.

[55] UNFCCC 1992
[56] UNFCCC 2015
[57] European Council: 2340th Council meeting 2001

Colour	Mitigation Level		VL	Emissions and waste generation	Energy consumption and efficiency	Consistency	Grade
	High		1.Joinville Mobility Action Group	not applicable	not applicable	not applicable	0
	Moderate		2.Promotion of high occupancy in private cars	1	2	2	5
	Low		3.City Green Certificate	4	4	1	9
			4.Citizen participation app for reporting transport issues	not applicable	not applicable	not applicable	0
			5.Open Data Platform	not applicable	not applicable	not applicable	0
			6.Establishment of a "Low emission area"	5	4	5	14
			7.Creation of a pedestrian Zone	4	2	4	10
			8.Outsourcing sidewalks construction and maintenance via property tax	not applicable	not applicable	not applicable	0

Figure 3. Example of the climate mitigation assessment tool (Table)

For better plausibility and impartiality assessment was done by 5 experts of Fraunhofer IAO and the average grade for each proposed project was calculated. According to the results of the assessment 8 projects were classified as moderate, 8 projects as high, and 9 projects as not applicable.

4.3 Projects ideas

GOVERNANCE

1. Joinville Mobility Action Group
2. Promotion of high occupancy in private cars
3. City Green Certificate
4. Citizen participation app for reporting transport issues
5. Open Data Platform
6. Establishment of a “Low emission area”
7. Creation of a pedestrian Zone
8. Outsourcing sidewalks construction and maintenance via property tax

Governance - Solution 1: Joinville Mobility Action Group

Establishment of a special group leaded by the city administration to connect several stakeholders in the action field of mobility and to enhance cooperation and implementation

Description and Objectives

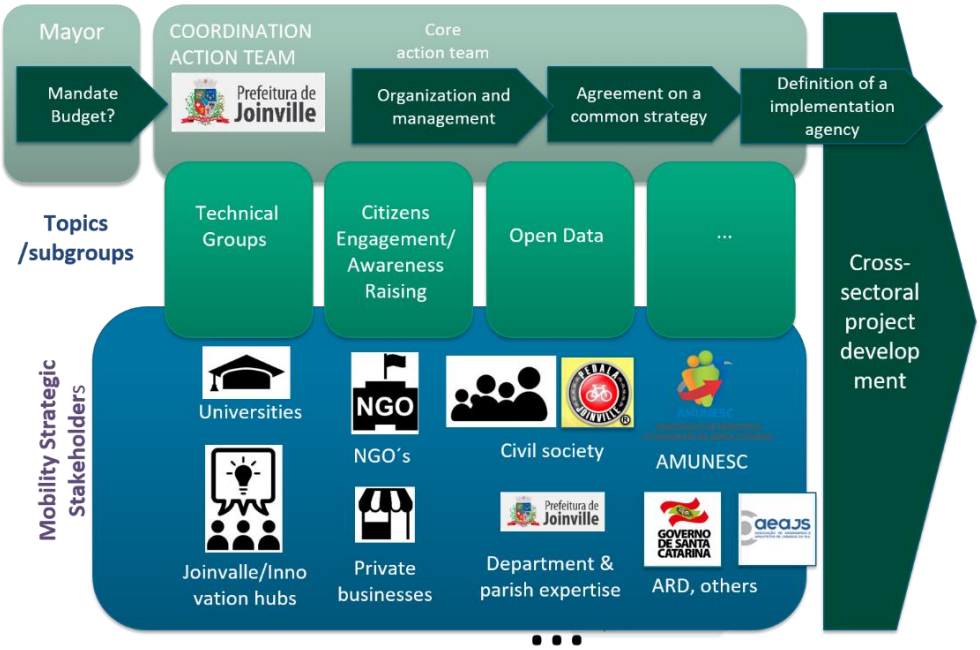
Joinville has already formed the “Observatório de Mobilidade” but it is necessary to extend this existing group with additional stakeholders. The action-group will be created, to connect several stakeholders (representatives of the city administration, regional administration, public transport, logistic companies, local companies and start ups, the universities as well as civil associations) as AMUNISC, Pedal a Joinville, Setracajo, A Caixa Federal, ADR. The group will regularly discuss relevant challenges and possible solutions relating to urban mobility. The group will define an “implementation agency” to warranty the implementation of the jointly projects developed.

Objectives:

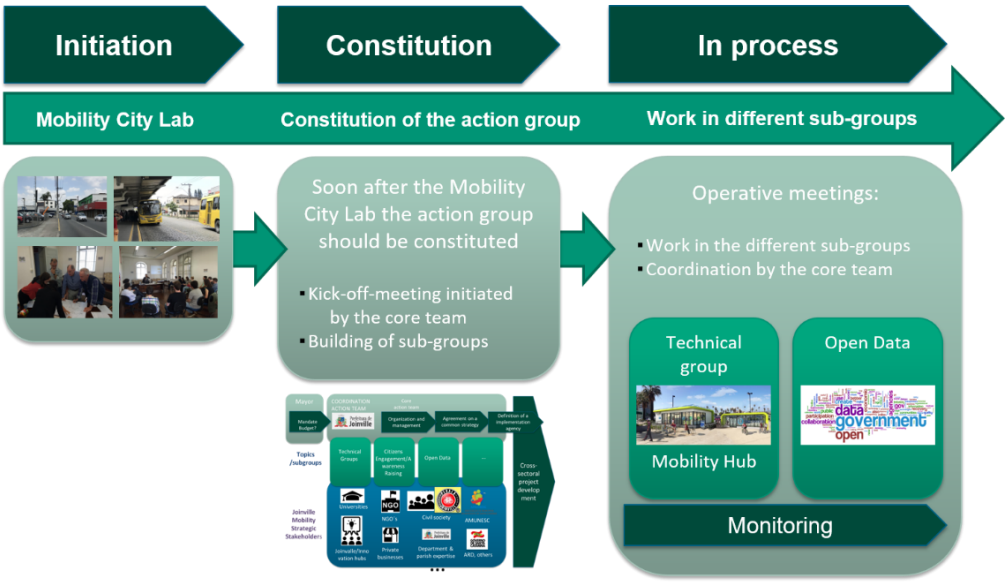
- institutionalize and enhance and expand already existing cooperations
- warranty the efficient implementation after the project idea development
- Initiation of a continuous, long-term process
- regular exchange of relevant stakeholders
- exchange of information
- to promote the relevant projects of the Mobility City Lab

Contribution to Climate Mitigation: **N.A.**

Possible structure of the action-group



First steps of the action-group



Governance - Solution 2: Promotion of high occupancy in private cars

Preferential transit during peak hours for private vehicles with an occupancy higher than 3

Description and Objectives

During peak hours, if cars are occupied by 3 people or more, these cars can take advantage of the preferential bus routes.

Objectives:

- encourage car owners to give rides to other people
- reduce the number of cars circulating
- change the culture of cars as a mean of transport
- promote initiatives as “ride sharing”

Contribution to Climate Mitigation: Moderate

Reference Project – Free bus lane usage for electric cars, Oslo (Norway)

Oslo kommune

Picture: Wikimedia.org

Promotion of urban electro mobility and reduction of emissions in the city of Oslo via different incentives such as free bus lane usage and cooperation with EV stakeholders.

Free bus lane usage // Free charging infrastructure // Privilaged parking slots // No tax purchase // No VAT

The city of Oslo, EV Users Associations, NGOs (Zero & Bellona), R&D organizations and EU projects (FREVUE, SEEV4 City)

1 year for adopting new regulations and promotion.

The City is replacing its car fleet (1100 cars) with EVs and is half way there. 2,000 charging points for electric vehicles have been established in the city.

Source: The City of Oslo oslo.kommune.no

Governance - Solution 3: City Green certificate

Discussed during the workshop 1st of November

Green certificate issued by the city for companies which promote green initiatives

Description and Objectives

The city can implement a “sustainability” or “green” seal for companies to encourage them to promote initiatives for a sustainable city, especially in mobility actions. For instance, the companies could offer changing rooms. Then employees who use bicycles to get to work can change before they go to their workplace. In addition, the could provide bicycles at no cost to employees, offering journeys for colleagues and promoting collective transport.

Objectives:

- reduce the number of cars on the street
- reach a higher number of people with initiatives that include companies
- reduce emissions

Contribution to Climate Mitigation: **Moderate**

Governance - Solution 3: City Green certificate

Discussed during the workshop 1st of November

Components

- Rainwater collection/ water re-use
- Solar Panels
- Environmentally preserved area
- Bicycle parking facilities
- Use of cars/ buses/ e-trucks and charging points
- Incentives to use public transport
- Deliveries with the use of bicycles
- Flexible working hours
- Carpool system for universities
- Active reduction of private cars/ motorcycles
- Award companies promoting bike/ pedestrian/ “ride sharing” initiatives

Stakeholders

- Public authorities (Municipal / State / Federal)
- ACIJ / Ajorpeme / CDL
- Public transport operators
- Fatma / SEMA / IBAMA
- Fraunhofer (concepts and ideas)
- Industry
- Badesc / BRDE
- Specific advisors
- Media and press
- Insurances

Next steps

Collect examples on:
- How does it work?
- How is it funded?
- Who issues the certificate?
- Who gains the benefit?

Definition of the system for Joinville:
- What measures need to be certified
- Feasibility study cost / impact
- Deployment plan
- Present to the private companies
- Create template booklet and deployment tips

Possible funding options

- Tax substitution/ deferral for investments into green mobility for local companies
- Partnerships with local commerce for discounts on products in exchange for advertising
- Lower interest rates and long-term payments on construction or purchase of bicycles or electric vehicles
- Card Operators
- Free advertisements at bus stops and bus stations

Governance - Solution 3: City Green certificate

Discussed during the workshop

Estimated cost	Estimated implementation time
Not discussed / defined	From 6 months to 5 years

Degree of complexity	Previous knowledge
[ ] high [x] medium [ ] low	[ ] yes [x] no

Urgency / priority?
[ ] very high [ ] high [x] medium [ ] low

Innovation degree	Citizen acceptance
[ ] high [x] medium [ ] low	[ ] high [x] medium [ ] low

Governance - Solution 4: Citizen participation app for reporting transport issues

Public Reporting Application

Description and Objectives

- An application that allows all the citizens to state problems in Joinville regarding mobility, e.g. problems with bike lanes, potholes, illegally parked cars, public transport system problems, etc. and also for public agencies (like the police) to feed the app with e.g. accident statistics, etc.
- Based on the collected data heat-maps could be developed that locates and illustrates the information. Citizen engagement is enhanced and city administration can use the information to set priorities for the interventions.

Specially for cyclists: RADar (https://www.radar-online.net/app/)

Objectives:

- Include citizens in processes
- Get problem information quickly and enable the municipality to act quickly

Contribution to Climate Mitigation: **N.A.**

Governance - Solution 5: Open Data platform

Discussed during the workshop 1st of November

Mobility Urban Data Platform

Description and Objectives

A platform that any institution of the city can feed to collect all different kind of information regarding mobility, e.g. public transport companies, sensors, telecommunication companies, citizens. The information should be accessible to citizens. Currently, universities, research institutes, the city administration, NGOs, and others collect and gather information related to mobility. This information should be collected in a common platform. The information can be then made available to the public. Hackathons and Makethons can be organized to promote for the generation of business ideas.

Objectives:

- ICTs offer new potential for the dissemination and proper use of data, while an "Urban Data platform" offers the possibility of digital networking of various ICT solutions in urban areas.
- Enhanced Efficiency through data-driven decision-making, improved targeting of user groups and new potential for improved automation ICTs can significantly optimize processes.
- Integrated ICT solutions can offer completely new approaches to address existing problems.

Contribution to Climate Mitigation: **N.A.**

Governance - Solution 5: Open Data platform

Discussed during the workshop 1st of November

Components

- Integrated platform with easy access to the user (citizen)
- Platform middleware (example: Fiware)
- Standard for data reception (standardize the data format)
- Storage server / infrastructure
- Traffic control equipment (traffic control / speed)
- Applications
- Legal framework for open data

Stakeholders

- City Hall
- Transport companies
- University and schools
- Corporations (industries, commerce, service)
- Firefighters, hospitals, military police, federal government, state government and ecosystem organizations (Softville, Inovaparq, Join.Valle, ACIS, etc.)
- ACIJ / Ajorpeme / CDL

Next steps

- Check legal feasibility
- "Buy-in" from public authorities
- Implementation of Fiware or other technical solution
- Public ecosystem development (marathons, incentives, dissemination, promotion)
- Pilot test of the bus, provide fee MOBQI
- Define responsible roles (in transportation)
- Evaluation of current contracts (in transportation)
- Integrate existing, discover new data and standardize them
- List the relevant data

Possible funding options

- EMBRAPII
- MDIC
- MCIDADES
- CHALK
- BADESC
- BANRISUL
- City Hall
- Secretary of State Transport
- Citizens
- You

Governance - Solution 5: Open Data platform

Discussed during the workshop

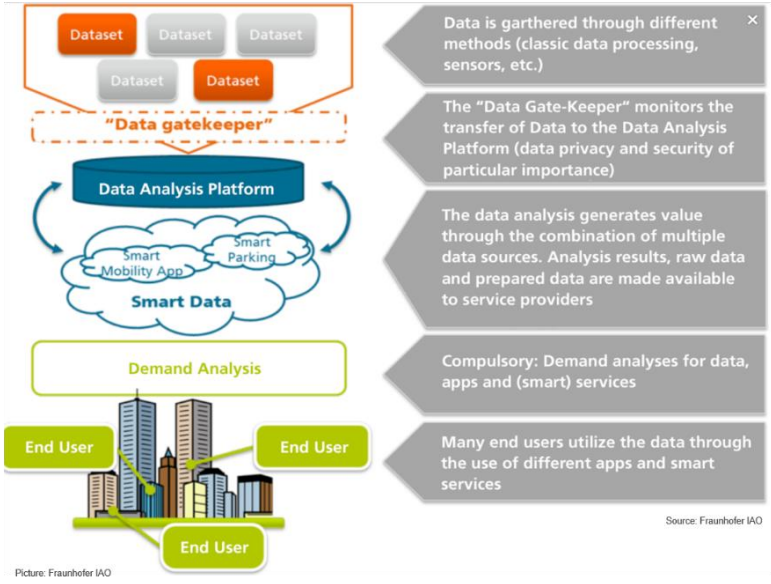
Estimated cost	Estimated implementation time
EUR 0.5 – 10 million	1 year (approximately)

Degree of complexity	Previous knowledge
[ ] high [x] medium [ ] low	[x] yes [ ] no

Urgency / priority?
[x] very high [ ] high [ ] medium [ ] low

Innovation degree	Citizen acceptance
[x] high [ ] medium [ ] low	[x] high [ ] medium [ ] low

Reference Project - Fraunhofer IAO Structure proposed (Germany)



Governance - Solution 6: Establishment of a "Low emission area"

Discussed during the workshop 1st of November

Creation of a low emission area in the city center

Description and Objectives

- Establish a green area in the city center as an environmental zone to control the emission of pollutants
- Introduce traffic restrictions based on the class of vehicles that the city would like to restrict traffic. High-emission vehicles may be excluded or pay more than others with low emissions
- The zone will be delimited by special signals and can be controlled ideally by cameras, along with pollution sensors. A supervision system needs to be installed.

Objectives:

- Reduce air pollution and noise in the center
- Reduce the amount of fine particles in the air
- Promote pedestrian and bicycle traffic
- Promote e-mobility and low emission vehicles

Contribution to Climate Mitigation: High

Governance - Solution 6: Establishment of a "Low emission area"

Discussed during the workshop 1st of November

Components

- Encourage low-emission vehicles
- Passenger and freight -> Rotation parking exemption
- Restricted access for very old vehicles
- Intelligent rotary parking
- Parallel road to the center for traffic divertion
- Green seal for clean vehicles
- Green zone control and monitoring center
- River water revitalization

Stakeholders

- Tech Industry (Bosch - Smart Cities area)
- Tech appliances: pollution sensors
- Software companies
- Transporters' Union
- PMJ
- ABVE (Minimum Development Plan PMD)
- Celesc
- UFSC / UDESC
- Bicycle deliveries

Next steps

- Green seal implementation
- Implement "Park & Ride" at strategic points
- Implement sport routes (running, cycling, rollerblading, better age gyms)
- Revitalization of the city center
- Afforestation plan for some lines
- Improve technology / product management and control of the green zone (pollution)

Possible funding options

- BRDE; BNDS; IFC; IDB;
- Private banks (bradesco, santander)
- Private initiatives (tax incentives)
- Green Climate Background
- Short-term parking (rotation)
- Inspection fee for green seal

Governance – Solution 6: Establishment of "Low emission area"

Discussed during the workshop

Estimated cost	Estimated implementation time
Low cost: green zone High cost: complementary activities (parallel path and "Park & Ride")	From 2 to 4 years

Degree of complexity	Previous knowledge
[x] high [ ] medium [ ] low	[x] yes [x] no

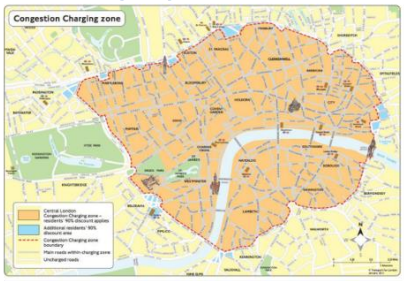
Urgency / priority?

[ ] very high [ ] high [x] medium [ ] low

Innovation degree	Citizen acceptance
[x] high [ ] medium [ ] low	[ ] high [x] medium [ ] low

Reference Project – City center congestion charge in London (UK)

Transport for London



Picture: tfl.gov.uk

The Congestion Charge is an £11.50 (€13) daily charge for driving a vehicle within the charging zone between 07:00 and 18:00, Monday to Friday. Exemptions and discounts are available.

"Auto Pay" System with possibility to reduce congestion charge to £10.5 (€11.9) // Additional charging of 'Euro 4' standard cars

Transport for London, City of London, London Assembly

£230 (€345) million to implement, operating costs £88 (€132) million, net revenue of £122 (€183) million. Annual present value of the scheme is around £90 (€135) million.

From 1 to 3 years.

Exemptions: motorbikes, emergency services, armed forces, cars used by disabled. Discounts for 9+seat cars and residents.

Sources: Transport for London tfl.gov.uk ; eltis.org

Reference Project – 'Paris agit contre la pollution' Paris (France)

Picture: paris.fr

Implementation of Low Emission Zone and infrastructure for low-emission transport. All vehicles lower then "Euro 4" engine standard will be banned from year 2020.

Construction of charging stations for gas and electricity // Identification of dedicated parking areas for these vehicles // Possibility to book time slots for delivery

Municipality of Paris offers subsidies up to EUR 9,000 for purchase of electric vehicle or hybrid.

Council of Paris

5 years

Source: paris.fr

Governance - Solution 7: Pedestrian Zone

Creation of a pedestrian zone in the city center to promote citizens exchange, pedestrian movement and make city more livable

Description and Objectives

Attractive pedestrian streets can help to revitalize the city center, add value to the zone, promote citizen interaction and enhance the quality of life .

Main issues:

- The city center has been lately losing its attractiveness due to the high amount of empty/poorly maintained buildings
- Shops leave the area due to losses and uncertainty.
- There are no pedestrian areas in Joinville at the moment

Objectives:

- Improve the city center
- Enhance citizen interaction and engagement
- Attract businesses
- Promote economic development

Contribution to Climate Mitigation: **Moderate**

Reference Projects

Carnaby Street, London (UK)

Stroget, Copenhagen (Danmark)

Rua XV de Novembro, Curitiba (Brazil)

Via Dante, Milan (Italy)

Pictures: ish.org.uk; visitdenmark.co.uk; gazetadopovo.com.br; flickr.com

Governance - Solution 8: Outsourcing sidewalks construction and maintenance

Construction and maintenance of sidewalks can be outsourced and financed through a "sidewalk tax" or an increased property tax (IPTU)

Description and Objectives

The city is not well suited for pedestrians: Pavements and its maintenance are the sole responsibility of the owner of the property. Currently, pathways present serious problems in terms of accessibility, continuity of routes and lack of standardisation. SEPUDE is working on the standardization of the responsibilities of the property owner regarding sidewalks but it is still complicated to enforce the law. Outsourcing the construction and maintenance can contribute to a better infrastructure.

Objectives:

- Promote pedestrian transit
- Improve the public infrastructure
- Improve accessibility

Contribution to Climate Mitigation: **N.A.**

SOCIO-ECONOMIC DEVELOPMENT

1. Virtual Reality Training
2. "Innovate your city" Platform

Socio-economical development - Solution 1: Virtual Reality Training

Virtual Reality based training courses for car, bus, taxi and truck drivers and cyclists

Description and Objectives

Virtual reality can contribute to make roads safer in the city, especially for pedestrians and cyclists. With the help of virtual reality technology drivers of cars, buses, taxis and trucks can learn, how to react, when for example many bicycles are on the streets. Cyclists on the other hand can be trained on more careful cycling. Virtual reality driving simulators, giving hands-on experience in driving and educating them on road safety precautions. Virtual Reality driving simulators can be used to help children with special needs to learn about street crossing and general street safety.

Objectives:

- Increase the safety on the streets
- offer hands-on experiences
- Awareness raising
- create a new traffic culture

Contribution to Climate Mitigation: **N.A.**

Socio-economic development - Solution 2: "Innovate your city" Platform

Discussed during the workshop 1st of November

Co-creation online platform - innovation contest to develop solutions to the problems presented by the citizens. Gamification based idea selection and implementation

Description and Objectives

1) Citizens are invited to name the pressing problems around mobility in Joinville.
2) Via a voting system, citizens can select the most "important" problems from their perspective.
3) A challenge for the creation of ideas and proposals to solve them is organized.
4) Best proposals are selected and receive initial funding for the implementation.

Objectives:

- Strengthening democracy and co-creation processes
- Social integration/breakdown barriers
- User-centric innovation/demand driven innovation
- Opening of city administrators
- Better understanding of what citizens want
- Increasing citizens acceptance

Contribution to Climate Mitigation: **N.A.**

Socio-economic development - Solution 2: "Innovate your city" Platform

Discussed during the workshop 1st of November

Components

Proposed (P) / Raised at meeting (M)
- Online platform (P)
- Open forum for inhabitants (M)
- Prize money for Startups (M)
- Evaluation bank with mobility expertise (M)
- Open Database (M)
- Promotion of mentoring (M)
- Fostering ideas created at universities (M)
- Discussion forums (M)
- Makethons in educational institutions (M)
- Define activities relevant to project (M)
- Once in 2 weeks meeting to monitor the development of projects by the GP and stakeholders (M)
- Guarantee of candid perpetuation (M)

Stakeholders

- SENAI - could support the development of the platform as part of the course of Systems Analysis and Development Technologist (P)
- Joinvalle - Ecosystem of co-creation (P)
- Joinville in 30 years - Citizen engagement platform to design the city of the future (P) - Community (M)
- SAP or T-System to develop the platform (M)
- Universities, schools (M)
- Stations and Municipal bodies (M)
- Public transport companies, taxi companies (M)
- Private companies (M)
- Social networks (M)
- ACIJ (M)

Next steps

- Create communication platform with the population
- Provision of data about city mobility
- Disclosure to involved agents
- Establish a process to capture, evaluate and foster ideas
- Create an open database
- Initiate cooperation with agencies and companies for data collection
- Define Manager / Responsibilities / Delivery Packages
- Establish action group
- Create a complete project
- Create a marketing strategy
- Assess legal feasibility

Possible funding options

- Federal Fund (P)
- BMW (P)
- ITAÚ (P)
- BNDS-National Development Bank (P)
- Energy Providers (P)
- Bill & Melinda Gates Foundation (M)
- Collective Financing - involves population, state and municipalities (M)
- Institute of Innovation of Joinville (M)
- Financial institutions with similar reasons to invest (M)
- Private companies (M)
- Web platform, with information to be given through checkbox, facilitating data mining (M)
- Development agency: CAPES, CNPQ, FINEP, etc. (M)

Socio-economic development - Solution 2: "Innovate your city" Platform

Discussed during the workshop

Estimated cost	Estimated implementation time
EUR 0.15 million (or less)	6 months

Degree of complexity			Previous knowledge	
[ ] high	[x] medium	[ ] low	[x] yes	[ ] no

Urgency / priority?			
[ ] very high	[x] high	[ ] medium	[ ] low

Innovation degree			Citizen acceptance		
[x] high	[ ] medium	[ ] low	[ ] high	[x] medium	[ ] low

Reference Project – iCity tender, Eindhoven (Netherlands)

EINDHOVEN

Picture: triangulum-project.eu

iCity
SMART CONNECTIONS, QUALITY LIVING

Entrepreneurs and start-ups develop innovative products and services that increase the quality of life in the city of Eindhoven.

iCity Tender consist of two rounds:
proposal development (5,000 EUR grant);
ready to use prototype (up to 20,000 EUR grant).

Eindhoven municipality,EU Triangulum Project, TU Eindhoven, VolkerWessels.

Solutions were tested in the smart city district Strijp-S in Eindhoven.

< € 50.000

0.5 year

Source: triangulum-project.eu

Reference Project – Desafios Porto (Portugal)

Porto.

Picture: scaleupporto.pt

Desafios Porto.

Competition created that aims, at first, to identify the biggest challenges faced by the city of Porto and, at a second phase, to find the tech solutions that give the most innovative and scalable answers.

Submission of ideas // Areas: Health, Energy, Digital City, Mobility & Environment // Prototype creation // Implementation phase

Municipality of Porto, NOS (media holding), Energias de Portugal, CEIIA, Ernst & Young

Competitors competing for up to € 62.500 to support the implementation of a single solution in Porto.

€ 250,000

0.5 – 1 year

Source: desafiosporto.pt/en

INTERMODALITY

1. Park & Ride Station
2. "Express line" South – North
3. Mobility Hub
4. Car sharing
5. Ride-sharing app
6. Bike sharing station

Intermodality - Solution 1: Park & Ride Station

Discussed during the workshop 1st of November

Development of "Park & Rides" in bus stations: ITAUM, Vera Cruz, TUPY, Iririú, Vila Nova

Description and Objectives

The creation of well equipped and attractive park and ride stations, complemented with express bus lines can promote the use of public transport.

1) There is a high density of population living in the southern region;
2) Great amount of population travelling for work daily from the southern regions to the industrial zone in the north;
3) Park & rides need to be combined with new "express bus lines" for making the transition more attractive.

Objectives:

- Promote the use of public transport
- Reduce the pressure on the infrastructure
- Reduce the amount of cars circulating in the city center
- Provide an alternative for new possible "car" buyers

Contribution to Climate Mitigation: High

Intermodality - Solution 1: Park & Ride Station

Discussed during the workshop 1st of November

Components

Proposed (P) / Raised at meeting (M)
- Secure parking for bicycles (private bicycles) (P)
- Bike Sharing service (P)
- Intelligent parking (sensors and application) (P)
- Cameras for security (P)
- Car Sharing (P)
- Repair / maintenance of bicycles (P)
- Accessibility (M)
- Commercial attractions in the surroundings (M)
- Infrastructure for users (BWC, cabinets) (M)
- City card 'Ideal' for other services (M)

Stakeholders

- Bus companies (P)
- Ticket bus (P)
- Car Sharing Company (P)
- BOSCH (P)
- IFSC (already has some information on how students move) (P)
- Private sector (L)
- Public sector (financing, strategic planning, shared management) (L)
- Banco Itaú - bike sharing project (L)
- Bicycle Companies (L)
- Academies (L)
- Car assembly plants (L)
- Advertising agencies (L)
- International agencies (L)
- Passebus (L)

Next steps

- Set service laws
- Municipal legislation
- Define model (PPP, public or private)
- Socioeconomic viability
- Design scenarios
- Demand analysis
- Run pilot projects
- Suggested area: Itaum or Vera Cruz - South Terminals
- Define partners and fundraising sources
- Encouraging existing startups projects
- Announce for public
- Perception of user value
- Encourage to use

Possible funding options

- Funding by public banks
- Public Private Partnerships
- Use of public spaces for selling advertisements and use the proceeds to support deployments
- Parking companies for management and logistics
- Tax Incentives / Compensations /
- Incentives for users
- urban instruments
- International organizations
- Municipal Mobility Fund
- Service Tax

Intermodality - Solution 1: Park & Ride Station

Discussed during the workshop

Estimated cost	Estimated implementation time
EUR 5 – 10 million	2 years (implementation of the pilot project)

Degree of complexity	Previous knowledge
[ ] high [x] medium [ ] low	[x] yes [ ] no

Urgency / priority?

[x] very high [ ] high [ ] medium [ ] low

Innovation degree	Citizen acceptance
[ ] high [ ] medium [x] low	[ ] high [x] medium [ ] low

Reference Project - Park + Ride VVS, Stuttgart (Germany)

Picture: stuttgarter-nachrichten.de

A total of 218 P+R stations are available for those who travel within VVS area (Stuttgart). 17,154 parking spaces are available for car owners.

Parking slots near bus and train stations // ticket machines // local sales points // smartphone app

Stuttgart City Council, Traffic and Fare network of Stuttgart (VVS)

1-2 years

Places are chargeable depends on the demand. As a rule of thumb, the further out in the region, the cheaper.

Source: stuttgarter-nachrichten.de

Reference Project – Leipzig Mobil (Germany)

Picture: presseportal.de

Leipziger Verkehrsbetriebe

A multimodal mobility product that clearly visible all over the city and ease interconnections between multiple modes of transport in the city: car-sharing, bike-sharing, tickets, customer service.

Charging infrastructure // bicycle parking // IT platform // Mobility hub point (touchscreen) // Smartphone app

Subscription: €6/month, for students €1/month, free for existing pre-paid customers of LBV. For non-subscribed users: car-sharing: €0.25/km; bike-sharing: €0,5 every 30 minutes.

Leipzig Municipality, Nextbike GmbH, Leipzig Public Transport (LBV), teilAuro, DB Flinkst

Source: leipzigmobil.com

Intermodality - Solution 2: "Express line" South – North

Discussed during the workshop 1st of November

New "express line" South – North as a part of promotion of Park&Ride system

Description and Objectives

Currently, there are only six trips per day for cargo transportation passing through the city. The existing infrastructure could be used for public transport. It is therefore proposed that a further railway line should run from Guaramirim and Araquari. In addition, the proposed mobility hub in Itaum district, in the southern part of the city, can be integrated into this line to connect passengers with the train.

Objectives:

- Promoting intermodality in Joinville
- Improve use of railway infrastructure
- Promote economic development

Suggested lines:

- ITAUM: offer Express line ITAUM até Norte via Centro
- Vera Cruz: express line Itinga- Vera Cruz – Centro – Norte
- Tupy: express line: Espinheiros – Tupy - Centro

Contribution to Climate Mitigation: **Moderate**

Intermodality - Solution 2: "Express line" South – North

Discussed during the workshop 1st of November

Components	Stakeholders
• Passenger train (electris is preffered) / VLT • E-Ticketing / App with real-time information • Integration with Park & Ride • Integration station with collective bus transportation (Terminal Nova Brasília and Itaum / Integration with North / South axis) • Intercity Line (North Coast) • Way to the coast • Link to the metropolitan region / Access to the industrial park • Modal axis with variety of use (Bike + bus + VLT)	• Universities • WEG / Rumo / Transtusa / Gidion / ANTT • City Hall Joinville / Secretary State Tourism • Ministry of Transport / Cities • GIZ / Franhoufer / Felicity • Future industrial zone planned near the end of the line • WRI • ICLEI Brasil • Simens

Next steps	Possible funding options
• Detailed survey on the demand for transportation services (no. of passengers, no. of trips) • The comparison of other alternatives: VLT; Bus; Subway • Trip cost raising • Develop next PlanMob study • Pilot line installation for tourist use • Use existing construction with point of boarding at the railway station and integration with terminal • Identify organizations interested in investment • Study legal model - grant / authorization • Railroad or track implementation analysis • Segmentation of steps: current structure; planning new use; construction (30 years perspective)	• Multilateral development banks (IDB, CAF, Fonplata) • Federal government (BNDES, MDIC) • Green Bonds - government bonds • Public-Private Partnerships (WEG; MAN (Volkswagen)) • World Bank (financial and technical support) • Celesc • KFW Brazil

Intermodality - Solution 2: "Express line" South – North

Discussed during the workshop

Estimated cost	Estimated implementation time
Not estimated / defined	Not estimated / defined

Degree of complexity	Previous knowledge
[x] high [ ] medium [ ] low	[ ] yes [x] no

Urgency / priority?
[x] very high [ ] high [ ] medium [ ] low

Innovation degree	Citizen acceptance
[x] high [ ] medium [ ] low	[x] high [ ] medium [ ] low

Intermodality - Solution 3: Mobility Hub

Discussed during the workshop 1st of November

Creation of Mobility Hubs in strategic points for transforming bus stations into interactive and attractive meeting points with various services.

Description and Objectives

The city has identified the need to transform bus stations into more interesting meeting places, with additional services offering different intermodality options. The different modes of transport need to be connected to promote the use of alternative modalities. Additional services such as: car sharing, bicycle sharing, car and bicycle repair stations, lockers, automatic food, etc. can also be implemented to create attractive meeting points for citizens and improve the user experience. The use of additional services such as car sharing should be possible by "updating" the Ideal card.

Suggested Locations and Focus:

- Perini: smart network, smart charging, E-Mobility promotion within the park / shared fleet for companies
- Whirlpool
- ITAUM: point of bike and car sharing, post office
- JK Avenue
- GIASSI / BIG / ANGELONI

Contribution to Climate Mitigation: **Moderate**

Intermodality - Solution 3: Mobility Hub

Discussed during the workshop

Components

- Intelligent Parking - Sensors and Smart Application (P)
- Secure Parking - Cameras (P)
- Collection points for electronic vehicles (P)
- Locker service (locker + mail box) (P) (M)
- Bike Sharing (P) (M)
- Railway Station (P) / intermodality (M)
- Food delivery service and Vending machines (P) (M)
- Bus schedules / Forecasted arrival of buses (M)
- Monitoring by cameras (M)
- Charging for cell phones, cars and electric bicycles (M)
- WI-FI Point / Fiber Cable / Software (M)
- Tablets (M)
- Shared services (M)

Stakeholders

- BIG / ANGELONI (P)
- PERINI (P)
- City Hall (SEPUD) (M)
- Gidion / Trastusa (M)
- Universities / Fraunhofer (M)
- Technology companies (M)
- Private companies (M)

Next steps

- Negotiations with City Hall
- Stakeholder / Sponsor Survey
- Cost survey for installation of station
- Project presentation workshop in commercial and industrial associations
- Make a pilot point, install software and screens

Possible funding options

- BNDS
- Private initiative / Start ups
- EMBRAPII
- SEBRAE
- MDIC
- MCIDADES
- Advertising companies
- Energy companies

Suggestions:

- Create better conditions to explore locations commercially;
- Create conditions for higher value rentals.

Intermodality - Solution 3: Mobility Hub

Discussed during the workshop

Estimated cost	Estimated implementation time
Completed hub – EUR 9.500 Implementation – EUR 5.000 – 25.000 Maintenance - EUR 1.000 – 5.000 / month	1 – 5 years

Degree of complexity	Previous knowledge
[ ] high [x] medium [ ] low	[ ] yes [x] no

Urgency / priority?

[ ] very high [ ] high [x] medium [ ] low

Innovation degree	Citizen acceptance
[x] high [ ] medium [ ] low	[x] high [ ] medium [ ] low

Reference Project – Station-I (Germany)

ZUWESO - FOR SUSTAINABILITY -

Picture: station-i.de

Station-I is a charging station roof which contains additional building blocks that contribute to the refinancing. PV-powered Mini-smart grid depending on desired performance. With monitoring and operating software.

The modular station includes additionally to the charger a snack vending machine, coffee machine, Wifi, displays, lockers etc.

Suevi GmbH, SoWe GmbH & Co. KG, BW-international, Solarcluster BW, etc.

The modular structure of the station's parts empowers an personalized construction for every client.

€ 250.000

6 months

Source: station-i.de

Reference Project – ParcelLock (Germany)

Pictures: parcellock.de

Vendor-independent parcel station for private houses and public use (bus station). Flexible time of parcel pick-up. ParcelLock system assigns unique TAN codes that enable secure and traceable delivery.

Easily modified parcel boxes // Intelligent opening system // ParcelLock App // ParcelLock Courier App

ParcelLock GmbH, BurgWächter, RENZ, Heibi, DPD, GLS, Hermes, UPS.

From € 1,000 per one parcel box system.

Depends on the number of box systems installed.

Based on the transaction history in your customer account you can understand all deliveries, with date, time and deliverer.

Source: parcellock.de

Intermodality - Solution 4: Car sharing

E-Car sharing service for the city.

Description and Objectives

Intermodality needs to be introduced and promoted in the city of Joinville and different alternative modes of transport need to be offered to the citizens. This can improve the number of cars circulating in the city. Well combined public transport and bicycle sharing systems as well as car sharing services can help to reduce the purchase of a private vehicle. Charging points can be installed in the proposed park & ride stations, mobility hubs and other strategic locations. Furthermore, the use of shared cars should be promoted through policies such as the “green zone”, and/or there should be a lower rate for parking within the planned blue parking zones.

Objectives:

- Create alternatives for potential future car owners
- Provide alternatives to the users of public transport
- Promote the use of public transport by increasing intermodality
- Promote the transition to e-mobility
- Attract further international investment

→ **For its implementation a demand study needs to be developed in order to assess the willingness to use the service and the potential use of the vehicle.**

Contribution to Climate Mitigation: **Moderate**

Reference project – Urbano Eco, São Paulo (Brazil)

The largest one-way car sharing service in Brazil. It operates to the public with 95 vehicles. Drivers can end the trip anywhere in one of the 35 designated Zones.

Smartphone app // "home zone" slots // e-cars // charging infrastructure

Sao Paolo municipality, BMW

80 Smart cars and 15 fully electric BMW i3s. On average, users will pay ~R$1.45 per minute.

< € 50,000 – 250,000

< 1.0 year

Source: urbano.eco.br

Intermodality - Solution 5: Ride-sharing app

Ride sharing app for commuter traffic/extension of the features in carronear

Description and Objectives

In order to reduce the amount of cars in the city, a ride sharing application for people who have the same A to B route to reach their destination can be developed. The already existing application "carronear" is mainly used among company workers and can be extended.

Objectives:

- Reduce the number of cars in the city
- Increase the number of passengers per car
- Lower costs for the driver and the passenger
- Serve areas that are not covered by public transport

Contribution to Climate Mitigation: **Moderate**

Intermodality - Solution 6: Bike sharing station

Discussed during the workshop 1st of November

Bike Sharing stations
(incl. integration with *Ideal* transport card and blue parking system)

Description and Objectives

72 % of public transport users say that it is not easy to combine the use of buses with bikes, 26 % showed a preference for using this mode of transport if available:

1) Alternatives modes of transport need to be offered to enhance intermodality
2) Bike sharing stations need to be located in strategic locations such as main bus stations and neighborhoods with more density. The commissioning of the bikes should be possible through the transport card Ideal

Objectives:

- Bike sharing stations in all 10 transition stations
- Bike sharing stations in the planned Park & ride locations
- Additional points in touristic points as museums, etc.

→ Blue parking zones need to foresee a space for parking of bike sharing system

Contribution to Climate Mitigation: High

Intermodality - Solution 6: Bike sharing station

Discussed during the workshop 1st of November

Components

Bike sharing:
- E-Bicycle (using the same paracycles) (M)
- App / Hardware for tracking / location (M)
- Type of bikes (M)
- Dressing room (M)
- Small Office (M)
- Location in bus terminals (M)

Stakeholders

- City Administration (P) / City Hall - SEPUD (M)
- Pedal Joinville (P) (M)
- Banks (M)
- Gidion, transtuse, passebus (M)
- Sponsors (use of parking and bicycles with logos - marketing) (M)
- Serttel / Mobilicity (M)
- ACID (M)
- Ciclo entrega (M)
- GIZ (M)

Next steps

- Registration of users
- Find bike provider (producer)
- Suggest new locations
- Stimulus to use (incentive actions)
- Introduce different bikes
- Equip terminals with good and safe infrastructure
- Develop application / technology

Possible funding options

- Mobility incentive policies financed by BNDS, IDB, FONPLATA.
- Partnership with companies (advertising + maintenance).
- Selo Verde - fiscal incentives of the municipality for users and companies (parking infrastructure).
- Incentive to bicycle user.
- Revolving parking (set% for mobility).
- Traffic zone
- Percentage of urban toll.

Intermodality - Solution 6: Bike sharing station

Discussed during the workshop

Estimated cost	Estimated implementation time
Not discussed / defined	Not discussed / defined

Degree of complexity	Previous knowledge
[ ] high [ ] medium [x] low	[x] yes [ ] no

Urgency / priority?
[ ] very high [x] high [ ] medium [ ] low

Innovation degree	Citizen acceptance
[x] high [ ] medium [ ] low	[x] high [ ] medium [ ] low

Reference Project – Nextbike Leipzig (Germany)

Picture: nextbike.at

Nextbike develops and operates public bike-sharing systems with around 2.000 bikes. Bicycle users are normally obtained through a subscription system, where each bike is locked to either itself or to a rental station.

Subscription system // Rental stations // Mobile app with map and locking code // Maintaintion by local service partner

Nextbike GmbH, Leipzig Public Transport (LBV), teilAuro, Lipzi Tours

It operates about 35.000 bikes in 100 cities around the world. Price: €1/30 min, €9/day, €48/year.

Ongoing development process. First stations were opened in 2004. One station – 1 month.

Sources: nextbike.de/de/leipzig/, nextbike.net

E-MOBILITY

1. E-Bus
2. Last Mile Delivery (E-Trucks)
3. Last Mile Delivery (E-Cargo bikes)
4. E-Vehicles for companies

E-Mobility - Solution 1: E-Bus

Pilot E- Bus line South-North (optional: express line)

Description and Objectives

The city is aiming for emission-free public transport by 2025:

1) A pilot project regarding e-mobility is needed to start the transition
2) The S-N line is one of the busiest lines and was therefore identified as a pilot. The return on investment would be shorter.

Contribution to Climate Mitigation: High

Reference Project – Battery bus in Leipzig (Germany)

Picture: lvz.de

Weight of battery system - 1.300 kg; maximum daily mileage - 180 km; medium energy consumption in line operation - 1,2-1,25 kWh/km

Leipziger Verkehrsbetriebe

LVB is testing a fully electric bus in regular service (Route 89. 5,4 km) for one year. The aim is to measure the actual energy consumption, to model a possible electric bus network and to consider the economic efficiency.

Fraunhofer E-bus // 86 kWh battery // 2 charging points (charging column with pantograph) // mobile charging device

Fraunhofer IVI, Municipality of Leipzig, Leipzig Public Transport (LBV GmbH)

Source: ivi.fraunhofer.de

E-Mobility - Solution 2: Last Mile Delivery

Discussed during the workshop 1st of November

Using E-trucks for last mile deliveries and distribution in the city center

Description and Objectives

Last kilometer distribution with e-vehicles can reduce the noise and pollution in the city center. Distribution of commodities inside a “extended city center” area can be done with e-trucks. Charging points can be installed (among others) in the planned “mobility hubs”.

Objectives:

- Reduce pollution, traffic and noise in the city center
- Promote local development
- Revitalize the city center and make it more livable

Contribution to Climate Mitigation: High

E-Mobility - Solution 2: Last Mile Delivery

Discussed during the workshop 1st of November

Components

- Place for cross-docking
- Charging points for e-cars / trucks
- Platform / app for bike deliveries
- Test partners (E-trucks / cars)
- System management format
- Insurance of fleet

Stakeholders

- Transport companies (P) (M)
- SENAI - laboratories, support in business development and incubators
- BOSCH. for the development of COCIERGE (customer service center)
- Industry of engines and electric vehicles (M)
- GIZ / Prototypes (M)
- Union of freight conveyors (M)
- Software / SOFTVILLE (M)
- ACIJ / CDL (M)
- City Hall / SEPUD / SEINFRA (M)
- Delivery Cycle Joinville (M)
- Post office (M)
- Cycling Collectibles (M)
- Truckvan

Next steps

- National regulations should be adapted to promote transition and create incentives for electric mobility
- Map volumes of loads (higher loads, food) and necessary modes (capabilities) (M)
- Choose locations / hubs for fractionation (M)
- Identify anatomy, weight and specifications by vehicle
- Identify current load demand
- Define rules and load insurance features
- Identify companies for prototypes in Joinville (GZIS)
- Identify carriers that work with split in the center
- Include parking spaces in the blue zone Make a pilot project with an establishment
- Pilot network management platform recharging

Possible funding options

Specific for e-truck:

- BNDS
- Cooperatives
- Carriers
- Companies

E-Mobility - Solution 2: Last Mile Delivery

Discussed during the workshop

Estimated cost	Estimated implementation time
E-truck: very variable, depends on spaces, licenses and permits for transport.	Concept: 6 months Navigation: 12 months

Degree of complexity	Previous knowledge
[x] high [ ] medium [ ] low	[x] yes [ ] no

Urgency / priority?

[ ] very high [x] high [ ] medium [ ] low

Innovation degree	Citizen acceptance
[x] high [ ] medium [ ] low	[x] high [ ] medium [ ] low

Reference Project – DACHSER elCarrito, Malaga (Spain)

DACHSER Intelligent Logistics

Picture: dachser.com/es/

New concept of distribution of goods inside the city using a small e-truck „elCarrito“ - 7 km/h when fully loaded but having a turning radius of only 1.65 m.

Source: dachser.com/es/

Shuttle that brings replenishments early in the morning // 48 V battery lasts 72 hours // underground garage with power outlet

Dachser Intelligent Logisticks, Malaga City Council

A small, secured shed, in which the merchandise can be stored, provides additional flexibility.

Approximately € 2,500-3,000 per unit

Less then 6 months.

Sources: dachser.com/es/; cleantechnica.com

Reference Project – London Camden Central Hub (UK)

Picture: lamiloproject.eu

Reorganisation of supply chain for public sector in Camden Borough (B2A delivery). Stimulate more efficient and effective large scale 'last mile' logistic solutions.

Central Hub (190 m2) // Shipment of orders for urban organisations // Sorting of goods // Optimised delivery route // e-trucks/ e-bikes

Camden Council, DHL UK Ltd, Institute for Sustainability, Perth and Kinross Council

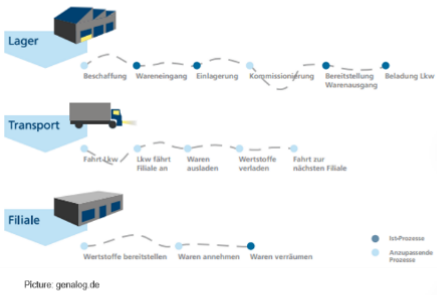
Co-financing from the European Regional Development Fund (€ 355 million)

1 – 2 years

The results of the trial are used to create a business case that looks to assess the financial viability of the consolidation centre.

Source: lamiloproject.eu

Reference Project – GeNaLog (Germany)



Picture: genalog.de

Concept of the "silent night logistics" via the use of electric vehicles that increase the time window for the transport and delivery of goods.

Examination of requirements and assessment of noise-relevant activities // Carrying out test delivery with partner trucks during night shifts

REWE, DOEGO,TEDi, Fraunhofer ISI, Fraunhofer IML

0.5 – 1 year

Companies are making their supply chains more economical generating efficiency advantages and thus having competitive opportunities on the market.

Source: genalog.de

E-Mobility - Solution 3: Last Mile Delivery

Discussed during the workshop 1st of November

Last mile distribution of smaller loads with E- cargo bikes (incl. micro logistic hub)

Description and Objectives

The municipality proposed to identify empty public properties located in the center and/or establish partnerships with companies, which already storage and delivery stations (e.g. shopping, supermarkets) which could be rented out to the logistic companies and transformed into cross-docking centers, e.g. Ivan Rodrigues building. From these points, final deliveries can be done with e-cargo bikes.

Objectives:

- Promote outsourced distribution in the city center
- Reduce the number of trucks in the center of the city
- Reduce the number of kms per delivery
- Reduce traffic/noise/pollution
- Promote economic development - smart distribution

Contribution to Climate Mitigation: High

E-Mobility - Solution 3: Last Mile Delivery

Discussed during the workshop 1st of November

Components

- Place for cross-docking;
- Charging points for e-bikes;
- Platform / app for bike deliveries;
- Test partners (E-bikes)
- System management format
- Insurance of fleet

Stakeholders

- Transport companies (P) (M)
- SENAI - laboratories, support in business development and incubators
- BOSCH. for the development of COCIERGE (customer service center)
- Industry of engines and electric vehicles (M)
- GIZ / Prototypes (M)
- Union of freight conveyors (M)
- Software / SOFTVILLE (M)
- ACIJ / CDL (M)
- City Hall / SEPUD / SEINFRA (M)
- Delivery Cycle Joinville (M)
- Post office (M)
- Cycling Collectibles (M)
- Truckvan

Next steps

- National regulations should be adapted to promote transition and create incentives for electric mobility
- Map volumes of loads (higher loads, food) and necessary modes (capabilities) (M)
- Choose locations / hubs for fractionation (M)
- Validate services
- Make cooperation with logistics companies for bicycle delivery.
- Buy / get electric bicycle fleet.
- Partnerships (public / private).
- Creating a cycling network that crosses the city.
- Raise awareness of the importance of deliveries with bicycles.
- Define an initial model of the electronic controller.

Possible funding options

Specific to e-bike:

- Private sector donations through Green Seal incentive and CO2 offset
- Partnership with suppliers of electric bicycles (business model)
- Lines of financing for sustainable development: BNDS / Ministry of the finance

E-Mobility – Last Mile Delivery

Discussed during the workshop

Estimated cost	Estimated implementation time
E-bike: USD 300 - 1.500 depends on specifications (power, capacity, electronics).	Concept: 6 months Navigation: E-bike = 2 years

Degree of complexity	Previous knowledge
[x] high [ ] medium [ ] low	[x] yes [ ] no

Urgency / priority?
[ ] very high [x] high [ ] medium [ ] low

Innovation degree	Citizen acceptance
[x] high [ ] medium [ ] low	[x] high [ ] medium [ ] low

Reference Project – Park-up, Stuttgart (Germany)

Picture: velocarrier.de

Parcels are delivered with environmentally friendly, electrically supported cargo bikes in the city of Stuttgart. The carrying capacity is up to 250kg.

E-cargo pedecels // Parking slots (can be rented out) // advertisement surface

BMVI, mFUND, VeloCARRIER, Radkutsche GmbH

The pricing for the used space can be defined depending on the specific context (traffic, capacity).

< € 50.000

< 0.5 years

Source: velocarrier.de

Reference Project – logSPAZE, Stuttgart (Germany)

Picture: stern.de

Alternative delivery concepts for Stuttgart city center. Project tests how to switch from trucks to an environmentally friendly solution. Goal - cover 75 % of the partner packages via alternative delivery options.

Carrier bicycles // Micro-hubs for goods in the city center //

Stuttgart City Council, UPS, DHL, Fraunhofer IAO

E-bike: from € 1,000 per unit

0.5 – 1 year

Goal is to create an evaluation basis between public and private actors, so promising concepts can be established in the long term and promoted accordingly.

Source: Fraunhofer IAO

Reference Project – Triangulum: Pedelecs for goods delivery, Manchester (UK)

Picture: triangulum-project.eu/

The municipality offers the use of cargo bikes to any organization in Manchester for end distribution. The bikes come with a tracking system which enables data collection and provides insights on usage.

Deliver E-bikes, WorkCycles, Long John, Urban Arrow, Tricycle Radkutche and I-Buillit Milk Plus (bikes are bespokely modified to suit the requirements of the users)

Manchester Bike Hire // Manchester City Council // Universities and companies using the bikes

< € 50.000

< 0.5 years

Each bike has a maximum carrying capacity of 180kg, and has a speed up to 15.5 mph. Used mainly for post services and food delivery.

Picture: triangulum-project.eu

E-Mobility - Solution 4: E-vehicles for companies

Introducing the use of e-vehicles in universities and companies as a beginning of the transition to electric transport

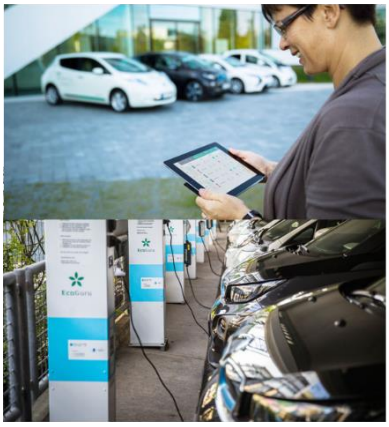
Description and Objectives

The transition to e-mobility can be initiated by universities and companies wishing to promote the use of environmentally friendly means of transport for their employees. Educational institutions such as IFESC and UNESC have shown interest in bringing this topic to discussion and proposing it to the directory. A pilot project can be carried out by introducing one or two electric vehicles into the fleet. Reference projects such as Manchester can be useful for the exchange of knowledge.

Contribution to Climate Mitigation: **High**

Reference Project – EcoGuru, Stuttgart (Germany)

Fraunhofer IAO



Pictures: Fraunhofer IAO

Introduction of e-vehicles in business fleets. Parallel integration of a booking and reservation platform. Consideration of route profiles, charging capacities and environmental aspects

Smart booking and reservation software // Controlled management of load and charge status // Simple user interface

Fraunhofer IAO, IAT University Stuttgart, EnBW Baden-Württemberg AG, Energy Solution Center (EnSoC e.V.), GIGATRONIK Stuttgart GmbH, Parkraumgesellschaft Baden-Württemberg mbH, SWARCO Traffic Systems GmbH

Project within the framework of Schaufenster Elektromobilität "LivingLab BWe mobil".

Approximately 3 years

Reference Project – E-Vans in Manchester (UK)

Source: Fraunhofer IAO

7 diesel vans from the university estate management team were replaced with new electric leasing vans. The vans are used for delivering mail and operational services.

E-trucks // Mobility solution provider // App

Manchester Corridor Board, The University of Manchester, Nissan Motor Manufacturing UK

€ 50,000 – 250,000

< 0.5 year

Simple and high scale replacement of vehicles due to a leasing model

Source: triangulum-project.eu

TECHNICAL

1. Upgrade transport card *Ideal*
2. New tariff-system with zones
3. Smart parking system in blue zones
4. Bicycle parking infrastructure
5. Real time information for the end user

Technical - Solution 1: Upgrade ideal card

Upgrading the mobility card *Ideal* for additional mobility services

Description and Objectives

With an upgrade of the ideal card, passengers can buy bus tickets monthly or semi-annual. The subscription of the ideal card could also include additional mobility offers like bike or car sharing.

1) This solution could be also combined with e-ticketing, which is planned by the public transport organizations in Joinville.
2) In addition, the rate system could be reorganized for example zone-dependent prices

Objectives:

- make the public transport more attractive
- easy access to several mobility offers
- reduce the long-term costs of ticket selling

Contribution to Climate Mitigation: **N.A.**

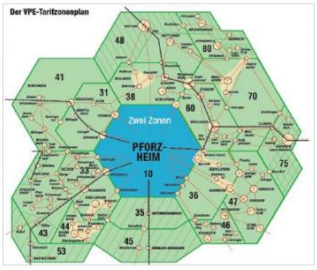
Technical - Solution 2: New tariff-system with zones

Discussed during the workshop 1st of November

Restructuring of the tariff-system with zones

Description and Objectives

More than 60% of public transport users are dissatisfied with the current fare system. The city currently has only one fare, regardless of the distance travelled or the time required. The tariff system could be transformed into zones. Clearly arranged fare systems are easy for passengers to understand and can reduce the price of tickets, especially for short distances, thus promoting public transport. The Ticketing Company is Passebus.



Objectives:

- make the public transport more attractive
- affordable ticket prices

Contribution to Climate Mitigation: **N.A.**

Technical - Solution 2: New tariff-system with zones

Discussed during the workshop 1st of November

Components

- Integration (shared bicycles / parking lots)
- Applications to obtain O-D, passenger counting, card recharge (eg. Analitics, Smart mobility, among others)
- Geo-referencing of vehicles
- New billing: charge less of those who use more (per mileage)

Stakeholders

- Passebus, Gidion, Transtusa
- City Hall / SEPUD / SEINFRA
- Companies, Schools, Universities (transport costs, hours)
- Advertising (bus, shelter, app)
- Observatório da Mobilidade

Next steps

- Data required: interview with users (to identify the acceptance of the new system), cost analysis, demand analysis, mileage of bus trips.
- Search for systems that exist in United Kingdom in similar cities.
- Stimulate user (comfort in the bus versus car), improving fleet, frequency, comfort, safety
- Division of tariff zones (per section or per km)
- Negotiations about subsidies
- Estimate loss of revenue
- Impact study on low-income population

Possible funding options

- Circulation of vehicles in restricted areas (Green Zone)
- Subsidies (through reduction of fuel taxes, ISS, among others)
- Funding for technological leap (Felicity - energy efficiency - between the EU and Brazil)
- Incentive by companies to employees (to increase the number of users of public transport)
- Mobility funds (funded via rotary parking)

Technical - Solution 2: New tariff-system with zones

Discussed during the workshop

Estimated cost	Estimated implementation time
• Zoning: cost of equipment for billing / new technology = approx. USD 1 million • Charge those who use more (mileage) - could not estimate the cost	Ticketing = 6 months - 1 year (implementation should be adapted to Joinville)

Degree of complexity	Previous knowledge
[ ] high [x] medium [ ] low	[x] yes [ ] no

Urgency / priority?
[ ] very high [x] high [ ] medium [ ] low

Innovation degree	Citizen acceptance
[ ] high [ ] medium [x] low	[ ] high [x] medium [ ] low

Technical - Solution 3: Smart parking system

Upgrade of Blue Parking paid system and implementation of smart parking in the proposed park and ride stations

Description and Objectives

Statistics show that around 30% of traffic is caused by people who are looking for a parking space. The city will soon introduce the paid parking system "estacionamento rotativo". This is complemented by an intelligent parking system that navigates the driver to the nearest free parking space. The user can also use this application for payment. Detection of free spots can be achieved by installing cameras and sensors. Additional components such as city screens for better orientation and personalized information can be added.

Objectives:

- reduce traffic in the city center

Contribution to Climate Mitigation: **Moderate**

Technical - Solution 4: Bicycle parking infrastructure

Discussed during the workshop 1st of November

Installation of safe bicycle parking infrastructure

Description and Objectives

58 % of the public transport users would cycle more if there were safe and monitored bike stations. Attractive and safe parking infrastructure for bicycles can be implemented in different strategic locations as the proposed park & ride stations and the mobility hubs.

1) For electric bicycles the parking infrastructure would need charging points or lockers for the accumulator.
2) Additional services (like a repair shop) could be combined with a bigger bicycle parking infrastructure.

Objectives:

- to attract cycling in the city
- safety bicycle parking

Contribution to Climate Mitigation: High

Technical - Solution 4: Bicycle parking infrastructure

Discussed during the workshop 1st of November

Components

Secure Parking:
- Secure Parking Infrastructure (P)
- Bicycle Parking (P)
- Cameras (P)
- Paratrans throughout the city all (M)

Stakeholders

- City Administration (P) / City Hall - SEPUD (M)
- Pedal Joinville (P) (M)
- Banks (M)
- Gidion, transtuse, passebus (M)
- Sponsors (use of parking and bicycles with logos - marketing) (M)
- Serttel / Mobilicity (M)
- ACID (M)
- Ciclo entrega (M)
- GIZ (M)

Next steps

- Registration of users
- Find bike provider (producer)
- Suggest new locations
- Stimulus to use (incentive actions)
- Introduce different bikes
- Equip terminals with good and safe infrastructure
- Develop application / technology

Possible funding options

- Mobility incentive policies financed by BNDS, IDB, FONPLATA.
- Partnership with companies (advertising + maintenance).
- Selo Verde - fiscal incentives of the municipality for users and companies (parking infrastructure).
- Incentive to bicycle user.
- Revolving parking (set% for mobility).
- Traffic zone
- Percentage of urban toll.

Technical - Solution 4: Bicycle parking infrastructure

Discussed during the workshop

Estimated cost	Estimated implementation time
Not discussed / defined	Not discussed / defined

Degree of complexity	Previous knowledge
[ ] high [ ] medium [x] low	[x] yes [ ] no

Urgency / priority?

[ ] very high [x] high [ ] medium [ ] low

Innovation degree	Citizen acceptance
[x] high [ ] medium [ ] low	[x] high [ ] medium [ ] low

Reference Project – Radstation, Münster (Germany)

Radstation

Picture: radstation.de

It is the largest bicycle station in Germany and is located in Münster. In 1999 an old underground passage was converted into a bicycle parking garage. Now it provides 3,300 bike slots with additional services.

Bike slots // repair shop // bike washing service // lockers // bike sharing service // vending machine

Radstation Münster, Münster Municipality, Münster central train station

13 million DM (€ 6,6 million), half of which was borne by the state of North Rhine-Westphalia.

Bicycles are parked in two-story stands. Prices: € 0,7 per day, € 8 per month, personal stand € 90 per year.

Source: radstation.de; radstation-nrw.de

Technical - Solution 5: Real time information for the end user

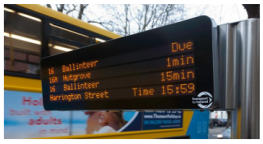
Installation of an onboard unit with GPS in busses and upgrade bus stops with real time data and mobility app

Description and Objectives

The bus sends a GPS signal to the passenger information and management system. The system compares it with the regular timetable and provides real-time information to various output devices (such as a monitor at bus stations or an application on smartphones) for stops along the route. Modern systems calculate the estimated time of arrival of public transport vehicles based on real-time traffic information and taking into account planned and unplanned traffic events.

Objectives:

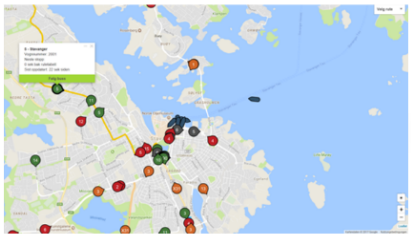
- Provide people access to real time information regarding bus arrivals and departing times
- Making public transport more attractive to citizens



Contribution to Climate Mitigation: **N.A.**

Reference Project – Real time monitoring system, Rogaland (Norway)

ROGALAND FYLKESKOMMUNE



Picture: triangulum-project.eu

Service allows people to access real-time data and make informed choices. It improves and enhances data and gives benefits back to the data provider. It gives an opportunity to create innovation.

On-board-units (GPS units, bus computer; 420 busses), display at bus stops and terminals, software, server for data storage

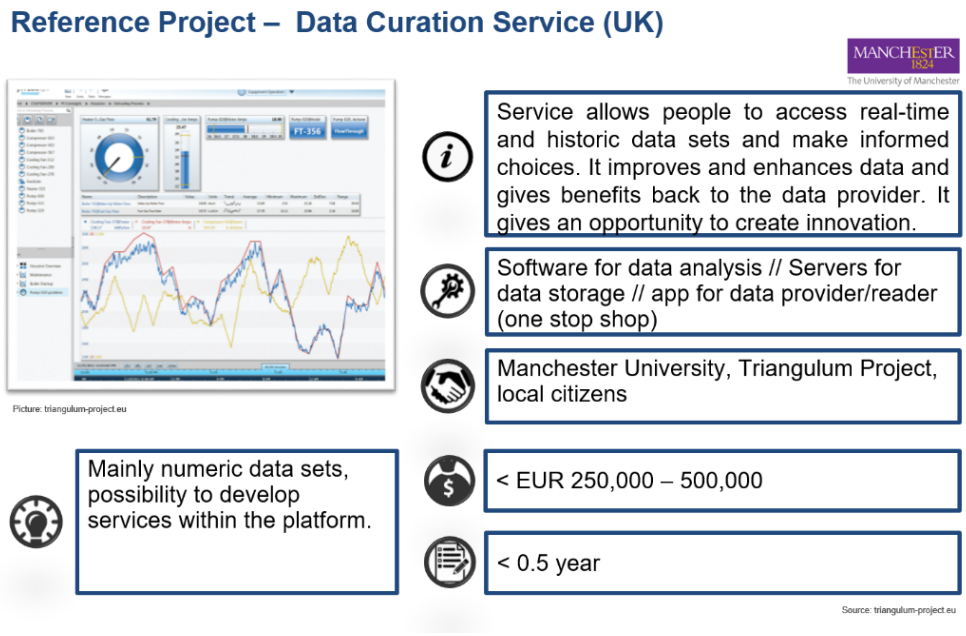
Kolumbus AS, Rogaland County Council, local citizens

Mainly numeric data sets, possibility to develop services within the platform.

€ 4,000,000

< 2 years

Source: triangulum-project.eu



5 The Way Forward – Roadmap

5.1 Steps towards smart mobility governance

Mobility is unquestionably one of the main concerns of the city administration. It is not only one of the main source of pollution but also very expensive and accounts for huge amounts of energy consumption. Today, cities are completely dependent on mobility dynamics and processes. When a city is striving to transform itself into a smart and sustainable city, mobility is inevitably one of the aspects that needs to be mastered. Mobility is a very complex topic and has to be treated as such. It is imperative to know how to best use the available knowledge and the existing technology to shape the future-oriented mobility of tomorrow.

5.1.1 Creation of a Mobility Action Group to guarantee implementation and innovation

The existence of an institutionalized group that coordinates, builds up synergies, and pushes forward innovation in mobility is crucial for transforming a city.

As outlined in the project description above, Joinville has already formed the "Observatório de Mobilidade". However, it is necessary to expand this existing group of stakeholders to ensure its impact and effectiveness.

The action-group should be created, to connect representatives of the city administration, regional administration, public transport, logistic companies, start-ups, the universities, cyclist associations, the regional government, financial institutions and others. The purpose of the group is to define an

"implementation agency" that will ensure the implementation of jointly developed projects such as those described above.

5.1.2 City Lab results in the PlanMOB

The PlanMOB is the most important guideline document regarding mobility in Joinville. Currently, the documents are being revised. This opportunity can be used to evaluate the possibility of incorporating the City Lab results into the updated version, which is due to be approved and released in 2018.This would ensure the political commitment for the implementation and would give it a legal character. This process is in line with the formation of the Action Group and can be managed and coordinated by SEPUD, which has accompanied entire City lab process.

5.2 Roadmap

From the City Profile above, it can be derived that Joinville needs an overarching approach to address urgent mobility challenges. One of the main problems is undoubtedly the absence of alternative modes of transport to promote intermodality and decrease the dependency on the private car. On the other hand, the public transport needs to be improved to increase the user satisfaction and enhance the user experience. The City Lab has managed in bringing together the most diverse stakeholders related to mobility in Joinvile and co-creating ideas for transforming the mobility in the city.

A stand-alone solution might not have a considerable impact but a coherent set of measures can. Important is to highlight that the technology alone cannot solve the problem; it needs to be accompanied by the right policies and through awareness raising in order to be successful and actually have an impact.

Given Joinville's level of innovation for some of the solutions as the mobility hub, it would be the best way to start with a pilot project, which allows assessing the potentials for the replication on a city level.

During the interviews with partners, great interest was shown in working together in the implementation of the projects and collaborating in their development and financing. This window of opportunity must be used to create synergies and initiate the roll out. The projects described below are considered to be ideal for the implementation of the *strategic alliance*, currently being developed by the GIZ. The suggestions are based, on the one hand, on the interest showed by partners during the on-site visit and subsequent follow-up conversations, and on the other hand, on the assessment results regarding the major problems in the city and the identified potentials as presented in the SWOT analysis above (e.g. intermodality, excessive use of private cars, etc.) In coordination with the GIZ, the feasibility of the project was assessed. The

evaluation was carried out by considering the impact of the intervention in promoting the modal shift, reducing emissions, promoting clean transport modes, reducing traffic in general and an initial rough feasibility assessment for its implementation based on the willingness of the identified stakeholders to participate in a public private partnership. However, this would have to be analysed further.

5.2.1 Smart policies: Low emission zone, green certificate and promotion of high occupancy in private cars

The creation of such an area is regarded as very important in order to effectively promote the transition to more environmentally friendly modes of transport, increase awareness and as an incentive for the implementation of the measures outlined above. After defining the model that this area should follow, the monitoring and billing system should be put in place. BOSCH is an experienced provider of such technologies.

Ideally, the creation of the zone should be combined with financial incentives for electric vehicles and bikes and the promotion of high occupancy in private vehicles as a complement to the restriction. The green certificate emitted as well to transport companies using green modes of transport can serve as a complement to promote the transition.

5.2.2 Last Mile Logistics

During the City Lab a big potential for realizing last mile logistic projects was identified. Here it would be important to distinguish in two different types of projects: last mile distribution with bikes and distribution with e-cars. For both cases a preliminary data collection and assessment is needed. For instance, information regarding the volume of shipments, the service provider structure, the receiver structure, the topography of the city, the share of heavy transport in traffic, etc. is the basis for an initial screening of needs and implementation options.

During the on-site visit the union of transporters showed great interest on outsourcing last mile deliveries. It is important to know what kind of shipments currently exist and where the recipients are, to define what can be done with bikes and what deliveries have to be done with e-cars. Depending on the former, possible micro hubs need to be identified. Implementation partners can be existing bike deliveries companies such as "Ciclo Entregas Joinville", others can be found or even formed inside the cyclist associations. BOSCH could be the technology supplier for motorcycles and cars, and Daimler Vans, Volkswagen and others the manufacturer of the body car. Local producers need to be found for the bikes.

5.2.3 Park and Ride

The creation of fully equipped park and ride stations is considered a indispensable to encourage people to switch to public transport. As highlighted in the project description above, the creation of new express lines are a pre-requisite for this project to be successful. The solution in its whole needs to offer car drivers a very attractive option in financial terms as well as in terms of comfort and driving time per trip. The express lines should be designed based on an A to B movements study. So far, such a study has not been carried out at a city level, however, this is crucial for the improvement of the service offered and for understanding whether the system meets the actual movement needs of people. Some institutions for instance, the universities have collected some kind of data for example, from their students. However, this is far away from being representative for the city. Telefonica has a big quantity of mobile data. In the last years it has developed a methodology that collects, adds and analyses different kind of data which provides very comprehensive information on A to B movements. This kind of study has already been carried out in other Brazilian cities, such as Sao Luis, Paraisopolis, Guaruja and Jandira.

The park and ride described in section 4 should be much more than a solely parking station. It but should be equipped with further components as the one of the mobility hub described below. Smart parking technology such as sensors and cameras for safety vigilance and safety need to be installed. Additionally, services, for instance car and bike maintenance should be also included. Local partners must be identified for this.

5.2.4 Business Park as a first showcase for integrated smart mobility

Representatives of the Business Park Perini located in the northern part of the city, has expressed its willingness to realize some of the implementations proposed. With more than 2.8 million square meters of land, this park constitutes the largest multisectoral business condominium in Brazil. It hosts dozens of national and multinational companies of small, medium and large size. The companies' sectors range from metallurgy and automotive to finance trade and services. Within the park, all kind of services such as maintenance, repairs, cleaning and mobility services as well as a shuttle bus are offered.

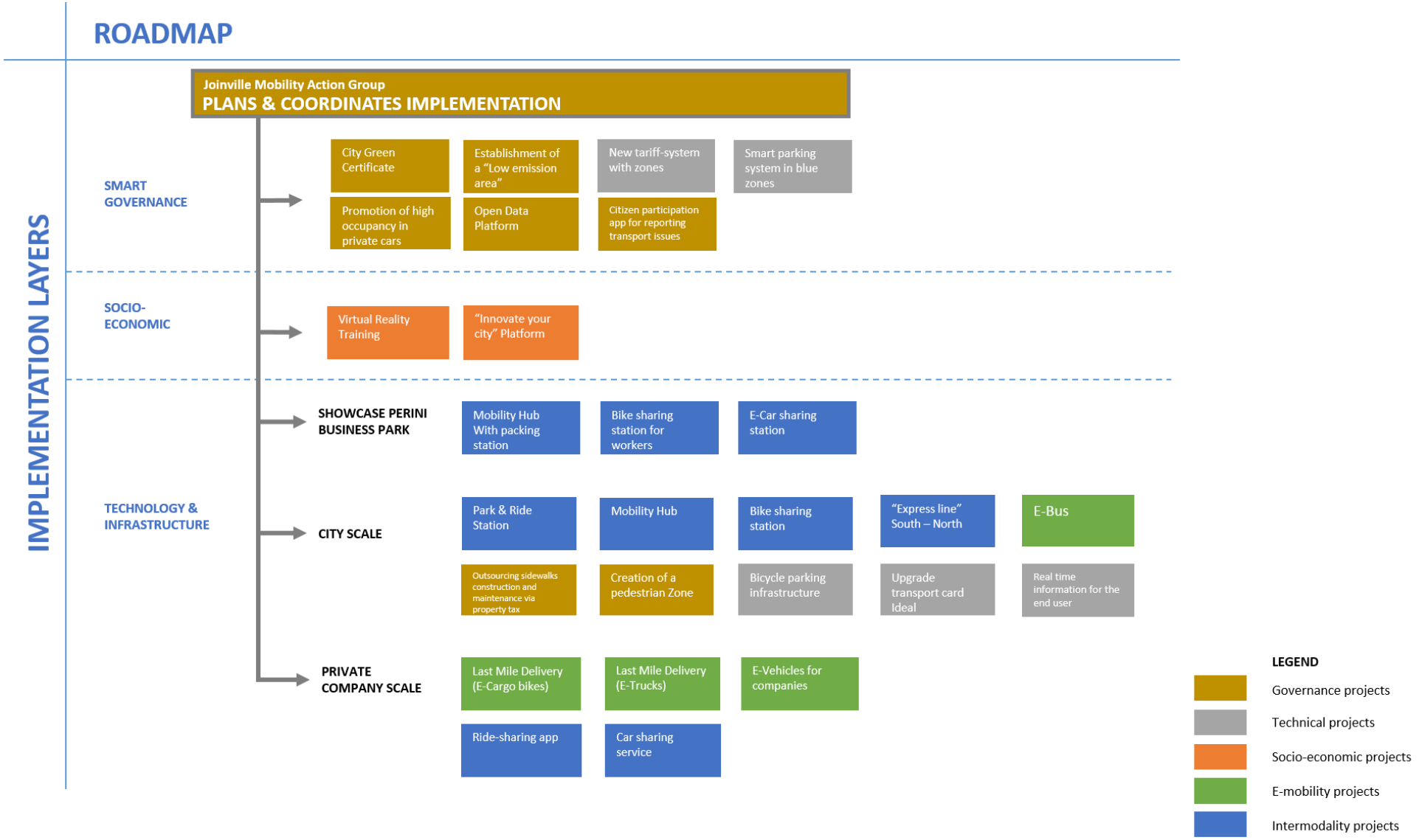
Photo 1. Perini Business Park
Source: perinibusinesspark.com.br

The park is the perfect location for the implementation of the first corporate e-car sharing fleet in Joinville. Likewise, an electric bus could be tested to complement or replace the existent shuttle. An internal bike sharing and a cargo bike system for deliveries within the park can complement the transports offered. The charging stations for bikes and cars can be integrated in a mobility hub. The mobility hub, as presented above in the reference projects, could include a package station such as a kind of micro hub or a grocery delivery station/box. In the implementation, companies as BMW for the e-cars, BOSCH for the E-Bikes, and Station-I for the hub infrastructure, EBG Compleo for the charging stations, as well as local bike producers, delivery companies, supermarkets and mailing companies need to be brought together, to defining the next steps and map different possibilities.

5.2.5 Further measures

Further measures such as the innovation platform, the virtual reality training, reporting app and real time information for end user (once GPS installed in public busses), can be implemented within a relatively short time and with little investment. The implementation of the projects will generate plenty of new data to be collected in the open platform. Therefore, the initial steps towards its creation must be one of the first topics to be discussed and projects to be rolled out within the action group. All this would serve to enhance the impact of the implementation of the technologies outlined above and create a comprehensive approach to address the needs of Joinville and transform its mobility.

The graphic below presents an overview of the projects developed and the approach proposed. As described above, the governance aspect is regarded as the basis for guaranteeing the sustainability of the implementation. In the technology and infrastructure layer the solutions are presented without a specific order for it. In general, they can be all implemented in parallel and are considered to complement each other.


ROADMAP
IMPLEMENTATION LAYERS
Joinville Mobility Action Group
PLANS & COORDINATES IMPLEMENTATION
SMART GOVERNANCE
City Green Certificate
Establishment of a "Low emission area"
New tariff-system with zones
Smart parking system in blue zones
Promotion of high occupancy in private cars
Open Data Platform
Citizen participation app for reporting transport issues
SOCIO-ECONOMIC
Virtual Reality Training
"Innovate your city" Platform
SHOWCASE PERINI BUSINESS PARK
Mobility Hub With packing station
Bike sharing station for workers
E-Car sharing station
TECHNOLOGY & INFRASTRUCTURE
CITY SCALE
Park & Ride Station
Mobility Hub
Bike sharing station
"Express line" South – North
E-Bus
Outsourcing sidewalks construction and maintenance via property tax
Creation of a pedestrian Zone
Bicycle parking infrastructure
Upgrade transport card Ideal
Real time information for the end user
PRIVATE COMPANY SCALE
Last Mile Delivery (E-Cargo bikes)
Last Mile Delivery (E-Trucks)
E-Vehicles for companies
Ride-sharing app
Car sharing service
LEGEND
Governance projects
Technical projects
Socio-economic projects
E-mobility projects
Intermodality projects

List of interviewed Partners

Name	Institution	Position
Volnei Francisco Batista	**ADR** (Regional Development Agency)	Planning Manager
Amir Ternes Hamad	**BMW Group Brasil**	Governmental and Social Affairs Manager
André Renato Back	**CAIXA** (Municipal Treasury)	Branch Supervisor GIDUR Chapeco / SC
Bruno Paim	**Caronear**	Chief Executive Officer
Alessandra Tobo	**Caronear**	Communication and Marketing Director
Jean Eduardo Constazi	**Celesc Distribuição S.A.**	Head of Regional Agency of Joinville
Udo Döhler	**City Hall of Joinville**	Mayor of Joinville
Samuel Luiz Bernardes Gomes	**DETRANS** (Department of Traffic)	Operations Manager
Mathias Kremer	**Domus Solar**	Chief Executive Officer
Luiz A. Negri	**Engenharia Electrica Negri**	Electrical Engineer
Gilmar Leo Kalckmann	**GIDION** (Public transportation operator company)	General Director
Moacir Bogo	**GIDION** (Public transportation operator company)	Advisory Director
Nelson Rogério Stahelin	**PASSEBUS** (Collective transportation ticketing company)	Director
Laércio Batista Jr.	**PEDALA JOINVILLE** (Urban Cyclist Movement)	Consultant
Jony R Kellner	**PEDALA JOINVILLE** (Urban Cyclist Movement)	Consultant
Oswaldo Profeta	**Robert Bosch Ltda**	Corporate Manager
Vladimir Tavares Constante	**Secretary of Urban Planning and Sustainable Development**	Executive Director
Glaucus Folster	**SEINFRA** (Department of Infrastructure)	Transportation and Public Transportation Manager
Clailton Breis	**SEMA** (Department of the Environment)	Manager at the Secretariat of Environment
Valdecir Moraes	**SEMA** (Department of the Environment)	Director
André Marcon Zanatta	**SENAI** (Innovation Institute for Manufacturing Systems)	Innovation Director
Wilson Steingräber Junior	**SETRACAJO** (Union of Freight Transportation and Logistics Operations Companies of Joinville)	President
Luiza Perdroso	**Softville** (Business/Startup Incubator)	Project Coordinator
Tobias Maurus	**Station-i** (ZUWESO GmbH)	General Manager
Vilmar Harger	**TRANSTUSA** (Public transportation operator company)	Director
Fabiano Baldo	**UDESC** (State University of Santa Catarina - Civil Engineering)	Researcher
Simone B. Lopes	**UFSC** (Federal University of Santa Catarina - Mobility Engineering)	Researcher
Marli Teresinha Everling	**Univille University**	Coordinator

Annex

Photo 2. Interview with bus company representatives and project development

Photo 3. Internal workshop for choosing priority projects for the discussion on the 1st of November

Photo 4. Joinville Central Bus station during the on-site transport examination

Photo 5. City Lab leader Marielisa Padilla presents the City Lab framework to workshop participants

Photo 6. During the presentation of the City Lab framework to workshop participants

Photo 7. Representative of the Joinville presenting the results of the workshop on the project Mobility Hub, workshop on the 1st of November

Photo 8. Local stakeholders during the discussion of the new tariff-system with zones for the city of Joinville, workshop on the 1st of November

Photo 9. Local stakeholders during the discussion of the creation of a green zone for the city of Joinville, workshop on the 1st of November.

Photo 10. City Lab team and participants of the workshop on the 1st of November

Photo 11. Meeting of the local team with the Mayor of Joinville – Udo Döhler

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