Strategy and Insights Engine Project

January 2022 Report

URBAN CO-CREATION DATA LAB

Cofinanciado pelo Mecanismo Interligar a Europa - União Europeia

EXECUTIVE SUMMARY

The present document was prepared by **Makebettersolutions, lda** with the aim of presenting an overview of the "Strategy and Insights Engine" Project implemented in partnership with the **Urban Co-Creation Data Lab** using a **Design Thinking** approach.

The goal was to integrate insights from both the **external** (students and citizens) and **internal** (partners and lab members) community and create a platform for behavioural research and idea-creation of new projects and services within the five challenges of the lab.

The report responds to the stage 1 of the Project "**Inspire & Discovery**" presenting the main insights from the desk research, netnography, in-depth interviews and overall conclusions of the student's challenge.

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METHODOLOGY

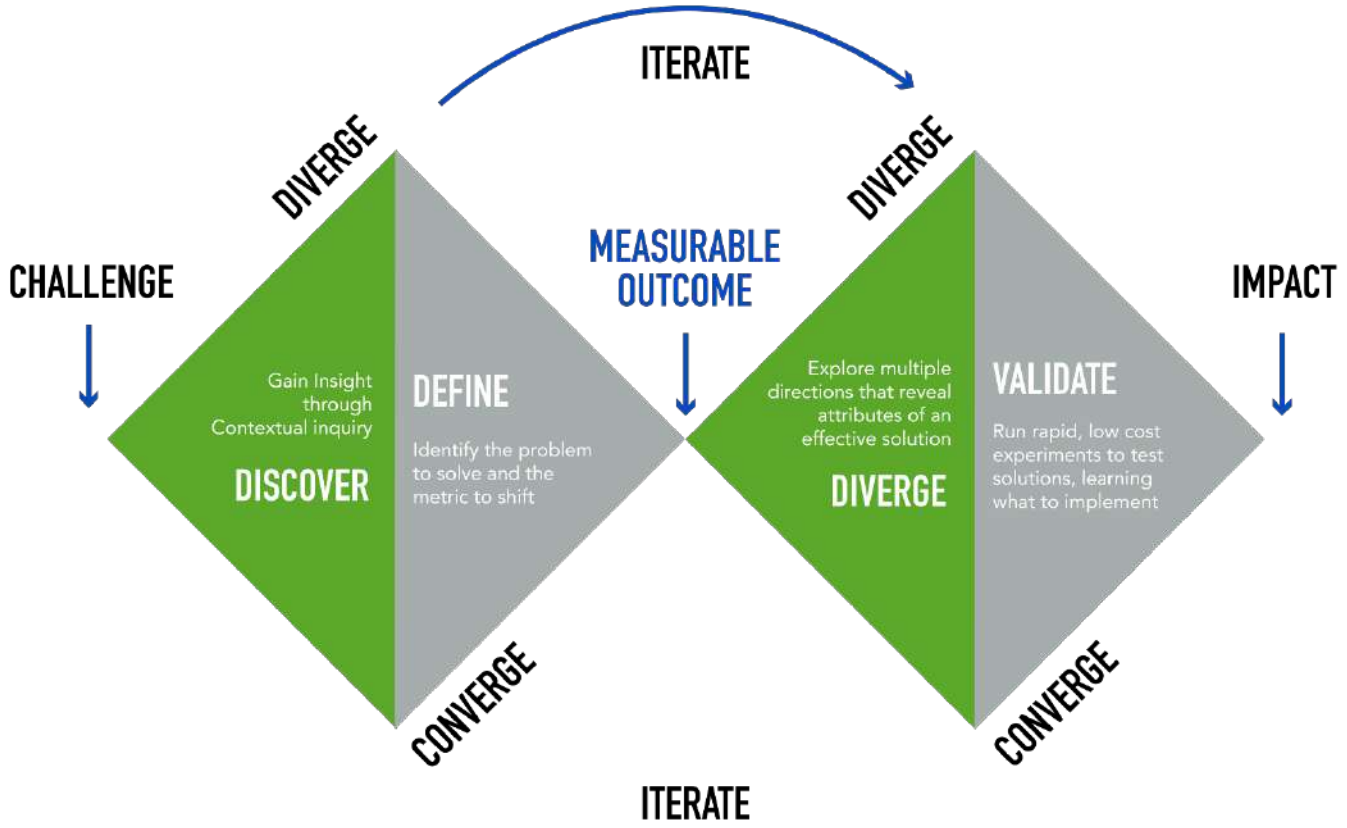
The present project was developed using the ***Design Thinking*** methodology, with particular focus on **Inspiration** phase.

Divided into **three parts**, this project allowed not only the creation of empathy with the 5 themes - Micromobility, Emergency, Parking, Pollution and Waste Management, but also the development of disruptive ideas for the future of the city of Lisbon.

- **PART I** Student Open Challenge
- **PART II** Research for Empathy
- **PART III** Open Innovation Co-Creation session

METHODOLOGY

In Design Thinking methodology, the double diamond model, represented in the image, is normally used to demonstrate the moments of divergence and convergence. In this project we followed this methodology throughout the three parts of the project.



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The proposed approach follows the process of *Design Thinking* – Observation, followed by Co-creation, synthesis, and opportunity spaces framing.

PART I: **STUDENT OPEN CHALLENGE**

The first part of the project was performed by NOVA IMS students, in a **Design Challenge** guided by the project team.

In this challenge, the goal is to design a possible disruptive innovation. Each of the groups focused in one of the five challenges – Micromobility, Emergency, Parking, Pollution and Waste Management. As for the process, the students were challenged to identify:

- **Trend analysis:** a news piece or article about a relevant and disruptive recent innovation in your topic at the national or international level.
- **Empathy Picture:** a picture that your family, friends, or strangers captured about a limitation resulting from the topic that negatively affected their life.
- **Benchmark:** one example of a particular project that represents an ideal or perfect solution for the challenge at stake.

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PART I: **STUDENT OPEN CHALLENGE**

- **Parallel world:** the identification of a brand or company that could better solve the challenge - in a hypothetical situation (e.g. Apple, Spotify, Uber,…).
- **MindMap:** after collecting the previous data, the students had to organize the information in a mindmap to facilitate the process of stating the **Innovation Opportunity Spaces**.

The last phase of this part was a guided brainstorming on the Innovation & Analytics Lab, where students were supposed to identify their winning idea for future prototyping and presentation. and a brief explanation of why.

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PART II: **RESEARCH FOR EMPATHY**

The Research for Empathy was conducted by ethnographic researchers and Design Thinkers with the main goals of creating empathy, listening to a diverse range of stakeholders, and identifying unique insights for the development of disruptive innovations.

In order to achieve these goals, different techniques were performed. For instance:

- **Netnography** and Desk Research were used to identify the trend analysis;
- **In-depth interviews** with specialist were performed to capture their unique view about the city of Lisbon;
- **Mobile Ethnography** complemented the in-depth interviews to create a complete mindmap for each one of the five challenges.

Based on all the information collected, it was possible to identify insights and create opportunity spaces for the brainstorming in Part III.

PART III: **OPEN INNOVATION CO-CREATION SESSION**

The last part of this project - Open Innovation Co-Creation session - is based on a **3 days hands-on workshop**. The activities for each day were divided as follows:

1. **Explore by Insights** (February 9th): Half-Day visit through the streets of Lisbon, with the aim of capturing, through interviews and photographs, the details of the city within the scope of the five topics of the project.
2. **Empathize** (February 10th): A Day full of sharing and learning, where the different insights of the project will be presented: starting with the sharing of student's research, passing through the personal experiences of the research safari in Lisbon and ending with the insights provided by the data collected during the research stage of the project.
3. **What can we... change?** (February 11th): On the last morning of this workshop, the brainstorm and debate about what are the essential interventions for a better management of the municipality, and what opportunities are there to innovate and implement data centered efficiency improvements.

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TIMELINE

G Project in **General** | I **Part I**: Student Open Challenge | II **Part II**: Research for empathy | III **Part III**: Open Innovation Co-Creation Session

SEPTEMBER

13-17 SEP
Kick-Off and Planning of Project Phases

27 SEP - 1 OCT
Student's Observation Tasks

29 SEP - 20 OCT
Netnography and Desk Research to Identify Trends and Benchmark

OCTOBER

4-8 OUT
Student's Visual Tool

11-15 OUT
Student's Data Driven Brainstorming

20-29 OUT
Script Development and Validation

NOVEMBER

Planification of the Co-Creation Session

2-6 NOV 6
Student's Presentations and Feedback Session

4-17 NOV
In-Depth Interviews

NOVEMBER

8 **8 NOV - 13 DEC**
Student's Presentations and Feedback Session

Student's Development of the final presentation

4-17 NOV
In-Depth Interviews

17-24 NOV
Mobile Ethnography' Parameterization

22-30 NOV
Mobile Ethnography Analysis

20-24 NOV
Interview's Analysis

DECEMBER

15
Explore for Insights

2-3 **3-10 DEC**
Empathy Maps Creation | Report Development

16
Empathize

6-14 DEC
Co-creation Sessions Preparation

17
What can we change?

JANUARY

28
Research Report Delivery

FEBRUARY

9-11 Feb.
Co-creation Sessions

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STUDENT OPEN CHALLENGE

As previously explained the Students were asked to participate in an Open Innovation Challenge, where each group of three to four students had one topic to focus their research. In order to guide the students, we divided the project in four stages.

Stage 1 (27 Sept – 1 Oct) - Explore for Insights
(Develop empathy for the topic:
Benchmarks, Trend Analysis, User Research)

Stage 2 (4 Oct – 8 Oct) - Visualize the information
(Organize the observations and
Identify opportunity spaces for Innovation)

Stage 3 (11 Oct – 15 Oct) - Brainstorm
Brainstorm for
Data-Driven solutions

Stage 4 (8 Nov) - Feedback
Storytelling & Feedback Time

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STUDENT OPEN CHALLENGE

After presenting their results on the 8th of November, Students had the opportunity of rethink their initial results and improve them for their final presentation day on the 13th of December.

The main goal of this part of the project was to introduce the Students to a new methodology for Innovation – Design Thinking, so they could merge it with their previous knowledge about Smart Cities.

Regarding the specifications of the tasks performed in each stage and the result present by each group, a brief summary will know be presented.

THE TASK BEHIND THE STAGES

Stage 1

The Students were asked to explore their surrounding, interact with other and explore to find:

- **One Trend analysis**
- **One Empathy Example**
- **One Benchmark**
- **One Parallel worlds**

Stage 2

For the second week, as the previous tasks had been completed, it was important to synthetize and organize the collected data.

It was advised to use a Mind map to organize their finding in the following categories:

- **What are the users Thinking?**
- **What are the users Seeing?**
- **What are the users Saying?**
- **What are the users Feeling?**
- **What are the users Hearing?**

To finalize the second stage, Students had to create opportunity spaces for their challenges.

Stage 3

Finally, having in mind the persona they have identified in Stage 2, and the trends and benchmarks spotted in Stage 1, the groups performed a **brainstorming session** in the Innovation & Analytics Lab.

The goal was to generate the **maximum number of ideas without restricting their creativity** to what is feasible and viable.

At the end of the class, they **decided on which idea they would invest** for the final presentation.

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THE STUDENTS' MAIN FINDINGS

Group 1 focused on parking and its challenges, in particular the case of **São José's Hospital from Monday to Friday** in working hours. The problem was divided in **3 possible causes and 1 consequence (4)**:

(1) Insufficient/reduced parking spaces inside the hospital;

(2) High prices in car parks around the hospital;

(3) Lack of interest/concern on the part of the administration to solve this problem;

(4) Increased carbon emissions and traffic in the city centre.

In order to reduce the stress from the hospital workers, they proposed a **parking solution** further away from the centre/hospital with the creation of **micro-mobility infrastructures that guarantee the ease of movement** of employees to the Hospital and guarantee affordable prices.

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THE STUDENTS' MAIN FINDINGS

Group 3 was exposed to the challenge of waste management. This group found two diferente solutions for the disposal of waste outside the bins.

(1) They thought about creating a rubbish route in each building of the city that would work as a lift and, using the CTT (mail deliver) route construction mechanisms, **the rubbish would be collected from people's buildings**.

Although **this idea would be desired** by the people, its in **not feasible in a city such as Lisbon** with a large number of inhabitants. Therefore, the group went for a second round of ideation. Their final idea was:

(2) Each inhabitant would be identified **by their fingerprint which would then be associated to their Fiscal Number**, and the people would receive a monetary prize according to the weight of material placed in the right container. The **prize given would be in the form of discounts on their taxes** (such as irs, imi, iuc,...)

THE STUDENTS' MAIN FINDINGS

Group 4 focused on pollution. Although the group has discriminated diferente types of pollution, such as air, water, sound, and light pollution, their work was mainly focused on **atmospheric pollution**.

Big cities lack green spaces **to absorve CO2 emission**, so this group wanted to incentivate people to grow plants.

In order to do that, they invented **Jungle**, a service wich provided **a community for plant lovers and beginners** to share their knowledge and doubts for free, and a paid service – the **plant sensor to help monitor plants' conditions**.

By providing this service, the group highlighted the benefits for the users: **stress reduction** when taking care of plants, **thermal and sound insulation**, **balance humidity levels**, and their main goal, capture and store carbon from atmosphere.

JUNGLE
CHANGING HOMES

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THE STUDENTS' MAIN FINDINGS

Multiple times citizens are confronted with full bins or even gatherings of garbage outsider the designated areas. **Group 5** investigated about waste managements, and its opportunity spaces.

On the assumption that people take care of what is taken care of in the first place, this group's proposal was to **develop intelligent bins**. The idea was for the bins to communicate with the people who dispose their waste, that would:

(1) Facilitate the communication with the **public administration to inform when the bins are full**;

(2) Provide **useful information** like the weather and the news to the users;

(3) **Expose the nearest bins** when that one is already full.

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THE STUDENTS' MAIN FINDINGS

Emergency was the focus of **Group 6**, in particular emergencies that require ambulance response.

Based on Uber Eats parallel world, the group chose to ideate the creation of a system that could track all the process, since the call for 112 until the final paperwork. The main goal of this system is to be more transparent to the users**, avoiding trouble with paperwork and the bureaucracies** in stressful times.

This group also created a **prototype in the SNS 24 APP,** as shown in the figure, where user could experiment interacting with data from previous occurrences. In case the 112 line was already called, **the route map will automatically appear providing information about the route the ambulance is taking and also the expected time**.

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THE STUDENTS' MAIN FINDINGS

The project of **group 7** was focused on micromobility and its pains. Although, the group have found six areas of intervention, they focused on the third.

(1) Limitations, Service, Availability, Infrastructures;

(2) Lack of Control/Regulation;

(3) Security and Fear of use;

(4) Reduced comfort and quality;

(5) Vandalism and Pavement Obstructions;

(6) Skepticism of local citizens.

For that, their solution was **Micromobility Officers**, that would manage real-time emergencies, identify Safe parking and collecting spots, accidents and road quality.

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NEWS

In order to understand the relevance of the challenges to the general population, we started by doing a cursory review on Google to count the number of news stories per topic:

- **99 400 000** news on pollution;
- **57 500 000** news on mobility (**97 300** in micromobility);
- **145 000 000** news on parking;
- **215 000 000** news on emergency;
- **24 700 000** news on waste management.

All the pressuring topics analysed in this project are well represented in the public sphere judging by the amount of media attention raised.

Talk of the Town | Examples of main topics addressed

MultiNews
Redução da poluição atmosférica, durante o confinamento ...
Redução da poluição atmosférica, durante o confinamento, salvou centenas de vidas um pouco por toda a Europa. Portugal, inclusivé.
23 hours ago

Green Savers
Novo estudo aponta que a poluição química já ultrapassou o ...
Uma equipa de cientistas avaliou o impacto no sistema terrestre da poluição química e chegou à conclusão de que já se ultrapassou o limite...
2 days ago

Monitor Mercantil
Multinacionais enviam manifesto à ONU sobre poluição por ...
Mais de 70 empresas e instituições financeiras pediram um tratado juridicamente vinculativo sobre poluição por plásticos em um manifesto...
17 mins ago

EcoDebate
Poluição dos mares e oceanos por microplásticos pode ser ...
Uma equipe de investigação do ICTA-UAB conclui que a diversidade de técnicas e métodos utilizados para estudar a poluição microplástica dos...
1 day ago

Mega Curioso
6 atitudes efetivas para acabar com a poluição dos oceanos
Isso significa que existirão mais pessoas aproveitando o mar e o sol, mas também representa um crescimento exponencial das taxas de poluição...
16 hours ago

Euronews
Poluição do ar mata 400 mil europeus por ano
Todos esses veículos provocam uma enorme poluição atmosférica. Queremos que os políticos levem isto a sério".
2 weeks ago

Pollution of the seas and oceans by **microplastics** may be greater than estimated

400,000 people on the European continent **die prematurely** every year because of the polluted **air they breathe** in cities.

More than 70 major international companies have petitioned the United Nations (UN) to sign a treaty against the **polluting use of plastics.**

Urban pollution led to the **premature deaths** of more than 1.8 million people in 2019.

Around two million children worldwide had **new cases of asthma** in 2019 from breathing in nitrogen dioxide, a pollutant associated with vehicles.

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A DAY IN A LIFE

In order to organize the information found about the different topics, we've created a **persona** based on mobile ethnography results. Thus, following one day in the life of **Carolina**, we delve into the current situation in Lisbon in the 5 challenges and show the solution proposals from other countries.

The topics are presented in the following order: (1) Pollution, (2) Emergency, (3) Mobility, (4) Parking, and (5) Waste Management.

In each theme the history of Carolina is introduced, followed by the current situation - Benchmark, and the proposals from other countries - In another countries... . At the end of each theme, some points were collected from the in-depth interviews regarding the perception of the situation of the city of Lisbon and proposals for a better future.

Pollution

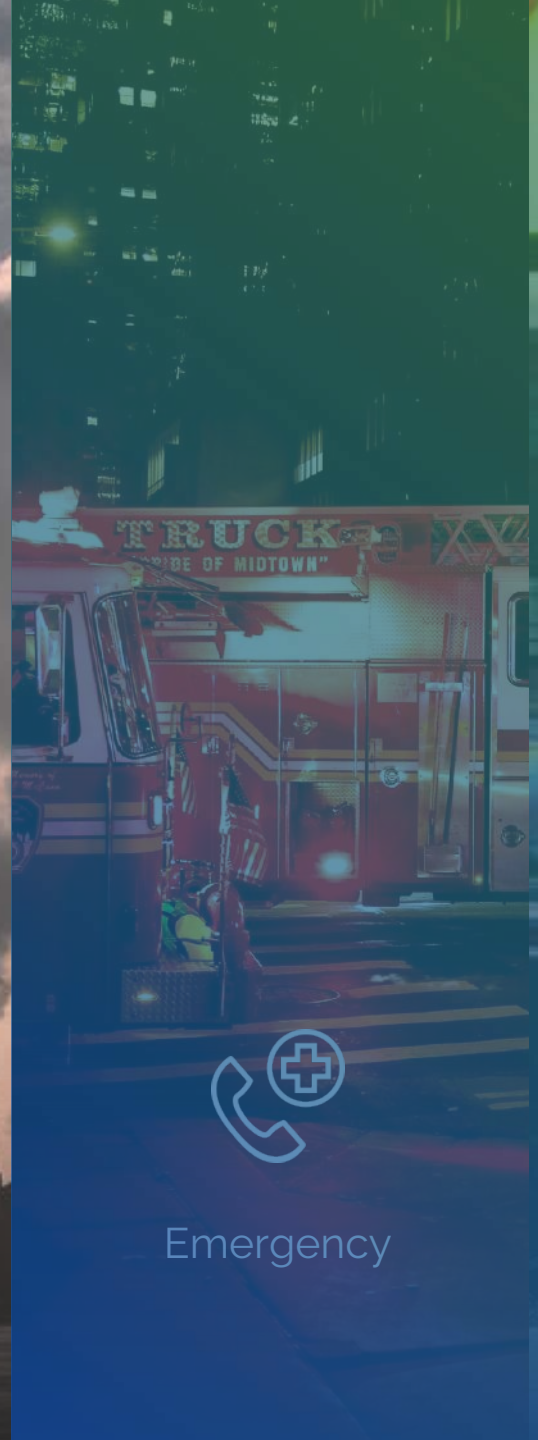
Emergency

Mobility

Parking

Waste Management

Pollution



Emergency

Mobility

Parking

Waste Management

1. POLLUTION

Carolina wakes up very early in the morning and before going to work she does her morning exercise. On a certain day, when she goes for a run by the river, as she normally does, she thinks about how we are dealing with the consequences of water pollution. As she pass through **Alcântara neighborhood**, looking at the river Tejo, she sighs about populations throwing the plastic waste into water bodies and recent news about the impact of industry discharges into the river .

Water Pollution

WHAT THE DATA?

Air Pollution

Regarding the air pollution in the city of Lisbon, the town hall developed a network with **three hundred sensors** with the aim to monitor the quality of the air. In this assessment, the sensors can identify the level of nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone and the particles PM2.5 and PM10.

In order to improve this system, there is an investment being made in the reinforcement of the sensors network. With this funding, is expected to increase the number of sensors and also enlarge the different particles that the sensors can identify. The detectors now are going to be able to recognize some particles that they weren't able before.. After this process of recognition, the sensors send their information to one of the **eighty stations** responsible to analyze the data received.

WHAT THE DATA?

This methodology to control the air pollution is able to reinforce the diagnose of the city in terms of the environment, identify the main areas where there is a need for intervention, but also inform the general public and promote more appropriate behaviors and measures to reduce the negative effects of potential air pollution episodes.

In addition to this, there is a website where you can see how the levels of atmospheric pollution are in that certain moment.

With the system that is already in use in Lisbon and also all the improvements that they are making, in case of an emergency there is an easy way to identify which areas are suffering more impacts, in case of some accident with danger substances. In addition to that, they can also see the different levels of the particles in analysis and compare it to the limit values legislated for the protection of human health. When the criteria are applied and checked, it´s easier for the town hall to create awareness to their concern, address it properly and present solutions for the problem.

Ar. (2021). MUNICÍPIO de LISBOA

IN OTHER COUNTRIES…

Urban outdoor air pollution is one of the more common problems.

The awareness of the hazards of air pollution has never been higher. We know that invisible particles can cause serious damage to our long-term health and cause heart disease, stroke, respiratory disease and cancer. Let's look at some of the measures that most important cities round the world have taken to combat outside air pollution.

China

Beijing's long-standing combat towards air pollution commenced in 1998.

An UN-led group of worldwide and Chinese professionals have compiled a record that details the city's evolving steps towards better air.

IN OTHER COUNTRIES…

By **2017**, the degree of awareness of particulate depend in Beijing's air had fallen by **35%**. This was once a first; because no other metropolis in the world has ever managed to limit air pollution degrees so drastically. Over **twenty years**, a complete air satisfactory management system has taken shape.

This system consists of legislative backing and ideal enforcement, implementation of well-researched and strong nearby standards, everyday monitoring at every level, and excessive stages of public awareness.
This system has been complemented by using economic incentives to curb pollution and monetary aid to those who helped the cause.

IN OTHER COUNTRIES…

For example, once it was realized that coal combustion was an important supply of particulate matter, the Government incentivized households to swap from coal-based heating to electricity-based heating. They presented to subsidise the buy of electrical heating equipment via taking on two-thirds of the cost. They also supplied a maximum bargain of **seventy-eight per cent** on the heating electrical energy invoice to those who made the switch.

Aashind, A. (2021, August 13). *How Major Cities Around the World are Fighting Air Pollution*. Unsustainable.

IN OTHER COUNTRIES...

Water pollution is one of the world's most pressing issues.

Unfortunately, the problem is constantly exacerbated via consumers. Since very few human beings are aware of how serious of a problem it is.

The People's Republic of China is extensively recognized as the world's most energetic manufacturer. It has performed this repute by presenting wonderful outputs at fees lower than somewhere else on the planet.

Did you know that **40%** of bodies of water in China are wholly polluted?

IN OTHER COUNTRIES…

Further, about **700 million** Chinese nationals consume this contaminated water on a every day basis. When in contrast to the total population of the People's Republic of China, 700 million people make up **more than half** of every body who lives in the country.

Humans are responsible for dumping some **1.2 trillion** gallons of untreated wastewater returned into our bodies of water, ranging from the massive ocean to tiny streams that go on to structure rivers. Thanks to all the water we pump again into planet Earth without treating it, roughly **forty seven percentage** of humans around the globe will be fighting to find sufficient stores of drinking water by way of 2050.

G. (2019, June 25). *Water Polution Statistics 2019–2018 - Ocean Polution Facts | Globe Water.* GlobeWater.

WHAT DO SPECIALISTS SAY?

About the current situation…

- Mobility and parking are interconnected along with pollution, since the use of private transport and parking contributed to the increase of pollution levels
- If the city is full of cars, it is polluted
- Most people thought of air pollution when imagined an hypothetical scenario of huge levels of pollution
- The pollution problem is a one-time thing. All the other issues are day-to-day ones

WHAT DO SPECIALISTS SAY?

For improving the Future…

- Often mentioned the fact that in the future we will have to wear a pollution mask
- Pollution is a problem that must be dealt with crucially in the next 3 years
- For pollution with this project, we want to develop a model used by municipal civil protection services to be able to respond to atmospheric emergencies based on results and forecasts
- In order for the city of Lisbon to achieve the levels it has set for itself, in terms of sustainable mobility, it must be concerned with reducing pollution from cars.
- “There has to be a change at the energy level, for example, cleaner energy alternatives that help reduce greenhouse gases, global warming, etc.”

WHAT DO SPECIALISTS SAY?

For improving the Future…

- "I would encourage pollution reduction policies and increase photovoltaic panels and encourage council workers to only come by bike to encourage that use. Then I would try to reduce individual transportation within the city and invest in parking lots. "

Pollution

Emergency

Mobility

Parking

Waste Management

2. EMERGENCY

After her run, and while she is preparing breakfast, **Carolina** usually turns on the TV or radio to find out how the traffic is and if there are any accidents on her way to work.

There is rarely a day when there is not at least one accident or traffic jam, and she believes that this conditions bad behaviour in other drivers.

In an ideal world, she would love if there was an app like the weather (IPMA) that gave a weekly traffic forecast.

WHAT THE DATA?

The mission of Autoridade Nacional Segurança Rodoviária (ANSR) is to plan and coordinate at a national level the support to the Government's policy on road safety, as well as to enforce the law on road traffic offences.

ANSR is defining the National Road Safety Strategy 2021-2030 – **Vision Zero 2030**, in accordance with the European Commission's road safety policy 2021-2030, the Stockholm Declaration and the Safe System approach.

Vision Zero 2030 intends to establish a medium-term road safety policy in Portugal and define the strategic and corresponding operational goals, which shall be achieved through biennial action plans, starting in 2021 and which will cover a total period of 10 years.

It is a platform that invites civil society to present its contributions with regard to the new **Vision Zero 2030**, and a means to disseminate and share the contributions received.

WHAT THE DATA?

MOPREVIS is a project of the University of Évora in partnership with the GNR Setúbal Territorial Command, funded by FCT.

The goal is, through predictive statistical models and artificial intelligence, to build an information system that identifies the places where accidents are most likely to occur.

According to the Coordinator of this project, it will be possible to build something that helps drivers, pedestrians and authorities in real time, and may also contribute to define public policies.

This scientific information is useful as a support "to the decision to better balance and optimize resources for the places, times and periods where, predictably, there may be a greater occurrence of accidents".

WHAT THE DATA?

The founders of **icollision** have a vast experience in the investigation and reconstruction of road accidents, in the study of the phenomenon of road accidents, in the training of qualified personnel in these areas and in the development of methodologies and computational models for the investigation and reconstruction of accidents.

Traffic Psychologists and **Ordem dos Psicólogos Portugueses** (OPP) collaborate in the analysis of incidents and accidents in articulation with technical experts, contributing to the investigation of their causes and the implication of the human factor in their occurrence. They study the interaction with other elements of the system, whether by means of transport, infrastructure infrastructures, as well as environmental and atmospheric conditions.

WHAT THE DATA?

When accidents occur, traffic psychologists investigate the relationship between behaviour, accidents, precipitating factors, the implication of the actors involved and the three motivations for operator behaviour: rational or planned behaviour, impulsive or planned behaviour, impulsive or emotional behaviour, and habitual behaviour.

The research also involves the analysis of aspects of human behaviour that contributing to the occurrence of the accident linked, for example, to age, consumption of alcohol and psychotropic substances, speed, non-compliance with rules, distraction, sleep, fatigue, as well as the interaction with external factors (e.g.: environmental signposting, infrastructure conditions, communication with traffic operators, among with traffic operators, among others).

TREND ANALYSIS

Spatiotemporal correlation of traffic accidents;

Predicting Traffic Accident Hotspots with Spatial Data Science;

Artificial neural networks and deep learning algorithms.

IN OTHER COUNTRIES...

Brazil: TechBalance offers an ecosystem of screening, risk assessment, follow-up, data analysis, active prevention and education services focused on motor wellness and fall and injury prevention for people of all ages, with a special focus on 60+ population and those engaged in sporting activities.

Germany: The German motorways ("autobahn") have dynamic speed limits due weather, time of the day and traffic.

United Arab Emirates: Data-mining techniques were employed to establish models to predict the injury severity of any new accident with reasonable accuracy, based on 5973 traffic accident records in Abu Dhabi over a six-year period from 2008 to 2013. The results indicated that the most important factors associated with fatal severity were age, gender, nationality, year of accident, casualty status, and collision type.

WHAT DO SPECIALISTS SAY?

Weather forecast: Using tools such as augmented reality, meteorologists are able to craft powerful visuals from sources such as weather radar and forecasting models to help their viewers better prepare for incoming storms.

Waze: The user, besides entering the point of departure and the destination, will be able to calculate the departure time according to the intended arrival time.

Inrix: delivers comprehensive data and solutions to help move people, cities and businesses forward. Their partners are automakers, governments, mobile operators, developers, advertisers, as well as enterprises large and small. *INRIX Dangerous Slowdowns* is a service that helps prevent back-of-queue, rear-end collisions where rapidly forming congestion creates a situation that requires advanced driver awareness. Based on real-time data from vehicles on the road, the location-based notifications warn drivers and transportation agencies of sudden reductions in speed or stopped traffic on the roadway.

WHAT DO SPECIALISTS SAY?

About the current situation...

- "difficulty of articulation between entities";
- "(...) what has been more challenging has been the emergency and the parking because they are rare phenomena in time and then in terms of modulation implies that you have to define strategies to deal with this rarity of events, to be able to have some kind of forecast";
- "(...) and the most complicated is the emergency";
- Positive opinion about the time of the emergency (ambulances);
- "There are situations where you call the police and they don't arrive or take a long time. I've seen two car accident situations where the police didn't arrive. And then it took so long that they effectively didn't even get there."

WHAT DO SPECIALISTS SAY?

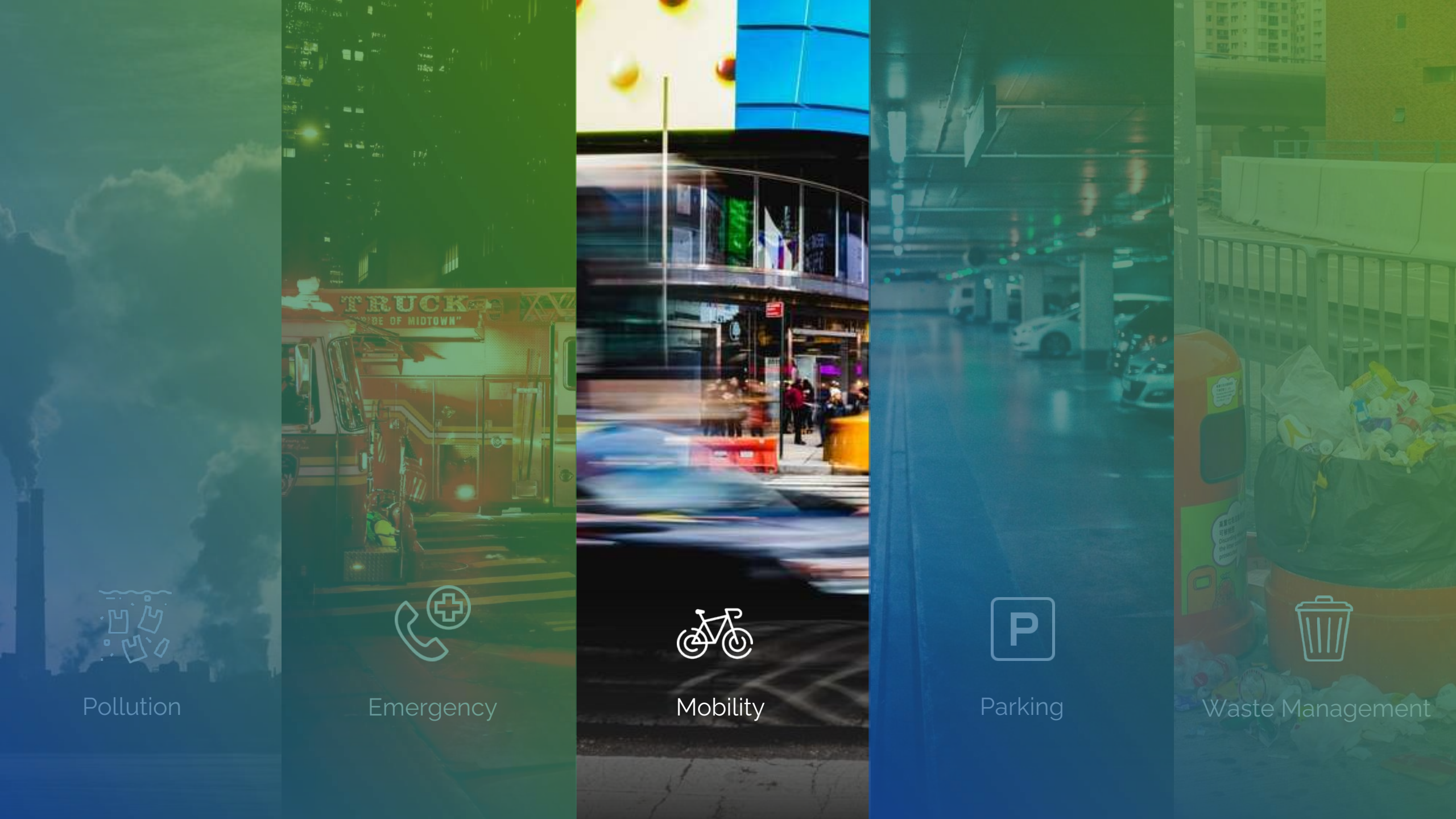
For improving the Future…

- A tool is needed that tells the probability of an emergency occurring at a given location, rather than relying on empirical knowledge;
- "Of all of these, the one that had the most value to society would be the emergency, improve the response, or even if we could predict it."
- "The city hall work must be invisible, the things must appear done, and people will not understand what is behind the scenes: "(…) if there is eventually an accident, the city can react and divert traffic somewhere else."
- Among the future challenges in road traffic forecasting lies the enhancement of the scope of the proposed models and predictions by the incorporation of heterogeneous data sources, that include geo spatial data, information from traffic volume, traffic statistics, video, sound, text and sentiment from social media, that many authors concur that can improve the precision and accuracy of the analysis and predictions

WHAT DO SPECIALISTS SAY?

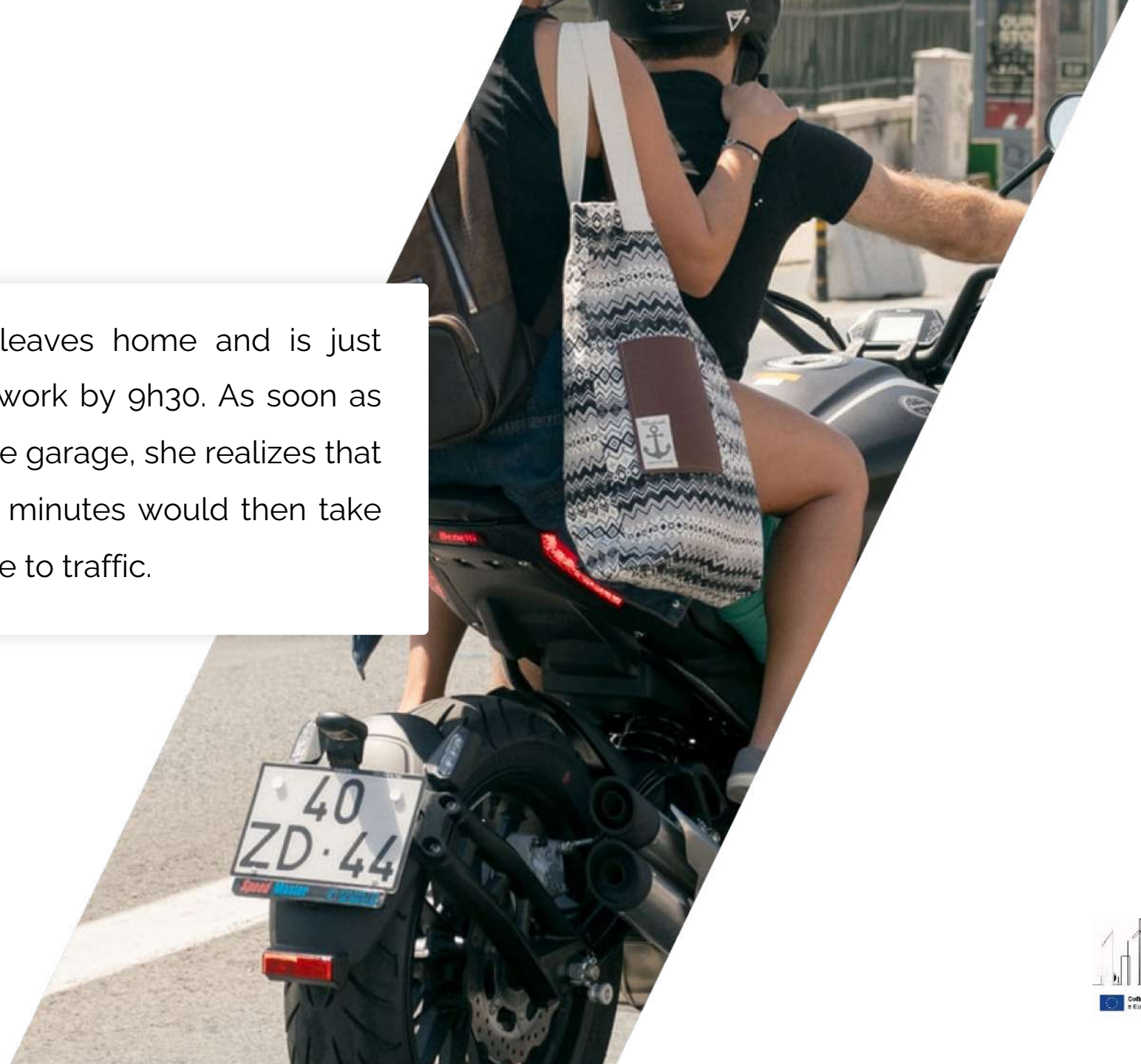
The particular case of firefighters:

- "We manage to have a very fast response, for example for house fires we have an average response time of 6 minutes, from the time it drops into our central office until it arrives on the scene. We have a great capacity for intervention, which allows us to respond to the first call."
- "The emergency in the city of Lisbon doesn't need much support, as long as you have the "sapadores" working."
- Accessibility (related to parking) can make the firefighters' work more difficult;
- "The city of Lisbon has a lot of work for firemen. People in the city, for anything, call the firemen and you never know if you are going to an issue where you don't have to use any of your knowledge or if you are going to a subject where you get stressed and have to dedicate all your knowledge. It's a little weird in this city, in that sense."


TRUCK
BE OF MIDTOWN"
Pollution
Emergency
Mobility
Parking
Waste Management

3. MOBILITY

Around 9 am, **Carolina** leaves home and is just ready to start the day at work by 9h30. As soon as she takes the car out of the garage, she realizes that a trip that initially took 15 minutes would then take more than half an hour due to traffic.



WHAT THE DATA?

In that sense, Lisbon's municipal transport company, **Carris**, is working to increase the number of electric vehicles in the public transport system. A €252 million investment is foreseen to increase the fleet with 420 electric buses and 25 trams by 2023, to contribute to shifting 150,000 motorists to more sustainable modes of travel by the end of the decade.

In parallel, Lisbon has embraced micromobility as a last-mile solution, with 9 companies operating over 12,000 e-scooters in the Portuguese capital. To address the constraints and unregulated parking created by the swarm of e-scooters, specific city districts have introduced fines for companies whose rented scooters litter pavements and public spaces.

IN OTHER COUNTRIES...

Shenzhen, China

Shenzhen has been a frontrunner in switching to electric mobility, particularly in its public transport system. In 2017 Shenzhen became the first city in the world to electrify all public (16,000+) buses with a view to cutting emissions, reducing noise pollution, and improving air quality.

The impact of this switch became evident in 2018, when the city recorded some of the cleanest air among all Chinese cities. The average amount of fine particles (PM2.5) in the air throughout 2018 dropped to 26 micrograms per cubic metre, one of the lowest levels in 15 years.

Further building on its aim to boost sustainable mobility, the city announced in January 2019 that 99 per cent of its entire taxi fleet (over 21,000 vehicles) was now electric-powered.

IN OTHER COUNTRIES...

Copenhagen, Denmark

Copenhagen has been one of the frontrunners in establishing a strong urban mobility infrastructure with a focus on non-motorised transport.

According to 2020 data, **45 per cent** of the city's inhabitants commuted by bike, travelling around 1.4 million kilometres every day. The city is also the home of the world's busiest cycle path with around **40,000** cyclists a day.

A focus on urban mobility solutions has helped Copenhagen to provide affordable mobility to its citizens. For instance the cost of public transport is just 1.83 per cent of average monthly income. Furthermore, 100 per cent of the city's metro rail system is automated to level 3 or 4 of Grade-of-Automation as defined by the IEC 62290-1 standard, making it one of the leading cities for new technology adoption and changing mobility infrastructure.

WHAT DO SPECIALISTS SAY?

About the current situation...

- "We can see in the city a high investment in bicycle paths, there was also a support for the purchase of bicycles and the expansion of the GIRA network."
- "However, it's the encouragement of public transportation that is slower."
- "Parking is a Mobility management tool."
- "The emergency response is as skillful as the general state of the city's mobility allows".
- "We have a deficient public transportation network."

WHAT DO SPECIALISTS SAY?

For improving the Future…

- "The ideal would be a maximum of 20 minutes by bicycle on safe roads."
- "Telework could greatly help mobility."
- "It is necessary to show children that they do not have to drive to school."
- "The schools should close a radious of 300 meters so children could walk safely."
- " We must think about transportation in the Lisbon metropolitan area, and not just in the center of Lisbon."
- "The elderly population must be considered when thinking about a more sustainable mobility"
- "A large area in Lisbon should be created where cars cannot enter."

Pollution

Emergency

Mobility

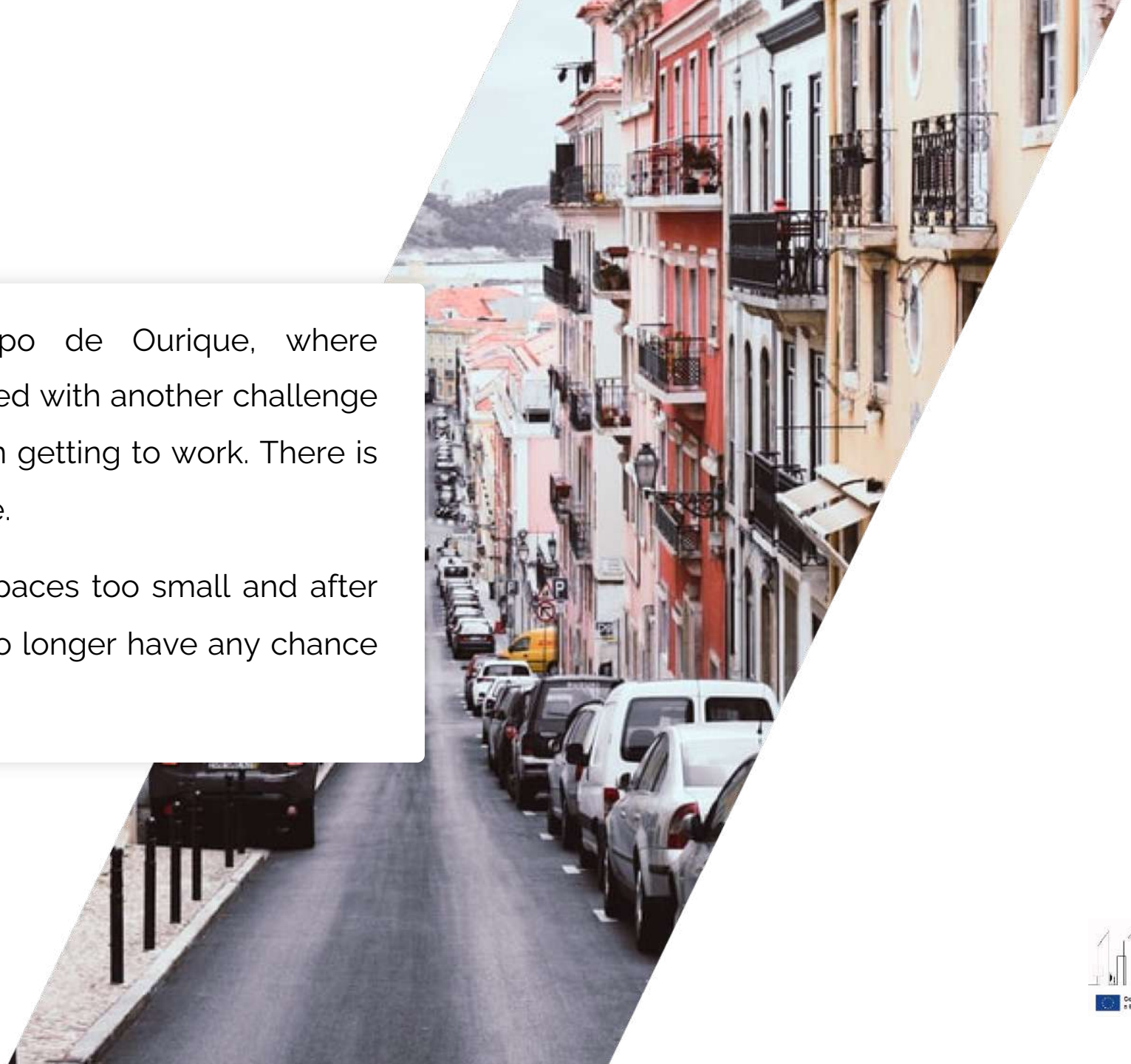
Parking

Waste Management

4. PARKING

When arriving to Campo de Ourique, where **Carolina** works, she is faced with another challenge that increases her delay in getting to work. There is no parking space available.

The number of existing spaces too small and after being late in traffic, you no longer have any chance of finding a place.



WHAT THE DATA?

Being the capital of Portugal, **Lisbon** receives everyday an enormous number of people that commute to work every day. From all parishes around the city, most of the people work in Lisbon contributing to the daily visitors.

Lisbon is distinctively recognizable by having and old town centre with old and narrow streets without a lot of free space to accommodate the needs of parking in the city.

By observing the available data, we can see that the time zone that most **illegal and irregular parking** happens during the week between **8 am and 10 am**, due to being the normal schedule to start your workday here in Portugal. We can also verify that during this time period there are more than **700 hundred** cases of irregular parking.

P WHAT THE DATA?

With this in mind, we can easily conclude that this is real problem that needs a solution. In Lisbon, the company responsible for making sure that everyone parks in accordance with the road code is **EMEL** together with the **municipal police**.

EMEL has an online site where you can access all the information regarding parking such as: where to park, mobility, parking lots, parking permits and different tariffs that may apply depending on the zone where we are.

EMEL has participated in several multidisciplinary research, development and innovation projects, in partnership with national and foreign institutions. This participation is fundamental for the development and competitiveness of the company in the market. The portfolio includes projects of European scope, in the areas of transport, mobility, and sustainable cities. However, despite being a recurrent and present problem nowadays, EMEL has no project dedicated to parking.

Seara.com. (2020). *Projectos*. EMEL.

IN OTHER COUNTRIES...

According to the author **Prof Ben-Joseph** of the “ReThinking a Lot”, our attitude towards parking needs a revolution. He claimed that we were drifting in the "ocean of asphalt" and called on architects to design more beautiful parking lots with less environmental impact.

There are an estimated **600 million** cars in the world and they all need to park somewhere.

In Europe, Japan, and American cities such as New York and Boston, where land is expensive, multi-storey parking lots—or “parking garages”—are the first choice.

Professor Ben-Joseph believes that parking lots should be more "environmentally friendly" and "aesthetically pleasing”

P IN OTHER COUNTRIES…

This author's improvement method proposes, trough **better design**:

Using new technology: A British company called Deteq invented a smart sensor system that can be installed in parking lots, allowing operators to know how many parking spaces they have and which times of the day are most popular. Adrian Bone, managing director of Deteq in Brighton, said: "We have also developed an app that allows drivers to find the nearest parking space."

Reducing environmental impact: For many years, it has been known that asphalt absorbing sunlight will cause the phenomenon of "urban heat island", making cities warmer than the surrounding rural areas. The so-called Lot 59 project saw a 5-acre parking lot at Arizona State University's Sun Devils Grill, covered with huge solar panels, which could generate 2.2 megawatts of electricity per year—enough to power 550 homes powered by.

Summers, B. C. (2012, May 1). *Is there a worldwide parking problem?* BBC News.

WHAT DO SPECIALISTS SAY?

About the current situation…

- View of parking as a mobility tool
- Very car-dependent culture
- Clogging around schools at peak times (cars on the sidewalk)
- Difficult to park on the surface, there is the need to look for underground parking
- Mobility, emergency and parking are all linked together (if no mobility, no parking)
- If you solve the mobility issue, the parking problem is solved
- The car should be an option, not a priority means
- Parking sometimes complicates the emergency a lot, you have to stop far away because you don't have access
- “When I need to use the car my concern is always where I am going to park”

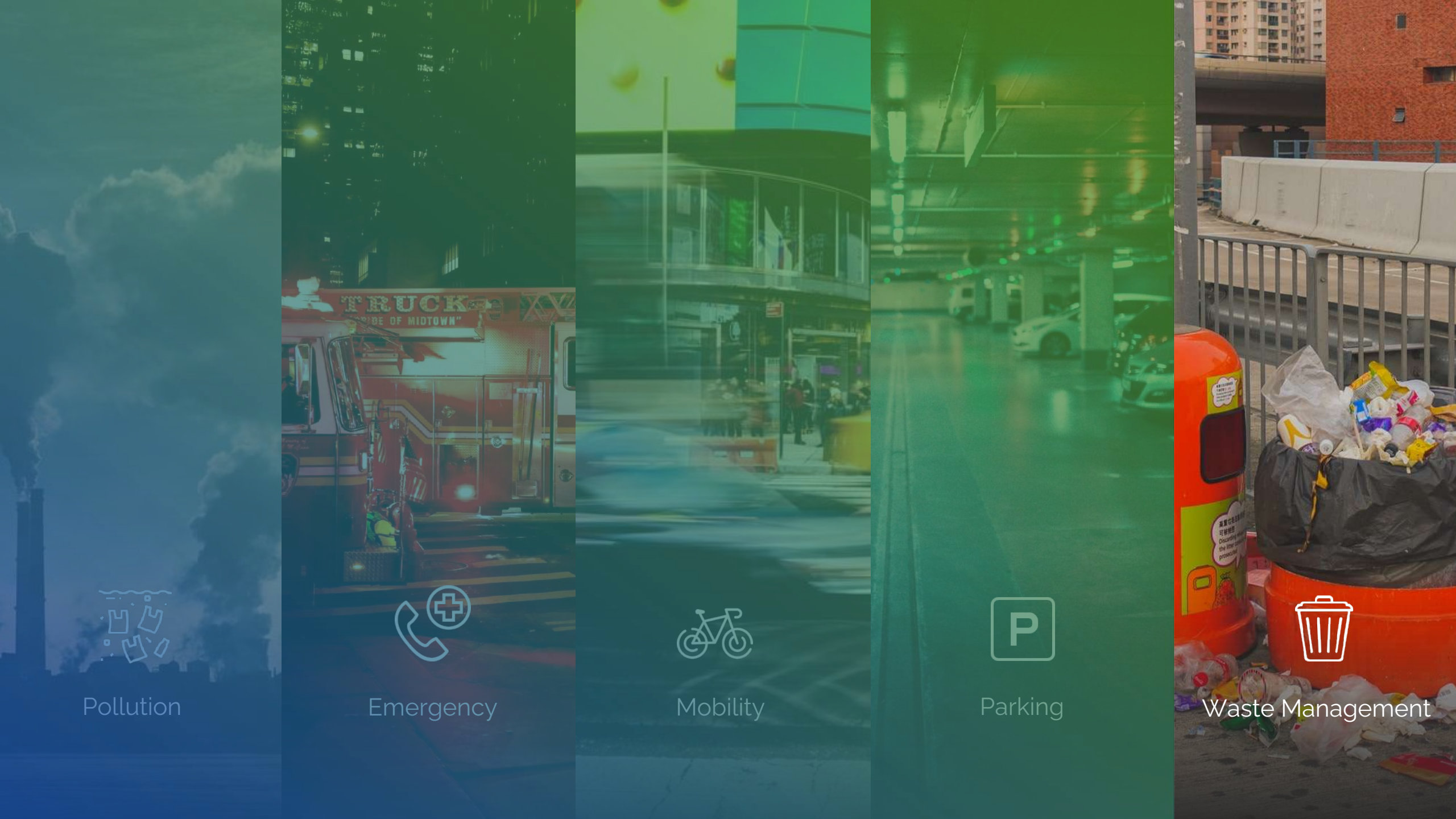
WHAT DO SPECIALISTS SAY?

About the current situation…

- “There are people who have no choice and have to drive”
- “There is difficulty for ambulances to circulate and difficult access, for example, on avenida almirante reis the cars have nowhere to turn to allow the ambulance to pass.”

For improving the Future…

- “We need to do better city planning and build parking lots in the city”



Pollution

Emergency

Mobility

Parking

Waste Management

5. WASTE MANAGEMENT

Late at night, **Carolina** goes home and feels a strange and bad smell in her street.

"As usual the bins are so full of organic waste which produces this awful smell"

Normally, when going to the supermarket, Carolina must take her waste with her so she can throw it away.

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WHAT THE DATA?

Waste management (or waste disposal) includes the processes and actions required to manage waste from its inception to its final disposal.[1] This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process and waste-related laws, technologies, economic mechanisms.

“Solid waste management is everyone’s business. Ensuring effective and proper solid waste management is critical to the achievement of the Sustainable Development Goals,” said Ede Ijjasz-Vasquez, Senior Director of the World Bank’s Social, Urban, Rural and Resilience Global Practice.

According to the World Bank’s What a Waste 2.0 report, the world generates 2.01 billion tonnes of municipal solid waste annually, with at least 33% of that not managed in an environmentally safe manner.

TREND ANALYSIS

An update to a previous edition, the 2018 report projects that rapid urbanization, population growth, and economic development will push global waste to increase by 70% over the next 30 years – to a staggering 3.40 billion tonnes of waste generated annually.

Smart waste management is just one of multiple components that can constitute a smart city. Cities face huge inefficiency challenges in the waste sector as almost 90% of waste across the globe is collected at the wrong time. Powered by IoT, smart waste solutions use fill level sensors and dynamic routing to help cities optimize their waste resources so they can collect waste at exactly the right time.

IN OTHER COUNTRIES...

Helsinki, Finland: Underground Waste Management

Helsinki, known fondly as the sustainability capital of Finland, has one of the world's most advanced underground waste management systems. It's called the Envac automated waste collection system and uses a series of pneumatic tubes hidden underground to transport recycling and waste to a central processing facility.

East Brunswick, New Jersey: Resident Recycling Network

In the Township of East Brunswick, recycling network technology was adopted to improve communications between the municipality and local residents. By rolling out the Recycle Coach app, connecting all of their residents, they were able to improve recycling rates, reduce wish-cycling, and raise the recycling IQ of their entire township.

IN OTHER COUNTRIES...

Nitra, Slovakia: Waste Collection Optimization

In Nitra, Slovakia it's the norm to use Internet of Things technology to improve waste disposal efficiency and collections. One company called Sensoneo Analytics has a smart process for waste management, which includes placing sensors on garbage collection bins to monitor which of them are full or not. This integrates with their analytics software to help automate and optimize when and how waste is collected in the city.

Stockholm, Sweden: Waste-to-Energy Sites

In the middle of Stockholm in Sweden, lies the largest biofuel plant in the country – and it runs on waste. This smart city uses collected sawmill industry waste to create a valuable energy commodity called biofuel, which can power the city itself. The waste-to-energy model is a smart city initiative that has been implemented all over the world, by cities and by corporations.

IN OTHER COUNTRIES...

San Francisco, California: Food Waste Composting

In San Francisco, a mandatory food waste composting law was put into place, along with a goal for the city to achieve zero waste by 2020 – with evolving sorting tech to back it up. Landfills are a finite resource, and the city understood that closed-loop recycling system will ultimately fulfill their need for a healthier, cleaner, and smarter city. A big part of that success would boil down to advances in IoT technology, data analysis, and making the city smarter. The right partnerships were crucial!

WHAT DO SPECIALISTS SAY?

About the current situation...

- "For **60%** of the population, the waste management is done door-to-door , which is a removal system in which each container is allocated to each building..."
- "However, ... in simultaneous we began to install underground containers in areas of door-to-door removal, now people are confused. "
- "International studies say that door-to-door achieves less contamination and a higher rate of waste separation."
- "The recycling bins are often full of garbage and people don't know when they will be picked up."
- There is plenty of material that could be recycled that continues to go to unsorted waste.

WHAT DO SPECIALISTS SAY?

For improving the future...

- "We don't need to collect the waste bins every day, we need to collect the waste bins when they are full."
- "The solution is to invest in Circular Economy. So, it is more related to production than to the final destination of waste."

DESK RESEARCH INSIGHTS

After creating the Carolina persona, we've decided to diverge again through more **academic, news, and articles' research**. At this stage, the goal was to identify new insights in each topic according to different sources analyzed.

Thus, in the following pages we present, by topic, the key insights and refences.

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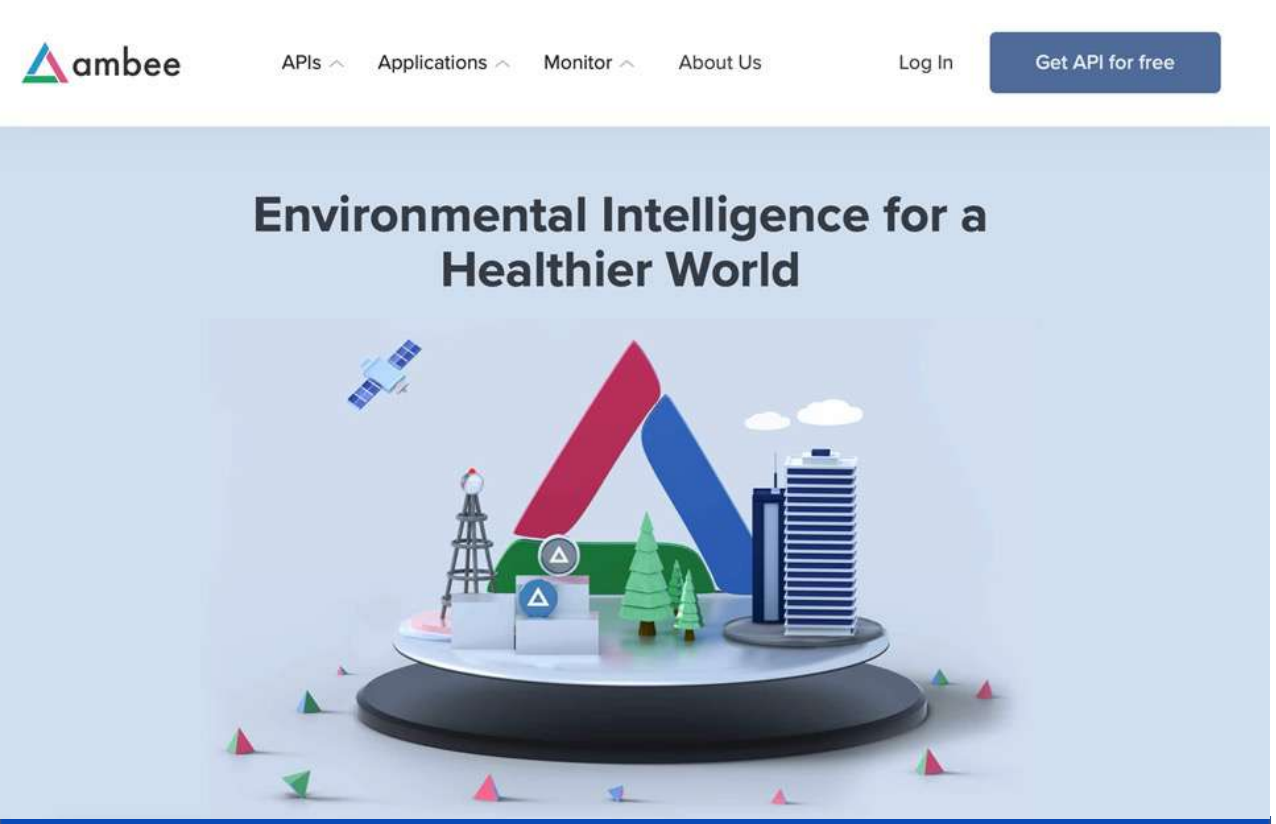

DESK RESEARCH INSIGHTS | **POLLUTION**

Key Insight

We combine the power of on-ground sensing and remote imagery from satellites. Our proprietary models measure, process and analyze data on environmental factors such as air quality, soil, microweather, pollen, and more.

Ambee aim to create a more environmentally informed society by providing access to data, and tools that enable a better living experience to individuals using the best of what science, humility and technology can offer.

Using our own technology called **AIONN-MetNet** (Aggregation & interpolation of Meteorology data over Neural Network) , which combines a model trained on decades of historical weather data, weather radar data, satellite information and Gaussian interpolation that gets us to a 200m² resolution of weather data for the whole world geospatially. A time tested method that is over **85% accurate** at all times.

https://www.getambee.com

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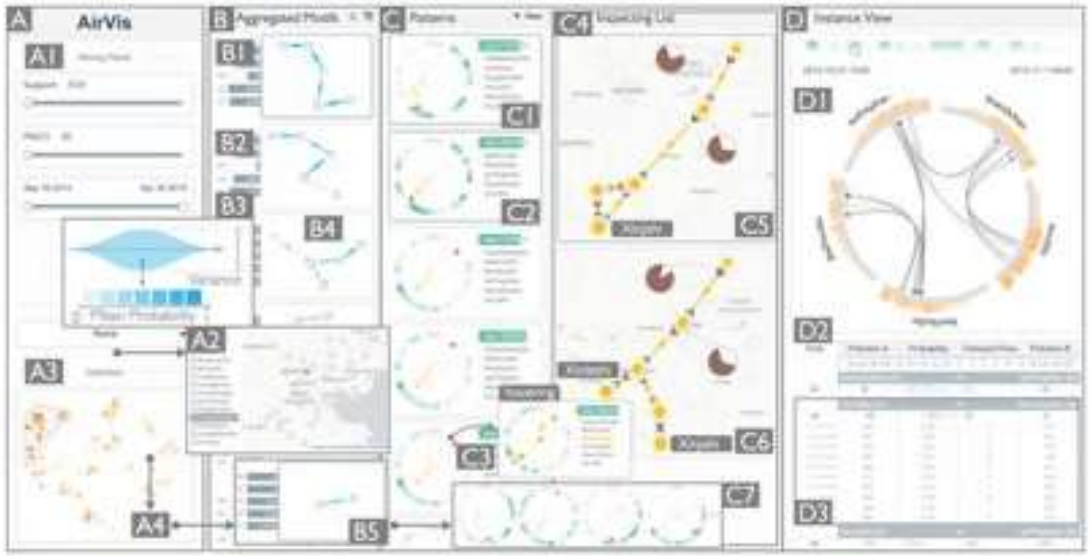
AirVis: Visual Analytics of Air Pollution Propagation

Zikun Deng, Di Weng, Jiahui Chen, Ren Liu, Zhibin Wang, Jie Bao, Yu Zheng, and Yingcai Wu



DESK RESEARCH INSIGHTS | **POLLUTION**

To find the causes of air pollution, the propagation processes of air pollutants must be studied at a large spatial scale. However, the complex and dynamic wind fields lead to highly uncertain pollutant transportation. The state-of-the-art data mining approaches cannot fully support the extensive analysis of such uncertain spatiotemporal propagation processes across multiple districts without the integration of domain knowledge.

Key Insight

AirVis is the first visual analytics system that efficiently incorporates users' expertise in the domain of air pollution propagation analysis

https://www.researchgate.net/publication/335355158_AirVis_Visual_Analytics_of_Air_Pollution_Propagation

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This Heat Map illustrates the geographical distribution of 5 out of 327 waste management startups disrupting smart cities.

Key Insight

A data-driven startup scouting approach to identify the most relevant solutions globally

DESK RESEARCH INSIGHTS | **WASTE MANAGEMENT**

Future Trends

Analyzed **327** waste management startups.

Interesting List of Promising Startups:

- ShareWaste,
- Flycatcher Technologies,
- Gringgo,
- Impact Bioenergy, and
- Recycling.

https://www.startus-insights.com/innovators-guide/5-top-waste-management-startups-out-of-327-in-smart-cities/

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DESK RESEARCH INSIGHTS | **WASTE MANAGEMENT**

Key Insight

Overall, as most waste management problems are inherently complex and ill-defined, it is evident that traditional methods - based on mechanistic models and strict algorithms - do not seem to provide an adequate solution in many cases, particularly those suffering from lack of data. AI models offer an alternative effective approach which has gained significant attention in the scientific community.

ELSEVIER

Waste Management

Volume 109, 15 May 2020, Pages 231-246

Artificial intelligence applications in solid waste management: A systematic research review

Mohamed Abdallah [a], Manar Abu Talib [b], Sainab Feroz [a], Qassim Nasir [c], Hadeer Abdalla [a], Bayan Mahfood [b]

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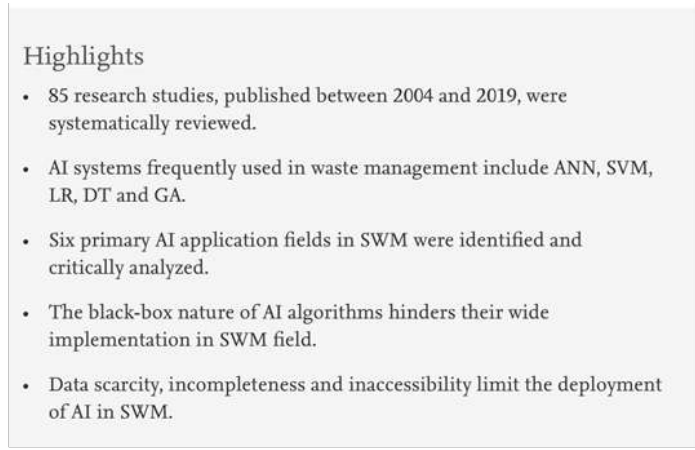
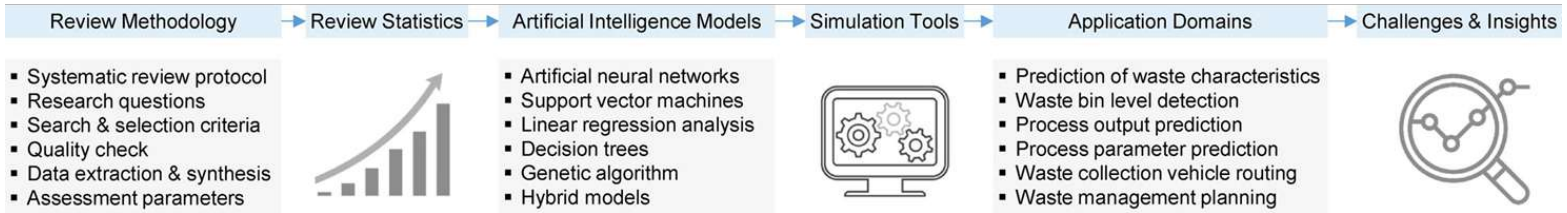


Highlights

- 85 research studies, published between 2004 and 2019, were systematically reviewed.
- AI systems frequently used in waste management include ANN, SVM, LR, DT and GA.
- Six primary AI application fields in SWM were identified and critically analyzed.
- The black-box nature of AI algorithms hinders their wide implementation in SWM field.
- Data scarcity, incompleteness and inaccessibility limit the deployment of AI in SWM.



https://www.sciencedirect.com/science/article/pii/S0956053X20302269?casa_token=6lZ7zQ0OiocAAAAA:x8tYeQKSCYeiNkF5MOJOndPPatxKiI9oEeVlnKNakBDM1923TNGMkEwyOTHL0LRg4cA0bw_9-SE

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The Future of Micromobility

How VCs and E-Scooters kicked off the future of micromobility (and what's up next)

Jason Eliasen Follow
Jan 15 · 16 min read ★

DESK RESEARCH INSIGHTS | **MOBILITY**

Future Trends in five areas:

1. Fleet Services
2. Regional & Local Platforms
3. Alternative Business Models
4. Alternative Vehicles, Autonomy & Robotics
5. Infrastructure

Interesting List of Promising Startups:

Pre-Seed: Weel Autonomy, Infinite Mobility

Seed Funded: Tortoise, CtrlWorks, QIQ Global, Enuu, Nimbus, Lit Motors, Kiwibot

Venture Funded-Early Stage: Organic Transit

Key Insight

Current leaders in the micromobility platform industry are likely not the comprehensive answer to the current problems with transportation. They do, however, have the opportunity as first movers in the space to build out capabilities and transform themselves to design the future of mobility

https://medium.com/swlh/the-future-of-micromobility-2d4d96d4e2dd

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McKinsey & Company
Automotive & Assembly

The future of micromobility: Ridership and revenue after a crisis

July 16, 2020 | Article

DESK RESEARCH INSIGHTS | **MOBILITY**

The global pandemic has transformed the way people think about travel, including micromobility. The short-term consequences have been profound, with micromobility declining as people reassess their transportation options. However, given current consumer sentiment, policy actions, and the potential for upside, we expect the industry to emerge stronger from this crisis. Consumers could become more aware of the value of sustainable and noise-reducing transportation modes after experiencing them during lockdowns.

Key Insight

In our 2019 consumer survey, less than 20 percent of all shared-micromobility trips typically involved commuting.

However, this survey also indicated that more than 70 percent of respondents would consider buying a private e-scooter for everyday commutes to work or school. This shift could boost private ownership in the e-scooter market.

https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-future-of-micromobility-ridership-and-revenue-after-a-crisis

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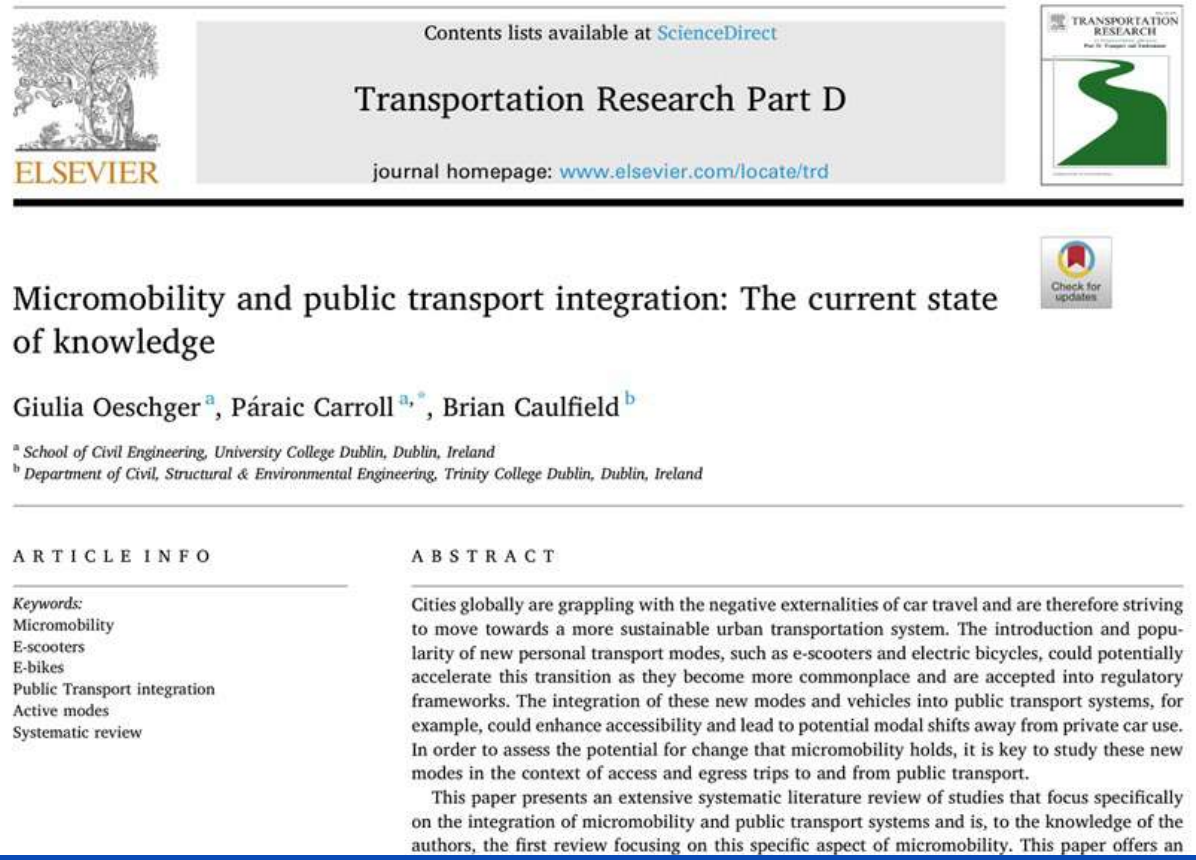

Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

Micromobility and public transport integration: The current state of knowledge

Giulia Oeschger [a], Páraic Carroll [a,*], Brian Caulfield [b]

[a] School of Civil Engineering, University College Dublin, Dublin, Ireland
[b] Department of Civil, Structural & Environmental Engineering, Trinity College Dublin, Dublin, Ireland

ARTICLE INFO

Keywords:
Micromobility
E-scooters
E-bikes
Public Transport integration
Active modes
Systematic review

ABSTRACT

Cities globally are grappling with the negative externalities of car travel and are therefore striving to move towards a more sustainable urban transportation system. The introduction and popularity of new personal transport modes, such as e-scooters and electric bicycles, could potentially accelerate this transition as they become more commonplace and are accepted into regulatory frameworks. The integration of these new modes and vehicles into public transport systems, for example, could enhance accessibility and lead to potential modal shifts away from private car use. In order to assess the potential for change that micromobility holds, it is key to study these new modes in the context of access and egress trips to and from public transport.

This paper presents an extensive systematic literature review of studies that focus specifically on the integration of micromobility and public transport systems and is, to the knowledge of the authors, the first review focusing on this specific aspect of micromobility. This paper offers an

Key Insight

while most studies were conducted to identify the reasons, preferences and mobility patterns of users that combine micromobility and public transport, most articles did not include the impacts that the integration of micromobility and public transport has on society, the economy and the environment.

DESK RESEARCH INSIGHTS | **MOBILITY**

Literarature Review Paper with suggestions and recommendations (48 selected articles) grouped into six different categories:

1. Infrastructure
2. Built Environment
3. Technology (Vehicles, Apps and Real Time Data)
4. Planning
5. Policies and Regulations
6. Pricing and Incentives

Comprehensive List of different Methodologies used to study the integration of micromobility and public transport.

https://www.sciencedirect.com/science/article/pii/S1361920920308130

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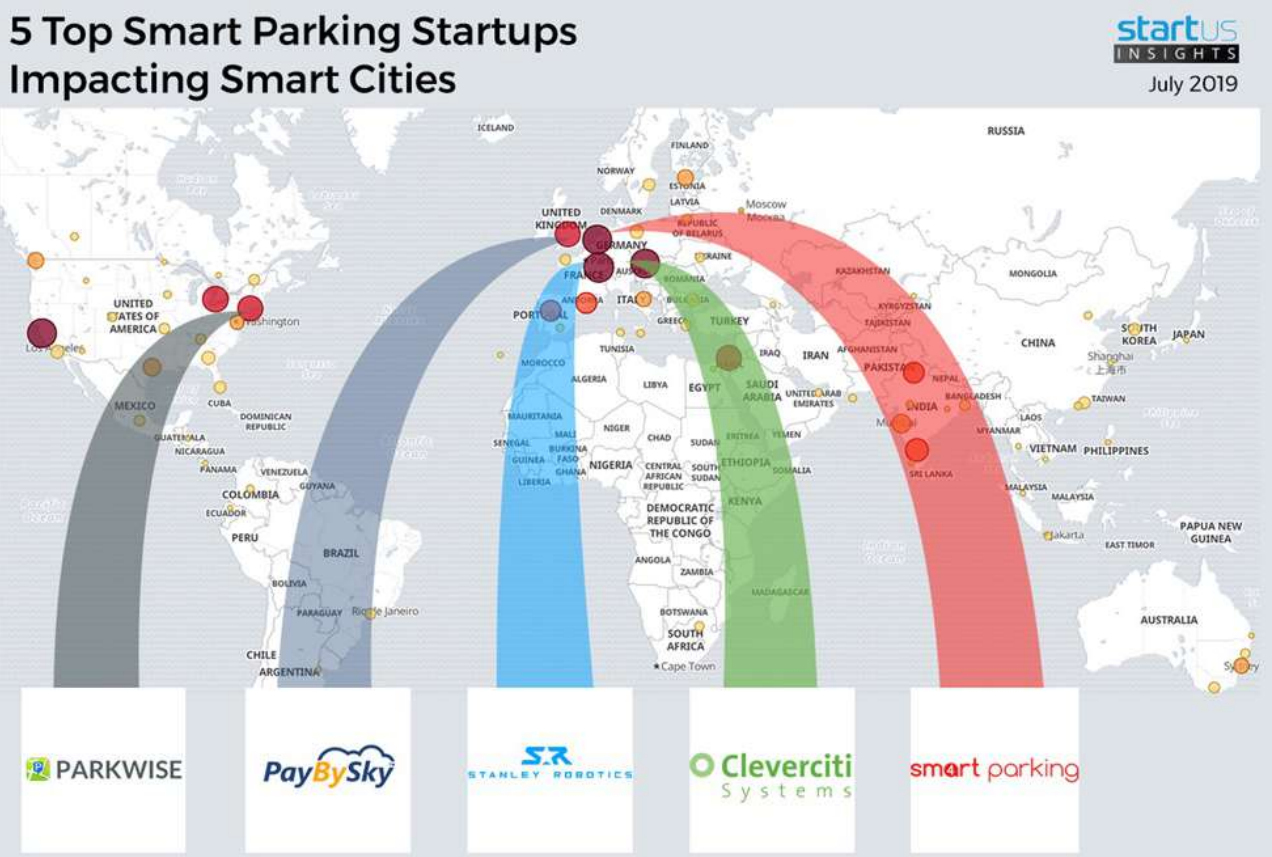
DESK RESEARCH INSIGHTS | **PARKING**



This Heat Map illustrates the geographical distribution of 5 out of 634 smart parking startups disrupting smart cities.

Key Insight

A data-driven startup scouting approach to identify the most relevant solutions globally

Future Trends

Analyzed **634** startups or parking solutions.

Interesting List of Promising Startups:

- Cleverciti Systems – Smart Smart Space-Monitoring Parking Sensors (SSMPS)
- Smart Parking – Smart Payment For Parking
- Parkwise – Real-Time Parking Guidance Software
- Stanley Robotics – Automated Valet Parking
- PayBySky – Parking By Satellite

https://www.startus-insights.com/innovators-guide/5-top-smart-parking-startups-out-of-634-in-smart-cities/

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Journal of Cleaner Production 312 (2021) 127684

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Contextual prediction of parking spot availability: A step towards sustainable parking

Goran Jelen *, Vedran Podobnik, Jurica Babic

University of Zagreb, Faculty of Electrical Engineering and Computing, Zagreb, Croatia

ARTICLE INFO

Handling editor: Cecilia Maria Villas Bôas de Almeida

Keywords:
Sustainable parking
Greenhouse gas pollution reduction
Parking spot availability
Smart city
Data science
Contextually enriched data

ABSTRACT

One of the challenges of living in today's cities is parking availability. Searching for available parking spots can be a time-consuming task that simultaneously increases traffic congestion and greenhouse gas pollution by a significant 40%. A solution that would increase drivers' ability to locate an empty parking spot would represent an important step towards more sustainable parking as it would have a direct impact on reducing greenhouse gas pollution in urban areas. This paper proposes how data science can help by evaluating the prediction performance of four machine learning models. Analysed machine learning models are based on different machine learning methods (i.e., CatBoost and Random Forest) and use different real-world data sets (i.e., parking sensor data only or contextually enriched parking sensor data). The dummy (baseline) model is considered as well, but with a R^2 score of 61.29% is outperformed by more advanced data science approaches. Prediction performance in the case of using parking sensor data only gives R^2 score of 84.31% and 88.16% for Random Forest and CatBoost, respectively. The best prediction performance is achieved using CatBoost and contextually enriched data, resulting in the high-performing machine learning model with the R^2 value of 88.83%, thus outperforming the Random Forest model by 1.7%. In fact, for both machine learning methods, the contextually enriched data approach gives better results for predicting parking spot availability. This suggests that parking data should be enriched with contextual data when designing and building sustainable parking solutions for smart cities of the future.

Key Insight

In most cases, people find an available parking space in the city by driving around and looking for it, attributing to more than 40% of all traffic congestion in urban areas

DESK RESEARCH INSIGHTS | **PARKING**

This paper presents the Parking Utilization Model for predicting Parking Utilization evaluated on Parking Sensor Data of the city of Split.

By predicting the utilization of a parking lot, the availability of free parking spots can be determined, which helps drivers to find an available parking spot faster. Each analyzed Parking Utilization Model consists of the data and machine learning method.

In this paper, two approaches are used for the data: Basic and Contextual.

- In the Basic Approach, only Parking Lot Utilization Data is used by the model.
- On the other hand, the Contextual Approach beside the Parking Lot Utilization Data uses the Contextual Data as well.

https://www.sciencedirect.com/science/article/pii/S0959652621019028?casa_token=VHATigjYrR8AAAAA:QOV_-gL4qv2a3kR_ELtY6ztNu3U-Vqcst71FjKMp_L8mRcah5fCqSGdTsuCOHkr_ByWaLUS_Dd0

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MIT News
ON CAMPUS AND AROUND THE WORLD

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Deep learning helps predict traffic crashes before they happen

A deep model was trained on historical crash data, road maps, satellite imagery, and GPS to enable high-resolution crash maps that could lead to safer roads.

Rachel Gordon | MIT CSAIL
October 12, 2021

Key Insight

Traffic accidents cost about 3% of the world's GDP and are the leading cause of death in children and young adults.

DESK RESEARCH INSIGHTS | **EMERGENCY**

To get ahead of the uncertainty inherent to crashes, scientists from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) and the Qatar Center for Artificial Intelligence developed a deep learning model that predicts very high-resolution crash risk maps.

"The model can be used to infer a useful crash map even in the absence of historical crash data, which could translate to positive use for city planning and policymaking by comparing imaginary scenarios."

https://openaccess.thecvf.com/content/ICCV2021/papers/He_Inferring_High-Resolution_Traffic_Accident_Risk_Maps_Based_on_Satellite_Imagery_ICCV_2021_paper.pdf

https://news.mit.edu/2021/deep-learning-helps-predict-traffic-crashes-1012

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AARIAN MARSHALL TRANSPORTATION 07.08.2019 07:00 AM

Waze Data Can Help Predict Car Crashes and Cut Response Time

Waze users notify the app of crashes an average of 2 minutes, 41 seconds before anyone alerts law enforcement.

Key Insight

Emergency medical service units take a mean of 7 to 14 minutes to arrival on scene after a 911 call.4 Crowdsourced traffic data might help to decrease that time by approximately 20% to 60% by enabling novel, low-cost, and early identification of car crashes.

DESK RESEARCH INSIGHTS | **EMERGENCY**

First, emergency medical service systems could use crowdsourced data tools to more efficiently mobilize resources and ambulances, especially for simultaneous collisions. Second, early crowdsourced crash data might be reported to trauma centers and hospitals to allow emergency departments to better prepare for injured patients.

Combine three datasets—on the city's road networks, on its crashes, and on its weather—to predict where crashes might happen with **85 percent accuracy.**

https://www.wired.com/story/waze-data-help-predict-car-crashes-cut-response-time/

https://jamanetwork.com/journals/jamasurgery/article-abstract/2734656

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IN-DEPTH INTERVIEWS

In the first three weeks of the project, **eight** in-depth interviews were conducted with experts in the different five topics.

Throughout the interviews we've collected information about the general perception of each interviewee about the **current state** of the city of Lisbon, and it was also collected their personal vision of what would be the **ideal smart city**.

The following pages summarize each interview through quotes, from which we've infered an **insight** and a possible **space of opportunity** to find inspiration for new interventions in the city.

Note that each interview was kept anonymous by assigning only a number to the interview.

IN-DEPTH INTERVIEWS | 1

"I think Lisbon has been making a very big effort to reach the goals of becoming a green capital, even earlier perhaps than the European Community initially anticipated. It remains to be seen whether it can reach them just with the procedures done by now."

"Part of waste management also has a lot of smart cities, you don't have to go and collect the recycling bins every day, you have to collect the recycling bins when they are full."

"I don't advocate telework 100 % because I think it's still important for mental health that people interact, but everyone staying at home once or twice a week we managed to reduce 20 to 40 percent of commuting to work."

"Parking as a mobility tool. "

"Very car-dependent culture."

INSIGHT

Parking is a mobility tool, not an issue in itself, because if people get around without needing a car, parking would be solved.

OPPORTUNITY SPACE

How might we reduce the time travelling to work/school avoid stress people?

IN-DEPTH INTERVIEWS | 2

"Very cautiously, I think we are trying to do too much, too fast, maybe more analysis and studies should be done in the implementations and in the transition of what has currently been done to transform Lisbon in a smart city."

"I think that in big cities and areas of large population it will always be to options for more environmentally friendly solutions."

"Pollution is a crucial problem to be dealt with in the next three years."

INSIGHT

People need a transition phase to adapt to new way of living.

OPPORTUNITY SPACE

How might we help people transition to smart cities without compromising the EU goals?

IN-DEPTH INTERVIEWS | 3

"I would like to add that Lisbon has a very high population age group so the bike path aren't always well thought out because people over 60 rarely ride bicycles."

"I think the main problem is mobility because pollution, emergency and parking and mobility are all linked together. So if there's no mobility, there's no parking."

INSIGHT

Not everyone is capable of transitioning to low carbon transports since not all the eldery population is able to ride a bike.

OPPORTUNITY SPACE

How might we include eldery people in low carbon mobility?

IN-DEPTH INTERVIEWS | 3

"Develop a network of shared cars like scooters, but with actual cars. When it's raining we don't want to walk and it's boring. With or without a driver would be interesting. This network can be through commercial cars for this purpose or by the people themselves who come to Lisbon in private cars as well. There might be a safety issue here of people feeling in danger, but I also think that this is a problem that could easily be solved, through cameras or an identification number, I don't know. People are afraid to go with people they don't know, but on public transport they also do."

"If public transportation works poorly, not because the equipment is bad, but because the coverage is not sufficient. Namely the municipalities that are around Lisbon, that interconnection doesn't exist. There is some, but it has nothing to do with a city in the center of Europe where a person easily takes a train and is in the center of the city and can have the bicycle etc."

"I go to work in my motocicle because the public transport alternatives I don't come ,because from Cascais to here I work,I would have to drive to the Estoril train station, then get off at Cais do Sodré, take the subway and make two or three line changes and still make a 20 minute walk to where I work, so I'll never get here and it's not feasible."

"I think that the transition in Lisbon to a green capital it's just kind of a mirage, I think we all live on pretty words and launch beautiful intentions, but in practice very little is done."

IN-DEPTH INTERVIEWS | 4

"The car, as far as I'm concerned, will continue to be an option, not as a priority means but an option that should not be discarded. Not everyone has the same needs."

"The pollution problem is a one-off, abnormal thing. All the others are day-to-day"

"I would like to address the issue of housing in the city, having more people in the city, having more conditions in the city (regardless of the neighborhood). To have the possibility of me being able to go and live in Lisbon as well as in Massamá, depending on where I work. Not having to go live two hours away when they have to work in Lisbon, because that has a big impact on their personal and family life"

INSIGHT

Cars will hardly be discarded due to the different backgrounds of the Lisboans' inhabitants.

OPPORTUNITY SPACE

How might we reduce air pollution with restriting the possibilities of social conditions?

IN-DEPTH INTERVIEWS | 4

"I think that the city of Lisbon has made efforts to achieve the levels it has set itself, at the level of sustainable mobility with the reduction of pollution from cars. In terms of waste management, I know that there has been an effort to reduce the production of waste that is produced by people and companies. There is a great concern with waste separation. The pandemic also helped a little bit to achieve these goals because a lot of people left the city... "

"We are developing models to be used by the municipal civil protection services so that they would based their work on results and forecasts. This model allows them to actually organize their response services (for example: atmospheric emergencies). There should also be an opportunity to expand these models to the rest of the departments in the city of Lisbon"

IN-DEPTH INTERVIEWS | 5

"With the vision of improving the city management, there is a need to create tools to be used by services naturally. So in terms of results it could be more optimization of collections of waste management, improve emergency response, ensure response for a limit situation like a hazardous materials spill and improve everything that is mobility and parking. These are all things that have quite an impact on the city."

"I think it's going to be harder and harder to transition in to a green capital. We're going to have a big impact on our well-being and our health. It's going to require and it's going to have very big costs both for the state and for the citizens. It's probably going to increase or accentuate more and more the inequalities between the richest and the poorest."

INSIGHT

People do not tend to take into account the composition of their products when separating garbage, since the most sustainable and easily separable products are more expensive.

OPPORTUNITY SPACE

How might we incentivise people to reduce their waste?

IN-DEPTH INTERVIEWS | 5

"Citizens don't have the money to spend on more sustainable things and objects on more sustainable products. It's all just a never-ending cycle."

"Making the city more cyclable it is interesting although I think that on some routes it has might have too costly an impact"

"When I used to use public transportations, at that time, you don't think there have ever been any stoppages, any breakdowns, any strikes (there have been many now) of the subway."

"My experience as a citizen is that the issue of urban hygiene has to be improved. All the garbage cans are often full and very often with garbage around and people don't know when there will be collection.

IN-DEPTH INTERVIEWS | 6

"Rush hour has one good thing, is that the accidents are never as bad. There are more, the quantity is much bigger, but the severity is much less. It's much more likely at 1 or 2 in the morning to have a car with five people trapped. The big accidents happen at high speeds."

"Of all the historic neighborhoods that we have in Lisbon, I would leave two for later to remember . I would leave Alfama and Bairro Alto, everything else I would turn into a forest."

"Denied entry to the city center should be done by emissions and not by year or class of car as it is nowadays. For example, my '97 peugeot can't get in, but a 2020 porsche can. It would be great if downtown lisbon had no cars, but it's hard."

"The hills in Lisbon are not easily traversed, making it difficult for bikes and on the climbs cars make more pollution."

""Increase the height of the buildings in some more accessible parts and reforest in less accessible areas."

INSIGHT

During rush hour accidents happen in bigger numbers but they are not as serious because people are going at low speeds due to the traffic.

OPPORTUNITY SPACE

How might we solve traffic congestions while keeping the emergency minor?

IN-DEPTH INTERVIEWS | 7

"In New York for example they use the degraded spaces to make gardens. The city buys the land and builds the garden, which allows there to be one garden per block. For me, that's very interesting, put half a dozen trees, a path in the middle and some benches and you can hear the birds and create an environment that's not so urban."

"I would encourage pollution reduction policies and increase photovoltaic panels and encourage council workers to only come by bike to encourage the rest of the citizens use. Then I would try to reduce individual transportation within the city and invest in the parks. Lastly connect the city with the river."

"The issue is that there is a need to have quick access to the cities. Lisbon and the surrounding municipalities have to live in synergy, not isolated from each other."

"In my ideal world, I would like my work place to be close to home or gain tools to telecommute more effectively."

INSIGHT

Green spaces can be made from abandoned building which improve not only the air conditions but also the community mental state.

OPPORTUNITY SPACE

How might we create green spaces in difficult urban areas?

IN-DEPTH INTERVIEWS | 7

"The green areas in the city are very good, not only for the landscape but also for the environment. Listening to the birds and breathing fresh air is good for you."

"There needs to happen and increase of the quality of life generally, in particular for residents through more green spaces, better public transportation, pollution removal, and then the cultural offerings."

"Then parking, can be very complicated, in case of emergency we have to stop far away because it is impeded by parking. Even for people who sometimes have to walk on the roads instead of the sidewalk. Better planning needs to be done in the city."

IN-DEPTH INTERVIEWS | **8**

"We have about 60% of the city covered by door to door selective collection systems of waste management, which means that each house has a set of multi-material containers, at least for paper and plastic and then glass is in the public road, keeping the ratio of 100 meters set by ESAR. So we have a global coverage in terms of selective collection multi materials."

"When we do the physical characterization of waste, we still have a lot of material that could be recycled that continues to go to the undifferentiated trash and we also have a lot of contamination in what is collected selectively. This has to do with cultural issues, awareness, education and not having access, because the concepts themselves of what is recyclable especially in yellow, paper and cardboard is relatively simple."

INSIGHT

There is no point in having a transformation to a smart city if people's life quality is not improved.

OPPORTUNITY SPACE

How might we create a parallelism between technology and social improvement?

IN-DEPTH INTERVIEWS | **8**

"The problem of mobility, it's the only instrument that can revolutionize all this. You will need to have policies that foster those issues."

"It costs me a little bit to have to push people around to get in the train. So that's definitely not a public transportation system that works."

"London, for many years has limited the access of cars to the center. Some days only cars with even license plates can drive, other days only odd license plates can enter. We have two ways to get there either with have effective measures to encourage that behavior or measures to punish them."

"As long as the city doesn't work deeply on the mobility issue, ditching the car is going to be difficult. Unless you start taxing the entrances in Lisbon, the Portuguese only perceive things in two ways."

"The truth is that technology is still quite expensive. So cost benefit ratio in some areas to use technology to transform Lisbon in a smart city sometimes is very questionable."

"No doubt, the pollution issue is the most problematic"

"There's no point in having a spectacular environment if people then don't have quality of life."

IN-DEPTH INTERVIEWS | **8**

"I think the problem within waste management, is not in the final destination, it is in the production. There has to be a strong focus on the production industry. For example: thre is a need to explore repair, to have a longer durability of goods and to reduce a little bit the impetus of consumption."

"There's no point in having a spectacular environment if people then don't have quality of life."

EMPATHY MAP

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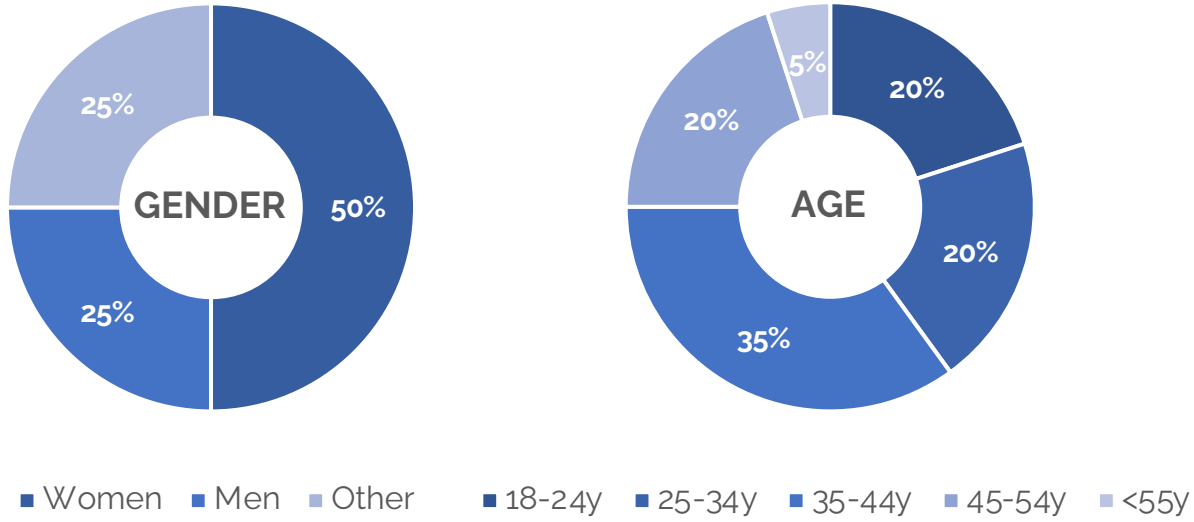
EMPATHY MAP

The empathy Map is a collaborative tool with which teams can gain a deeper insight into their users view. The following five empathy maps, one for each topic, where created based on the participation of **18 people** in the mobile ethnography exercise.

Therefore, the quotes and the images used are real shares from different **citizens of Lisbon**.



Participants Caracterization

8 participants completed the 6 tasks with 6 or more uploads

8 participants uploaded at least one response

2 participants have only registered in the platform

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EMPATHY MAP | **PLATFORM**

In this stage of the project, ***Indeemo Platform*** was used to acquired the image from the participants.

There were **6 challenges** released to be perfomed at each participant pace.

The tasks were the following:

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EMPATHY MAP | **PLATFORM**

1. Record a short video, maximum 1 minute, or take a picture where you can portray your perspective on: What would a perfect Smart City look like? Or What do you associate with the Smart City?

2. When we talk about Pollution in Lisbon, what is the first image that comes to your mind?

Depict that mental representation through a photo and a short description.

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EMPATHY MAP | **PLATFORM**

3. Regarding waste management, are there any trends that you can identify in your neighborhood. Share it with us with an explanatory photo.

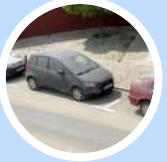
4. Now, a question that has had two very distinct opinions, are bicycles and scooters a positive or negative investment for the city of Lisbon? Detail your answer with a visual representation: video or photo.

5. Emergencies are never easy to solve in big cities like Lisbon. In this matter, what do you consider most worrying? Record a short video, maximum 1 minute, explaining your concern.

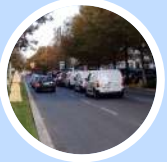
6. Last but not least, when traveling by car, public transport or bicycle, parking can be a problem. Why? Represent your opinion through a picture that transcribes your thoughts.

SEE

"The amount of traffic that is formed mainly in the morning and at the end of the day."



"Pollution marks on the road and cars, dust clouds when buses and other vehicles pass"



"Cars, cars, cars... No collective public transportation in sight!"

DO

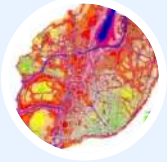
"Walking around constantly breathing smoke from the exhaust pipes"

"The dust in my area that is currently under construction and makes the air a little less breathable"

USER

THINK

Day



"Neighborhood interventions that involves potholes, repaving, and reorganization of parking spaces. It is not possible for a pedestrian to move around this street because there are no safe, visible, and protected paths from air pollution."

" Av. da Liberdade is a central point where there is a lot of traffic."

Night

"Light pollution is a big problem near the El Corte Inglês."

"Noise pollution is often underestimated in Lisbon."

"Lack of zeal on the streets of Lisbon."

"Lack of poultry population control in conjunction with lack of cleanliness of common usufruct spaces."

SAY

"Pollution is synonymous with continuous car traffic"

"Pollution is also a lack of care with the streets."

EMPATHY MAP | **POLLUTION**

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SEE

"This recycling garbage can is one of the rare ones in the area where I live and it is usually always full, I usually have to leave the garbage on the ground."

DO

"Combosting of organic residues."

USER

THINK

"Selective collection must remain a priority. Accompanied by a paradigm shift aligned with the idea of circular economy."

"Is there a lack of recycling bins in Lisbon or is this just bad education and lack of civism?"

SAY

"If there is a possibility of recycling, even if people don't immediately know why, they gain curiosity, sensitivity, knowledge, and perhaps the initiative to contribute."

"There is social education work to be done."

EMPATHY MAP | **WASTE MANEGEMENT**

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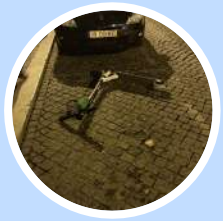
SEE



"Scoters everywhere, even where they shouldn't"

"Drivers running red lights."

"There are more and more people with bicycles on the street."

DO

USER

THINK

"The issue of insurance is another point that should be looked at in the law. In an accident with a bicycle or scooter, it may cause damage in the vehicle, but does the insurance cover such damage?"

"Traffic chaos is clearly a long-standing problem in Lisbon. Bikes are the best solution."

"Regarding the Gira Docks I am sorry that many of them are not working ."

SAY

"My father was almost hit by a scooter."

"There are still dangerous areas for cycling."

"Move to more distant bicycle disposal areas due to unavailability of parking."

"Micro-mobility has its place but must be part of an integrated system with other adapted options."

EMPATHY MAP | **MOBILITY**

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SEE

"Parking for bicycles"

"Bus stop full of parked cars. It forces the bus to stop in the street and clogs traffic. "

"Several times in the city we find cars blocking the passage of public transportation or making it so difficult that in 5 minutes there is impossible traffic around."

"When commuting we can see that parking is not an easy task, especially since the city is getting fewer and fewer spaces available, a consequence of the ambition to remove cars from the city."

DO

"The biggest embarrassment is often spending more time looking for a place than on the actual trip."

USER

THINK

"Mandatory parking associated with housing must be a priority, even more so when talking about the transition to electric mobility"

"Me on a bicycle would not feel comfortable leaving my personal bicycle out of my sight for the risk of it being stolen."

SAY

"The ideal parking is like in Av. Guerra Junqueiro, this is because it offers more visibility when we are leaving and in case of emergency will be faster to exit. So more security when parking is done this way."

EMPATHY MAP | **PARKING**

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SEE

"It is distressing when emergency vehicles leave these garages at peak traffic times."

"There is traffic and parking management at the entrance of the IPO."

"Only exit (...) In an emergency situation there is no ability to evacuate vehicles or people."

USER

"Homelessness, how can we help them?"

"Constructions that do not take into consideration the various scenarios, for example this sidewalk cannot be climbed by ambulances."

"How long will it take for the ambulance to get here? There is a lot of traffic and a shortage of ambulances."

"The proximity of emergency services is critical for a rapid response."

"There may be people who are ready for something better if given the opportunity."

"It scares me that people don't know what to do in case of an earthquake. We lack training!"

THINK

SAY

EMPATHY MAP | **EMERGENCY**

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CONCLUSION

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CONCLUSION

Over the past few months we immersed ourselves in the **Smart Cities** theme, particularly within the **5 challenges**. This was a rewarding challenge that allowed us to have contact with more than 20 stakeholders, through in-depth interviews and with the help of mobile ethnography techniques.

Thus, it was possible to research for **empathy**, identify different **insights** and present the **opportunity spaces** to be explored in the Co-creation Session (February 2022). In addition, we had the opportunity to collect information from articles, news, and industry reports to deepen the understanding of this vast theme.

As for the **Students Open Challenge**, it was possible to introduce them to Urban Design Thinking techniques , in order to define disruptive innovations to improve the quality of life for the citizens in Lisbon.

In this way, and in alignment with the objectives, it was possible to integrate insights from both the **external** (students and citizens) and **internal** (partners and lab members) community and create a platform for behavioural research and idea co-creation of new projects and services within the five challenges of the lab.

INSIGHTS AND OPPORTUNITY SPACES

Resume

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INSIGHTS

Parking is a mobility tool, not an issue in itself, because if people get around without needing a car, parking would be solved.

People need a **transition phase** to adapt to new way of living.

Not everyone is capable of transitioning to low carbon transports since not all the eldery population is able to ride a bike.

Cars will hardly be discarded due to the different backgrounds of the Lisbons' inhabitants.

People do not tend to take into account the composition of their products when separating garbage, since **the most sustainable and easily separable products are more expensive**.

During rush hour accidents happen in bigger numbers but they are not as serious because people are going at low speeds due to the traffic.

There is no point in having a transformation to a smart city if **people's life quality** is not improved.

Green spaces can be made from abandoned building which improve not only the air conditions but also the community mental state.

OPPORTUNITY SPACES

How might we **reduce the time** travelling to work/school **avoid stress** people?

How might we help people **transition to smart cities** without compromising the EU goals?

How might we **include eldery people** in low carbon mobility?

How might we incentivize people to **reduce their waste**?

How might we **reduce air pollution** with restricting the possibilities of social conditions?

How might we **solve traffic congestions** while keeping the emergency minor?

How might we create a parallelism between **technology** and **social improvement**?

How might we create **green spaces** in difficult urban areas?

Design thinking *is a kind of problem solving that results in better, more innovative solutions.*

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Special thanks to the Urban Co-Creation Data Lab for all the amazing support and team work during the development of this project.