



AMSTERDAM  
INSTITUTE FOR  
**ADVANCED  
METROPOLITAN  
SOLUTIONS**

# Annual Report 2021



# Annual Report 2021



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## Amsterdam Institute for Advanced Metropolitan Solutions

Kattenburgerstraat 5, Building 027W  
1018 JA Amsterdam  
The Netherlands

Website: [www.ams-institute.org](http://www.ams-institute.org)  
E-mail: [office@ams-institute.org](mailto:office@ams-institute.org)



# Reinventing the City

Amsterdam, like many cities worldwide, aims to be a sustainable city. To achieve this ambition, we need to tackle the most pressing urban challenges. Amsterdam Institute for Advanced Metropolitan Solutions (AMS Institute) plays a crucial role in designing scalable solutions focusing on six urban domains: mobility, energy, circularity, food, climate, and digitization.

At our institute, we create synergies between our education, research & innovation, and entrepreneurship activities. Fostering collaborations between experts from various interdisciplinary backgrounds leads to cross-fertilization of innovative ideas. Our institute also builds an environment where connections are made between knowledge institutes, private and public organizations. With our mission-oriented collaborative approach, we generate societal impact. Jointly, we reinvent the city, and make Amsterdam resilient and just for current and future generations.



### Amsterdam as a 'living lab'

We use the Amsterdam Metropolitan Area (AMA) as our living lab. Living labs – a co-innovation approach that provides a setting for multiple stakeholders to jointly test, develop and create solutions for real-life issues – are important when it comes to designing metropolitan solutions that deliver long-term impact and transformations.

On various locations throughout the city, we test and experiment to find sustainable solutions together with users, private and public partners, as well as knowledge institutes. We firmly believe that solutions that are co-created by all parties involved are better and can be adopted faster – resulting in truly improved living environments.

**"Working with AMS Institute is inspiring and engaging. Staff and students have a curious attitude and a desire to make a difference. They are involved, and in their search for solutions that the city desperately needs, they prove to be a good contribution to the larger ecosystem. Regarding collaborations between knowledge institutions and other partners in the AMA, this community has become indispensable over the past 5 years."**

**Caroline Nevejan**, Chief Science Officer, City of Amsterdam

### Core institute activities

To create impact for the city of Amsterdam and beyond, AMS Institute focuses on three main activities:

**Education:** At the heart of AMS Institute's educational activities is the two-year master program Metropolitan Analysis, Design & Engineering (MSc MADE). Our master aims to provide innovative education and deliver excellent, interdisciplinary urban engineers with the right balance between theoretical grounding and practical skills to deal with the complex challenges of cities.

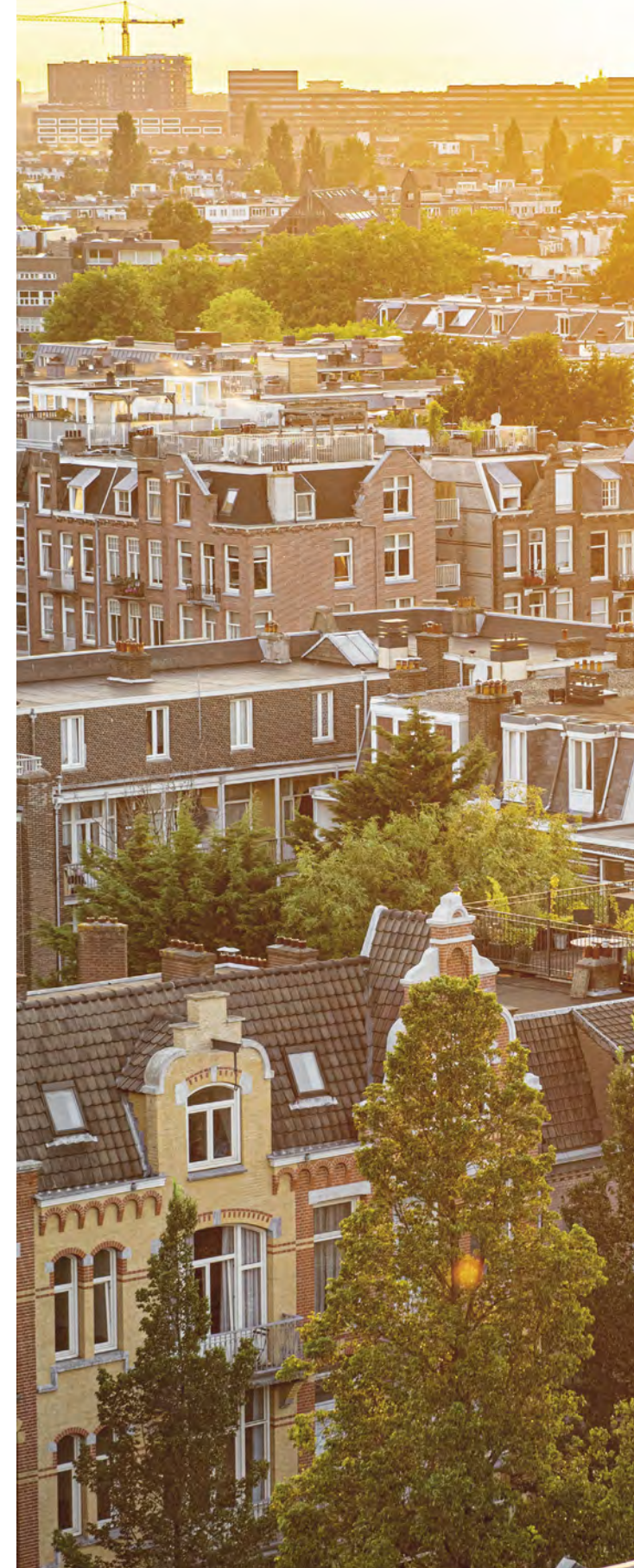
Just like our MSc MADE targets and attracts students from all over the world, so do our professional training activities – such as summer and winter schools by our AMS Academy – as well as innovative Massive Open Online Courses (MOOCs).

**Research & Innovation:** Our portfolio, which consists of 161 projects and programs in total (from 2014 - 2021), is developed and executed by our community of experts in close collaboration with public and private organizations, our core academic partners – TU Delt, WUR and MIT – and the City of Amsterdam.

Our research & innovation activities are set up to achieve mission-oriented open innovation. The process to achieve this is distinguished by three different stages (each with its own set of activities):

- 1 Explore and mobilize
- 2 Research and validate
- 3 Launch and scale-up

**Entrepreneurship:** Plenty of opportunities for new business ideas arise from our education and research & innovation activities and collaborations. We stimulate entrepreneurship, and aim to propel innovative ideas towards impactful business, through strategic collaboration within our network. Moreover, our own entrepreneurship programs help launch and fast-track promising business ideas of start-ups on the topic of urban sustainability.







### **Sensing the city from a data-driven perspective**

Cities are extremely data-rich environments. We believe data is a valuable catalyst to gain new insights into our urban environments.

Our data experts work closely with cross-domain stakeholders in our community – from project partners, researchers, entrepreneurs to students. Together they study and develop novel technological methods and tools for the acquisition, integration, visualization, and exploratory analysis of urban datasets in a fair, accurate, and accountable manner.

Sensing the data from our city contributes to an increased understanding of the metropolitan challenges we address and helps us design off-the-shelf technological and methodological solutions.

### **Integrating our expertise and skills to re-invent the city**

In this annual report, we showcase how the work of our students, researchers, entrepreneurs, and partners brings forward innovations that tackle the city's most urgent challenges – such as creating a future-proof Amsterdam, tackling the City's building challenge in a sustainable way, and accelerating the energy transition while considering the challenges involved in integrating new energy solutions in the city, both above and underground.

By integrating our main activities, and through the combined knowledge and dedication of all the experts involved in our community, we work towards reinventing the city.

### **An internationally leading knowledge institute**

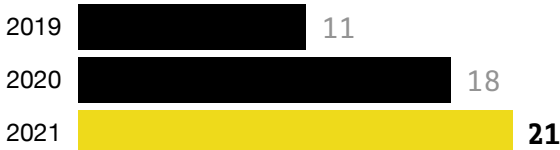
AMS Institute was founded in 2014 by three core academic partners: **Delft University of Technology** (TU Delft), **Wageningen University & Research** (WUR) and **Massachusetts Institute of Technology** (MIT). AMS Institute is an internationally leading knowledge institute. We design solutions for urban challenges and educate tomorrow's engineers.



# Key Figures 2021

## Research & Innovation

### Projects awarded



### Total value of awarded projects

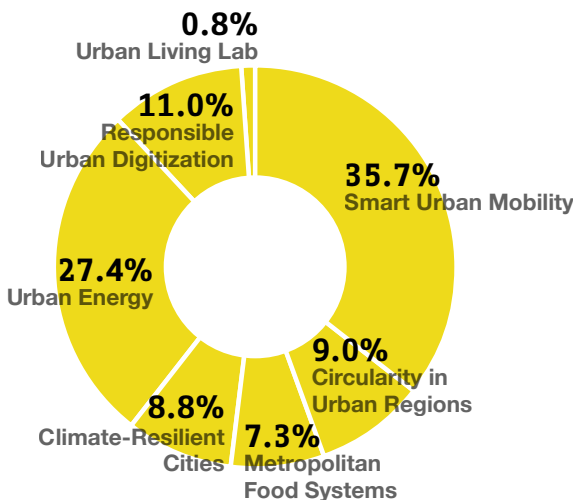
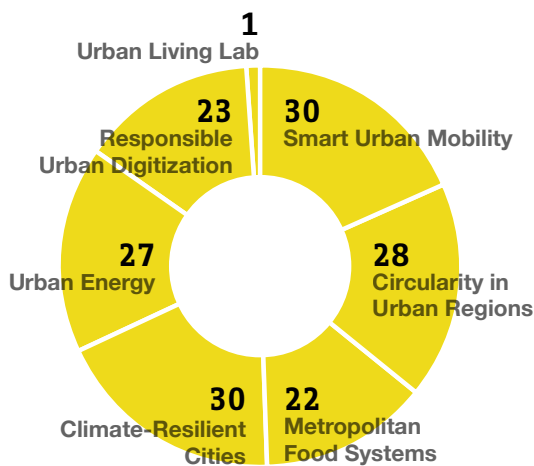


161

Total number of projects

€119M

Total value of project portfolio



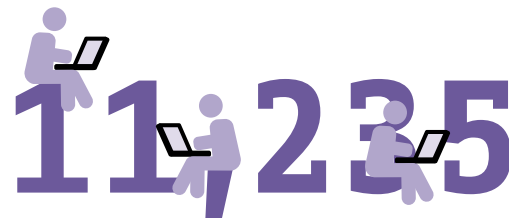
## Education

58

New MSc MADE students in 2021  
61 in 2020



34 MSc MADE graduates in 2021  
18 in 2020



M00C participants in 2021  
10,564 in 2020

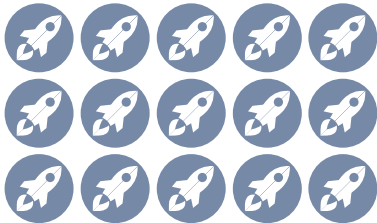
76,587

Total number of M00C participants

## Entrepreneurship

28

Affiliated startups in 2021



15

AMS Startup Booster teams

## Communications

	2020	2021
Number of online posts and articles mentioning AMS Institute	806	1,346
Posts by different authors	235	519
Posts on different websites	368	489





# Directors' Report

**We look back on a remarkable year. Like all parts of society, AMS Institute felt and experienced the restrictions related to COVID-19. Despite those limitations, we managed to grow and strengthen the AMS community: MSc MADE students, researchers from TU Delft, WUR and MIT, AMS staff, our partners from the municipality and private parties.**

Now more than ever we realize the importance of this community. It is the composition, cohesion, and diversity within and between all these parties that makes AMS Institute so unique. It is this community, combined with the fact that we can use the city of Amsterdam as our laboratory, that makes our approach so distinctive. Only with a strong and connected community, and only in the context of the city of Amsterdam, can we work together on the solutions needed to reinvent the city.

## **Strong and multidisciplinary connections**

In 2021, we made great strides with our Research Fellows. Supported by WUR and TU Delft, our Research Fellow Community developed into a group of 15 researchers from a wide range of disciplines to our community. By bringing together this pool of diverse expertise to find solutions to metropolitan issues, AMS Institute is a melting pot for new ideas and innovation. This group of Research Fellows started to truly take root and connect in 2021 and is adding great value within the AMS Community. Each Research Fellow is strongly connected to one of our Principal Investigators as well as (a) colleague(s) from the research & innovation team.

Here too in 2021 we saw the importance of strong connections within the group of Principal Investigators and with the rest of the AMS community. Despite the distance imposed by the lockdown restrictions, we still managed to move forward with this part of the community and expect to see even more benefits in the coming year.

## **Creative, intelligent, and integral**

Our master's program Metropolitan Analysis, Design and Engineering (MSc MADE) entered its fifth year with 58 new aspiring urban engineers. Dealing with the COVID restrictions was especially hard for them and their professors, but in true AMS Institute-spirit, this was again greeted as an opportunity to experiment and viewed as 'just one more urban challenge'.

Online and hybrid approaches have become second nature, culminating in a stunning real-time online presentation of second-year Living Lab work. The creative, intelligent, and integral approach to urban challenges by our students was not lost on our partners. As many of the partners approached our students asking them to continue the work they were doing as part of their MADE curriculum, the Young



Urban Engineers platform was established. In 2021, Young Urban Engineers proved to be a valuable venture within the AMS Institute ecosystem, with a real challenge to meet the demand.

**Intertwining within the community**

This year we managed to further intertwine our education, research & innovation and entrepreneurship activities. The MADE students worked closely with our Research Fellows and Principal Investigators, staff and partners to tackle urban challenges in a cross-disciplinary and integral way; testing and experimenting with prototypes or proof-of-concepts in real-life environments in the city of Amsterdam and in our many living labs.

This Annual Report shows how the combined efforts of our mission-driven approach led to cumulative impact to reinvent the city. Before we dive into our challenge-oriented chapters, we would like to share some 2021 highlights.

**New partnerships for carbon neutrality and sustainable mobility**

Our partnership with MIT resulted in two important new steps in 2021. First, the research and engineering team of MIT and AMS Institute demonstrated two fully ULL autonomous Roboat full-scale prototypes during inspiring demo days in October in Amsterdam. Achieving full autonomy in the small harbor at Marineterrein Amsterdam inspired many collaborators,

stakeholders, and new partners to get involved in the next steps of bringing the technology to the market. Online exposure amassed well over 40M views and interactions across the world.

Secondly, a new partnership with MIT and the City of Amsterdam marked the beginning of the development of the Senseable Amsterdam Lab at AMS Institute. This local lab will focus its research and innovation activities on the newest AI and urban data analytics technologies to help Amsterdam and cities worldwide to achieve their missions towards carbon neutrality and sustainable mobility.

**Successfully boosting early-stage startups**

In 2021, AMS Institute ran two editions of our Startup Booster program to help entrepreneurial teams create a positive impact on the quality of life in our cities through a start-up business. The AMS Startup Booster focuses on early-stage start-up teams from the AMS community.

These teams fully benefit from the expertise and coaching available from our strong network and facilities in Amsterdam, and relationship with European networks like the EIT and other cities in Europe. In 2021, AMS Institute supported over 20 start-up teams.







### **Life-long learning programs to accelerate urban transformations**

AMS Institute firmly believes that alongside the new generation of talents, we should stimulate professionals to learn and develop in terms of expertise, skills, and attitude. Together with the City, AMS Institute developed a dedicated ‘AMS Academy’ learning program for the living lab coordinators at the program organization for quays and bridges. To accelerate urban transformations, we need to scale up life-long learning centered on urban challenges.

### **Taking co-ownership of the problem**

A common denominator of the highlights is that they start from a real-world challenge in the city. In the past year, we saw more clearly than ever that investigation of the problem is only one side of the coin when tackling urban challenges. The other equally important side is to involve the problem owner directly. The only way to reach impactful solutions is to both address the issues on the ground and to make close connections with stakeholders who have day-to-day responsibilities for these urban challenges.

In fact, we go one step further: while close collaboration with the formal problem owner is essential, we at AMS Institute consider ourselves to be co-owners of these challenges. It is our joint task to take them on together and bring forth innovative solutions.

This co-ownership approach characterizes the entire AMS community and is the vision that underlies our daily work to solve the most pressing metropolitan challenges in Amsterdam and beyond.

### **Looking forward**

This Annual Report celebrates our results in 2021. We are very proud of what the AMS-community achieved under challenging circumstances. We hope you enjoy reading this selection of our many results. The strong development of the institute in 2021 underlines the urgency and importance of AMS Institute’s mission to reinvent cities.

We thank our Principal Investigators, Research Fellows, lecturers, students, staff and all our partners for a memorable and inspirational year and look forward to growing an even stronger and closer community. Because only together are we able to create the impact needed.

**Eveline van Leeuwen**, *Scientific Director*

**Kenneth Heijns**, *Managing Director*

**Stephan van Dijk**, *Director of Innovation*





# Cumulative Impact to Reinvent the City

Amsterdam, and other cities around the world, face major urban challenges. The City of Amsterdam formulated a number of ambitions to tackle these challenges. AMS Institute's aim is to contribute to the ambitions of the City by developing solutions. In order to achieve this, our education, research & innovation and entrepreneurship activities are strongly intertwined.

This year, the integration of AMS Institute's educational, research & innovation and entrepreneurship activities was stronger than ever before. Many MSc MADE students collaborated on the institute's research & innovation projects. Teams of students, alumni and researchers also participated in our entrepreneurship program to turn their innovative ideas into a business. This all adds up to our goal of reinventing cities worldwide. Amsterdam's most pressing challenges are not unique and are precisely those that cities in the Netherlands and around the globe struggle with. Our goal is to develop solutions that work for Amsterdam and beyond.

In this chapter, we bundle seven of the City's ambitions. At the same time, we present a selection of our many activities – showcasing how we contributed to these ambitions in 2021.



## Amsterdam's ambition #1

# Develop a sustainable built environment

Not only is it the City of Amsterdam's aim to reduce the use of primary raw materials by 50% in 2030. Amsterdam is, like other cities around the world, also committed to becoming fully climate neutral and circular by 2050. Here, the focus lies on resources such as water, food, energy and building materials. With reference to the latter, the Netherlands faces the challenge of building a great many new homes and insulating even more existing homes by 2050.

Currently, the built environment mainly uses building materials that are non-renewable and emit large amounts of CO<sub>2</sub> during production – such as steel and concrete. Climate change, material scarcity, the increasing supply risks and price fluctuations of conventional building materials, and the current housing shortage show the urgency of using alternative building materials. Mainstreaming these would limit the environmental damage caused by the building sector whilst making it more resilient and future-proof.

To reach the greater goal of a climate-neutral and circular Amsterdam by 2050, the Metropolitan Area of Amsterdam (AMA) signed the 'Green Deal Timber Construction in the Metropolitan Area of Amsterdam' covenant in October. The starting point is to make a scale jump for all new construction in the AMA from 2025 onwards by building at least 20% with sustainable bio-based materials such as timber.

### Education

- **Circular Urban Wood:** understanding the material and social dynamics of urban wood flow in Amsterdam
- **Replex:** upcycling valuable components of urban wastewater, cellulose-fibers retrieved from toilet paper and a 'biological glue' called Kaumera®, to create a bio-composite material to be used in the built environment

### Research & Innovation

- **Green Tower Living Lab:** a testbed for innovation in addition to being a vertical city park – accessible to a wider audience
- **REHAB:** development of two circular building components for home renovation: a circular 'shell' and a circular extension
- **Building in Timber for a Climate-neutral and Circular City:** an integrated knowledge and innovation program supporting bio-based construction in the AMA - as part of this program, we started a series on 'Timber construction: facts and fiction'
- **Bio-receptive Concrete:** testing if green facades – this innovative solution makes for ideal soil for moss to grow on any structure – can contribute to the city's climate adaptivity and livability

### Entrepreneurship

- **Muuras:** living walls with wetland flower species that filter waste water for in-building reuse
- **Mublio:** a digital design and manufacturing solution to provide beautiful, space-saving interiors
- **Circy House:** a model of a tiny house as fully circular, mobile, affordable yet comfortable housing to offer a helping hand in fighting both the housing and climate crisis



"Biobased materials, in particular the latest generation of mass timber products, are part of the solution to make our city climate neutral and truly circular. We are involved in several timber related initiatives to drive innovation and research – and ultimately more adoption – on this important topic."

Arjan van Timmeren, Professor Environmental Technology & Design & AMS PI, TU Delft



## A closer look at some of our activities focused on a sustainable built environment

### Education

#### MSc MADE Living Lab: Circular Wood Flows

The City of Amsterdam recently established an auction system for the collection and distribution of this precious material, to provide everyone with equal access to urban wood. As the City has adopted the goal of being circular by 2050, the Circular Urban Wood Living Lab helps the City explore how to achieve circularity in urban wood flow in Amsterdam.

For their Living Lab project, among other things this student team organized co-creation sessions to better understand the needs, requirements and capacities of the stakeholders involved in urban wood flow, such as wood businesses, contractors, artists, and small-scale wood workers.

The students developed three products, each focusing on a different component of urban wood flow to deliver a complete plan to the City of Amsterdam.

"Mass timber systems could be the go-to solution for meeting the growing demand for housing in the limited space we have in the Amsterdam Metropolitan Area, the Netherlands and beyond."

Joke Dufourmont, Program Developer Circularity in Urban Regions, AMS Institute





## Research & Innovation

### Project: Building in timber for a climate-neutral and circular city

This October, we underlined the ambitions in the AMAs Green Deal regarding Timber Construction. In the upcoming months and years, our commitment is to support the implementation of the ambitions as a knowledge partner. Among other things, through an integrated knowledge and innovation program supporting bio-based construction in Amsterdam and beyond.

As part of this program, we started a series on 'Timber construction: facts and fiction' with our Program Developer Joke Dufourmont and research

associate Pablo van der Lugt (TU Delft). In these articles, we shed light on common misconceptions regarding timber construction, using examples, data and research results.

**Project lead:** Arjan van Timmeren (TU Delft)

**Partners:** AMA, TU Delft, WUR, Aldus Bouwinnovatie, Adviesbureau Lüning, IGG Bouweconomie

Read our booklet  
on mass timber  
construction  
'facts & fiction':



"Although the use of abiotic materials in construction has literally taken us to great heights, these materials have a major impact on the environment. The latest generation of mass timber products can replace these materials one-to-one, without harming the environment. Moreover, they actually act as huge carbon sinks."

Pablo van der Lugt, Research Associate, AMS Institute



"The Circularity in Urban Regions program is establishing itself more and more as a leading knowledge hub on data- and evidence-based insights for the circular economy. From bio-based building to circular solar panels or investigating sustainable paving materials on the scale of the City: we focus our work on where the biggest impact is to be made"

Arnout Sabbe, Program Developer Circularity in Urban Regions, AMS Institute





## Entrepreneurship

### AMS Startup Booster: Ciry House

Circy House is based on a combined design and engineering concept for a circular and future-proof housing system. In this regard, the startup offers a complete service for retrofitting existing residential units with circular infrastructure systems powered by smart technologies and nature-based solutions.

Circy House forms a network with the key actors including homeowners, property managers, municipalities, green technology companies and financial institutions to overcome the challenges such as lack of motivation, knowledge and finance for such transitions in the housing system.

## Our Research Fellows and Principal Investigators working on this ambition

### Research Fellows

- **Peter Mooij**  
Bio-based Materials/Valorizing waste-streams using algae and bacteria (TU Delft)
- **Mariet Sauerwein**  
Bio-based Materials (TU Delft)
- **Rusnė Šilerytė**  
Environmental Technology & Design (TU Delft)

### Principal Investigators

- **Arjan van Timmeren**  
Environmental Technology & Design (TU Delft)
- **Ellen van Bueren**  
Urban Development Management (TU Delft)
- **Mark van Loosdrecht**  
Environmental Biotechnology (TU Delft)



"We visualized the process of how timber stores CO<sub>2</sub> and why timber construction allows for more CO<sub>2</sub> to be stored in both our forests and built environment. As such we can avoid emissions from traditional construction."

Erik Boertjes, Data Visualization Engineer, AMS Institute



## Amsterdam's ambition #2

# Become future-proof

The City of Amsterdam aims to become climate-neutral by 2050. More specifically, in 2050 CO<sub>2</sub> emissions must be 95% lower compared to emissions in 1990. In addition to these mitigation goals, the City implemented a climate adaptation strategy to make it resilient to unavoidable climate effects, especially heat, drought, extreme rainfall and flooding.

In close collaboration with the City of Amsterdam, we work on investigating, scaling-up and standardizing innovative solutions linked to climate challenges. Our experts help with designing the city's infrastructure in a more climate adaptive and resilient way. Ultimately, to make cities future-proof.

### Education

- **Urgenda: More trees now:** transplanting seedlings to slow down climate change, restore biodiversity and positively impact neighborhoods
- **Climate Cost Model:** a data-driven decision-making tool to assess climate damage on a local scale
- **Urban Living Labs Winter School:** specifically designed for the managers of the living labs in the City's Amsterdam Bridges & Quay Walls program

### Research & Innovation

- **Bridges & Quay walls Living Lab:** investigating Amsterdam's historic quays' subsurface conditions
- **Urban Comfort Lab:** testing circular and sustainable designs of buildings to reduce the exposure to aircraft noise and air pollution
- **Bio-receptive concrete:** testing if green facades can contribute to the city's climate adaptivity and livability
- **i-Tree 2.0:** developing metrics on the optimal cooling performance of hundreds of tree species grown in Dutch cities

### Entrepreneurship

- **The Advisory Model Sustainable Development:** an application tool to comprehend sustainability ambitions for the built environment and infrastructure as efficiently and effectively as possible
- **Asset Hubble:** an objective and efficient solution to measure and monitor cracks in masonry buildings and quay walls
- **The Leaf:** climate-adaptive pergolas to increase greenery in cities whilst using minimal space above and below the ground level



# A closer look at some of our activities focused on future-proof assets

## Education

### AMS Academy: Urban Living Lab Winter School

Life-long learning on urban challenges is required to accelerate urban transformations. Together with the City, AMS Institute developed a dedicated ‘AMS Academy’ learning program for Amsterdam’s Bridges & Quay walls living lab coordinators.

This Urban Living Lab Winter School consisted of lectures by experts, online co-working sessions, coaching, real-life interviews and ‘online visits’ to inspiring examples. The sessions focused on theoretical frameworks of the AMS Living Lab methodology, process tools to help deliver a plan of approach and deploy teamwork on the real-life challenge to renovate the city’s historic bridges and quays.



## Research & Innovation

### Living Lab: Amsterdam’s historic quays sub-surface conditions

About 200 kilometers of quay walls in Amsterdam have to be renovated in the coming years. As part of its duty to keep Amsterdam safe, accessible and ‘future-proof’, the City developed a ‘Bridges and Quay Walls’ program.

This year, two of our Research Fellows, Mart-Jan Hemel and Pantelis Karamitopoulos, continued their research, in close collaboration with the City of Amsterdam, into the structural and shallow subsurface conditions affecting the behavior of the historic quay walls.

With their research, we are contributing to the urgent task of mitigating unsafe conditions with appropriate solutions to extend the lifespan to avoid costly renovation, and technical solutions to renovate and replace the quays. Several Living Labs throughout the city, and in particular a quay walls proof-load experiment at Overamstel, have seen further developments this year.

**Project lead:** Dirk-Jan Peters (TU Delft)  
**Partners:** TU Delft, City of Amsterdam  
**Total budget:** €2M  
**Duration:** 2 years

Take a deep-dive into the complexity of this topic with these 3 special episodes of the Mayor’s Manual Podcast:



“In our MSc MADE Living Lab, we aimed to find new ways to involve citizens in the City’s renovation processes of Amsterdam’s quay wall. We hosted two sessions with the goal to create mutual understanding between the City of Amsterdam and residents. Based on these sessions, we created an advisory report for the City.”

Sarah Bleeker, Frederique Huls and Loeki den Uyl, Msc MADE students





## Research & Innovation

### Project: Urban green strategy for urban climate adaptation

Urban green, such as trees, can be an effective climate adaptation measure in cities. Trees, however, differ a lot in their cooling effectiveness, depending on tree height, size and density of the tree crown, and its moisture evaporation capacity.

This project studies these characteristics for some 30 tree species by measuring and modeling. The results are extrapolated to some 300 species based on a series of tree characteristics to enrich an online database that can be used by urban green professionals to pick the right tree for any urban location. In addition, the effects of different tree scenarios in four historical neighborhood types are simulated.

The results of this project provide urban professionals with practical, hands-on information on the climate adaptation effectiveness of different greening strategies and the performance of 300 tree species.

**Project lead:** Jelle Hiemstra (WUR)

**Partners:** WUR, De Groene Stad, Royal Flora Holland, VHG, Boot & Dart, M. van den Oever, Ebben, Royal Anthos, Floriade, Boomkwekerij Udenhout, Van Den Berk, HvA, AERES, Van Hall Larenstein, Stadswerk, Oogstfonds, City of The Hague, City of Amsterdam, City of Wageningen, Niek Roozen Landschape, Topsector Tuinbouw & Uitgangsmaterialen

**Total budget:** €762,300

**Duration:** 5 years

"We need to future-proof our city's assets and create new standards. In this process we should continuously ask the question: are we building solutions that last? Considering urbanization, shortage of raw materials, climate changes and digitization."

**Sacha Stolp**, *Director of Innovation Future Proof Assets, City of Amsterdam*



## Research & Innovation

### Living Lab: Urban Comfort Lab

Aircraft noise around airports is a major (urban) challenge. What if the way we build houses might hold the key to solving this problem? A test set-up in Hoofddorp with 120 containers simulates a residential neighborhood in which the urban microclimate is being studied as well as noise.

This lab will run for two years at least. During the first year, the project team conducts measurements with the ordinary 'hard' surfaces. During the second year, the team will lay out gardens and green structures and attach porous/green structures to the facades, after which we will carry out new measurements.

**Project lead:** Arjan van Timmeren (TU Delft)

**Partners:** TU Delft, City of Haarlemmermeer, Ministry of Internal Affairs

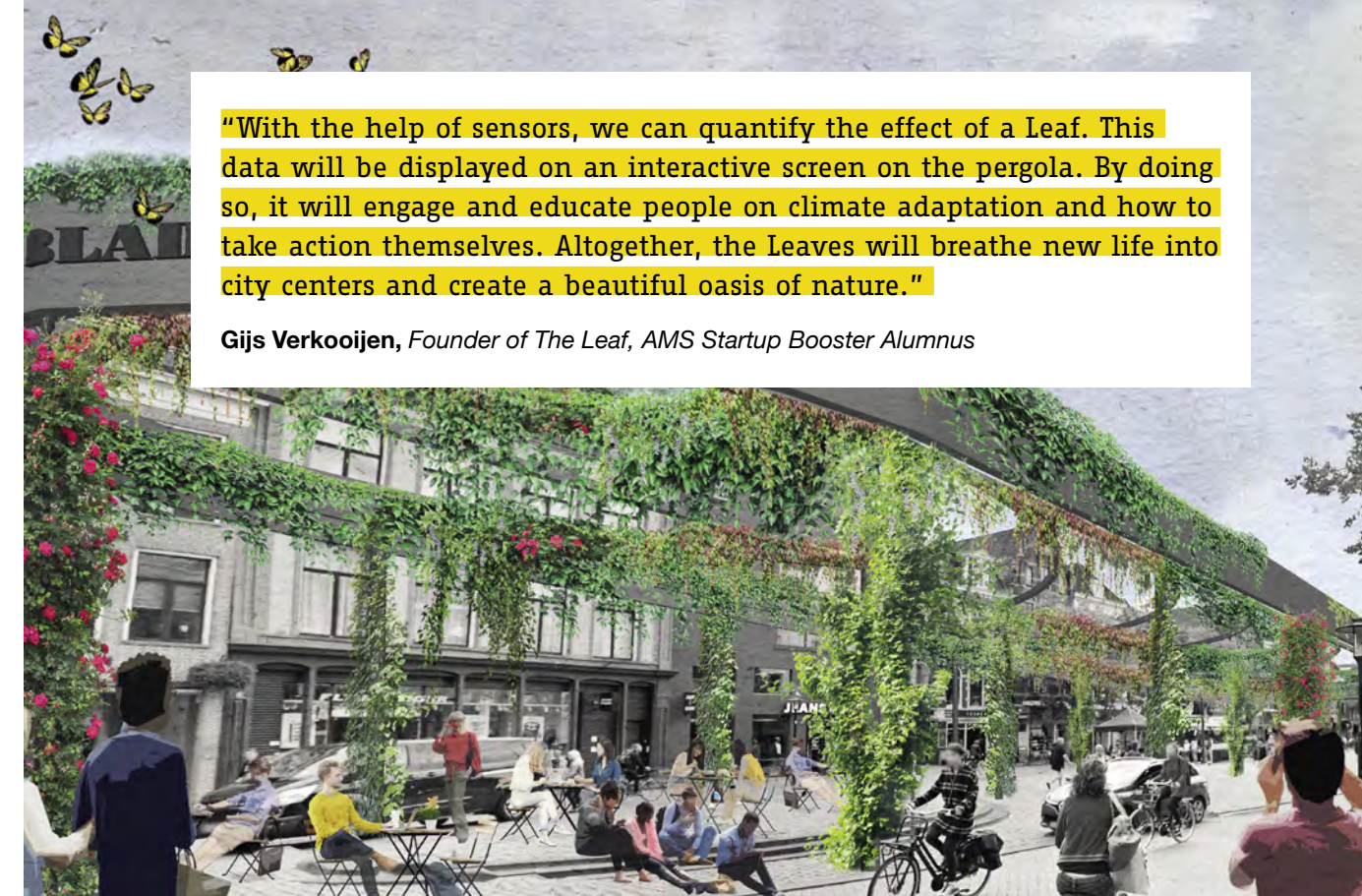
**Total budget:** €1,49M

**Duration:** 2 years



"In addition to noise reduction, greenery and gardens near buildings have a positive effect on the temperature and the evaporation of moisture. Interventions aimed at reducing noise might also help address problems such as heat stress or flooding in urban areas. In other words: two birds with one stone."

**Martijn Lugten**, Research Fellow Circularity in Urban Regions, AMS Institute



"With the help of sensors, we can quantify the effect of a Leaf. This data will be displayed on an interactive screen on the pergola. By doing so, it will engage and educate people on climate adaptation and how to take action themselves. Altogether, the Leaves will breathe new life into city centers and create a beautiful oasis of nature."

**Gijs Verkooijen**, Founder of The Leaf, AMS Startup Booster Alumnus

## Entrepreneurship

### AMS Startup Booster: The Leaf develops pergolas to make our city climate-adaptive

Worldwide cities are heating up, experiencing biodiversity loss and more heavy rainfall. Adding greenery in urban areas mitigates such climate change impact. Where should this greenery be placed if urban space is limited?

The entrepreneurial team behind The Leaf 'looked up in the air' and saw an abundance of space left for greenery in cities. Now, this startup – boosted by the AMS Startup Booster no less – develops climate-adaptive pergolas. These constructions covered with

greenery can, for example, be built over city squares. They require little space on and below the ground.

The pergolas give room for vegetation to grow, provides shade and natural cooling. Furthermore, these 'Leaves' provide a habitat for insects and birds, and gives room for urban biodiversity to grow. This solution also improves water management. Since the pergolas' retention systems are built underneath the construction this allows for easier infiltration of water into the ground and ultimately reduces the pressure on sewage systems and risks of flooding. Finally, each Leaf will be equipped with sensors that measure different parameters such as air quality, temperature and amount of water captured.





"Challenges in the city related to drought and advancing salinization are increasing due to climate change. In 2021, we started a NWO project, AquaConnect, which focuses on developing solutions to make Amsterdam's water and green infrastructure future-proof. Together with more than 35 partners, we work with over a dozen enthusiastic PhD's and Postdocs from 6 universities on 4 cases – including the urban drought case in the Amsterdam Metropolitan Area."

Arjen van Nieuwenhuizen, R&D and Innovation Director Circular and Bio-based Solutions & AMS PI, Witteveen+Bos

#### Our Research Fellows and Principal Investigators working on this ambition

##### Research Fellows

- **Sitong Luo**  
Landscape Architecture & Spatial Planning (WUR)
- **Mart-Jan Hemel**  
Civil Engineering & Geosciences (TU Delft)
- **Pantelis Karamitopoulos**  
Civil Engineering & Geosciences (TU Delft)
- **Raphaël Klein**  
Climate-Resilient Mobility (TU Delft)
- **Martijn Lugten**  
Architecture & the Built Environment, Building Physics (TU Delft)

##### Principal Investigators

- **Arjan van Timmeren**  
Environmental Technology & Design (TU Delft)
- **Sanda Lenzholzer**  
Landscape Architecture (WUR)
- **Gert-Jan Steeneveld**  
Meteorology & Air Quality (WUR)
- **Maarten Krol**  
Meteorology & Air Quality (WUR)
- **Huub Rijnaarts**  
Environment & Water Technology (WUR)
- **Bas van Vliet**  
Environmental Policy (WUR)
- **Arjen van Nieuwenhuijzen**  
Renewable Energy, Water & Resources (Witteveen+Bos)
- **Tina Comes**  
Engineering Systems & Services (TU Delft)



## Amsterdam's ambition #3

# Integrate new energy solutions above and underground

The City of Amsterdam has the ambition to become 'climate-neutral', i.e. reduce CO<sub>2</sub> emissions by 55% by 2030, and by 95% by 2050 – in comparison to 1990. This implies major transformations of the current energy system.

Therefore, the City has set out four theme-specific ambitions:

- 1 The built environment: The City wants to eliminate the use of natural gas by 2040;
- 2 Traffic and transport: In 2030, all traffic on our Amsterdam roads and water should be emission-free;
- 3 Electricity: The City's production of sustainable electricity should be maximized;
- 4 The port and industry: By 2050, the port of Amsterdam will be a fully sustainable energy and fuel cluster with green hydrogen, biofuels and synthetic fuels. The City aims to phase out fossil fuels by 2050.

To smartly reduce energy consumption, integrate renewables and minimize fossil energy in cities worldwide, large physical changes in dense urban environments are inevitable. These changes need to be integrated respectfully into their supporting infrastructure and with societal support, be it the integration of solar and wind energy, sharp increases in the insulation level of the existing building stock or the electrification of heating and mobility systems.

### Education

- **Exploring thermal energy recovery:** this MSc MADE Living Lab team assessed the potential of, and City interest in, thermal energy recovery from the water transport company Rijn-Kennemerland (WRK) infrastructure.
- **Reigersbos Retrofit:** MSc MADE students created room for discussion amongst stakeholders in Amsterdam Zuidooost regarding steps to be taken to improve living situations while at the same time becoming a (more) energy-efficient neighborhood.
- **A future-proof Djame Masdjied Taibah Mosque:** our students worked on 4 aspects of the mosque's energy transition — this included making the kitchen future-proof and taking concrete actions for more responsible use of energy.

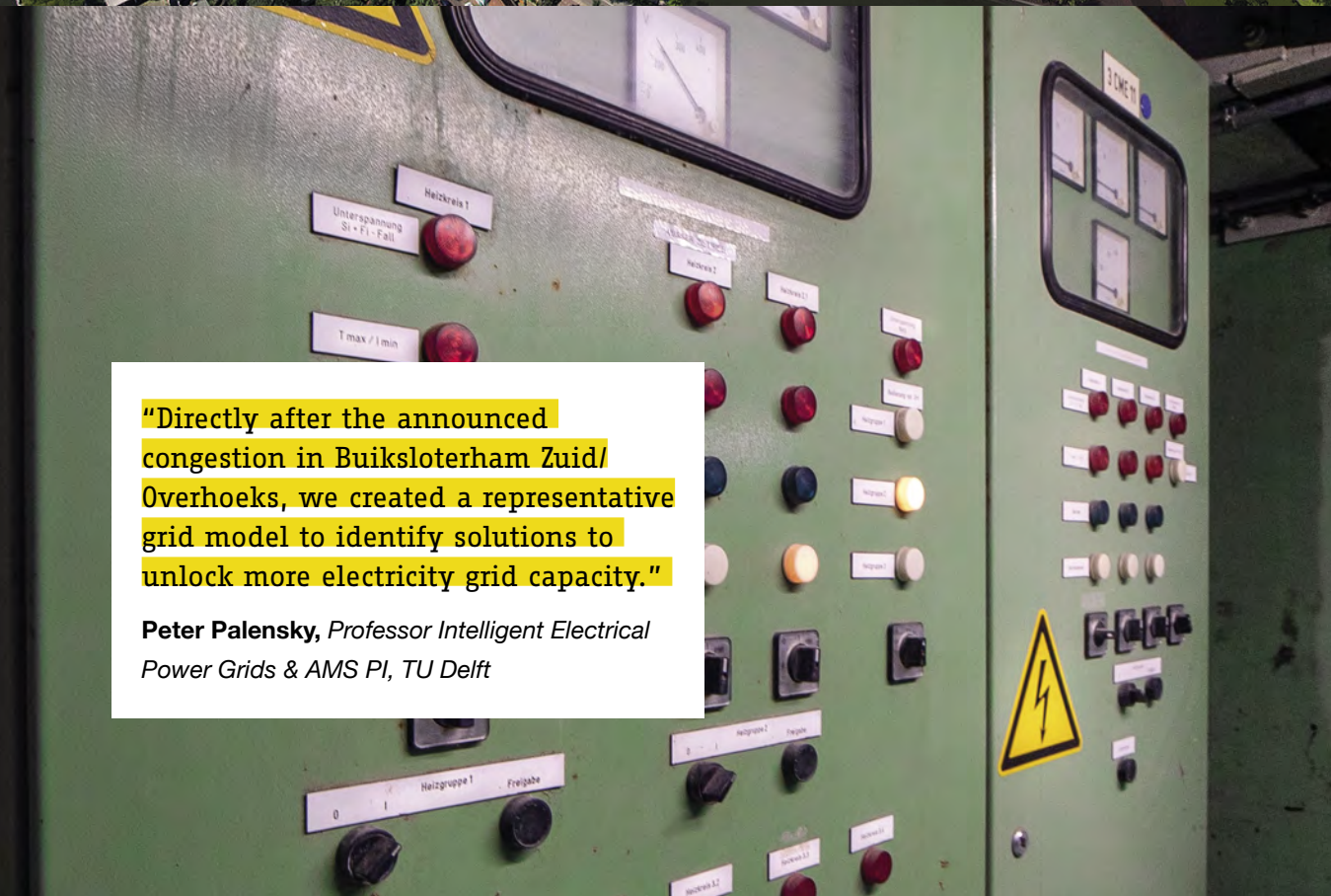
### Research & Innovation

- **Energy Lab Zuidooost:** bringing together stakeholders and scientific expertise from different disciplines to make Amsterdam Zuidooost climate-neutral
- **Local Inclusive Future Energy (LIFE) platform:** testing a smart, electricity-grid friendly and community inclusive platform that plans for energy demand and supply in the area of Amsterdam ArenApoort
- **Congestion analysis Buiksloterham-Zuid/Overhoeks:** investigating potential solutions for medium voltage congestions in urban areas based on an Amsterdam case study

### Entrepreneurship

- **Urbex:** an algorithm based solution that gives cities and mobility providers insights on what consequences are associated with (potential) interventions in urban spaces – this way the tool better strategic decision making
- **PV Works:** a solution that allows for multi-scale modelling in the field of photovoltaics to facilitate the large-scale deployment of PV technology in the urban environment





"Directly after the announced congestion in Buiksloterham Zuid/Overhoeks, we created a representative grid model to identify solutions to unlock more electricity grid capacity."

Peter Palensky, Professor Intelligent Electrical Power Grids & AMS PI, TU Delft

## A closer look at some of our activities focused on sustainable energy solutions

### Education

#### MSc MADE Living Lab: Exploring Thermal Energy Recovery

In 2020, all 27 European Union (EU) member states committed to the European Green Deal with the goal to become climate-neutral by 2050 to combat climate change. To accomplish this goal, the Dutch government has established the Regional Energy Strategy (RES), dividing the Netherlands in 30 energy regions.

The RES has assigned a leading role to municipalities: together with property owners, residents, network operators and all municipalities were required to

deliver a transition vision for heating by the end of 2021. Identifying local alternatives, natural gas-free sources to be used for heating, cooling, and cooking within the municipality boundaries.

This Living Lab team assessed the potential, possibilities, and municipality interest for extracting heat and cold from WRK did you know that thermal energy recovery from water transported by water transport company Rijn-Kennemerland (WRK) could serve as one of the natural gas-free alternatives for municipalities along its trajectory to becoming climate neutral by 2050?

"It was amazing to witness the students' adaptability and willingness to gather knowledge and to grasp opportunities regarding the complex matter of the Water-Energy Transition. Especially considering the great number of angles and stakeholders."

Ljiljana Zlatanovic, Policy Advisor Drinking Water, PWN





"To reach the goal of becoming energy-neutral by 2040, significant steps need to be taken. We need not only new technologies, but also smart ways to organize the transition, and adaptations to our lifestyle. This requires cooperation among many different parties."

**Else Veldman**, Program Lead  
Energy Lab Zuidooost, AMS  
Institute

## Research & Innovation

### Living Lab: Energy Lab Zuidooost

Amsterdam Zuidooost aims to be energy-neutral by 2040. This requires systemic change, at both a technical and a social level. Energy Lab Zuidooost ensures structural collaboration and exchange of knowledge between projects, organizations, and disciplines. From the government, residents to researchers and companies, the Lab connects expertise to the urban challenges in Zuidooost.

By experimenting together in different Living Labs, we develop and test new innovations in a real-life environment in line with the topics of the Urban Energy program. This helps us understand what works and how to scale and implement these innovations in Amsterdam Zuidooost and other metropolitan environments. We develop several scalable pilots and experiments around these topics. All projects and pilots are carried out with different companies, public organizations, and residents.

**Project lead:** Else Veldman (AMS Institute)

**Partners:** City of Amsterdam, HvA, UvA, TU Delft

## Entrepreneurship

### Research & Innovation: PV Works

This startup 'PV works' – a follow up on the PV Advent Calendar research project – developed a tool that maps the city's solar panel-potential, indicating the maximum possible PV energy yield per building, considering all surfaces receiving sufficiently high irradiation. A grid impact model also tests how much generated power the grid can take in from each building cluster before problems arise for the relevant grid components.


This news publication covers the full potential of solar panels in Amsterdam:



"In collaboration with the City of Amsterdam, we aim to develop a 3D environment for solar panel integration for the historic city center. Among others, these data-layers can support citizen decision making and permit tooling in historical buildings."

**Paul Voskuilen**, Program Developer Urban Energy, AMS Institute





"The goal of our company is to facilitate the large-scale deployment of PV technology in the urban environment. We want to achieve this by accurately evaluating the PV potential in urban environment and the impact of solar electricity on the local grid."

Maarten Verkou, *Research Fellow Urban Energy, AMS Institute*


## Our Research Fellows and Principal Investigators working on this ambition

### Research Fellows

- **Maarten Verkou**  
Sustainable Energy Technology (TU Delft)
- **Maéva Dang**  
Climate Design & Sustainability (TU Delft)
- **Frank van der Pijl**  
Electrical Engineering (TU Delft)
- **Hung-chu Chen**  
Climate Design & Sustainability (TU Delft)
- **Michel Handgraaf**  
Urban Economics (WUR)

### Principal Investigators

- **Tamara Metze**  
Public Administration & Policy (WUR)
- **Pavol Bauer**  
Electrical Sustainable Energy (TU Delft)
- **Andy van den Dobbelsteen**  
Climate Design & Sustainability (TU Delft)
- **Bas van Vliet**  
Environmental Policy (WUR)
- **Olindo Isabella**  
Electrical Sustainable Energy (TU Delft)
- **Peter Palensky**  
Intelligent Electrical Power Grids (TU Delft)



"AMS Institute connects the scientific community to society. For me and my team working on the massive implementation of PV in urban areas, this institute is the ideal place for testing scientific breakthroughs in a relevant, societal environment."

Olindo Isabella, *Professor Electrical Sustainable Energy & AMS PI, TU Delft*



## Amsterdam's ambition #4

# Design responsible urban digitization in public space

Digitization in cities is taking endlessly diverse forms and is developing rapidly. New technologies are also bringing new questions. With the development of its 'Digital Agenda', the City therefore aims to ensure responsible and fair use of technology for all Amsterdam residents.

This agenda highlights the added value of data for the city and stresses how and why the City is working to develop laws and regulations to protect digital rights by using data and technology responsibly. Ultimately Amsterdam's goal is to make sure that everyone benefits from all the technological possibilities available, while maintaining privacy. The three pillars of this Digital Agenda are:

- 1 **Free digital city:** The ambition is to consciously deal with the opportunities and threats of digital technologies, to ensure protection of civil rights, and fair access to and fair distribution of the proceeds of digital technologies. Companies must adhere to the rules in the field of data and technology.
- 2 **Inclusive digital city:** Technology must help all citizens to participate in city activities and become digitally resilient. Digitization should provide access to all kinds of information and education.
- 3 **Creative digital city:** Together with the city, digitization is used to contribute to solving social challenges, to put (ethical) issues around technology on the agenda and to make them public. Another aim is cooperation with other (inter)national cities.

### Education

- **Future Amsterdam Curbs:** connecting street curbs, the space on streets not designated for public transport, to the digital layer of the city to develop solutions to make these curbs dynamic in function and make more efficient use of limited urban space

### Research & Innovation

- **Senseable Amsterdam Lab:** in this Lab, we work on research and innovation activities that help Amsterdam, and cities worldwide, become carbon neutral and enable sustainable mobility by means of evidence-based approaches such as using AI and data analytics technologies
- **Responsible Sensing Lab:** the projects in this lab focus on exploring how to integrate social values in the design of sensing systems in the public space
- **DCODE:** training PhD students in design(-anthropology), media studies, science and technology studies & data science, and equipping them with a holistic understanding needed for the human-centric design of product service systems powered by Big Data & AI
- **BRIDE:** the world's first stainless steel 3D printed smart bridge in the city center of Amsterdam allows us to conduct research into the ethical consequences and regulation of smart infrastructures in the city

### Entrepreneurship

- **Place AI:** providing a one-of-a-kind dashboard that illustrates a wide range of park metrics to help cities know how park visitors are perceiving, using, and giving feedback about parks, to facilitate park design and management
- **Biometeors:** providing accurate UV-index tracking through a mobile app and API service





## A closer look at some of our activities focused on responsible urban digitization

### Education

#### MSc MADE Living Lab: Future Amsterdam Curbs

Curbs – the physical space on the streets not dedicated to public transport – fulfill a multitude of functions for the city, such as (bike) parking, loading and unloading of goods, recreation, and urban green. In this research-based MSc MADE Living Lab, street curbs were connected to the ‘digital layer of the city’.

Using urban data about Amsterdam, computer vision, and machine learning, the students aimed to make informed decisions on how the City of Amsterdam can better leverage its curbs. By first defining key characteristics of the built environment surrounding the curb, they co-created solutions with the City of Amsterdam. Solutions to make the curbs dynamic in function, serving more people throughout the day, and making more use of the scarce space in the city.

**“We live in a rapidly changing society. With the rise of digitization, it is an interesting question of who takes ownership. Do we let technology make decisions for us? Or do we, humans, decide what technology will do for us?”**

*Ger Baron, Director Digital and Innovation, City of Amsterdam/CTO Innovatieteam*



## Research & Innovation

### Project: Responsible Sensing Lab (RSL)

Technologies like smart sensors can help solve urban challenges. Functionalities of these smart devices range from calculating and measuring (i.e. sensors) to steering processes in the city (i.e. actuators) such as traffic lights, charging stations, adaptable street lights, barriers that go up and down, and adaptive digital signs. Among other things these devices help to optimize mobility flows in Amsterdam's urban environments and rationalize garbage removal.

But what public values are involved when collecting data? Together with the City of Amsterdam we work on several projects in our Responsible Sensing Lab. Here we explore how to integrate social values in the design of sensing systems in public space. A selection of projects in the RSL portfolio: Shuttercam, Shutterring, mmWAVE, Responsible Drones, and Transparent Charging Station.

Explore our other  
RSL projects here:



## Research & Innovation

### Project: BRIDE

In July 2021, Her Majesty Queen Máxima officially opened the world's first stainless steel 3D printed smart bridge in Amsterdam. Equipped with a sensor network, the interactive bridge by MX3D is innovative in both design and technology.

In the coming two years, Amsterdam's residents can make use of the futuristic bridge which is located at one of the oldest canals in the city's red-light district at the Oudezijds Achterburgwal.

With the 'BRIdging Data in the built Environment' (BRIDE) project, we will also conduct research into the ethical consequences and regulation of smart infrastructures in the city.

Questions such as: 'what data do we, city residents, want to be collected and measured' and 'to whom does the collected data belong' and 'do we actually want a city full of sensors', are central to this.

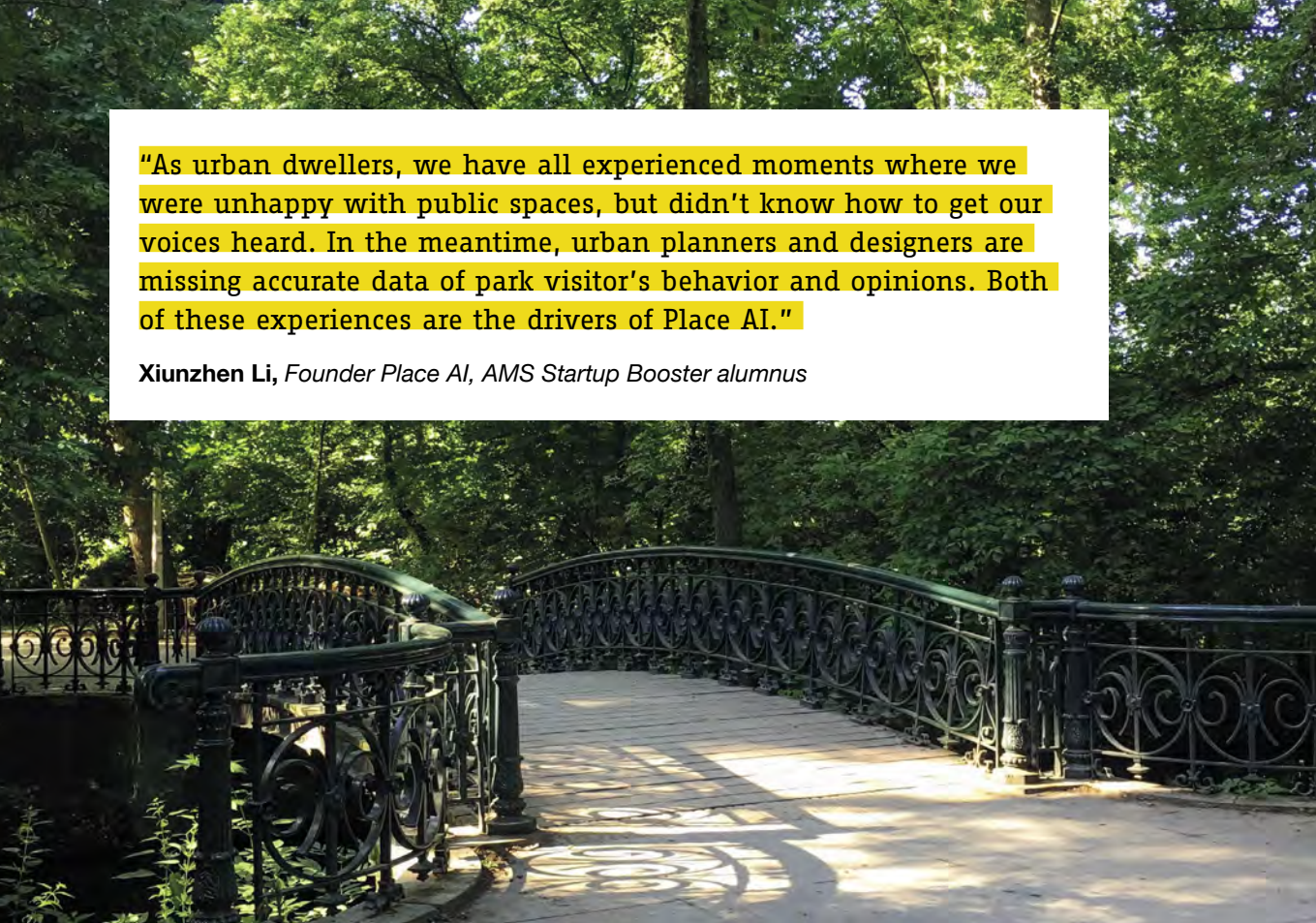
**Project lead:** Peter-Paul Verbeek (University of Twente)

**Partners:** University of Twente, TU Delft, City of Amsterdam, MX3D

**Total budget:** €476,050

**Duration:** 4 years





"As urban dwellers, we have all experienced moments where we were unhappy with public spaces, but didn't know how to get our voices heard. In the meantime, urban planners and designers are missing accurate data of park visitor's behavior and opinions. Both of these experiences are the drivers of Place AI."

Xiunzhen Li, Founder Place AI, AMS Startup Booster alumnus

Entrepreneurship

AMS Startup Booster: Place AI

Worldwide, park design and management in large metropolitan areas are based on a limited understanding of actual park use patterns and user needs. Because of the lack of data and efficient analytical approaches, there is a huge mismatch between park design and actual user needs.

Place AI aims to bridge this gap, by providing a dashboard that illustrates a wide range of park metrics to help cities understand how park visitors perceive and use parks.

This solution consists of two key components; a space utilization module and a performance monitoring and alert module. The 'space utilization module' combines natural language processing, computer vision, and spatial data mining technologies, to develop an in-depth understanding of park user behavior patterns and to calculate essential metrics such as spatial preferences, behavior types and hotspots. The space utilization module automatically generates park usage reports, providing useful insights for Park Departments

Place AI has its roots in the smart city research conducted at Harvard University and MIT.

Our Research Fellows and Principal Investigators working on this ambition

Research Fellow

- **Andrea Mauri**  
Human-Centered Intelligence (TU Delft)

Principal Investigators

- **Gerd Kortuem**  
Internet of Things (TU Delft)
- **Alessandro Bozzon**  
Sustainable Design Engineering (TU Delft)





## Amsterdam's ambition #5

# Develop sustainable and healthy food systems

The transition towards sustainable and healthy (urban) food systems is one of the major challenges of today. With its food strategy, the City aims to work towards reducing consumption of meat and processed food, decreasing waste and developing shorter lines between farmers and citizens. This food strategy contains six core elements:

- 1 **The inclusive and social function of food:** Contribute to a healthy, social, and sustainable food system.
- 2 **Waste and wasting food:** This mainly concerns the end of the food chain: the catering industry, stores and people's homes. Also closely linked to Amsterdam's circular strategy to raise awareness of this waste, suggest alternatives, and have leftover food retain its value.
- 3 **Healthy food environment:** Play a leading role to make healthy food affordable and accessible for everyone.
- 4 **Regional production and distribution:** Amsterdam's aim is to produce 25% of our food locally by 2030, together with partners from the region.
- 5 **Entrepreneurship:** Realize short(er) lines from producer to consumer. Such change requires innovation. Entrepreneurs therefore play an important role.
- 6 **Animal welfare:** Inform and stimulate Amsterdam's residents to choose healthy plant-based alternatives instead of animal-based proteins.

### Education

- **Restaurant 'De Kas':** MSc MADE students aimed to improve the circularity of 'De Kas' by solving the current challenges through a multitude of proposed interventions focused on water, waste, urban agriculture, and public perception
- **A future-proof Djame Masdjied Taibah Mosque:** MSc MADE students worked on 4 different aspects of the mosque's energy transition; how to make the mosque's kitchen future-proof, a communication strategy around sustainability, concrete actions for more responsible use of energy, developing a pathway for other mosques to join this sustainability journey

### Research & Innovation

- **Space for Food:** applying space technology in an urban context to recover and transform these nutrients from wastewater for food production
- **Cultural Culinary Heritage:** exploring the culinary heritage of different cultures in Amsterdam Zuidoost to identify opportunities for local and sustainable production of traditional exotic vegetables, fruit and herbs
- **CustUNize:** stimulating inclusive food production for local supply and producing urban food for all citizens
- **Insects for kitchen waste valorization:** examining the possibility of processing kitchen waste by black soldier flies

### Entrepreneurship

- **CINDERELA:** offering flower producers and urban farming initiatives a circular and sustainable liquid fertilizer for plants made from urine – this contains fast depleting resources like phosphorus required for producing mineral fertilizers





## A closer look at some of our activities focused on developing sustainable and healthy food systems

### Education

#### **MSc MADE course: Circularity roadmap for Restaurant De Kas**

Twenty years ago, the renowned restaurant De Kas took the lead in the field of catering sustainability and is now striving to reinvent itself as the prime example of contemporary restaurant innovation.

Our MSc MADE student teams aimed to accelerate De Kas' circularity by solving the current challenges through a multitude of interventions. To ensure an

efficient and effective introduction of sustainable initiatives, the interventions proposed by the different expert teams of Water, Waste, Urban Agriculture and Public Perception have been synergized.

The students used a 'roadmap' structure to organize the proposed interventions within one, two, five and ten years. Now, De Kas already works on different issues and is planning to go ahead with strengthening the relationship with the neighborhood.





## Research & Innovation

### Project: Insects for kitchen waste valorization

The City of Amsterdam has a clear food and circularity strategy. For municipal waste streams, it has set a target for 50% recycling in 2030 and 100% in 2050. With an existing overall performance of around 30% of household waste separation, the City has some way to go to reach the targets. Add to this, that there are plans to build around 70,000 new homes within the inner circle of Amsterdam.

A breakthrough in high quality collection and processing of raw materials is therefore required: for organic materials, construction materials and consumer goods. Although organic waste constitutes a vast part of the municipal waste, it is hardly separated from the municipal waste. Urban residents in inner cities produce little garden waste, meaning that organic waste is mainly formed by kitchen waste (fruit & vegetable waste and food scraps).

"One of our aims is to increase the availability of plant-based food in the city. This way, we can realize a healthy food environment – one that's inclusive and accessible for all – independent of people's socioeconomic position."

Willie van den Broek, Program Developer Metropolitan Food Systems, AMS Institute

The main research question is: how to valorize the collected household waste? This project examines the possibility of processing this type of kitchen waste by black soldier flies. Kitchen waste from the residential area IJburg will be collected and first tested for its quality performance: physical parameters (e.g. stones, glass, metals), microbial parameters (e.g. bacteria, viruses), pharmaceutical parameters and chemical and metal traces. After passing the quality test, the waste material will be tested for its performance to cultivate insects. Dietary quality and cultivation performance will be tested for practical applicability.

**Project lead:** Marco Appel (WUR)

**Partners:** WUR, HAS Hogeschool, VENIK, AVINED, Nijssen, NEVEDI, Darling Ingredients, The Insectory, Ingredient Odyssey, Dorset, Meatco, Wadudu

**Total budget:** €1.6M

**Duration:** 40 months exploration



"The transition towards a more sustainable and healthy food system requires a multidimensional view of food in the city. In developing solutions that fit in the daily lives of all different kinds of citizens, we need to explore multiple pathways from high-tech innovation to regional supply chains, while proactively engaging with citizens and their creative ways in shaping their daily food consumption."

Sigrid Wertheim-Heck, Associate Professor Global Food System Sustainability & AMS PI, WUR

## Our Research Fellows and Principal Investigators working on this ambition

### Research Fellows

- **Oona Morrow**  
Rural Sociology (WUR)
- **Lucas van der Zee**  
Farm Technology, Vertical Farming (WUR)
- **Daniel Polman**  
Circular Food Policy (WUR)
- **Stephanie Begemann**  
Knowlegde, Technology & Innovation (WUR)

### Principal Investigators

- **Leo Marcelis**  
Horticulture & Product Physiology (WUR)
- **Huub Rijnaarts**  
Environmental Technology (WUR)
- **Han Wiskerke**  
Rural Sociology (WUR)
- **Sigrid Wertheim-Heck**  
Environmental Policy (WUR)



## Amsterdam's ambition #6

# Become a low-car city

First and foremost, Amsterdam aims to be the world's number 1 smart mobility city. This includes exploring the use of shared mobility options and stimulating inclusive, clean and healthy transportation, with extra attention for vulnerable groups and areas where accessibility is under pressure.

Secondly, the City also wants to make travel cleaner and smarter for all its citizens, visitors and suppliers of goods by providing attractive choices and affordable and clean alternatives.

Last but not least, the City's traffic center collects data digitally – and centrally – in order to manage, analyze and predict mobility flows in real time.

With this ambition to become a low-car city, Amsterdam inspires other cities in the Netherlands and around the world.

### Education

- **Car-free Marineterrein:** investigating the potential 'micromobility' in this case if existing bicycle racks in the Amsterdam city center can be used as e-scooter hubs
- **Mobility as a Service (MaaS) for the Elderly:** gaining knowledge about the mobility of elderly for the development of MaaS suitable to this group

### Research & Innovation

- **Senseable Amsterdam Lab:** in this Lab, we work on research and innovation activities that help Amsterdam, and cities worldwide, become carbon neutral and enable sustainable mobility by means of evidence-based approaches such as using AI and data analytics technologies
- **SmartHubs:** increasing the implementation, accessibility, and last-mile challenge regarding shared mobility hubs in metropolitan areas
- **Code the Streets:** a joint effort of cities, service providers and science to stimulate car users to choose safer, more sustainable routes to improve urban mobility
- **Noord-Zuid Metroline:** investigating how this large infrastructure project impacts the city by in terms of accessibility, development in the area, economy and public space for the city and urban area
- **CriticalMaaS:** the development of network, operations and behavioural concepts, theories and models for the emergence of more flexible on-demand mobility services (in comparison to the traditional division between private and public transport): Mobility as a Service

### Entrepreneurship

- **Swugo:** with swugo's swappable smart batteries, everyone can instantly turn their bike into an electrified one
- **SmartHubs:** assessing the commercialization of a decision-support tool to locate the most optimal locations for mobility hubs within cities in Europe – can such a tool be offered to municipalities and clients in the automotive industry?



# A closer look at some of our activities focused on the transition towards low-car cities

## Education

### MSc MADE Living Lab: Mobility as a Service (MaaS) and the elderly

Around the world, droves of young people are adopting new methods to move around. These mobility modes come together in an overarching integrated vision for our transport systems: Mobility as a Service (MaaS). These new developments promise, among other things, the potential for decarbonization of mobility systems, reduction of car-dependence, and the freeing of limited urban space. But this begs the question: who will be excluded from the rapid changes happening?

Think of the elderly for example. Elderly people typically have considerably less mobility than the

under-60s due to physical or cognitive obstacles. Accessibility for the elderly – meaning the capacity for them to turn desired trips and resources into personal mobility – is crucial to the future of our systems of movement. MaaS could be a solution to provide access to diverse mobility options to the elderly.

For this Living Lab, the students focused on gaining knowledge about the mobility of elderly people, an important prerequisite for the development of MaaS suitable to this group. Considering the lack of available data to work with, they chose to create their own. The dataset was created by going door-to-door, asking qualitative as well quantitative questions which gives insights into this group’s mobility at a high level of detail.



## Research & Innovation

### Project: SmartHubs

With the rapid urbanization we are experiencing, a solution like shared mobility can decrease the pressure on urban space and keep cities livable and accessible for residents and visitors. Therefore, SmartHubs was born. SmartHubs is an EIT Urban Mobility project working on increasing the implementation and use of shared mobility hubs in metropolitan areas.

The project aims to accelerate the successful implementation of the hubs, maximizing citizens’ accessibility and reducing transport invasiveness. When focusing on Amsterdam, the idea is to reduce the parking pressure in the city, free-up public space and work towards a more sustainable traffic system in the face of a growing city.

**Project lead:** Sander Oudbier (AMS Institute)

**Partner:** EIT Urban Mobility

**Total budget:** €2.16M

**Duration:** 2 years





## Research & Innovation

### Project: Code the Streets

As Amsterdam's metropolitan area continues to grow, so does the number of people that move around. More commuting also means more issues related to traffic such as congestion, crowded streets, and increasing pressures on fragile infrastructures.

The City of Amsterdam, like cities worldwide, faces the challenge of finding better ways to manage urban mobility. The Code the Streets project is a joint effort of cities, service providers and science to stimulate car users to choose safer, more sustainable routes to improve urban mobility. The consortium focuses on creating new mobility management tools.

These tools enable cities to directly communicate with their citizens via mobility providers. By adding information about school zones, congestion and pollution to navigation systems, cities can promote safer, cleaner route options improving the livability of urban space.

**Project lead:** Tom Kuipers (AMS Institute)

**Partners:** City of Amsterdam, TU Delft, Forum Virium Helsinki, EIT Urban Mobility, TomTom, City of Budapest, Mercedes Benz, Aalto University, City of Helsinki, Future Mobility Network

**Total budget:** €1.1M

**Duration:** 1 year

"One of the highlights in 2021 was the presentation of our Code the Streets project at Smart City Expo/Tomorrow Mobility in Barcelona. Not only for being able to meet in a real-life environment again during COVID times, but most importantly to share the results and experiences of one of the projects that we built and executed for scratch."

**Tom Kuipers**, Program Developer Smart Urban Mobility, AMS Institute



## Entrepreneurship

### AMS Startup Booster: swugo

Cities are growing at a rapid pace. As a result, there is an increase in demand for urban mobility by people who need to move around in the city. Clean, affordable, and inclusive urban transport is essential to realize the livable cities of the future. So, how to reduce pollution in cities and make electric mobility more affordable?

Swugo wants to help reduce CO<sub>2</sub> emissions in our urban environment and attribute to getting Amsterdam car-free by electrifying bikes. With swugo's swappable smart batteries, everyone can instantly turn their bike into an electrified one.

Their circular subscription service enables cyclists to convert any 'regular' bike into an e-bike. First, they replace your front wheel with an electric front wheel. The smart batteries can be installed on any standard bike and are swappable; they can be charged at home or customers are free to refresh their batteries anytime at one of the service centers. This way, anyone can have an electric bike for a fraction of what it would normally cost them to buy a new electric one.



## Our Research Fellows and Principal Investigators working on this ambition

### Research Fellows

- **Marco Rinaldi**  
Integral Design & Management of Infrastructures (TU Delft)
- **Jaime Soza-Parra**  
Civil Engineering & Geosciences (TU Delft)
- **Giorgios Laskaris**  
Integral Design & Management of Infrastructures (TU Delft)
- **Raphael Klein**  
Climate Resilient Mobility (TU Delft)
- **Nadia Pourmohammadzia**  
Hydraulic Engineering (TU Delft)

### Principal Investigators

- **Serge Hoogendoorn**  
Traffic Flow Theory, Simulation & Management (TU Delft)
- **Oded Cats**  
Passenger Transport Systems (TU Delft)
- **Bart van Arem**  
Transport & Planning (TU Delft)
- **Javier Alonso-Mora**  
Cognitive Robotics (TU Delft)

"From our digging, we learn that hubs are more than transport options, they are place makers that are generating a very important discussion about how we want our cities to look like in the future."

*Gonçalo Correia, Associate Professor of multimodal urban transport and smart mobility, TU Delft*





## Amsterdam's ambition #7

# Reduce heavy road logistics in inner cities

Logistics are indispensable to the city. Think about delivery vans and trucks that provide supplies to stores and restaurants. And what about construction logistics, necessary for the building tasks in the city (i.e. housing construction and repair of streets and bridges), or waste collection to ensure a clean urban environment.

At the same time, all these mobility movements do not come without consequences for the city. Traffic in our urban areas affects the quality of life, road safety, and accessibility. For example, the wear and tear on our historic bridges and quay walls is, amongst other things, the result of intensive freight transport.

From 2025, a zero emission zone applies in Amsterdam and only zero-emission vans and freight vehicles are allowed in the city. Also, the ambition of emission-free transport applies to transport over water.

With a 'car-free program' and 'action plan for air quality', Amsterdam sets a number of frameworks to transform urban logistics and to reduce the impact of mobility on the city. The goal is to decrease traffic in the (inner)city and implement mobility solutions that are (more) sustainable.

### Education

- **Future Amsterdam Curbs:** connecting street curbs, the space on streets not designated for public transport, to the digital layer of the city to develop solutions to make these curbs dynamic in function and make more efficient use of limited urban space

### Research & Innovation

- **Senseable Amsterdam Lab:** in this Lab, we work on research and innovation activities that help Amsterdam, and cities worldwide, become carbon neutral and enable sustainable mobility by means of evidence-based approaches such as using AI and data analytics technologies
- **Roboat:** autonomous vessels to provide multi-functions for the city – such as waste management, delivery of goods, and transportation of people while collecting data about the city (i.e. water quality)





"By, for instance, using Roboat to collect waste from Amsterdam's city center, heavy traffic within the city can be reduced. This way, these autonomous vessels not only contribute to alleviating pressure from the fragile bridges and quay-walls. With Roboat we can reduce congestion, pollution and noise in our urban environments altogether. It is designed by people and deployed for a specific purpose."

Stephan van Dijk, Director of Innovation, AMS Institute



"Amsterdam faces a number of challenges regarding urban logistics: keeping the busy city accessible, improving road safety, reducing the load on quays and bridges, and reducing the impact on air quality."

Ynse Deinema, Roboat Project Coordinator, AMS Institute



# A closer look at some of our activities focused on reducing heavy road logistics in the inner-city

## Research & Innovation

### Project: 2 full-scale designs of autonomous Roboat ready for tests on Amsterdam's canals

Considering Amsterdam's water-rich infrastructure, this provides an opportunity for innovation to relieve the city of traffic. Instead of a cab, how about ordering an autonomous boat to take you from A to B? In 2021, Roboat – a research project by MIT and AMS Institute – successfully developed autonomy for two full-scale prototypes.

Roboat has come a long way since the team first started prototyping small vessels in the MIT pool in late 2015. After five years of R&D, the project is ready for the next steps towards pilots and commercialization. This year, the researchers and engineers focused on developing autonomy for the two full-scale vessels, including: way-point finding, autonomously docking and undocking, and collision avoidance.

"Roboat navigates autonomously using algorithms similar to those used by self-driving cars, but now adapted for water. Cooperative transport, using a team of water vehicles, poses distinctive challenges not encountered in aerial or ground vehicles. This is an innovative technical contribution of Roboat."

Carlo Ratti, Professor of Urban Technologies and Planning & AMS PI, AMS Institute

Roboat is self-learning and adapts its abilities based on experiences on the water. The 12 kW battery currently provides 9-hours of non-stop operating time which enables the possibilities for various use cases.

From November 2021 onwards, the project team focuses on developing three use cases: passenger transport, logistics (waste collection) and surveying water infrastructure and monitoring water quality. Tests take place at the inner-harbor of MALL.

**Project lead:** AMS PI Carlo Ratti (MIT)

**Partners:** MIT, City of Amsterdam, Waternet, Murata, Torquedo, Vetus, Stormer

**Total budget:** €5M

**Duration:** 5 years



"The first phase of the MIT-AMS Institute collaboration had its pinnacle with the demo of the two full-scale and fully autonomous Roboat in Amsterdam in October 2021. For the next phase, we continue to develop Roboat, and are opening up new research avenues, including the use of artificial intelligence to tackle climate change in Amsterdam. Furthermore, we're expanding our collaboration with more AMS researchers and students."

Fábio Duarte, Research Scientist, MIT

Keep track of our  
Roboat developments:





## Research & Innovation

### Living Lab: Senseable Amsterdam Lab

Sensors embedded throughout the city, and pervading our lives, generate data at unprecedented scales. This gives unique opportunities to understand and design cities in novel ways — for this, we need new methods and tools.

The Senseable Amsterdam Lab (SAL) is a research initiative between AMS Institute and MIT that challenges what exists today, and introduces novel data- and science-based methods and tools to transform city planning.

SAL partners with the City of Amsterdam to use it as a testbed for innovation. It will focus on three research tracks: autonomous navigation, visual intelligence, and solutions aiming to making Amsterdam a carbon-neutral city by 2050.

This Lab's research will contribute to improving the quality of life in Amsterdam based on the development of critical scientific research, with the potential of extending it to other cities worldwide.



## Our Research Fellows and Principal Investigators working on this ambition

### Research Fellow

- **Nadia Pourmohammadzia**  
Hydraulic Engineering (TU Delft)

### Principal Investigators

- **Carlo Ratti**  
Urban Studies and Planning (MIT)
- **Daniela Rus**  
Electrical Engineering and Computer Science (MIT)
- **Dennis Frenchman**  
Urban Design and Planning (MIT)
- **Andrew Whittle**  
Civil and Environmental Engineering (MIT)

"Senseable City Lab in MIT is excited to strengthen its partnership with the City of Amsterdam. Together with AMS Institute we do this by forming Senseable Amsterdam Lab – a new initiative that will allow a more substantial physical presence in the city, forging new collaborations to help improve Amsterdam."

*Tom Benson, Research & Business Manager, MIT Senseable City Lab*



### **Ideal(s) Monitor: measuring impact based on the ideals of the city**

Amsterdam wants to be a sustainable and inclusive city. However, it is clear our city still faces a number of environmental, social and economic issues. Many urban challenges are intertwined, and as such there is a need to work based on a (more) integrated approach. Until now, there was no overarching monitor in which information on various values and ideals comes together and issues can be monitored in relation to each other. Such a framework, in which ambitions come together, can help in making trade-offs.

In 2021, we officially launched the research program 'Ideal(s) Monitor'. In this program we want to relate different, existing monitors in one overall framework. We strive to develop a framework that can be used to make better and more transparent higher order,

strategic decisions for the city, and that can also be used to measure the impact of concrete projects on the ideals of the city.

Furthermore, in the program we work on the development of a value and ideals framework that can be used to weigh the choices that have to be made for the city. As part of the Ideal(s) Monitor, we also monitor the city's various social and sustainability policies and goals. We measure the impact of implemented innovations – among others related to energy, climate adaptation, mobility, and the circular economy.

The Ideal(s) Monitor is a collaboration with the City of Amsterdam and various partners from the AMA. The first phase of the program runs until the end of 2023, but the intention is to make it a long-term program.

**"We need to develop a more integral and broader way of monitoring and measuring impact. Namely, innovative solutions should contribute to sustainability, economic growth, equity and accessibility. AMS Institute and the City are joining forces to map ambitions, indicators and projects, measure their progress and identify where the greatest potential for improvement lies."**

**Kenneth Heijns**, *Managing Director, AMS Institute*



**"Both within the municipality and at AMS Institute a sense of urgency has arisen to work on a 'new economy' focused on 'what really matters' and on measuring and mapping this. This new economy and the associated sustainable development require an integrated way of working, rather than working in separate sectors or directorates."**

**Lieke Dreijerink**, *Program Developer Ideal(s) Monitor, AMS Institute*



# The AMS Living Lab Approach

The previous chapter clearly shows: the urban challenges we face today are multidisciplinary by nature. To create solutions, different disciplines and types of skills and expertise must be connected. Yet, for a solution to really make impact, it needs to develop from fundamental research to a solution that is ready for society-wide implementation.

To realize this, living labs are our guiding principle and fundamental to our way of working. Living labs provide an innovative co-creative setting in which different stakeholders jointly test, develop and create metropolitan solutions – solutions that are viable to be implemented on city level.



### **From science to implementation**

The goal within our living labs is to make impact by developing new products on a small scale. This can be an object, a service, a technology, an application, or a system. The stakeholders involved are a mix of users, private and public actors and academics, and in the process, the feedback gathered from use and evaluation of the product is used to accelerate further development.

Since the product is implemented in a real-life setting and validated by different actors, it is more likely to be adopted smoothly and swiftly by all involved. We then scale-up these solutions and implement them on city scale. And, as a result, to make a significant and rapid impact on urban life.

**"The urban living lab approach has grown and matured tremendously. New labs were started by the Living lab Team. Collaborations with MSc MADE students, researchers, AMS Academy and the Booster program brings synergy. The bonds between the City of Amsterdam, AMS Institute and the global urban innovation community are fruitful – thereby speeding up the urban innovation machinery."**

**Leendert Verhoef**, *Program Lead Living Labs, AMS Institute*







### Amsterdam as a living lab

We are involved in several living labs throughout the city. The main goal is to create scalable innovations that make and keep cities livable. Take Marineterrein Amsterdam Living Lab (MALL) for example – located at the institute's home base. Here, our MSc MADE students, researchers and entrepreneurs conduct numerous experiments on water, energy, mobility, sensing and circularity. Furthermore, we applied the AMS living lab approach in multiple research & innovation projects throughout the city and beyond.

More information on  
our Living Lab  
approach:



**"Marineterrein Amsterdam offers interesting possibilities for research to grow into new solutions for urban challenges. This bustling living lab, located in the heart of the city center, has its own set of rules and regulations. A perfect ambience to to conduct experiments in a real life context."**

**Gian Luca van der Putten**, *Project Lead Marineterrein Amsterdam Living Lab, Bureau Marineterrein Amsterdam*



# Amsterdam as a Living Lab

This map showcases a selection of Living Labs, projects, and experiments our community worked on in 2021. In some cases, locations are plotted approximately.



### Education



### Research & Innovation



### Entrepreneurship



### Replex

Urban waste to urban material



### Climate Cost Model

A data driven decision making tool to assess climate damages on a local scale



### Urban Comfort Lab

Circular and sustainable design of buildings to reduce the exposure to aircraft noise and air pollution



### ATELIER

Transforming neighborhoods in Amsterdam and Bilbao into 'Energy Positive Districts'



### What's Under Your Water?

Bubble barrier to improve water quality in the city



### Urban Water Storage

Upscaling urban water storage systems



### De Regenboog Groep

Social vacancy management



### CityFlows

Improving the liveability of crowded pedestrian spaces with crowd monitoring techniques in three European cities



### ARTIS

Waste separation: reusable cups



### Bridges & Quay walls

Assessing the structural and safety conditions to prioritize renovation and replacement



### Quay walls proof-load experiment

Geo-physical investigation of the Overamstel proof-load experimental site



### Bajes Kwartier Living Lab

Test ground for healthy living, urban food systems and circular materials



### WRK Water

Thermal Energy Recovery

### Marineterrein Amsterdam Living Lab

Inner city test ground for a sustainable living environment



### mmWAVE sensor

Privacy friendly object recognition cameras



### CINDERELA

Demonstration plant that transforms urine into a nutrient-rich fertilizer



### Responsible Sensing Lab

Designing smart technologies that are in line with societal values



### Senseable Amsterdam Lab

Using AI and urban data to help cities achieve carbon neutrality and sustainable mobility



### Roboat

World's first fleet of autonomous vessels



### Bio-receptive concrete

Demonstrating functional performance



### SIPCAT

Interactions of pedestrians and cyclists with automated transportation



### Future Amsterdam Curbs

Efficient use of urban space by making curbs dynamic in function



### Space for Food

Using space technology to improve circularity in the city



### Urgenda: More Trees Now

(Re)planting seedlings for a climate resilience city

### Energy Lab Zuidooost

Scalable renovation and system transitions towards an energy-neutral district



### Local Inclusive Future Energy (LIFE)

Neighborhood energy platform



### Residual Waste Heat Data Centers

Warming up buildings with residual heat from data centers



### Reigersbos Retrofit

Deep retrofit of 288 dwellings with scaling potential of 10,000 buildings



### Cultural Culinary Heritage

Developing new types of urban farming for a multicultural society in Amsterdam



### Volgermeerpolder

Finding a new narrative for wasteland



# Education



Because AMS Institute is an ever-learning community, education is essential. To form engagement with our urban environments, as well as to develop solid solutions for the cities of today and tomorrow. In 2021, AMS Institute continued to develop its educational activities – ranging from our master's degree 'Metropolitan Analysis, Design & Engineering' (MSc MADE), AMS Academy for professional education, and Massive Open Online Courses (MOOCs).

As always, our educational activities were geared towards accelerating transformations through co-creative learning to create sustainable, resilient and just cities. And what better way than to utilize Amsterdam as a living lab to foster and develop the research, design, and innovation skills of our (future) urban engineers?



## **MSc MADE: A new type of professional**

Our master's program Metropolitan Analysis Design and Engineering (MSc MADE) – a joint degree from TU Delft and WUR – is located at the core of AMS Institute's educational activities. The two-year program focuses on the metropolitan challenges of Amsterdam and, as such, uses the city as a case study and a living lab.

The MSc MADE students, representing a broad variety of academic backgrounds and fields of expertise, are challenged to strengthen their academic knowledge and hands-on skills in real-world projects in the city.

During the master program, we connect them to the institute's multidisciplinary Research & Innovation portfolio, real-life cases in Amsterdam and stakeholders from our network – be it case-owners from the City of Amsterdam, businesses, and societal partners. In close collaboration with these stakeholders, we are educating a new type of professional – urban engineers – to address questions such as:

- How can we keep our cities connected?
- How can urban environments safeguard their vitality?
- How can we create truly circular cities?

Trained to try and test their innovative ideas in practice, these urban engineers are ready to tackle the challenges of today's and tomorrow's cities in an interdisciplinary way. To create better, just, and more resilient urban environments.

**"Knowledge and skills at the institute are integrated at every level. Next to linking our students to our researchers, many more experts from our community, such as our program developers, acted as sparring partners and liaisons for the MSc MADE students. Our community as a whole plays an active role in mentoring our city's future urban engineers."**

*Arjen Zegwaard, Program Director MSc MADE, AMS Institute*



**"Our MSc MADE graduates are topic experts on the one hand and integrators on the other. These young professionals have developed their expertise and skills to create synergy between specialists from different disciplinary backgrounds."**

*Toine Andernach, Educational Coordinator Second Year MSc MADE, AMS Institute*







"With the Living Lab Midterm Documentaries, we stimulate our students to make an impact with visual storytelling. This year, one of the documentaries was picked up by World Economic Forum!"

Anita van Oosten, Educational Coordinator MSc MADE, AMS Institute



## Education that adapts to the needs of our ever-changing urban environment

The capacity to deal with changing circumstances, which is at the core of MADE's curriculum, was once again particularly apparent this year. Overnight educational activities switched to online and courses were redeveloped to match the changing situation.

As our cities are ever-changing, we make sure to continuously fit the MADE methodology to the skills our students need to be(come) the future engineers that our cities need. This year our education team therefore investigated the adding of an urban data track to our master's degree.

Our education team also explored how to showcase our student activities in the city and increase the reach of their innovative solutions. The result quickly materialized by working closely with the City of Amsterdam, and now our MSc MADE students have the opportunity to showcase how their work impacts the city on [openresearch.amsterdam](https://openresearch.amsterdam).

Get inspired by  
MSc MADE student  
portfolios on  
[openresearch.  
amsterdam](https://openresearch.amsterdam):



"This year's Living Lab exhibition suddenly had to take place online. It was impressive to witness how effortlessly our students take on a leading role. They 'took over' the AMS building and live-streamed their projects from different rooms – an impressive showcase of the adaptability of our MSc MADE staff and students."

Nina Bohm, Research Fellow & Coordinator Living Lab, AMS Institute



### Professional Education: the AMS Academy

Our Institute's AMS Academy is a learning environment for professionals, researchers and entrepreneurs. Within the AMS Academy we are developing new concepts for professional education. The fundamentals of every program are academic knowledge and how to implement it.

Each year the Academy organizes an 'Urban Living Lab Winter school'. A week filled with inspiring lectures, a lot of teamwork, rapid exercises and a toolbox filled with practical tools for professionals to work with in their own practice. The program is designed to inspire participants to work with a new mindset and to have them build a new network of professionals and academics. By selecting cases together with our partners, like the City of Amsterdam, professionals get the opportunity to work on some of Amsterdam's key projects.

"Participants are challenged to collaborate in teams on real-life cases. They work on skills that help them take ownership of change, apply new knowledge and create solutions in a co-creating setting. Always with an entrepreneurial mindset."

Femke Haccou, Program Developer Professional Education, AMS Institute

# Education in numbers

**67** MSc MADE graduates in total from 2017-2021

**34** MSc MADE graduates in 2021

**58** first year students

8 out of the in total 15 AMS Startup Booster teams include MSc MADE students



Urban Living Lab Winter School

**12** professionals  
**5** researchers

from 7 countries

Urban Living Lab Summer School

**11** professionals

from 3 countries

A record number of **25** MSc MADE Living Lab cases



**76,587** Total number of AMS MOOC participants from 2017 - 2021



**11,235** MOOC participants in 2021



# Research & Innovation

It is revolutions in new technologies, research and design methods that enable us to create solutions for the challenges our cities face, e.g. related to climate change, biodiversity loss, aging infrastructures, or resource scarcity. Our research and innovation portfolio revolves around six urban challenges to create an innovative, sustainable, and just city.

We run over 60 research projects yearly. All projects are defined and executed by interdisciplinary consortia of knowledge institutes, public and private partners, and in close collaboration with the City of Amsterdam. By involving all relevant stakeholders, we contribute to the development and implementation of sustainable solutions that guarantee livability and accessibility of the Amsterdam Metropolitan Area (AMA).





# Smart Urban Mobility



"As part of the SmartHubs project, we develop and pilot smart mobility hubs across 7 European countries. With AMS Institute as the project lead, this provides enormous concrete input for Amsterdam's hub strategy and vision around shared transport and hubs."

*Sander Oudbier, Program Developer Smart Urban Mobility, AMS Institute*

## **AMS Institute's ambitions**

Our Smart Urban Mobility program explores the feasibility and impact on the city of concepts such as user-driven shared mobility, mobility hubs and data-driven intelligent traffic management. The program aims to develop solutions and tools that enhance the (re)design and use of public spaces and improve the use of existing (public) transport infrastructures. The goal is to alleviate pressure on urban mobility and contribute to a more sustainable, inclusive, and better mobility system.



# Circularity in Urban Regions



"In the transition towards a circular economy, we need to reuse materials and design products in a circular way. For instance, as the number of solar panels installed in Amsterdam continuously increases, we need to find solutions how to accelerate circularity of these products. Among others, the overseas production of solar panels requires a great amount of resources and is accompanied by pollution. In 2021, we organized a Circular Economy Lab on how to accelerate the circularity of solar panels with front runners in the sector. As a result, now we are setting up field labs with circular solar panels in Amsterdam."

*Joppe van Driel, Program Developer Circularity in Urban Regions, AMS Institute*

## AMS Institute's ambitions

Circularity in urban regions focuses on re-designing resource flows that come in, move through and go out of the city. Think of building materials, consumer goods, food and materials for the energy- and digital transitions. The goal is to enhance the lifespan of these resources through improved maintenance and re-use, rather than dispose of them after use.

Simultaneously, the concept of circularity asks us to establish integrated and sustainable urban ecosystems supported by a new, resilient economic model, including novel ways of procuring, pricing, contracting and monitoring. By bringing together research, innovation, education, entrepreneurship and policymaking, we aim to accelerate the transition from a linear economy to a fully circular society in the Amsterdam Metropolitan Area.



# Metropolitan Food Systems



"To stimulate inclusive food production for metropolises, we focus on initiatives that help food systems become circular. This includes the re-use of nutrients and raw materials, reduction of water and energy, and local production."

Alexander Laarman, Program & Business Developer Metropolitan Food Systems, AMS Institute

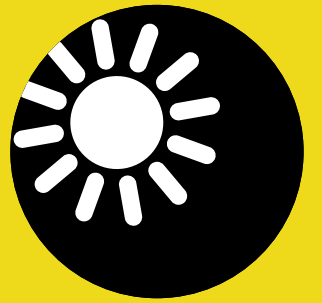
## AMS Institute's ambitions

The food we consume in today's globalized society is produced all over the world and often transported over long distances. This uncouples food production from food consumption, which raises concerns about its impact on society and on the environment. To reconnect Amsterdam's citizens to food, we explore whether and how Amsterdam can inspire, professionalize and stimulate citizens' involvement in the (local) production and consumption of sustainable food.

As a result, our Metropolitan Food Systems program team developed an innovation program to contribute on two basic aspects of the Amsterdam Food Strategy: inclusive food production and a healthy food environment. Inclusive food production considers ecological, social, and economic aspects.



# Climate-Resilient Cities



"Effective urban climate adaptation needs a well-thought-out strategy vis-à-vis greening the city. The right choice of trees - with characteristics that truly provide cooling, like shade and moisture evaporation - is essential."

*Gerben Mol, Program Developer Climate-Resilient Cities, AMS Institute*

## **AMS Institute's ambitions**

The Climate-Resilient Cities program helps the City of Amsterdam create an evidence-based climate adaptation approach that uses designs and interventions that are either nature-based, such as greening, or technological, such as roads with water-storing constructions underneath. Experimentation with and research on new designs, technology and ideas takes place in real-life living lab situations in the city of Amsterdam and in cooperation with companies and contractors. The goal always is to find solutions with impact that qualify for further implementation in the city.



# Urban Energy



"The limitations of the energy system that surfaced in 2021 clearly shows the need for innovative practices to be implemented responsibly but fast where possible. This year, both large- and small-scale projects of AMS Institute kicked-off that directly contribute in easing the grid stress and the integration of sustainable energy in the city."

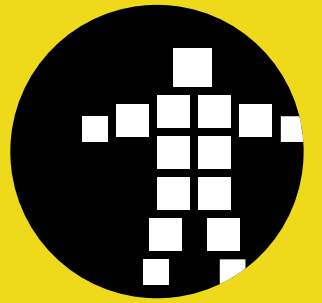
*Paul Voskuilen, Program Developer Urban Energy, AMS Institute*

## **AMS Institute's ambitions**

How to integrate sustainable and affordable solutions in a reliable energy system? That's the main question our Urban Energy program aims to answer. In our energy projects, we explore how new sustainable energy systems can supply the demand for electricity, heating and mobility in the Amsterdam region, while keeping both societal support and systems reliability in mind. Ultimately, our goal is to help design smart infrastructures that contribute to accelerating Amsterdam's urban energy transition.



# Responsible Urban Digitization



"Societal concerns about digitization are rising. If cities want to keep making use of the benefits of digital technology to fulfil their responsibilities to run the city, we must find ways to maintain citizen trust in these systems."

*Thijs Turèl, Program Manager Responsible Urban Digitization, AMS Institute*

## AMS Institute's ambitions

In our Responsible Urban Digitization program, we research and develop advanced and novel tools and technologies that help run the city more efficiently and safely and improve the quality of life. At the same time, it is key to maintain citizen trust in these new systems. We believe societal trust in these tools and technologies should and can be maintained by developing responsible urban technology that is fit for the context in a state that is sovereign, liberal, democratic and adheres to the rule of law. This way, we end up with technology that is in line with societal values such as autonomy, privacy, transparency, inclusiveness and empowerment.



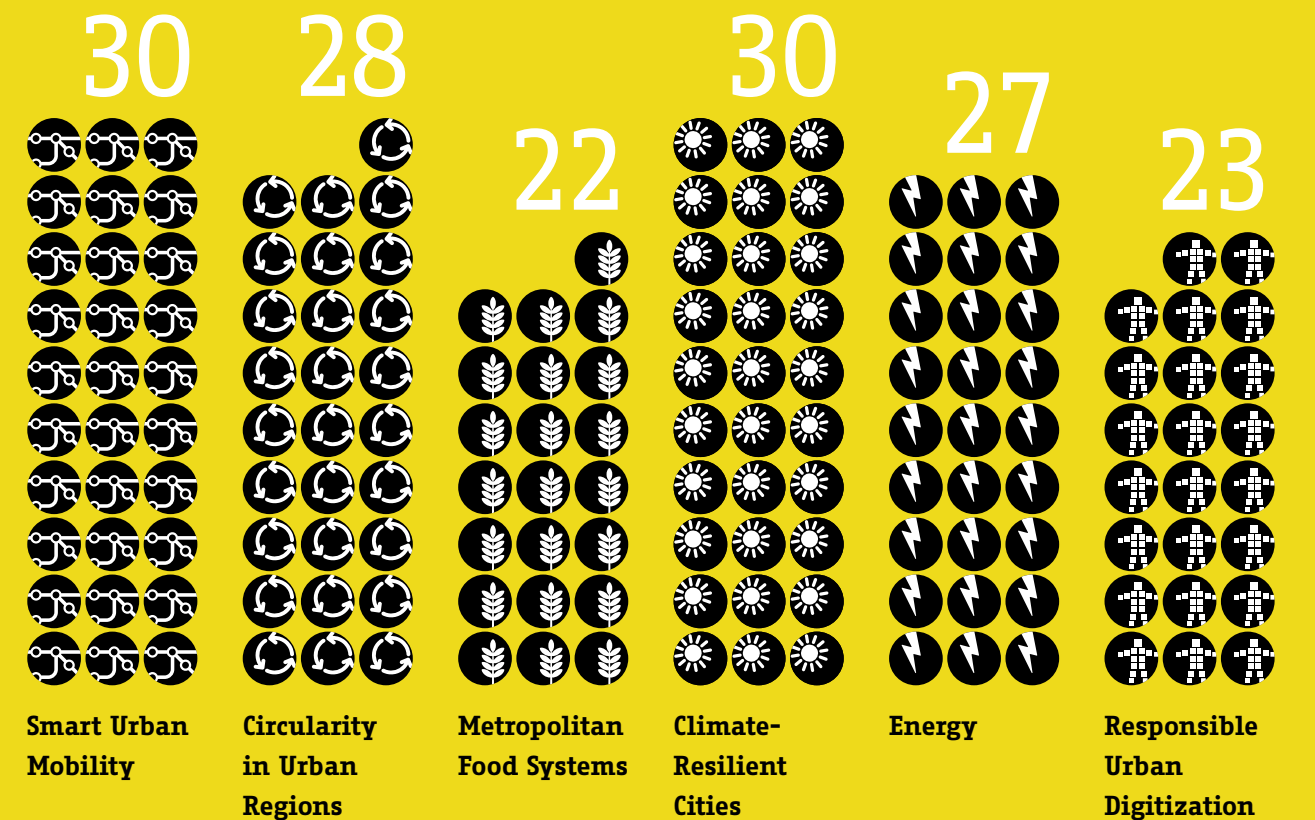


# Research & Innovation in numbers

Accumulated research portfolio **160** projects

**21** projects awarded in 2021  
with a total value of **€22.9M**

Total number of projects per urban challenge (2014 – 2021):





# Entre- preneurship



AMS Institute is strongly committed to helping the next generation of ambitious entrepreneurs turn their ideas for sustainable urban environments into reality: from an open invitation to take part in our own pre-incubator program to develop solutions for specific urban challenges the City of Amsterdam faces, to guiding and challenging entrepreneurial spirits to develop their startup ideas.



**The AMS Startup Booster**

In our community, we witness many innovative business ideas emerge – ideas that simply need to see the light of day. From our MADE curriculum and research activities to entrepreneurs in our network, we often encounter bright minds that are looking for the right eco-system and a place to grow and develop their business models.

To help develop and establish these new start-up ideas we have developed an incubation program, the AMS Startup Booster. In this pre-incubation program, we aim to help the next generation of ambitious urban and sustainable startups with their next steps to turn ideas into reality.

"In 2021 AMS Institute guided over 20 startups in their journey to market success. We saw startups going through customer discovery and development, and we witnessed them pitch in front of large audiences and acquire their first customers. Some of the startups experienced funding rounds and hired their first employees. All those amazing results make us proud for our entrepreneurs and excited for the new batches to come."

*Ioannis Ioannidis, Entrepreneurship Program Associate, AMS Institute*

**EIT Urban Mobility Accelerator Program**

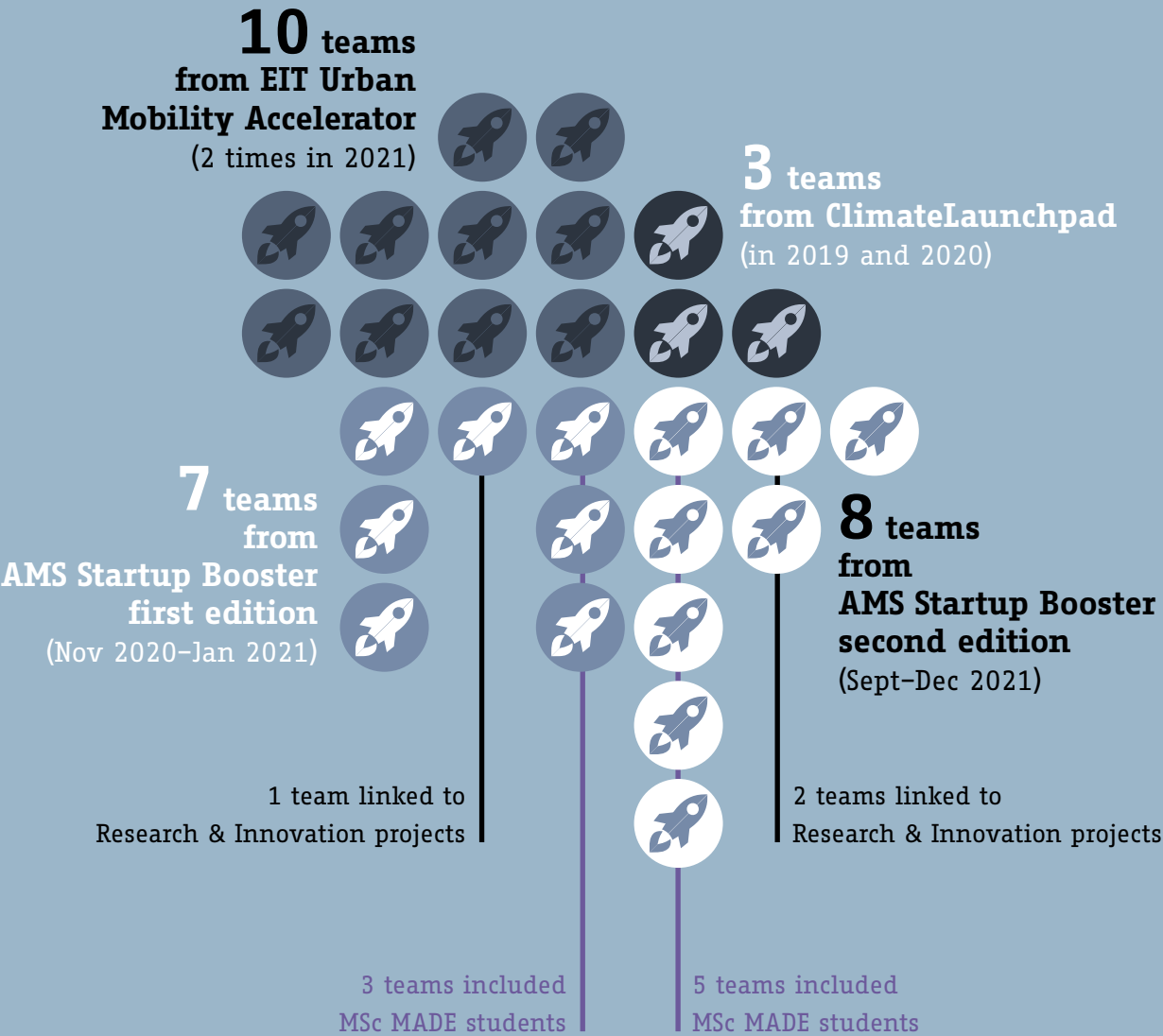
Our institute is a partner of EIT Urban Mobility, which acts to accelerate positive change on mobility to make urban spaces more livable. One of its activities is stimulating business creation, through their EIT Urban Mobility Accelerator program. AMS Institute, together with TU Eindhoven, City of Amsterdam and Brainport is responsible for the acceleration program for startups from the Benelux, the United Kingdom and the Northern France region. The focus is on startups working on reducing congestion and increasing efficiency in the transport system.

"With the support of EIT Urban Mobility, we organized several interviews with founders of successful companies in the urban mobility domain. By sharing the nice experiences as well as the hurdles they had to encounter, these business role models offered the participating startups inspiring, yet realistic and practical insights towards their road ahead. For me, it was a great pleasure to have the chance to create such a unique opportunity for the startups and to collaborate with AMS Institute."

*Monique Greve, Manager Incubation Program, Eindhoven University of Technology*

Entrepreneurship  
in numbers

28 AMS Institute affiliated startups at the end of 2021





# AMS Startup Booster teams



## First edition Asset Hub

An automated method to detect cracks in masonry infrastructures such as houses

## City Analytics

A license-based Software-as-a-Service (SaaS) ‘Crowd Management Decision-Support System’ for city officials to better manage crowds in urban areas

## Container Collectief

This traveling hybrid design agency helps stakeholders design sustainable solutions during a 6-week co-creation process

## Meli

A mobile app that helps curious travelers uncover any monument’s story on the spot. The app can also be used for city officials as way of crowd management

## Mublio

An automated tool to efficiently create custom-made furniture

## Muuras

Living walls with wetland flowers to make our cities more green – constructed by lightweight helophyte filters that can be attached to the facade of (highrise) buildings

## swugo

A smart battery to transform any standard bike into an electric bike

## Second edition

## Advisory Model Sustainable Development (AMSD)

A methodology and data application tool to comprehend sustainability ambitions for the built environment and infrastructure as efficiently and effective as possible

## Bio-meteors

Providing accurate UV-index tracking through a mobile app and API service

## Place AI

Providing a one-of-a-kind dashboard that illustrates a wide range of park metrics to helps cities know how park visitors are perceiving, using, and giving feedback about parks, to facilitate park design and management

## SPATwater

This startup hosts accelerator-sessions to establish the main challenges stakeholders face in their mission to become water- and heatproof and subsequently creates connections with technical experts to develop a fitting solution



## Circy House

A model of a tiny house as fully circular, mobile, affordable yet comfortable housing to offer a helping hand in fighting both the housing and climate crisis

## The Leaf

Climate-adaptive pergolas to increase greenery in cities whilst using minimal space above and below the ground level

## CINDERELA

Offering flower producers and urban farming initiatives a circular and sustainable liquid fertilizer for plants made from urine – this contains fast depleting resources like phosphorus required for producing mineral fertilizers

## SmartHubs

Assessment of commercialization potential of a decision support tool to locate the most optimal locations for mobility hubs within cities in Europe

Learn more how our  
affiliated startups  
accelerate  
sustainability in cities:





# Board Report

**AMS Institutes' board was founded on August 26, 2014 and is registered with the Amsterdam Chamber of Commerce (KVK 854305610). It consists of four representatives – two each from our founding partners Delft University of Technology and Wageningen University & Research.**

In 2021, the composition of the AMS Institute Board was as follows:

- **R. Mazier**  
Chair, Wageningen University & Research
- **H.P.S. Althuis**  
Member, Delft University of Technology
- **J.G.A.J. van der Vorst**  
Member, Wageningen University & Research
- **D.E. van Gameren**  
Member, Delft University of Technology

The board was supported by the interim executive secretary **Monique van de Griendt** (WUR), and starting from Summer executive secretary **Rosalie Lemmen** (TU Delft) took over gradually.

The board met 11 times, including twice with the executive boards of Wageningen University & Research and Delft University of Technology, and one informal dinner meeting.

During these meetings, the board addresses a broad range of topics, including:

- The 2020 Annual Report, the 2021 Budget and Annual Plan and the preparation for the 8-year review (coming in 2022).
- The strengthening of the PI and Research Fellow community within the institute.
- Research and Valorisation developments (such as Roboat demo-day), innovation flagship-projects, entrepreneurship programs (such as the AMS Startup Booster) and professional education offerings.
- The joined-degree master MADE: the progress of student-projects, applications for the new academic year, the corona-struggles amongst students and a possible new track within the master.
- The preparation of important events in 2022, including: the AMS Scientific Conference and the

visit of the Mayor of Amsterdam, Femke Halsema.

- The approval of Research & Innovation projects, including amongst others:
  - SmartHubs
  - FDMM
  - DIT4TRaM
  - ArenApoortEnergy – LIFE
  - AquaConnect
  - Proefbelasting Overamstel
  - Digitale Projectwarmte in de MRA
  - iChange
  - Uitvoering voedselvisie PNH
  - Field Lab Noise
  - Ideale Monitor Fase 1
  - MIT-AMS Senseable Amsterdam Lab
  - Imagination in Transitions

The overall Research & Innovation portfolio reached a grand total of 161 projects with a total of €119M.





# References

**On the cover:**  
Energy in the City of Amsterdam  
Visualization by AMS Institute based on pdok dataset Liander

**Page 4-5:**  
AMS Institute at Marineterrein Amsterdam  
Photo by AMS Institute - check

**Page 7:**  
The city of Amsterdam  
Photo by Wynand van Poortvliet

**Page 8:**  
Shuttercam interviews at Marineterrein Amsterdam  
Photo by AMS Institute - check

**Page 12 top:**  
AMS Institute's team of directors  
Photo by Chevalier Studio

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Roboat cruising the Amsterdam canals  
Render from video footage Oculus Film by MIT/AMS Institute

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Signing the Green Deal Timber Construction  
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Timber construction  
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Bridges & Quay Walls Proof-load experiment at Overamstel  
Photo by Frank Auperle

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MSc MADE students at AMS Institute  
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The city of Amsterdam  
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# Glossary

**AMA**

Amsterdam Metropolitan Area

**COMPRO**

Converting **Com**posite into building **pro**ducts

**CTO**

Chief Technology Office of the City of Amsterdam

**EIT**

European Institute of Innovation and Technology

**HvA**

Amsterdam University of Applied Sciences

**MALL**

Marineterrein Amsterdam Living Lab

**MIT**

Massachusetts Institute of Technology

**MOOCs**

Massive Open Online Courses

**MSc MADE**

Metropolitan Analysis, Design & Engineering  
Positive Energy Districts

**PI**

Principal Investigator

**RES**

Regional Energy Strategy

**RF**

Research Fellow

**RSL**

Responsible Sensing Lab

**SAL**

Senseable Amsterdam Lab

**TU Delft**

Delft University of Technology

**ULL**

Urban Living Lab

**UvA**

University of Amsterdam

**WUR**

Wageningen University & Research

