



AMSTERDAM
INSTITUTE FOR
ADVANCED
METROPOLITAN
SOLUTIONS

The background of the cover is a map of Amsterdam, where the streets and canals are represented by a dense network of thin, multi-colored lines (including yellow, blue, pink, and white). Small, multi-colored dots are scattered across the map, representing various data points or locations. The map is set against a dark, almost black background.

Annual Report

2017



Annual Report 2017

Contents

5	Introduction	
6	Key Figures 2017	
8	How we work	
11	Directors Report	
21	Education	
26	MSc MADE – A living lab way of learning	
31	Data Platform	
37	Research & Valorization	
39	Circular City	
42	Highlighted Projects Circular City	
42	The urban water transport infrastructure as enabler for resource recovery: New Urban Water Transport Systems (NUWTS)	
43	Designing innovative and socially responsible heating systems	
43	REPAiR: Resource Management in Peri-urban Areas: going beyond urban metabolism	
47	Connected City	
50	Highlighted Projects Connected City	
50	Noord/Zuidlijn	
51	Living Urban Office (LUO)	
51	Robots among Humans	
53	My-TRAC@AMS	
53	AMS Social Bots	
53	Citizens as Sensors (Het Schone Waterexperiment)	
56	One year of Robot	
61	Vital City	
64	Highlighted Projects Vital City	
64	Urban Pulse II	
65	Evidence-Based Food System Design	
65	The Logistics and Circular Economy (LogiCE) community	
68	The Future of Public Space, Part I – Physical Activity	
68	City Rhythm	
69	Healing Garden	
70	AMS Science for the City	
77	Board Report	



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Introduction

The world is urbanizing at a tremendous rate. Cities increasingly face challenges of sustainability and quality of life, challenges that put our resources, food security, mobility and logistics, water and waste management, health and wellbeing at risk.

Cities need metropolitan solutions, made possible by revolutions in new technologies, research and design methods. But no stakeholder can do this alone; finding metropolitan solutions requires cooperation between knowledge institutes, companies, cities and citizens.

AMS Institute is an internationally leading institute where talent is educated and engineers, designers, and both natural and social scientists jointly develop and valorize integrated metropolitan solutions.

After winning an international tender written out by the City of Amsterdam, AMS Institute was founded in 2014 by Delft University of Technology (TU Delft), Wageningen University & Research (WUR) and Massachusetts Institute of Technology (MIT) in close collaboration with TNO, IBM, Cisco, Shell, Accenture, Alliander, ESA, Waternet, Port of Amsterdam, Amsterdam Smart City, KPN and the City of Boston.

Our mission is to develop a deep understanding of the city – sense the city – to design solutions for its challenges, and integrate these into the city of Amsterdam. Our research evolves around applied technology in themes such as water, energy, waste, food, data and mobility, and the integration of these themes for a prosperous society.

What makes AMS Institute unique is that we valorize our research in practice, using the city of Amsterdam as a living lab: a valuable context for experiments that helps develop and test advanced solutions for challenges in urbanized metropolitan areas around the globe.

Our topics of focus are organized around the following activities:

Education: an educational program with innovative Massive Open Online Courses (MOOCs), summer schools, professional training and the Master Metropolitan Analysis, Design & Engineering (MSc MADE) that targets and attracts top students from all over the world.

Research & Valorization: a dedicated portfolio of projects and programs, defined and executed by an interdisciplinary consortia of knowledge institutes and private companies in cooperation with the City of Amsterdam and its citizen platforms.

Value Platform: a platform for storing and combining knowledge, networks and infrastructures (e.g. living labs and data collection), to enable education, research and valorization activities.

Key Figures 2017

Research

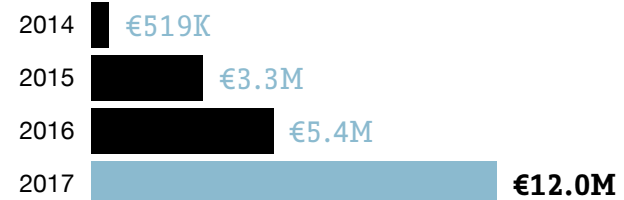
Projects awarded



Total value of awarded projects



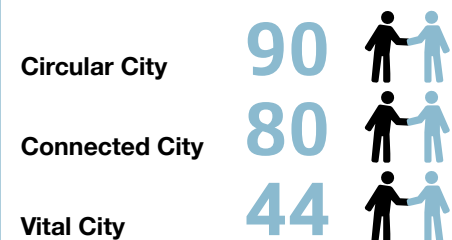
Average turnover projects



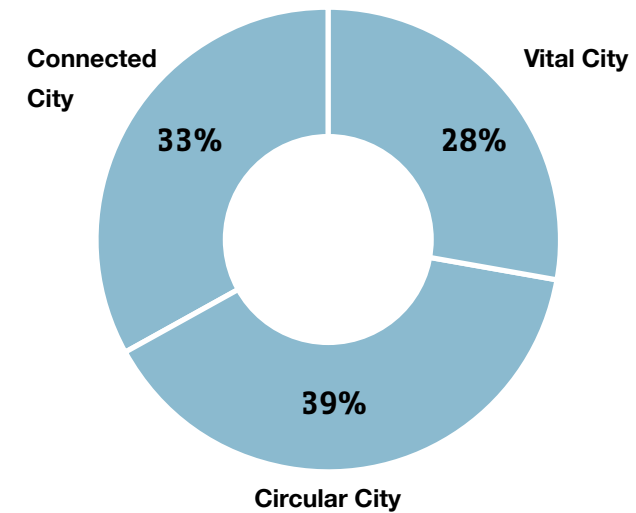
Number of running projects



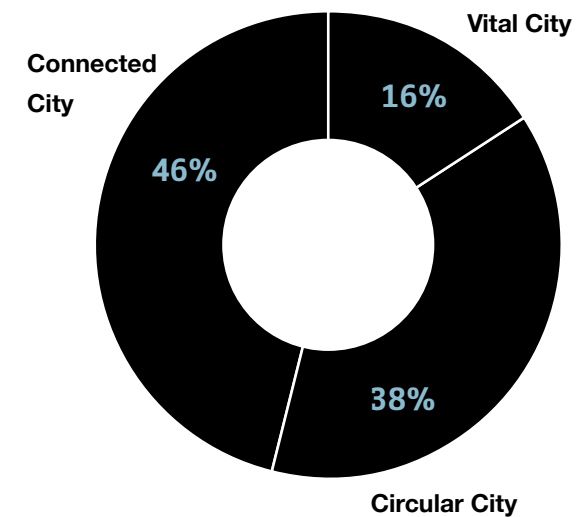
Number of partners we work with



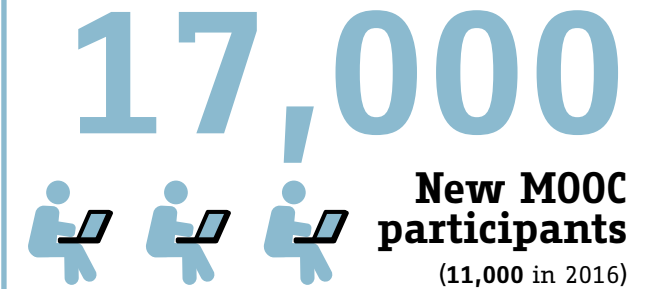
Overview research portfolio



% of the budget per research theme



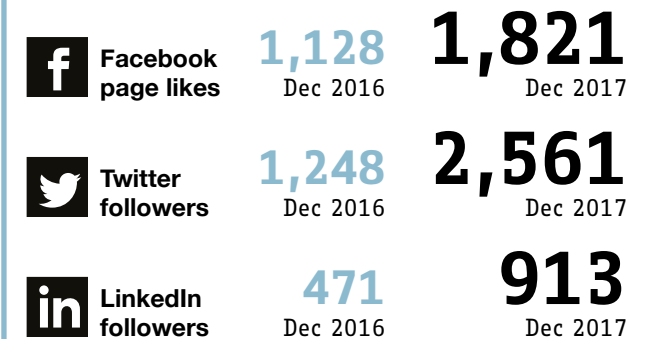
Education



Press

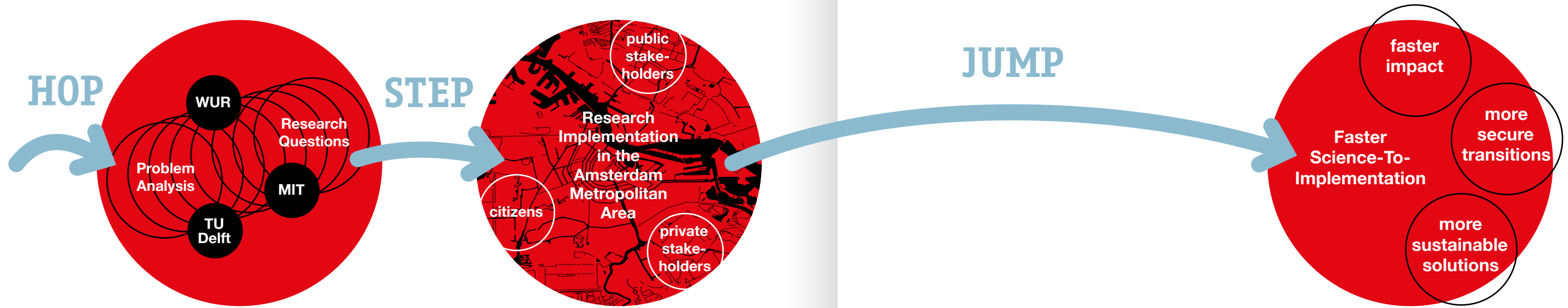


Social media



How we work

AMS Institute is positioned at a crossroad between fundamental sciences and the society-wide application of innovative solutions for metropolitan challenges. Bringing together the brightest minds in the field, our innovations have a state-of-the-art research core and are tested and demonstrated in pilot projects and experiments throughout the city of Amsterdam. Moreover, all innovations are developed and tested together with local, national and international private and public partners, citizens and future users.



Hop: First, together with our key stakeholders and AMS partners, we make a problem analysis of specified societal challenges in the metropolitan context and then formulate research questions. At this stage the fundamental science, including modelling and laboratory research within conditioned environments, mostly takes place at the three founding universities (TUD, WUR and MIT), assuring creation of cutting edge science leading to solutions which aim for true paradigm shifts.

We then move on to a new and truly innovative part of the research process: the outcomes of the first phase of the research activities are implemented and validated in real, living environments inside the Amsterdam Metropolitan Area (AMA) within partially conditioned settings, while involving all public and private key stakeholders. This unique in-between **Step** forms the basis of the AMS Institute's focus: generating solutions which are better tuned to the well-known 'double complexity' of real life and urban environments.

We can then take a longer **Jump**: faster science-to-implementation trajectories which achieve a higher impact faster, with more secured and successful transitions to more sustainable, just and resilient futures in this increasingly urbanizing and challenged world.



Stimulus Project 2017:
Circular supply Chain for the City – 3D Printing Biomaterials

Directors Report

We are delighted to report another year of great results on our key objectives. In 2017 we continued to make significant progress in creating a positive impact on the life of citizens through innovative metropolitan solutions. Since our inception three years ago we have cultivated and built on our core: our research & valorization activities, our education program and our value platform. In the reporting year our focus was on integrating these activities to jointly develop and implement cutting-edge metropolitan solutions that enhance the urban environment justly and sustainably.

Developing metropolitan solutions

At AMS Institute we define metropolitan solutions as responses to the urban challenges of sustainability and quality of life. Presently, society faces a number of concurrent and increasingly intractable global crises that pose a serious threat to sustainability and quality of life, and to civilization as we know it. Adapting our urban communities in the face of these intertwined crises will be the greatest challenge of our time. It requires cities to secure and ‘greenify’ their essential flows and infrastructures for energy, food, waste and transportation. But above all to help citizens change their behavior and commitment, making them an integral and supportive part of these solutions.

Continued growth of our research portfolio

In 2017 AMS Institute continued to intensify the pace of growth in building its research portfolio: with 81 research projects - of which 20 finished - we addressed a focused range of topics, clustered around three themes: Circular City, Connected City and Vital City. At year-end 2017 the total value of

the research portfolio stood at €40M¹. To give an idea of the topics we worked on in 2017, a selection of research projects is described in the *Research & Valorization* chapter.

From ‘stimulus’ towards upscaling of research

In 2017 the research sub-program ‘Stimulus projects’ was completed. The aim of our Stimulus projects is to give new and existing AMS partners support to conduct innovative research that has strong up-scaling potential. Stimulus Projects realize short-term research output which can act as a catalyst for a new solution direction, concept or approach.

Several of the successful Stimulus projects have been taken as a starting point for scaled-up research and valorization of their outcomes. This demarcates the step towards research projects of a ‘larger grain’ where the focus will be on maturing and agenda-setting projects. Research scale-ups sprouted from Stimulus projects are, among others, SocialGlass and 3D Printing in the Circular City.

¹ Non-IKT based valuation



A Living Lab way of working

Given the multidisciplinary nature of our research and educational activities, it is important to include a step in between fundamental, and theory-based, laboratory-based or modelling-based research. We call this the Living Lab way of working. An in-between step of real life research with its multiple stakeholders, in a co-innovating inclusive setting – or living lab – is crucial to achieve metropolitan solutions with impact that will be adopted smoothly and swiftly by all involved.

In 2017 AMS Institute published a practical methodology for setting up urban living labs. AMS Research Fellow Kris Steen and AMS Principal Investigator Prof. Ellen van Bueren developed a clear methodology to set up such research settings. It is based on an analysis of existing living lab research literature and an analysis of 90 local experimental projects in the Amsterdam region. Through a promising global uptake of the Living Lab way of working, which is detailed in this guide, AMS Institute has set out an effective methodology which helps many urban professionals and initiatives in the world to establish their living labs.

Research fellows boosting our research activities

In 2017 the existing group of 34 AMS Principal Investigators (PIs) was expanded by a fast growing group of dedicated high-potential AMS Research fellows (RFs) connected to them. These AMS RFs help to set the agenda and develop and valorize the

upcoming AMS research and education portfolio, while involving their colleague researchers and teachers at the founding universities, and several other academics and related universities.

Thriving education program

2017 was an important year for AMS Institute's education program with the successful launch of an innovative master program, two summer schools and massive uptake of our MOOCs.

MSc MADE: a flagship master program

Following accreditation, TU Delft and Wageningen University & Research successfully launched the innovative two-year masters' program Metropolitan Analysis, Design and Engineering (MSc MADE) in September 2017. MSc MADE is tightly integrated with AMS Institute. The first intake of upcoming urban professionals are critical thinkers, with entrepreneurial spirit, plenty of initiative, and an open mind to major challenges. Their experiences and feedback on the MSc MADE will help us finetune the program. Our aim is to further deepen methodologies and impact and attract growing numbers of students in coming years.

We are proud to note that the launch of the MSc MADE educational program received substantial exposure in general public media in the Netherlands. We believe this to be a result of the innovative character of the master.

Summer Schools for tomorrow's urban professionals

AMS Institute organized two successful summer schools in 2017. For PhD candidates the Summer School 'Urban Transitions: Reshaping Urban Districts', organized in collaboration with Climate KIC, focused on challenges in Bologna and Amsterdam and cross over-learnings, together with stakeholders from both cities. For graduate students and young professionals, we organized the Summer school, 'Making the Metropolis', together with the International Forum on Urbanism (IFoU) and Delft Deltas, Infrastructures & Mobility Initiative (DIMI), and with support of the Dutch Ministry of Infrastructure and Water, and the Municipality of Amsterdam.

These Summer Schools are inspiring and defining weeks of learning and international collaboration. The students will become tomorrow's urban professionals with Amsterdam as an important step towards their careers in metropolitan solutions.

AMS MOOCs: teaching around the globe

In the Fall the second AMS MOOC entitled 'Co-creating Sustainable Cities' attracted over 3,000 students around the world. There was also a rerun of the first AMS MOOC ('Sustainable Metropolitan Development') which now attracted over 14,000 students, bringing the total enrolment of this first AMS MOOC to 28,423 students from 174 different countries (at year-end 2017). We believe that the MOOCs act as an amazing catalyst to raise exposure

for the institute and the topics we are working on. Moreover, MOOCs make it possible for lower-income students around the world to study and become better urban professionals.

From data to value

In principle, all themes in metropolitan solutions concern urban flows and require data (including big data) analytics. AMS Institute's Value Platform includes a neutral host for data generated by digital urban networks.

In 2017 we launched several initiatives to help us realize the Value Platform we are aiming for. This will include novel data science methods and technologies based on computer science and ontology engineering for big and dynamic geo-social data acquisition, integration, enrichment, analysis, simulation, and visualization that can be used by researchers and professionals.

In 2017 we set up and consolidated the management and governance structure for the AMS DataHub/DIST (Data Infrastructure and Stewardship Team). We also launched the AMS data champion initiative (with 'AMS good data ambassadors') and addressed important principles of data handling with open science ambitions, for instance through the TADA Amsterdam manifest, which sets out data principles that should be valid in responsible digital cities.





In December 2017 AMS Institute hosted the first European Seminar on Urban Data Science. The seminar brought together leading experts in the fields of quantitative geography, data science, computational social science, and urban planning. We believe that this event firmly positioned us for future leadership on this topic.

Expanding our brand and its value

In 2017 we took important steps to expand the expertise and brand of the institute, its people and the value created in education and research. Overall we developed and strengthened the institute's brand strategy and corporate identity, while engaging with the AMS community. With a total PR value of almost €2.3M in 2017, we are proud to conclude that AMS Institute is at the forefront of academic and societal debate related to our most relevant topics.

An important and successful program named 'Science for the City' was set up jointly with Pakhuis De Zwijger in Amsterdam. It consisted of six evening events on challenges for the Amsterdam metropolitan area, its citizens and society as a whole. We also held many 'in house' activities, like national and international conferences and thematic seminars. PR-actions on these topics and activities resulted in coverage in a broad range of publications in national and international newspapers, magazines, (scientific) journals and several interviews on radio, internet platforms and television. Numerous invited contributions and keynotes on the portfolio of AMS

Institute, and the institute itself, were given in the Netherlands and many places around the globe.

Thriving collaborations in and outside of Amsterdam

It is becoming increasingly clear that the outcomes related to our education program, research programs and value platform are considered as innovative, and that the institute itself is seen as an example of institutional innovation as well. Naturally one of the most important results is strengthening our position within the Amsterdam eco-system itself: through collaborations at program or project level with Amsterdam-based universities, schools and institutes as well as in other cities, and also through long-term programs and MoUs with leading innovators in the AMA. These include the MoUs with *The Student Hotel*, *Metabolic* and *Alliander*, each involving a long-term collaboration set up with a clearly defined program with multiple projects.

At the same time we are seeing increasing interest to set up similar institutes around the globe: from Vienna, Melbourne, Santiago de Chile, São Paulo and Buenos Aires, to name but a few. Our existing collaboration with Paris was further strengthened, and upcoming collaborations such as Sydney and Singapore were underpinned through MoUs and government-supported PiBs (Partner in Business consortia).

In 2017 we welcomed numerous delegations from governments, cities, universities and representatives like mayors, secretaries of state, ministers, consuls

and ambassadors from around the world who visited us to learn about and connect with similar initiatives to AMS Institute and Amsterdam.

Changes in our governance structure

AMS Institute developed well in 2017, taking important steps forward both in content and governance. The changes to our governance structure in the Fall signal a new phase of development as we gear up to meet new challenges. In November 2017 Kees Slingerland stepped down as Business Director for AMS Institute and the Board appointed Kenneth Heijns as interim Managing Director. Kenneth Heijns has been part of the institute since its inception, as executive secretary to the Board. As interim Managing Director he will work alongside Scientific Director Arjan van Timmeren until a permanent appointment is made.

Words of gratitude

People are the key to success in all organizations, but particularly in a networking organization like ours. What makes this institute amazing is the predominantly young team of dedicated and bright women and men that form the AMS Research & Valorization team, AMS Education team, AMS Value platform team and the different support teams within the Institute (Office support, Finance, Communications & PR). And the hundreds of researchers and teachers involved from the three core academic partners TUD, WUR and MIT.

As ever, we are grateful for the continuous support we receive from the City of Amsterdam, as well as from our steadily growing group of (semi-)public and private partners around the world. One very sad event in the Fall of 2017 was the death of the mayor of Amsterdam Eberhard van der Laan, who was a keen supporter and major stakeholder of our institute. He is sadly missed.

The road ahead

It is this team of people and the many new initiatives and successes that lie ahead of us which make us confident that AMS Institute will further establish itself in coming years. We will continue to strengthen our ties with business, scientific, educational and societal partners on leading projects and programs with practical applications that benefit the metropolitan area as a whole, here and around the world.

We hope you will continue to accompany us on this road, or join us if you are not yet involved. Together we can move forward to find solutions that help build a prosperous, sustainable, resilient and just future. We are happy to present you the work of AMS Institute and our related partners in our annual report 2017.

Enjoy the reading, and let's move forward together!

Arjan van Timmeren, *Scientific Director*
Kenneth Heijns, *Managing Director a.i. (since November '17)*





Education

Generating and disseminating knowledge is essential to develop a deep understanding of, and solid solutions for the cities of today and tomorrow. With Amsterdam as a living lab, the institute's educational activities for current and future professionals, aim to create a perfect environment to develop the research, design and innovation skills essential for a vital, connected and circular (future) city.

The new master program *Metropolitan Analysis, Design & Engineering* (MSc MADE) is at the core of AMS Institute's educational activities. MSc MADE brings together multidisciplinary teams of students in Amsterdam to address questions as: How can we keep our metropolises connected? How can urban environments

safeguard their vitality? How can a circular city be created? This two-year master program is a combination of in-situ and online education. Not only does it provide students with thorough training in academic skills and project work, it also connects to the research portfolio of AMS Institute and our network of business and societal partners.

Other educational activities include summer schools, lecture series, professional training and Massive Open Online Courses (MOOCs). The overall aim is to provide innovative education and deliver excellent, interdisciplinary engineers equipped with the theoretical basis and practical skills to tackle the complex challenges metropolitan areas have to deal with.



Education

In 2017 AMS Institute further developed its core educational activities and increased its impact and reach. What makes our approach unique is that we create an inspiring, cross-over learning environment: we align our educational activities not just with our growing research portfolio, but also with a network of business and societal partners implemented in Living Labs in the Amsterdam Metropolitan Area. Our educational activities are growing and developing according to plan, in terms of student numbers and coverage of the scientific domains of the institute.

Master program Metropolitan Analysis, Design and Engineering (MSc MADE)

Following accreditation of the two-year master program Metropolitan Analysis, Design and Engineering (MSc MADE) a new generation of engineering students started at AMS Institute in September 2017. In this joint degree program by Wageningen University & Research and Delft University of Technology, an interdisciplinary team of highly qualified academics trains students to challenge the metropolis by studying its interrelated data, actor networks, flows and systems. The curriculum is enriched by presentations on topics derived from the AMS research portfolio and interactive sessions with partners and principal investigators. The focus is on helping students to develop innovative and entrepreneurial skills that will aid their ability to tap into creative solutions for increasing metropolitan vitality, connectivity and circularity.

In line with the educational strategy, several graduate courses have been consolidated into the MSc

MADE, providing a solid base from which to expand educational activities in the Living Lab Amsterdam. This unique learning environment is simultaneously an incentive to develop our distinctive didactics and to prepare next year's graduate courses. In the second year of the MSc MADE, inter- and transdisciplinary students will contribute to the AMS research portfolio, working as interns with our societal and industry partners, as research assistants in our projects, or incubators developing a start-up benefitting the Amsterdam Metropolitan Area.

Massive Open Online Courses (MOOCs)

In 2017 we ran the Massive Open Online Course (MOOC) 'Sustainable Urban Development: Discover Advanced Metropolitan Solutions' for the second time. Successful completion of this course is a prerequisite for admission to the MSc MADE. In 2017 the new MOOC 'Co-Creating Sustainable Cities' was added to the AMS educational program. As the name implies, these courses are open to anyone with internet access and an interest in metropolitan solutions, and are free of charge. The AMS MOOCs engaged respectively another 14,000 and 3,000

participants in more than 174 countries in 2017. Participants included cross-disciplinary academics and professionals in urban development with a desire to expand their knowledge. There is global interest in the educational activities of the AMS Institute and the MOOCs have a significant role in raising the international profile of the institute.

Graduation and thesis projects

Once again, in 2017 a wide variety of students from Wageningen University & Research and Delft University of Technology carried out their final thesis projects on AMS topics. We expect that the launch of MSc MADE will help attract even more students with interest and enthusiasm for the cross-over themes offered by AMS Institute.

MSc Courses

As interdisciplinary activities are a spearhead of the institute, AMS Institute actively provides research cases and is host to a variety of educational courses organized by Wageningen University & Research (WUR) and Delft University of Technology (TU Delft). Examples in 2017 included WUR's Urban Hydrometeorology course and TU Delft's Mid City studio on complex urban development by integrated architectural design.

Summer School: Making the Metropolis

The 'Making the Metropolis' Summer School, which explored interdisciplinary approaches in design engineering, attracted 70 graduate students and young professionals with 29 nationalities. This Summer School was initiated by AMS Institute in partnership with the Delft Deltas, Infrastructures & Mobility Initiative (DIMI), the International Forum on Urbanism (IFoU) and Delft University of Technology. In an intensive course setting, Summer School students explored approaches in metropolitan design engineering. While working in interdisciplinary and intercultural groups, the students challenged the world's globalization processes. How can we keep our cities connected and vital, and how can we simultaneously aim for a circular city? Participants used Haven-Stad Amsterdam as the test-bed, introducing the area as one of the major AMS Living Lab locations to co-develop strategies and sustainable metropolitan solutions with users while monitoring their implementation.

PhD: supporting courses and doctoral theses

The second AMS PhD Summer School entitled 'Urban Transitions: Reshaping Urban Districts' was held in July 2017, once again demonstrating and confirming the institute's role as conveyor of doctoral education. 18 participants attended this intensive AMS course, which was developed in close cooperation with Climate KIC, the University of Bologna and

Wageningen Institute for Environment and Climate Research. AMS Institute has a rising number of PhD-candidates and affiliated post-doc researchers. This group is supervised by our Principal Investigators in close cooperation with our Research Fellows and the Research & Valorization team.

Creating an AMS Learning Community

In 2017, the first foundations were laid for a formally organized student association at AMS Institute. In the coming year, the society will organize a wide variety of extra-curricular events. The first MSc MADE students will graduate in June 2019, creating a new group of urban professionals. AMS Institute likes to keep close contact with these professionals, as part of our network and as a source of potential clients and partners in the long term. For this an alumni network will be set up.





MSc MADE

A living lab way of learning

More than half the jobs we will do in 2030 have not yet been invented, and cannot even be predicted. The rapid pace of urbanization and technological changes is expected to cause significant changes in the way we work in the coming decade. Urban challenges - the transition to renewable energy resources, safeguarding the accessibility of city centres and the development of a healthy urban food system - demand smart and interdisciplinary solutions that are developed in close collaboration with both citizens and industry. In turn, these challenges require urban professionals who see opportunities in the most complex sustainable problems and are capable of shaping the context of their future jobs.

The start of the MSc MADE at AMS Institute last September saw the launch of the first two-year engineering program in the Netherlands that is specifically dedicated to the sustainability challenges of metropolitan areas. By offering MSc MADE as a joint degree program in Amsterdam, Wageningen University & Research and Delft University of Technology are expanding their joint research activities at AMS Institute. At the same time, they are developing a new transdisciplinary educational concept at the heart of Amsterdam, with its buzzing environment and specific urban challenges.

Amsterdam as educational Living Lab

Amsterdam has a unique position in the program as the living lab where students can dive into the actual, real-life challenges of the city. “MSc MADE is fully embedded into the metropolitan challenges that AMS Institute addresses, which in turn offers students a dynamic, authentic learning environment,” says Thomas Lans, coordinator of the Entrepreneurship courses in the program. The learning environment and the associated learning activities in the MSc MADE are continuously changing and adapting in terms of their content (what is important) as well as their social context (who is important). “This is rather unique if you compare it with a more traditional, predefined and discipline-based curriculum, where there is very little interaction with the outside world.”

Maurice Hartevelde, educational program director of the MSc MADE, explains that what makes MSc MADE an unrivalled program internationally


is its combination of the focus on the city and the close collaboration with partners. “Built on the solid foundation of AMS Institute, MSc MADE uniquely operates in an integrated physical, social and digital environment. The program trains students to explore answers by interrelating various metropolitan systems, and overlapping them to engineer smarter ways to facilitate the flows of the city.”

Transdisciplinary education

MSc MADE aims to provide progressive education in collaboration with AMS Institute and deliver excellent, interdisciplinary engineers who can deal with the complex challenges of cities. The students in MSc MADE (from a range of disciplinary backgrounds) are challenged to work together and make use of the combined expertise of the group.

Within the MSc MADE curriculum, students collaborate with both academic and industrial partners of AMS Institute. For instance, the network energy company Alliander. Marisca Zweistra from Alliander presented at the first course: “Even some time after my lecture, I was still receiving questions and remarks. Which confirmed my first impression of the MSc MADE students: they are a very dedicated group that is still actively thinking about the issues I raised with them.”

The ambition to develop parts of the curriculum in collaboration with other organizations in the city of Amsterdam gives the MSc MADE a unique transdisciplinary nature. Nono Leermakers, one of the MSc MADE students:



“I think it is important that students are able to cooperate with actors in other fields and bring the knowledge together in multidisciplinary projects which seamlessly and naturally fit our surroundings.”

Data Science

Students are not only required to respond flexibly to the different backgrounds and expertise in their own group, they are also immersed in specific knowledge fields that can help them to analyze metropolitan challenges and find new ways to design solutions. “The variety of topics addressed within the MSc MADE is very interesting, and encourages me to make new connections and discover other parts of the city,” explains Nono Leermakers.

Data science is one of the specific knowledge fields for all MSc MADE students. Maurice Harteveld: “The MSc MADE students bring together the city and its citizens. This is now truly possible thanks to geographic and human-generated (social) urban data, which links together the geo- and web-information systems which exist in our metropolis.” Students learn how to gather, analyze and represent geographical, mobility and social data to get a better understanding of the metropolis. This understanding of urban data makes them well-equipped to develop future-fit approaches for the city by means of big data.

Entrepreneurship

MSc MADE does not train students for one specific professional profile. On the contrary, the students in MADE are educated for jobs

that probably do not yet exist. Which is why students are continuously asked to define what their unique position in the city is. MSc MADE wants to challenge students to use their specific perspective on the city to take action. “Entrepreneurship is a vehicle for students to truly work on actionable ‘solutions’ for metropolitan challenges, and learn to continuously redefine the context they work in,” explains Thomas Lans.

The combination of this entrepreneurial and energetic attitude of the first cohort of MSc MADE students and the unique set of technological skills that are specifically aimed at the sustainability challenges of the city puts future MSc MADE graduates in a unique position: as the professionals who will shape and design future jobs and their impact on the city. Gwenhwyfar Spil, MSc MADE student: “It is important to challenge, educate and create awareness for students about the current problems in the world and give them tools to take action for a sustainable future.”

Data Platform

A hand with a black beaded bracelet and a gold ring points at a colorful, stylized city map on a screen. The map is composed of various colored blocks representing buildings and streets, with a dark background. The hand is positioned in the lower-left quadrant of the image, pointing towards the center of the map. The overall scene is illuminated with a warm, orange glow, suggesting a digital or futuristic environment.

Data is the catalyst needed to make the vision on smart cities a reality in a transparent and evidence-based (i.e. data-driven) manner. Urban data and urban data science methods are the essential link that enables the transformation of data into a valuable resource for the solutions that support

smart cities. This applies to any smart city solution where the interactions between data streams and their interpretation can lead to understanding and new discoveries about the life of the city. These in turn drive decisions and transformation within the metropolitan fabric.



Data Platform

Capitalizing on its broad research projects portfolio and network of partners, AMS Institute is developing infrastructural capabilities in the realms of urban data management with its Data Infrastructure and Stewardship Team (DIST) team, and in urban data science with its Data Science Enabling Technologies (DSET) team.

Data Infrastructure and Stewardship

The information and data collected during research projects supported by AMS Institute can be of great value for researchers, students, citizens, governmental parties and companies in metropolitan areas around the world. The diversity of disciplines, expertise, and partners call for processes and systems able to store, prepare, and secure data for reuse.

In 2017, in collaboration with De Waag Society, the AMS DataHub was designed and developed.

This system aims to manage the life-cycle of data, reports and other outcomes of AMS research and education. The DataHub is designed to extend its reach towards external data-systems, including data-related developments from the City of Amsterdam, and data relevant and applicable for the city, for instance from private parties.

Data Science Enabling Technologies (DSET)

The Data Science Enabling Technologies (DSET) activities consist of the design and development of novel computational methods and tools for social urban data acquisition, integration, visualization, and

exploratory analysis that capitalizes on time-varying and dynamic (big) urban datasets. DSET contributes to the impact of the Data Platform in concrete projects and issues that require a better understanding of urban dynamics, that concern citizens' everyday life, and support better planning decisions.

DSET activities are organized around two pillars: the Social Urban Data Lab, and the City Simulation Lab, both established in 2017.

Social Urban Data Lab (SUDL)

The goal of the Social Urban Data Lab (SUDL) is to support researchers, students, and city stakeholders by providing novel methods and tools for urban analytics and spatial data science. Through research, education, and outreach activities, SUDL aims to disseminate its innovative toolset, thereby helping a variety of audiences to better understand and predict the dynamics of cities and metropolitan regions.

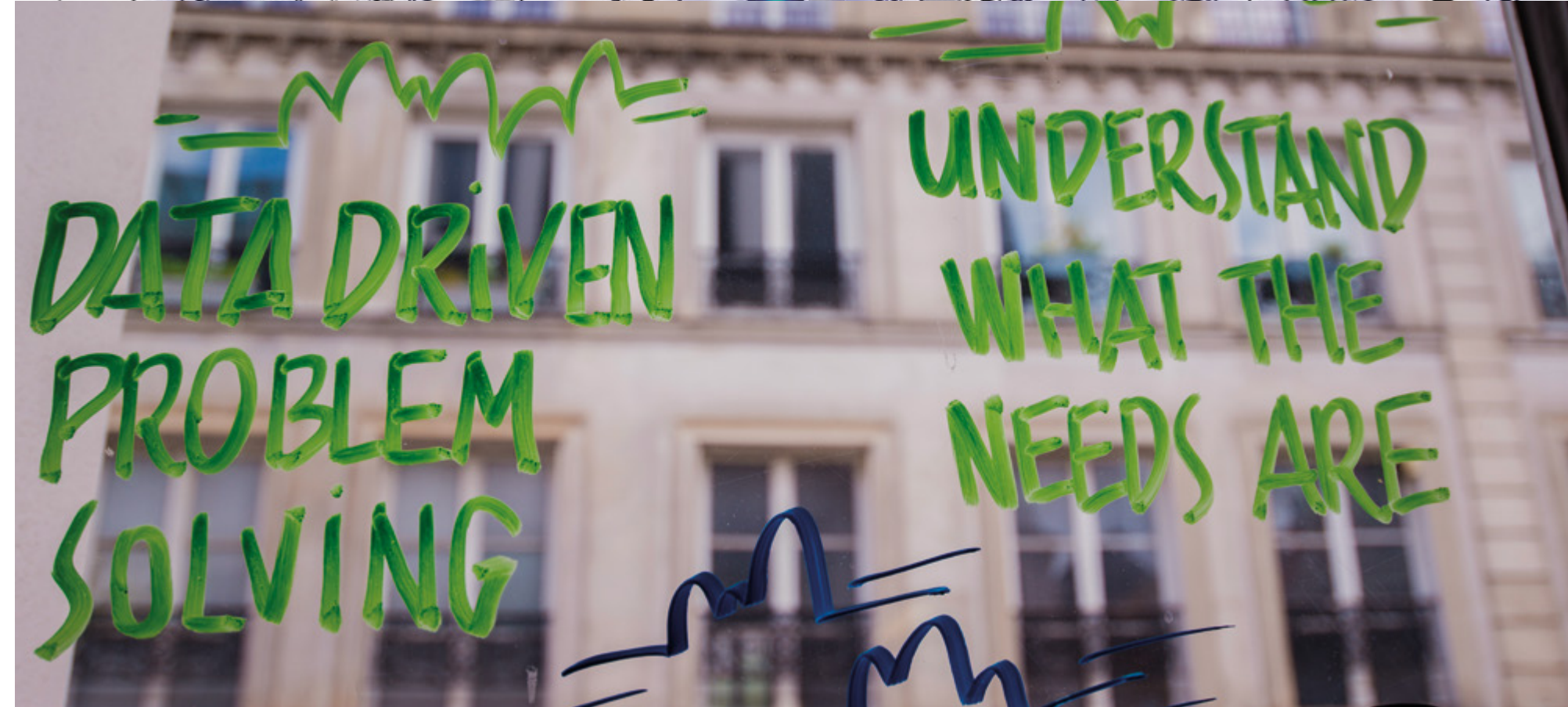
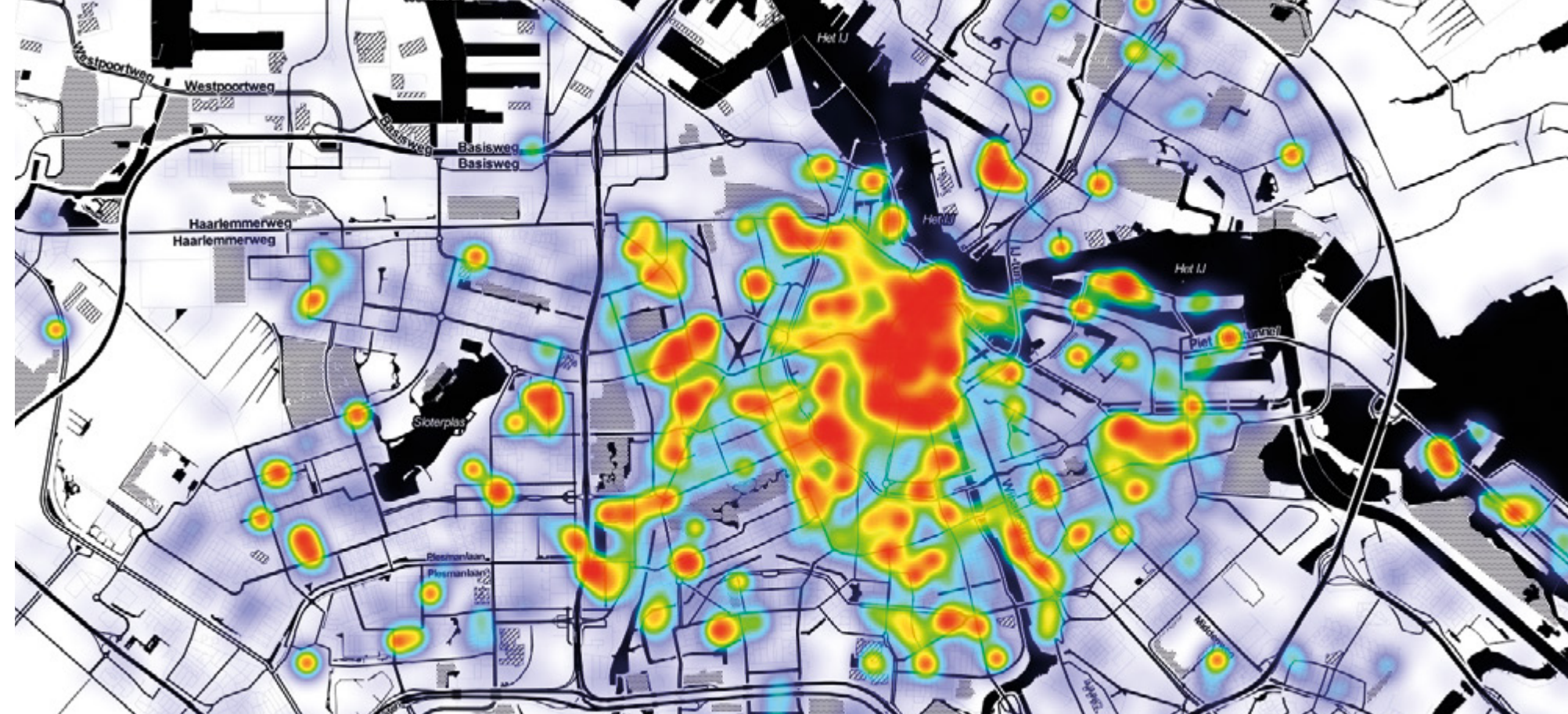
SocialGlass is a flagship project of SUDL and has been used in a number of real-world experiments and scientific studies. These include King's Day and Europride 2017. SUDL initiated a variety of projects in the realm of crowd management (e.g. EIT Digital

CrowdInsights), Energy Consumption (CODALoop), and human-enhanced conversational agents for urban data (AMS Social BOT).

In 2017, there were significant developments in making SocialGlass technology available to municipal authorities, in the form of a Platform-as-a-Service (PaaS) model, as well as concrete plans for distributing the system to wider audiences.

City Simulation Lab

The goal of the City Simulation Lab (CSL) is to provide researchers and students with a set of simulation techniques and tools to explore and simulate use patterns of the city. Urban dynamics exhibit many complex problems in which both the issue at hand and the potential solutions strongly depend on the perspectives of the stakeholders. Our current understanding and capacity to anticipate these complexities is limited. The City Simulator Lab will provide tools that increase our understanding of the multi-scale and multi-level processes leading to specific spatial-temporal patterns in urban systems and that improve our capacity to anticipate the resulting complex urban dynamic. As a case study the City Simulator Lab will focus on the expansion of tourism in Amsterdam and its spillover effects.



Research & Valorization

In 2017 AMS Institute continued to accelerate and build up its research portfolio, reaching an accumulated value of €40M. The core of the research is built around the three main themes: Circular City, Connected City, Vital City.



Circular City

A massive amount of people, information, water, materials, energy, food and waste flow through cities and city regions daily. With urban areas constantly changing in size and density, the accelerating advances in technology, and issues like climate change and resource scarcity becoming more pressing by the day, finding ways to make resource systems and infrastructures responsive, circular and agile is crucial for the cities of the future. The Circular City theme focuses on researching, designing and developing regenerative approaches to resource use in the city. This is important from an environmental, economic and social point of view, and pivotal for increasing the quality of life for all citizens in a sustainable way.

Using Amsterdam's metropolitan area as our field lab, AMS Institute is developing new approaches to circular, regenerative resource systems. Together with public and private partners, we work on multiple platforms and projects to develop and exchange knowledge and skills, test innovations and upscale them, to accelerate circular city development.

Within the *Circular City* theme, we distinguish three strongly interrelated subthemes. Each subtheme has its own research priorities, based on the interplay between society, business and science:

Materials & buildings

Cities contain a wealth of materials that can be reused effectively. Regenerative design and use have to be anticipated for both new construction and renovation. Key research questions are: how can we map and reuse materials temporarily stored in built constructions? And how can we streamline the supply, demand and conversion processes of materials, components and buildings?

Nutrients recovery from (waste)water streams

To assure food and drinking water security in cities, innovative concepts for water treatment are essential. Moreover, water treatment processes and infrastructures can play a role in renewable energy, materials and chemicals production. The key research question is: how can we reutilize nutrients, materials and energy better in water flows, and in the integration of waste water treatment systems, on different scales in urban regions?

Renewable energy systems

The transition to renewable energy sources requires smart infrastructures that are able to deal with increased variability in consumption, storage and production at multiple scales. Cities raise opportunities and challenges in this respect, for instance due to population diversity and density. Key research questions are: how can the transition be made to renewable energy sources in cities, bearing in mind that increased variability? And what are the infrastructural and spatial implications?



"The decision of the Dutch government to stop the extraction of natural gas from the Groningen gas field has increased the urgency for the successful roll-out of sustainable heating systems. However, not all stakeholders support this change. In the 'Designing innovative and socially responsible heating systems' project, we investigate how to improve acceptability and establish the costs and benefits of different sustainable heating systems."

Niek Mouter

Project Lead Designing innovative and socially responsible heating systems, TU Delft

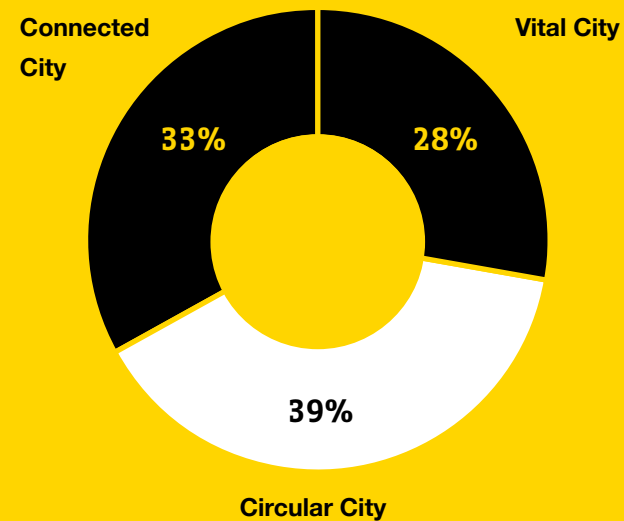
Highlighted Projects

Circular City

In 2017 the Circular City research program encompassed 24 projects, organized in cooperation with 90 partners and a total value of €15.2M. Below a selection of projects within the Circular City theme.

Total research portfolio

(in #projects)



The urban water transport infrastructure as enabler for resource recovery: New Urban Water Transport Systems (NUWTS)

Recovery of resources in the urban environment becomes increasingly important to safeguard continuous access for everyone to limited yet essential resources. Resource recovery should be included as an important design parameter in the transition towards circular urban environments. This project focusses on an integrated assessment of how the urban water transport infrastructure can become a key enabler for resource recovery.

Project lead: Prof. Jan Peter van der Hoek (Waternet, TU Delft, AMS Institute)

Partners: TU Delft, Waternet, AMS, Evides, Brabant Water, Waterschap De Dommel, RoyalHaskoningDHV, WML

Project Budget: €334K

Project Duration: 24 months

Designing innovative and socially responsible heating systems

Innovative heating systems that are more sustainable will help districts and neighbourhoods reduce their carbon footprint. However, these technologies are not always acceptable to end-users or investors. This research aims to improve acceptance of heating systems by explicitly addressing fairness and societal valuation during the design of such socio-technical systems.

Project Lead: Niek Mouter (TU Delft)

Partners: TU Delft, RUG, Twynstra Gudde, Decisio, Ecorys, Inventum, BodemenergieNL, Platform Geothermie, EnNatuurlijk, Eigen Haard, Nuon, Eneco WarmteKoude, Waternet

Total project budget: €835K

Project duration: 48 months

REPAiR: Resource Management in Peri-urban Areas: going beyond urban metabolism

A shift towards a more circular economy is crucial to achieve more sustainable and inclusive growth. To help local and regional authorities reduce waste flows in peri-urban areas, REPAiR is developing and implementing a GDSE (geo-design decision support environment) in living labs in six metropolitan areas in Europe, including the Amsterdam Metropolitan Area. By promoting the use of waste as resource, the GDSE assists in creating integrated, place-based spatial development strategies.

Project lead: Prof. Arjan van Timmeren (AMS Institute, TU Delft)

Partners: Delta, GeoCol, Municipality of Haarlemmermeer, City of Amsterdam, Ghent University, DiARC UNINA, Naples Federico II, HafenCity University Hamburg, Institute for Regional Studies CERS of HAS, MTA KRTR, Institute of Geography and Spatial Organization Polish Academy of Sciences, Europe Joint Research Centre (JRC), BLOKOM Nonprofit Ltd, Gertz Gutsche Rügenapp Stadtentwicklung und Mobilität GbR, OVAM - Public Waste Agency of Flanders, Campania Regional Authority, Pheno horizon, Bauer Umwelt GmbH, IVAGO Flandres, Stadtreinigung Hamburg.

Research lead: TU Delft

Total project budget: €5.1M

Duration: 48 months

"The NUWTS project – which involves regional water authorities, drinking water companies, municipalities and an engineering consultancy – researches new urban water transport systems as enablers for resource recovery in the urban environment. This is crucial for Amsterdam to develop into a competitive and sustainable European metropolis. It's great to see the interplay of all the participants."

Jan Peter van der Hoek

Chief Innovation Officer at Waternet & Principal Investigator AMS Institute





Connected City

As the number of people living and working in Amsterdam's metropolitan area continues to rise, so do issues of congestion, crowded streets, misalignment of public transport's supply and demand, and air pollution. However, being able to move from A to B efficiently, safely and with no to low negative environmental impact, is essential for a prosperous, healthy and fair urban environment. Setting out to connect the area's people, goods and data both physically and digitally, this theme develops solid solutions for an accessible, seamless, efficient, inclusive and empowering connected city, that eliminates pollution and diminishes negative environmental impact.

Within the *Connected City* theme, AMS Institute focuses on three subthemes: *Urban Mobility*, *Citizen Sensing & Empowerment*, and *Intelligent Urban Infrastructures*.

Urban Mobility

Concentrating on moving through the city, the subtheme urban mobility explores concepts of user-driven Mobility as a Service (MaaS). It researches active mode travelling, Intelligent Transport Systems (ITS) and autonomous vehicles, and brings together mobility data to develop tools for better insights into the (re)design of public space and a better use of existing transport infrastructure.

Citizen Sensing & Empowerment

The participation of citizens in the process of identifying and solving urban problems is essential for the development of an adaptive and resilient city. Besides diminishing the distance between research and the needs of the city, it accelerates the process of generating social impact. Citizen sensing & empowerment works on innovative ways for enabling the participation of citizens in research projects.

Intelligent Urban Infrastructures

How can high-scale, urban sensor and actuator networks be designed that work together intelligently, are able to process complex data, and produce real-time, cross-analyses insights at city scale? By connecting data from different domains and scales, this subtheme focuses on the development of sensing systems and big-data analytics for city-scale deployments, infrastructures and large-scale applications.

"The Noord/Zuidlijn is a unique transport project that will change mobility patterns and public spaces within the city and the region. Amsterdam is eager to understand the implications and learn from them. The cooperation between science and practice in the research project is an excellent opportunity to develop new knowledge, contribute to innovation and improve policy making."

Barry Ubbels

Senior Researcher Mobility, City of Amsterdam



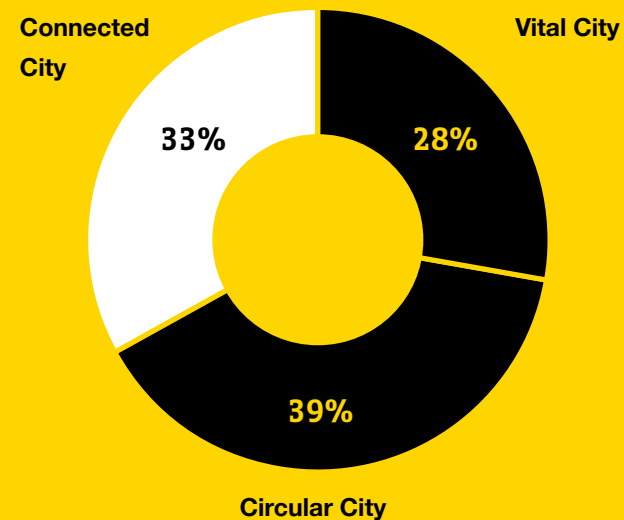
Highlighted Projects

Connected City

In 2017 the Connected City research program encompassed 20 projects, organized in cooperation with 80 partners with a total value of €18,4M. Below a selection of projects within the Connected City theme.

Total research portfolio

(in #projects)



Noord/Zuidlijn

In 2018 the first metro trains will go into operation on the new Noord/Zuidlijn metro line under the centre of Amsterdam. What is the impact of such a large-scale new infrastructure for the Amsterdam Metropolitan Area? The Noord/Zuidlijn offers a unique opportunity to investigate the effects on mobility patterns and behavior, socio-economic and spatial aspects and quality of life by comparing the situation before and after it goes into operation.

Project Lead: Niels van Oort (TU Delft)

Partners: City of Amsterdam, Vervoerregio Amsterdam, University of Amsterdam (UvA), Vrije Universiteit Amsterdam (VU), Centrum Wiskunde & Informatica (CWI)

Total Project Budget: €1.9M

Project duration: 48 months

Living Urban Office (LUO)

Mobile technology permits people to perform knowledge work activities from wherever they are; be it a corporate office flex-desk, a co-working environment, a café, train, park or home. With more people becoming 'knowledge work nomads', this raises questions about the purpose and nature of offices as places in a city when the city becomes the office itself. Students and researchers explored possibilities and presented innovative prototypes in the AMS office environment.

Project Lead: Tomasz Jaskiewicz (TU Delft)

Partners: TU Delft (Faculty of Industrial Design) and participation of Office Vitae, Ahrend, AKKA, Mapic, Makerversity, A-Lab, INFO.NL

Total Project Budget: €178K

Project duration: 6 months

Robots among Humans

In the near future mobile robots, autonomous vehicles and autonomous boats will co-exist with humans in the urban public space. This research will provide algorithms and solutions that allow a mobile robot to safely navigate and coordinate with other robots and humans. Control and communication methods that grant high performance and demonstrate safe motion through changing, dynamic, and crowded environments are therefore required. An important area of application will be for autonomous boats for transportation ('Roboats') to navigate the crowded canals of Amsterdam and water-based cities worldwide.

Project Lead: Javier Alonso-Mora (TU Delft)

Partners: Waternet (this project is closely linked with the Roboat project)

Total Project Budget: €310K

Project duration: 36 months



My-TRAC@AMS

How do people move to and from the train station? This research project investigates and surveys the travelling behavior of people before leaving and after arriving and gaining actionable insights into Amsterdam's urban mobility problems. The main objective of the My-TRAC (My TRAVel Companion) project is to develop an advanced intelligent app for train travellers that supports them in making smarter travel choices to maximize efficiency and comfort in their travel experience. The project also aims to create an analytical platform for public transport operators, providing them with aggregated anonymized behavioral data.

Project leads: Prof. Hans van Lint (TU Delft & AMS Institute), Niels van Oort (TU Delft), Viktoriya Degeler (TU Delft)

Partners: NS, GVB and European partners of the My-TRAC consortium

Total Project Budget: €1.1M

Project duration: 36 months

AMS Social Bots

The AMS Social Bots project will design, develop, and test a novel solution for citizens' interaction and awareness during city-scale events, by means of social conversational agents (social chat bots). The Social Bot Engine will be deployed during at least four events, occurring within the project timespan and taking place in Amsterdam and Trento.

Project lead: Alessandro Bozzon (AMS Institute, TU Delft)

Partners: Delft University of Technology, Politecnico di Milano, KPN, Telecom Italia, Fluxedo

Total project budget: €551K

Project duration: 12 months

Citizens as Sensors (Het Schone Waterexperiment)

In this project, over 200 Amsterdammers measured the quality of surface water in Amsterdam, using a water box for a number of small experiments that could be conducted independently. The project monitored the water quality throughout Amsterdam, and gaged the attitude of Amsterdam citizens to surface water. As a result, most participants increased their knowledge and some changed their use of Amsterdam surface water.

Project lead: Suzanne van der Meulen (Deltares)

Partners: Wageningen Environmental Research (Alterra), Deltares, KWR, Waternet, Pavel van Houten

Total project budget: €213K

Project duration: 10 months

"Every morning my neighbours and I would go for a swim in the IJ river and I would do my experiments. That waterbox really made me feel like a young explorer! It's great to participate in scientific research and contribute to knowledge. It gives you the idea that you're doing something meaningful and makes you stronger."

Marjolein Padmos
Participant 'Het Schone Waterexperiment'



One year of Roboat

Exploring possible use cases and small-scale model testing

Imagine autonomous vessels sailing through the city of Amsterdam, transporting people and goods, assembling to create on-demand bridges and sampling water to assess its quality. Exploring the rich set of possibilities that Amsterdam's waterways offer, Roboat ushers in a new chapter in the international push for autonomous vehicles, setting out to deploy the world's first autonomous fleet for moving people, moving goods, dynamic infrastructure and environmental sensing.

The Roboat project aims to provide the city of Amsterdam with a reconfigurable framework of mobility services and infrastructures: multifunctional vehicles, capable of transporting goods and people, moving independently, but also combining with each other to create bridges and platforms.

Roboat is a five-year program conducted by four multidisciplinary teams: Urban Design, Robotics, Urban Analytics and Environmental Sensing. Below are some of the insights drawn from the first year of research.

Urban Design: Towards possible use cases

The team, led by Principal Investigator Dennis Frenchman, developed design solutions for three areas of life in Amsterdam: waste, food, and transportation. Waste solutions focus on how to use autonomous, water-based trash collection to alleviate the current problems in central Amsterdam from the accumulation of rubbish on the streets and the noise pollution and congestion caused by truck collection. In the area of food solutions, researchers

proposed a system of floating markets that could supplement the robust network of markets already present in Amsterdam, highlighting the potential to tap into the greater region's food production. The research also discussed the options for water-based distribution to cafés, restaurants, and bars. Transport solutions show how autonomous water taxis might help reduce congestion for both commuters and visitors.

Robotics: Towards efficiency and controllability

In developing the first prototypes, the Robotics research team of Principal Investigator Daniela Rus focused on technical design and autonomous robotics techniques within the following themes: hull design, propulsion system, dimensional units, system modularity, and re-configurability. The main research

question in 2017 was to determine how an autonomous boat should be technically equipped to move around in the most efficient, safe and controllable way.

Experiments show that a propeller-driven boat achieves higher controllability and power efficiency than a jet-driven boat. Regarding the latching mechanism, the research team searched for the most stable latching mechanism for autonomous boats, considering the water disturbance. This latching mechanism is key for use cases involving people and goods. Roboat is intended to be more than a series of individual self-driving boats, but rather a complex, dynamic network of pixels that can combine and recombine. To achieve this, a strong latching mechanism must be designed and implemented. The team has also investigated how this latching mechanism might

be incorporated into the canal edge. This work is ongoing and will be developed in tandem with use-case development.

Another principal research question within the first year of Roboat has been how to design a suitable feedback control system for autonomous navigation, subject to stability and power constraints. In other words: what system do we need to make sure the boats drive autonomously? To answer this question, a dynamic model and implementation of model predictive controller (MPC) was identified. This was tested during indoor and outdoor experiments. This is still work in progress, but we can say the Roboat can now successfully

(autonomously) path-follow along pre-selected routes – sinusoidal and rectangular curves.

Urban Analytics: Interfacing with the city

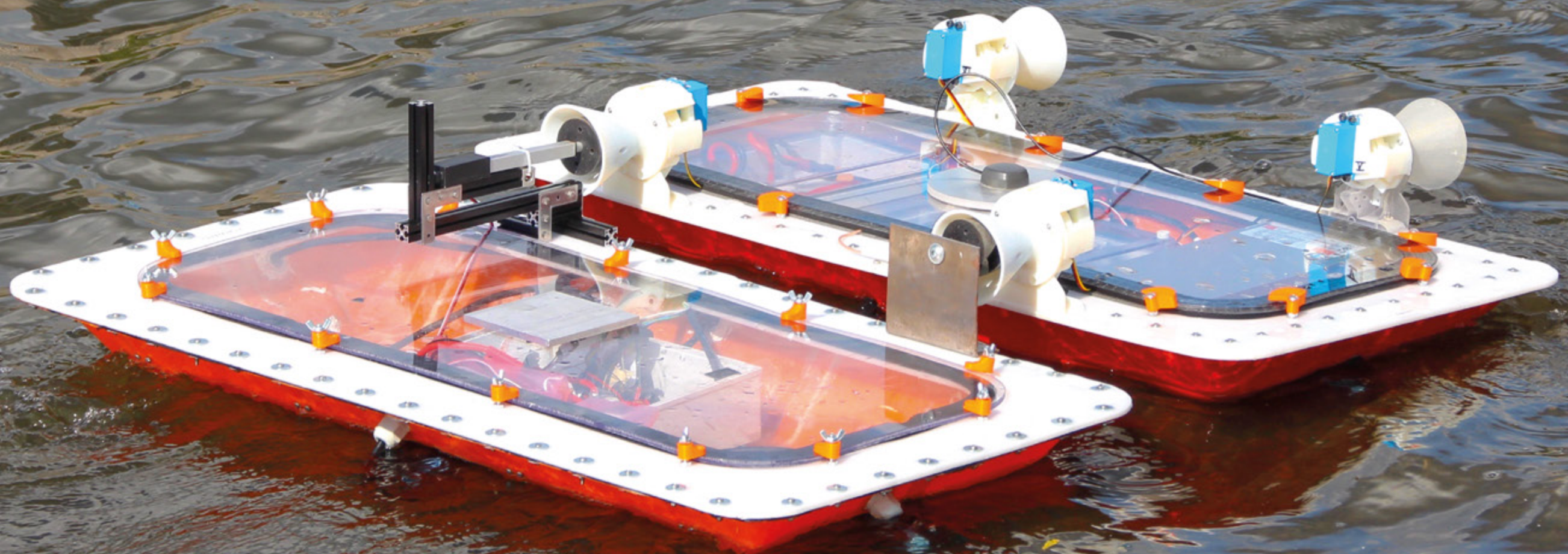
Principal Investigator Carlo Ratti and his team at the Senseable City Lab worked on inquiries related to the possible implementations of Roboat in the city network of Amsterdam, focusing on: the nature of Amsterdam's canal network, how autonomous boats could contribute to the transport portfolio of the city, whether the boats are suitable for transporting people and goods, what other service opportunities Roboat could fill, and how they interface with the city.

The research demonstrates that autonomous boats have great potential to become part of Amsterdam's transport network as well as create innovative urban services in the city. The research team at the Senseable City Lab frame the work in relation to the overall goals of the Roboat project: to create a dynamic new infrastructure for the city of Amsterdam while tackling the novel problem of autonomy in urban waters.

Environmental Sensing: Data on water quality

In September 2017, in partnership with Waternet, Andrew Whittle's team deployed a boat with a series of water quality sensors along

three routes in Amsterdam's canals. The goal was to determine a baseline for water quality in Amsterdam. The three routes were selected by Waternet because of the range of environments. In the central canal loop, the considerations are spatial gradients and local emissions. The south-west Amsterdam route consists of isolated parts of the system, while the Bijlmer route has brackish water discharges from deep polders as well as discharge from a sewage treatment plant. Moving into the second year, the goal is to design sensor packages for Roboat and select the key water quality parameters.





Vital City

Amsterdam's metropolitan area acts as a magnet for business and people alike. As the Dutch economy is growing, investments, employment rates and Amsterdam's popularity among start-ups, visitors and new residents has been rapidly increasing. Although very welcome, these intensified urban dynamics pose huge challenges for the city's vitality.

A vital city needs a healthy and active population. A vital city is resilient to climate change and offers its citizens a sustainable food system. These three topics are at the heart of the AMS *Vital City* theme.

Healthy urban living

In our search for healthy urban living, we investigate how some of the most pressing health challenges – obesity, mental health issues, physical inactivity and the needs of an ageing population – can be influenced by the way we design the city, and more specifically its public spaces. This is an important focus topic for the Vital City Research program, run in close cooperation with our French partners La Fabrique de la Cité and Arup.

Urban climate resilience

This research program looks at how the urban climate system functions and how ecosystem services can support adaptation to change. We deal with typical urban issues like exposure to air pollution by traffic emissions, the urban heat island phenomenon, and the storage of precipitation.

The sustainable urban food system

The sustainable urban food system research program was triggered by the many initiatives in this area by residents and businesses, and by the Urban Food Policy Pact which was signed by 129 mayors in Milan in 2016. We aim to find solutions for new types of fresh food production, improved last mile logistics, reductions in the amount of food waste and design of metropolitan food systems.

"In partnership with Arup, we opted for the perspective of sport and physical activity in public space. The project brings together some fifty international experts (researchers, architects, designers, sports professionals, artists, associations, technicians and elected officials) in Plaine Commune and Amsterdam. The common goal is to improve the design of public spaces and to develop assessment tools."

Cécile Maisonneuve
Executive, La Fabrique de la Cité



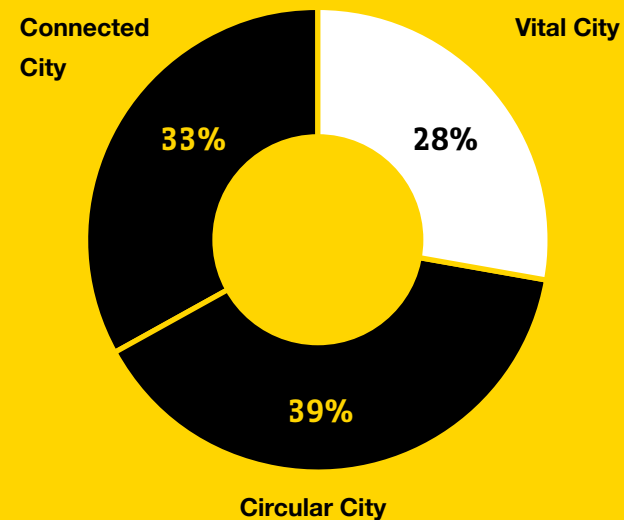
Highlighted Projects

Vital City

In 2017 the Vital City research program encompassed 17 projects, organized in cooperation with 44 partners with a total value of €6.4M. Below a selection of projects within the Vital City theme.

Total research portfolio

(in #projects)



Urban Pulse II

This is the follow-up research on the 2015 Urban Pulse project. A novel approach to ‘urban metabolism’ and flows within the city, in which researchers used a combination of methods and technologies informed by local residents, knowledge and industry partners. Urban Pulse II will focus on surface water quality, water availability and energy flows.

Project lead: Nora B. Sutton, Wageningen University & Research (ETE)

Partners: Wageningen University & Research, TU Delft, Deltares

Total project budget: €1.4M

Duration: 60 months

Evidence-Based Food System Design

The food system of the Amsterdam Metropolitan Area interfaces with many topics including economic development, health, mobility, quality of life, attractiveness of the region, and sustainability. This project addresses the current lack of insight and vision on the larger metropolitan food system by unlocking/disclosing food system data. The outcomes provide spatial and logistic scenarios and solutions for a healthier and more sustainable food system in the Amsterdam Metropolitan Area.

Project Lead: Dirk Wascher, WENR

Partners: WENR, Amsterdam University of Applied Sciences, Aeres University of Applied Sciences, Vervoerregio Amsterdam, Municipality of Zaanstad, Municipality of Almere, Bedrijvencoalitie Food Center Amsterdam, Schiphol Area Development Corporation (SADC), Port of Amsterdam

Total Project Budget: €300K

Project duration: 12 months

The Logistics and Circular Economy (LogiCE) community

The transport and logistics sector in the Netherlands can play a big role in achieving a circular economy: a system in which waste is re-used as a resource, with less environmental impact. To fulfill this role, logistics providers must possess knowledge of and practical experience in the circular economy. They can achieve this via a community of practice which is created by LogiCE.

Project lead: Prof. Jacqueline Bloemhof-Ruwaard

Partners: Wageningen University & Research, Amsterdam University of Applied Sciences, Het Groene Brein, FBR/ The Source Shakers, Port of Amsterdam, SADC

Research lead: Jacqueline Bloemhof

Total project budget: €664K

Duration: 24 months



"The growing appetite of cities for food is one of the greatest challenges for the future. Which is exactly why we've set up this research at Flevo Campus in Almere as a Living Lab. The Feeding City project collects and visualizes regional data on food production, distribution and consumption. The graphics enable us to uncover patterns and relations that are not easy to discern through rough data only."

Sigrid Wertheim

Professor Food and Healthy Living, Aeres University of Applied Sciences

The Future of Public Space, Part I – Physical Activity

In 2016 AMS Institute and La Fabrique de la Cité committed to a three-year research partnership to investigate the relationship between public space and the well-being of urban dwellers. In 2017 we focused on how to design public spaces that support opportunities for physical activity. Through sports, play and mobility, physical activity can improve health outcomes and contribute to increased levels of social cohesion and wellbeing.

Project lead: Natasha Sena (AMS Institute)

Partners: La Fabrique de la Cité, Arup, City of Amsterdam – The Moving City, Wageningen University & Research, TU Delft, Kompan, Plaine Commune, Vinci Immobilier, Charbonneau Consultants, William Gasparini, Track, New Citizen Factory, Geoff Thompson, The Pokemon Crew.

Total project budget: €203K

Duration: 36 months

City Rhythm

The City Rhythm study explores the potential of using rhythm analyses for enhancing social safety in neighborhoods in the Netherlands. The project studies rhythm in the physical domain and in the data domain, by using 9 case studies. The aim is to apply rhythm and rhythm analysis as a new approach for urban policy making.

Project lead: Prof. Caroline Nevejan

Partners: TU Delft, Wageningen University & Research, 6 Dutch cities – Amsterdam, The Hague, Rotterdam, Zaanstad, Zoetermeer, Helmond, Amsterdam Health and Technology Institute (ahti), Delph Business Intelligence and Blooming Data.

Total project budget: 199K

Duration: 15 months

Healing Garden

As part of AMS' 'The Feeding City' research program at Flevo Campus Almere, we are testing the extent to which gardening can help cancer patients in meeting the norms of physical activity and fruit and vegetable intake. And to what extent gardening in a group can function as a form of social support. This is a pilot research program to examine the physical and mental effects gardening can have on recovering cancer patients.

Project lead: Esther Veen, Rural Sociology Group Wageningen University & Research

Partners: Wageningen University & Research, Parkhuys Almere, Flevo Campus, Donkergroen
Total project budget: €138K

Duration: 6 months





AMS Science for the City

In Pakhuis de Zwijger

How can big data, prototyping, and science-based innovation help to solve the complex challenges facing the Amsterdam metropolis? To answer these questions we teamed up with Pakhuis de Zwijger and put together a program on metropolitan development and innovation. We developed a series of 6 events designed not just for a professional audience, but also to bring research out of the ivory tower to reach and interact with the people of Amsterdam.

Upcoming and established national and international urban professionals from AMS Institute, our Principal Investigators and academic and industry partners presented the latest research and practical solutions on urban themes including water, energy, waste, food, data and mobility.

#1 Improving cities through social media

How can Twitter and Instagram help make overcrowded cities more liveable?

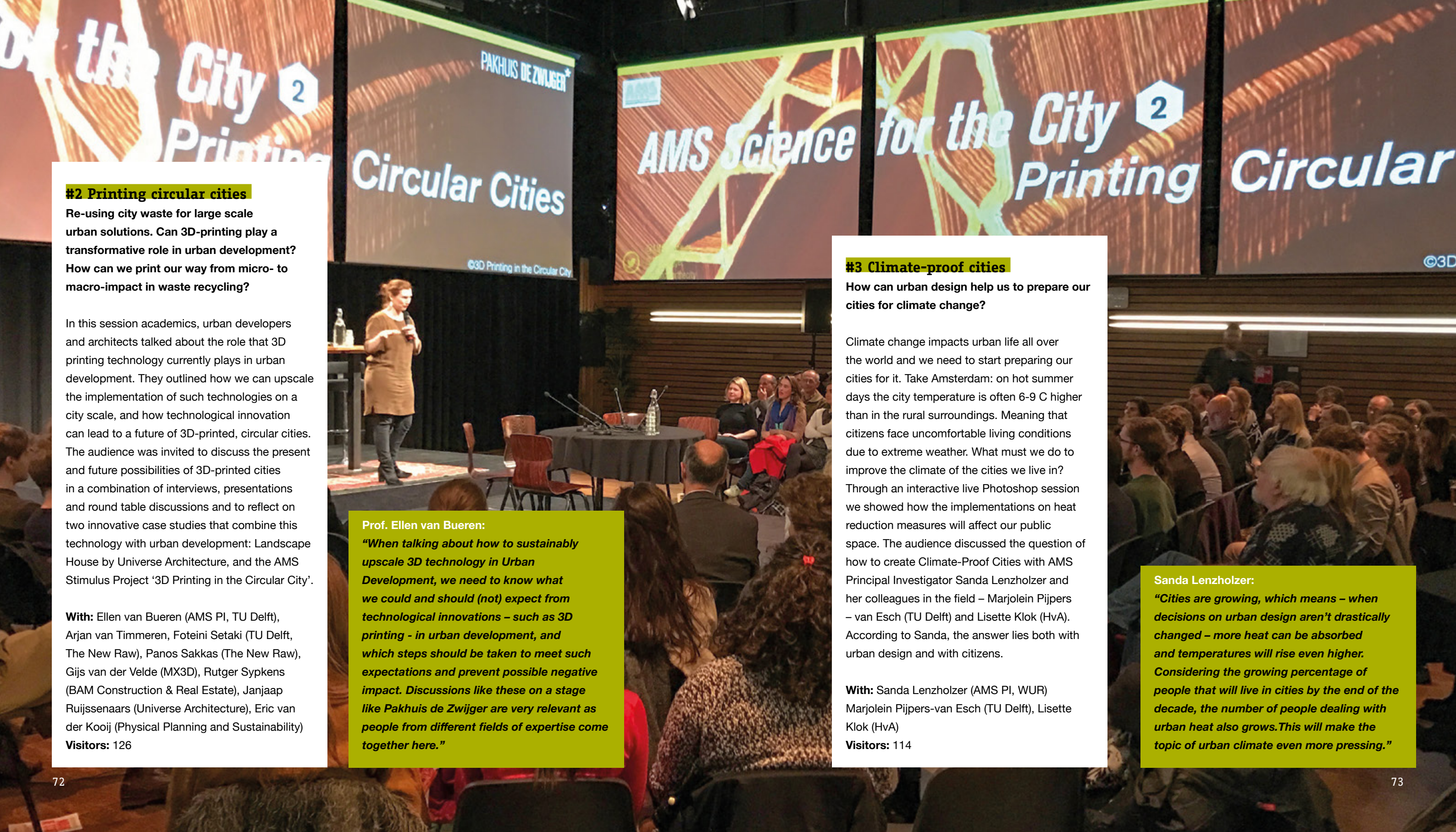
Two of AMS' data talents, Alessandro Bozzon and Achilleas Psyllidis, shared their work and insights on how urban data science can help us better understand and organize city environments. Answering questions such as: how can we sustain quality of life and a liveable urban environment in increasingly overcrowded cities? And what is the role of scientific research in solving these issues? Specifically they showed how social data (for instance from Twitter and Instagram) can help cities and citizens enhance their ability to sense, interpret, and understand city environments.

With: Alessandro Bozzon (Program Manager Data Platform, AMS Institute) and Achilleas Psyllidis (Research Fellow AMS Institute)

Visitors: 82

Alessandro Bozzon:

"With our work, and projects like SocialGlass, we want to provide methods and tools rooted in computer science to help better understanding cities and their citizens. With inclusivity, privacy, and accessibility as key operating principles."



#2 Printing circular cities

Re-using city waste for large scale urban solutions. Can 3D-printing play a transformative role in urban development? How can we print our way from micro- to macro-impact in waste recycling?

In this session academics, urban developers and architects talked about the role that 3D printing technology currently plays in urban development. They outlined how we can upscale the implementation of such technologies on a city scale, and how technological innovation can lead to a future of 3D-printed, circular cities. The audience was invited to discuss the present and future possibilities of 3D-printed cities in a combination of interviews, presentations and round table discussions and to reflect on two innovative case studies that combine this technology with urban development: Landscape House by Universe Architecture, and the AMS Stimulus Project '3D Printing in the Circular City'.

With: Ellen van Bueren (AMS PI, TU Delft), Arjan van Timmeren, Foteini Setaki (TU Delft, The New Raw), Panos Sakkas (The New Raw), Gijs van der Velde (MX3D), Rutger Sypkens (BAM Construction & Real Estate), Janjaap Ruijsenaars (Universe Architecture), Eric van der Kooij (Physical Planning and Sustainability)

Visitors: 126

PAKHUIS DE ZWIJGER
Circular Cities
©3D Printing in the Circular City

AMS
AMS Science
©3D

for the City
Printing
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Circular
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Prof. Ellen van Bueren:

"When talking about how to sustainably upscale 3D technology in Urban Development, we need to know what we could and should (not) expect from technological innovations – such as 3D printing - in urban development, and which steps should be taken to meet such expectations and prevent possible negative impact. Discussions like these on a stage like Pakhuis de Zwijger are very relevant as people from different fields of expertise come together here."

#3 Climate-proof cities

How can urban design help us to prepare our cities for climate change?

Climate change impacts urban life all over the world and we need to start preparing our cities for it. Take Amsterdam: on hot summer days the city temperature is often 6-9 C higher than in the rural surroundings. Meaning that citizens face uncomfortable living conditions due to extreme weather. What must we do to improve the climate of the cities we live in? Through an interactive live Photoshop session we showed how the implementations on heat reduction measures will affect our public space. The audience discussed the question of how to create Climate-Proof Cities with AMS Principal Investigator Sanda Lenzholzer and her colleagues in the field – Marjolein Pijpers – van Esch (TU Delft) and Lisette Klok (HvA). According to Sanda, the answer lies both with urban design and with citizens.

With: Sanda Lenzholzer (AMS PI, WUR) Marjolein Pijpers-van Esch (TU Delft), Lisette Klok (HvA)

Visitors: 114



Sanda Lenzholzer:

"Cities are growing, which means – when decisions on urban design aren't drastically changed – more heat can be absorbed and temperatures will rise even higher. Considering the growing percentage of people that will live in cities by the end of the decade, the number of people dealing with urban heat also grows. This will make the topic of urban climate even more pressing."

#4 Mixing mobility

How can we optimize urban mobility in the most sustainable way?

Car-free city centers, bicycle sharing initiatives and responsive public transport are topics that are widely debated. Against this background we explored the possibilities of combining different means of transport to create an efficient, space-friendly and environmentally sound way to move through the city. Regarding travel times within cities, some estimates predict that travel time will double by the year 2050. AMS Principal Investigator Prof. Serge Hoogendoorn and Assistant Professor Niels van Oort believe that the answer to such congestion lies in creating an optimal mobility mix and new patterns. Which steps should be taken to achieve the ideal mobility cocktail? And how can existing plans and interventions in the city be incorporated into this approach? During this event, several PhD students shared our research and insights on different types of transport systems, different types of users and their patterns, passenger experience and choices, and the prospects for self-driving cars.

With: Prof. Serge Hoogendoorn (AMS PI, TU Delft), Niels van Oort (TU Delft)

PhD'ers TU Delft: Viktoriya Degeler, Maria Alonso Gonzalez, Danique Ton, Paul van Erp Sascha Hoogendoorn-Lanser (KiM), Robert Jan ter Kuile (GVB), Julie van Heteren (Smart Mobility vervoersregio Amsterdam)

Visitors: 106



#5 Democracy by Design

How to safeguard human, social and democratic values within smart cities?

The risks and threats that smart technology poses to our democratic values, and how these can be included in smart decision-making processes were the main topic of this session lead by Gerd Kortuem (AMS PI, TU Delft), Merel Noorman (University of Maastricht) and experts from energy company Alliander. They discussed how we could design our smart cities in such a way that we can utilize the positive effects, without sacrificing our human, social and democratic values. The Transparent Charging Station developed by Elaad and Alliander was presented and used as a case. The charging station aims to make visible the invisible logic of algorithms when charging an electric vehicle.

With: Prof. Gerd Kortuem (AMS PI, TU Delft) Thijs Turel (Alliander), Merel Noorman (University of Maastricht)

Visitors: 74

#6 Energy & spatial changes

How does energy transition transform our cities and landscapes?

During AMS Science for the City #6 we dived into the dynamics of the sustainable energy transition and explored possible solutions for it. We also examined some of the spatial, social and technological issues that will affect the city of Amsterdam, its metropolitan area and the Netherlands as a whole. A wide range of experts from the energy sector presented their work and participated in round table discussions. The transition towards a low-carbon future is accelerating across all sectors in the Netherlands, but many questions are still to be answered. Are we pursuing the right strategies? How much space will the transition to sustainable energy require? Will we be able to accommodate this in our densely populated country? And what is the impact of this transition on the living environment in terms of spatial planning in urban and rural landscapes?

With: Sven Stremke (AMS PI, WUR), Prof. Andy van den Dobbelsteen (AMS PI, TU Delft), Pallas Agterberg (Alliander), Ewald Breunesse (Shell), Bob Mantel (City of Amsterdam), Pauline Westendorp (02025), Leonie van den Beuken (Port of Amsterdam), Marco Broekman (architect)

Visitors: 125



Board Report

The board of AMS Institute – founded on August 26, 2014 and registered at the Amsterdam Chamber of Commerce (KVK 854305610) – consists of four representatives from the two founding partners Delft University of Technology and Wageningen University & Research, each with two persons.

In 2017, the composition of the AMS Board was as follows:

- Paul Althuis, TU Delft
- Prof. Huub Rijnaarts, Wageningen University & Research
- Prof. Peter Russell, chairman, TU Delft
- Bram de Vos, Wageningen University & Research

The board was supported by Kenneth Heijns, executive secretary.

The Board met 12 times in 2017 to discuss and steer the general development and long-term strategy of AMS Institute. The Board made decisions on a broad range of topics including:

- Annual report 2016, quarterly reports 2017, budget and annual plan 2018.
- New projects and programs in 2017, including Citizens as Sensors, AMS Social Bots, Green Health Check, Evidence Based Food Systems, Effectenrapportage Noord-Zuidlijn, My-TRAC@AMS, Ultimate urban greenhouse, New Urban Water Transport Systems and the second year of the MIT Roboat program. Furthermore, AMS started the formal collaboration with the Flevo Campus and the Feeding the City program. The overall R&V-portfolio reached a grand total of 77 projects.

- Launch of the MSc Metropolitan Analysis, Design and Engineering program (MSc MADE) after accreditation was confirmed, August 2017.
- Internationalization and City Data strategy.
- Setting up an internal financial committee.
- Future housing facilities for the institute.

In Q4 2017 the AMS Board decided to adapt the management of the Institute to prepare it for the next phase of development. The AMS Board appointed Kenneth Heijns as interim Managing Director to succeed Business Director Kees Slingerland.

Scientific Advisory Committee

As a formal body, the AMS Scientific Advisory Committee (SAC) advises the AMS Board on the scientific strategy, including the R&V themes and the overall R&V portfolio. In 2017, the composition of the SAC was as follows:

- Prof. Michael Batty, Professor of Planning at University College London, Chair of the Centre for Advanced Spatial Analysis (CASA)
- Prof. Karel Luyben, Rector Magnificus of Delft University of Technology
- Cécile Maisonneuve, Chair of La Fabrique de la Cité
- Prof. Arthur Mol, Rector Magnificus and Vice President of Wageningen University & Research
- Prof. Dean Sarkis, Dean of MIT's School of Architecture and Planning (new appointment).

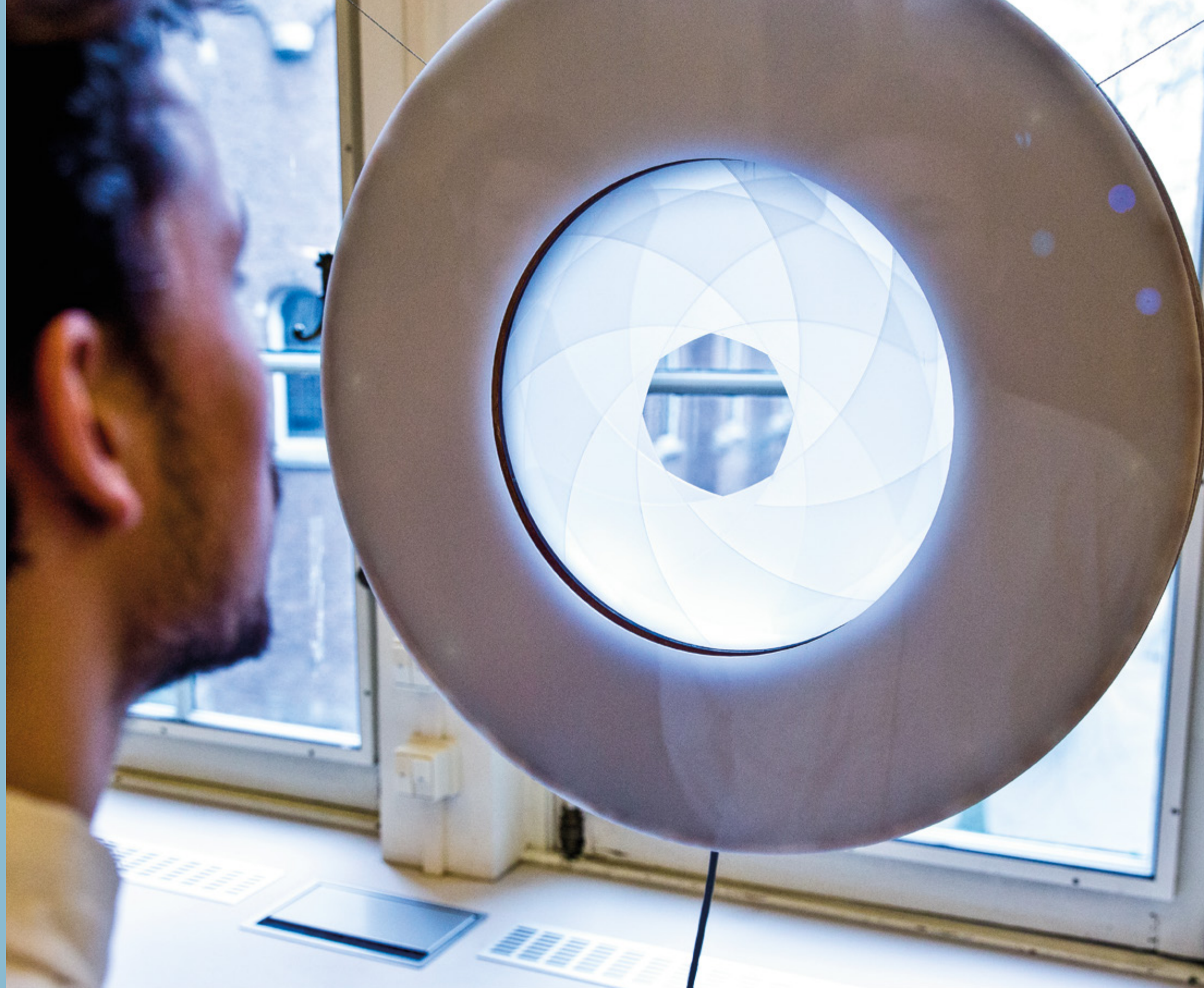


Image References

On the cover: Spatial model of activities and flows involved in the production, consumption, waste management and recycling of beverages in glass bottles within the Amsterdam Metropolitan Region.

Image by: REPAiR – Resource Management in peri-urban Areas (2017 – unpublished). Authors: A. Wandl, J. van der Leer and C. Bellstedt. Data sources: CBS and Kadaster Wijk- en Buurtkaart 2015; Bureau van Dijk, ORBIS - European Company Data (2016); OpenStreetMap.org contributors under CC BY-SA 2.0 license (2017). *This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 688920.*

P4: Panoramic aerial view of Amsterdam.
Picture by Stutterstock – photo-id: 596127962

P10 top: Arjan van Timmeren teaching MSc MADE students.
Picture by Maartje Meesterberends

P10 bottom: Stimulus Project 2017: Circular Supply Chain for the City.
Picture by AMS Institute

P12 top: AMS Summer Event 2017.
Picture by Jelmer Jeuring (JJ Perspectives)

P12 bottom: Person reading 'Urban Living Labs'.
Picture by Jelmer Jeuring (JJ Perspectives)

P15 top: Students of 'Making the Metropolis'.
Picture by Maurice Hartevelde (AMS Institute)

P15 bottom: Workshop at NUMA Paris, July 2017.
Picture by Maartje Meesterberends (AMS Institute)

P16 top: After signing the MoU with The Student Hotel.
Picture by The Student Hotel

P16 bottom: After signing the MoU with Metabolic.
Picture by Maud Kaan (AMS Institute)

P19: AMS Summer Event 2017.
Pictures by Jelmer Jeuring (JJ Perspectives)

P20, 21, 22 top: MSc MADE students during introduction day.
Picture by Maartje Meesterberends

P22 bottom: Making-off the AMS MOOCII.
Picture by AMS Institute

P25: Visiting University of Technology Sydney (UTS).
Picture by Nina Bohm (AMS Institute)

P26, 27: Student taking a picture.
Picture by Maurice Hartevelde (AMS Institute)

P28, 29: Students of 'Making the Metropolis'.
Picture by Maurice Hartevelde (AMS Institute)

P30, 31: Person putting a pin in a map of Amsterdam.
Picture by Jelmer Jeuring (JJ Perspectives)

P32: Map of Amsterdam showing individual trajectories of Amsterdam residents during SAIL 2015.
Image by SocialGlass

P35 top: Heat map depicting the intensity of Amsterdam residents' activities during the Amsterdam Light Festival (27/11/2014 – 18/01/2015), as inferred from Twitter data.
Image by SocialGlass

P35 bottom: Window with texts.
Picture by Maartje Meesterberends (AMS Institute)

P36,37: Living Urban Office (LUO) exhibition.
Picture by Guus Schoonewille

P38 top: Person sitting on 3D-printed XXX Bench.
Picture by The New Raw

P38 bottom: Scrap tubes, future resource?
Picture by Barta IV

P40: District heating system in Nijmegen.
Picture by Jorrit Jousberg

P45: Manhole cover Amsterdam.
Picture by Pixabay – photo-id: 1455059

P46: MX3D printing a steel bridge.
Picture by Olivier de Gruijter

P49: Noord/Zuidlijn
Picture by Gé Dubbelman

P52: Tram departing from Central Station.
Picture by Rob Dammers

P55: Waterbox for Het Schone Waterexperiment.
Picture by 'Het Schone Waterexperiment'

P56,57: Prepping the Roboat prototype for a test.
Picture by Maud Kaan (AMS Institute)

P58, 59: Roboat prototype testing the latching system.
Picture by Maud Kaan (AMS Institute)

P60 top: Plant under LED lighting.
Picture by AMS Institute

P60 bottom: Girl on a bike at Grote Markt Almere.
Picture by Jelmer Jeuring (JJ Perspectives)

P63 top: Physical activity in public space.
Picture by Bas Breeman (AMS Institute)

P63 bottom: Excursion with Future of Public Space Project.
Picture by AMS Institute

P66: Flevo Campus Radio.
Picture by Jelmer Jeuring (JJ Perspectives)

P69: Plants on a wall at De Ceuvel.
Picture by AMS Institute

P70, 71: Andy van den Dobbelsteen during AMS Science for the City #6.
Picture by Jelmer Jeuring (JJ Perspectives)

P72, 73: Opening of AMS Science for the City #2.
Picture by AMS Institute

P74, 75: Tom Kuipers during AMS Science for the City #4.
Picture by Andrii Degeler

P76: AMS Institute flag.
Picture by Julia Gunther

P79: Living Urban Office (LUO) exhibition at AMS Institute.
Picture by Guus Schoonewille

