

ORGANISING SMART CITY PROJECTS

Lessons from Amsterdam

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PREFACE

How can cities foster innovation to make themselves more attractive? In Amsterdam, the Amsterdam Smart City (ASC) platform is where smart city projects are born, run and shared. The ASC community brings together dozens of projects whose stakeholders range from private companies to public organisations and from knowledge partners to citizens. Some of these projects are successful; others fall short of their goals. But what actually makes projects tick? What is their added value? How can these partnerships be run effectively? How does Amsterdam's innovation ecosystem work? And what is ASC's role as a project accelerator? ASC was challenged by all of these questions.

In 2015, the idea to take up these questions at Amsterdam University of Applied Sciences (AUAS) was born. We had just founded our Smart City Entrepreneurial Lab as part of the University's newly established Entrepreneurship programme. This lab was set up as a collaboration between the chairs of the faculty of Technology (Inge Oskam of the Urban Technology research programme) and of Business & Economics (Willem van Winden of the Urban Management research programme). We sat together with staff from the ASC platform of which AUAS is a founding partner, and discussed what role our university could play in the smart city partnership. We decided to start with a thorough evaluation of projects to draw lessons to make future smart city projects more effective.

We did not start from scratch: so far, our university had been a partner in several smart city projects. At those times we provided technological knowledge or students for internships or thesis work. This time was different: the idea was to analyse the non-technological aspects of smart city projects (partnerships, business models, scaling potential), and derive lessons from a sample of projects.

We assembled a team of five researchers (besides Inge and Willem: Daniel van den Buuse, Egbert-Jan van Dijck, and Wieke Schrama), supported and facilitated by Margot Frederiks, the driving force behind the team. As a team, we systematically analysed 12 smart city projects in Amsterdam that we selected, together with the ASC platform, from three domains – energy, mobility and circular economy – four projects each. Some already closed, some were still in progress but well underway; some successful, others less so. We held lively discussions with numerous project leaders and other stakeholders, and the results are in this booklet. To our surprise, we found out that such systematic comparisons are very rare. The smart city is a domain where change is rapid. It is a world of experimentation, learning by doing, and moving from project to project.

With this booklet, we hope to provide valuable insights into the complexity of setting up and managing smart city projects and facilitate cross-learning between projects not only for Amsterdam, but also for other cities and actors that want to run smart city projects to make their cities better. We plan to extend this study and create a 'learning platform' on subjects that we found to be vital for the success of smart city projects: enabling smart partnerships, facilitating user involvement, disclosing data science potential and enabling upscaling.

The authors,
Amsterdam, 15 november 2016

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INTRODUCTION

Willem van Winden and Inge Oskam

Context

In recent years, city administrations around the world have been initiating, promoting and supporting technology projects, reflecting the belief of urban policymakers and other stakeholders that technology might help to make the city more liveable, sustainable, competitive and inclusive, and improve public services. A wide array of funding opportunities from the local, national and EU levels has become available. More than ever before, technology companies see the ‘smart city’ as a big and growing market, and act accordingly.

The wealth of funding opportunities, combined with growing interest from businesses, research institutes and all kinds of urban stakeholders has led to a proliferation of smart city technology projects. City administrations have set up institutional arrangements (platforms, specialised agencies) to promote experimentation, partnership formation, and knowledge sharing. Smart city platforms and projects are fascinating new arenas where urban stakeholders, public, private and civic, engage in coalitions and innovate together.

Often, smart city projects are framed as technology/R&D projects: testing and delivering promising new technological solutions for sustainability, pressing societal problems, better public spaces, or improved public services. But smart city technology, like any technology, is not neutral or independent: it intermingles, in complex ways, with people and organisations that use it, reject it, or embrace it. It has ethical implications, and sometimes unintended or undesired outcomes, and it creates conflicts of power and interests.

A smart city, smart city projects. What are we talking about?

There is no generally accepted definition of a smart city. In many definitions, the word 'smart' refers to the application of new technologies to improve urban services or the quality of life of the city. The Amsterdam Smart City (ASC) platform takes an even broader perspective, and even includes projects without a strong technology component. It 'supports innovative ideas and solutions for urban issues' and thus contributes to the liveability of the region.

In our study, the smart city projects meet three criteria: 1) there is development or use of new technology, intending to generate not only economic value but also ecological and/or social value; 2) there is an element of innovation or experimentation and 3) the project is not run by only one organisation, but as a partnership.



Why this study?

Getting smart city solutions off the ground is not just about developing and applying technology: it demands new networking and management competencies. Solutions are not developed and implemented by one single company, but take shape in networks, at the intersection of technologies and industries, and with the involvement of citizens/end users. For example, when the grid company wants to introduce smart meters and displays into homes, it must work together with housing corporations, with citizens, and with technology partners. It needs not only technological and engineering skills, but also the competences to involve communities and communicate effectively. Collaboration among multiple stakeholders is key in the development of innovative technology-driven solutions for sustainability in cities.

In this study, we analyse a number of smart city projects in Amsterdam, in their wider context. We do not attempt to tackle all the issues mentioned above. Rather, we analyse smart city projects from a managerial angle. We want to understand how partnerships are formed, how they work, and what challenges they face. We focus on the following questions: *How do organisations with different agendas, collaborate on smart city projects? What challenges do they face? What kind of value is created? How are risks and returns shared, and how are users involved? What is the upscaling dynamic of smart city solutions, if any? How can smart city projects be managed professionally?*

The goal of this study to establish insight in current practices and lessons learned across a broad range of smart city projects in Amsterdam in three key themes in urban sustainability: energy, mobility, and circular economy. The projects analysed here did not develop in isolation, but are shaped by their context: the Amsterdam region. To interpret smart city projects in Amsterdam, it is important to have insights into Amsterdam's wider 'ecosystem'¹ consisting of key players, as well as relevant policies/ambitions, legal frameworks, network organisations, connectors, and funding sources. In chapter 2, before going more deeply into the projects, we describe this ecosystem.

1 The term **ecosystem** describes the large number and diverse nature of participants and resources, and their interrelations. Source: Jackson, DJ. (2011) 'What is an Innovation Ecosystem?' National Science Foundation, Arlington, VA.

The methods we used

This study is based on a combination of desk research and field work.

We selected 12 smart city projects in three key domains²: energy, mobility and circular economy. These are domains in which ASC concentrates its efforts. Projects were selected out of a large number of projects that are active in the region, on the basis of the following characteristics: 1) their development stage: we excluded projects that had just started, because it would be too early to draw conclusions or lessons from them; 2) their complexity in terms of partners/stakeholders: we excluded 'simple' projects with only one or two partners, and projects run by only one player; 3) the availability and willingness of project leaders to discuss their experiences candidly with us.

For each project, we collected the available documentation and reports, and held in-depth semi-structured interviews with 3-4 representatives of the project's key partners. This gave us a balanced picture of the project's development. In the interviews, we focused on the following:

- The project's history, its rationale, and defining moments.
- The partnership: Which actors participated in which stages of the project, what were their motives, how did the partnership evolve; who took the lead; division of costs, benefits, risks and returns; and the role of the Amsterdam Smart City platform.
- User involvement: Who are the users in the project, how were they involved in the project and how did they experience the project?
- The value of the project: What economic, social and ecological value was created in the project, for both the city and the individual partners, and to what degree have their expectations been realised?
- Upscaling: To what extent was the (pilot) project scaled up after the initial phase, and what were critical issues in this respect? We discern three types of upscaling: expansion, replication, and roll-out (see box for explanation).
- Key insights: What are lessons learned, according to the partners?

The interviews were conducted by three teams of two researchers (one team per domain), recorded and transcribed. The data were analysed in two stages. First, within each domain, we conducted a cross-case comparison; second, we completed an overall cross-case analysis. Preliminary outcomes of this study were discussed in round tables with project actors, representatives of ASC and the City of Amsterdam and other interested parties.

² Four cases in each category.

Upscaling unravelled

A key question in our study was how and under what conditions pilot projects can be scaled up. We distinguish three types of upscaling: roll-out, expansion, and replication (Van Winden, 2016).

In **roll-out**, a technology or solution that was successfully tested and developed in the pilot project is commercialised/brought to the market (market roll-out), widely applied in an organisation (organisational roll-out), or rolled out across the city (city roll-out). Scaling does not require new partnerships, major behavioural or organisational changes, and does not challenge big vested interests or organisational cultures. The transition from the pilot to the scaling stage can be achieved without major modifications of the product/solution. The roll-out process is typically managed by one organisation, often the one that initiated the pilot.

Expansion is the second type of upscaling. Here, the smart city project is expanded by a) adding partners, b) extending the geographical area covered by the solution, or c) adding functionality. This type of upscaling applies to platform projects, for example smart cards for tourists, where the value of the solution grows with the number of participating organisations. Expansion involves higher transaction and coordination costs as new partners enter (implying negotiations) or new geographical conditions are to be met. There cannot be a straightforward 'roll-out' because there is limited control over the process and several independent organisations are involved.

Replication is the third and most problematic type of upscaling. With replication, the solution that was developed in the pilot project is replicated elsewhere (another organisation, another part of the city, or another city). Replication can be done by the original pilot partnership but also by others, and the replication can be exact or by proxy. Replicating a project always involves the complexity of the new context (legal, organisational or partner) and requires a redesign of the solution by the new partners. A typical barrier to the replication of smart city projects in other cities (especially data-based solutions) is the lack of standards, open data formats and protocols. Replication is complicated because of poor knowledge transfer mechanisms and hampered by the 'not invented here' syndrome.

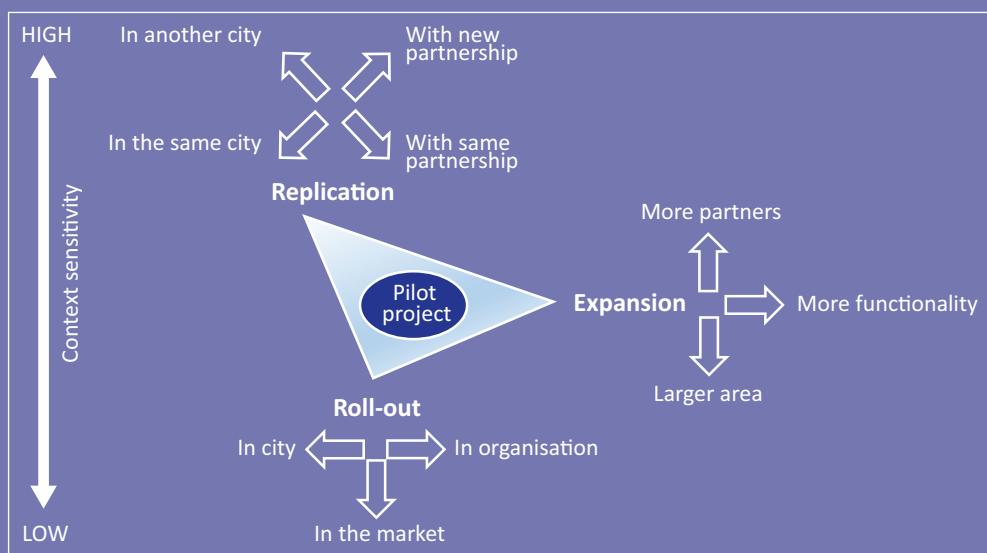


Figure 1: Three types of upscaling

Partnerships visualised

For each project studied here, we identified the partners: private companies, public organisations, knowledge institutes, NGOs, citizens, and utilities.

They are represented in a circle. The lead partner or initiator is depicted in the interior of the circle; the others on the outside.

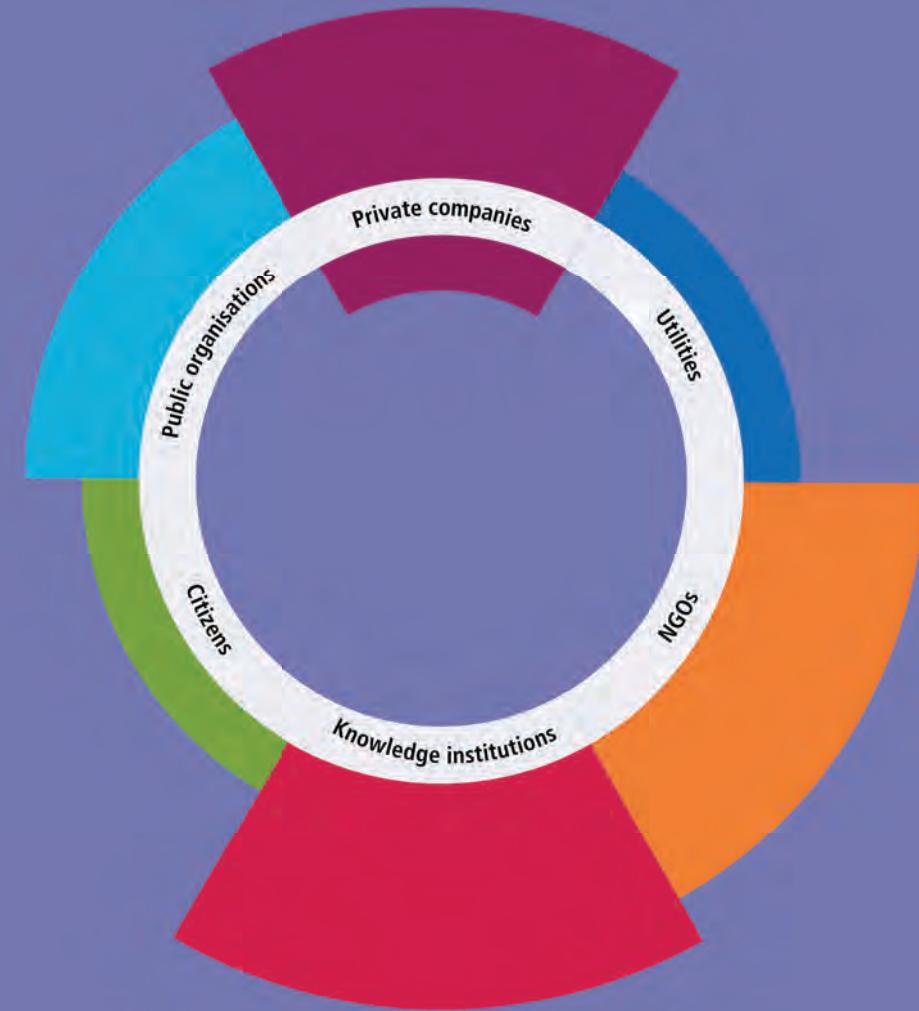


Figure 2: Types of partnership

Organisation of this report

This report is aimed at professionals from technology companies, grid companies, city administrations, knowledge institutions, policy makers and others interested in how smart city projects work and how smart city initiatives can contribute to making cities smarter.

The report is organised as follows. Chapter 2 describes Amsterdam's 'smart city ecosystem'. Here, we introduce a number of key organisations, institutions, platforms and networks that are the engines of many smart city initiatives in the Amsterdam region. Chapters 3-5 form the heart of this report: they contain a systematic description and analysis of smart city projects in the fields of energy (chapter 3), mobility (chapter 4) and circular economy (chapter 5). Each chapter starts with a short description of the domain, and ends with a cross-case comparison.

Chapter 6, draws conclusions based on the findings of all projects, and provides the main insights.

Chapter 7 offers concluding remarks.

How to read this report

Do you want to know more about Amsterdam's innovation ecosystem and its main players?

Read chapter 2.

Are you interested in learning more about the smart city projects that we analysed? Read chapter 3 (Energy), chapter 4 (Mobility) or chapter 5 (Circular Economy).

Are you interested in the main lessons, insights and takeaways from our project analysis?

Read chapters 6 and 7.



AMSTERDAM'S SMART CITY ECOSYSTEM

Willem van Winden

The city of Amsterdam (834,000 inhabitants in 2016) is the heart of the Amsterdam Metropolitan Area (2.3m inhabitants), a dominant economic region of the Netherlands and figuring high in many European city rankings. In this chapter, we give an overview and interpretation of the city's smart city ecosystem: the key organisations, platforms, networks and connectors that drive innovation in the smart city domain.

Amsterdam at the forefront?

Amsterdam has a long tradition of innovation; it is known for freedom, ideas, and entrepreneurship, science, and arts, but it is also a city that nurtures social innovation and diversity in the public space. This blend makes it well-positioned to develop urban technology innovations, where new technology typically becomes embedded in the social, civic life and commercial life of the city. In recent years, Amsterdam has raised its profile in the smart city movement. The city proudly carries the title of 'European Capital of Innovation 2016 and 2017'. The Amsterdam Smart City platform was the winner of the European Commission's City Star Award 2011 for its role in the use and promotion of sustainable energy³. The City of Amsterdam won the World Smart Cities Awards for its Open Data Program for transport and mobility at the 2012 World Smart Cities Forum⁴, and Amsterdam was listed second in Fast Company's 10 smartest cities in Europe ranking for 2013 after Copenhagen⁵⁶. In 2015, Amsterdam ranked

3 <http://www.dutchdailynews.com/amsterdam-smart-city/>

4 <http://www.worldcitiesnetwork.org/knowledge-hub/article/amsterdam-leads-the-way-in-becoming-a-smart-city-91/>

5 <http://www.amsterdameconomicboard.com/nieuws/1033/amsterdam-tweede-smart-city-in-europa>

6 http://www.fastcoexist.com/3024721/the-10-smartest-cities-in-europe?partner=rss&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+fastcoexist%2Ffeed+%28Co.Exist%29

fourth in the Arcadis Sustainable City Index⁷, which reflects Amsterdam's continuing commitment to urban sustainability. In some respects Amsterdam lags behind comparable cities. In particular, the share of renewables in energy production and consumption is lower than in many Nordic and German cities. Moreover, in the field of electrification of mobility, several Nordic cities (i.e. Oslo, Lund) are bolder in their ambitions and investments.

Several factors explain Amsterdam's strong reputation. Amsterdam is a city of early adopters; it has a large number of citizens receptive to new technologies or willing to take initiatives to make the city more sustainable. Many smart city projects start at the grass roots, not with the government but by citizens or organisations that want to make a difference. It is also a city with a strong entrepreneurial spirit and commercial competences. It has many companies, big and small, start-ups and established ones, that have the technological skills and clout to set up smart city solutions, and some of them see Amsterdam as a great testing ground for new concepts. Moreover, Amsterdam has a rich and broad knowledge base, including two research universities (University of Amsterdam and Free University), two universities of applied sciences (Amsterdam University of Applied Sciences and InHolland), and a new (small) university AMS (Advanced Metropolitan Solutions) fully dedicated to 'engineering the future city'. The city administration also wants Amsterdam to be at the forefront of the energy transition and the shift towards closing material cycles by adopting new technology, and setting ambitious goals for CO2 reduction. We see similar ambitions among the city's housing corporations, energy suppliers, infrastructure providers, the port, the airport, and private companies.

Amsterdam as a project factory

Amsterdam's smart city ecosystem can be viewed as a 'project factory' where smart city projects in fields such as mobility, economy and open data are co-produced by a large and diverse mix of people and organisations. The factory has some key ingredients (see Figure 3).

The orange diamonds represent organisations that are particularly active as initiators, orchestrators or drivers of smart city projects.

- **The Amsterdam Smart City Platform (ASC)**⁸ is the heart of Amsterdam's smart city ecosystem. This organisation was created in 2008 to speed up and facilitate the take-up of new technologies that would benefit quality of life and sustainability in the metropolitan region. Central to the approach of Amsterdam Smart City is addressing urban challenges through collaboration between public and private actors. ASC has two types of partners: strategic and project. The eight strategic partners sit on the board and provide staff to the ASC organisation. They pay an annual fee, and commit human resources to the organisation. The box on page ... provides more details.

⁷ <http://oud.amsterdamsmartcity.nl/news/detail/id/432/slug/arcadis-sustainable-cities-index-balancing-the-economic-social-and-environmental-needs-amsterdam-and-rotterdam-finished-in-the-top-10>

⁸ <https://amsterdamsmartcity.com>

- **The Chief Technology Officer (CTO)**⁹ is a unit (created in 2014) in the city administration, responsible for following technological developments and applying technology where necessary to reach the cities' targets and ambitions faster or better. It works against the silos of the municipal bureaucracy, taking a problem-based approach, organising smart coalitions to solve them. It is also the first port of call for firms that need help from the city to develop new products or services. Moreover, the CTO takes initiatives such as the Startup in Residence Programme¹⁰, where startups are invited (and the most promising ones supported) to devise innovative solutions to social issues.

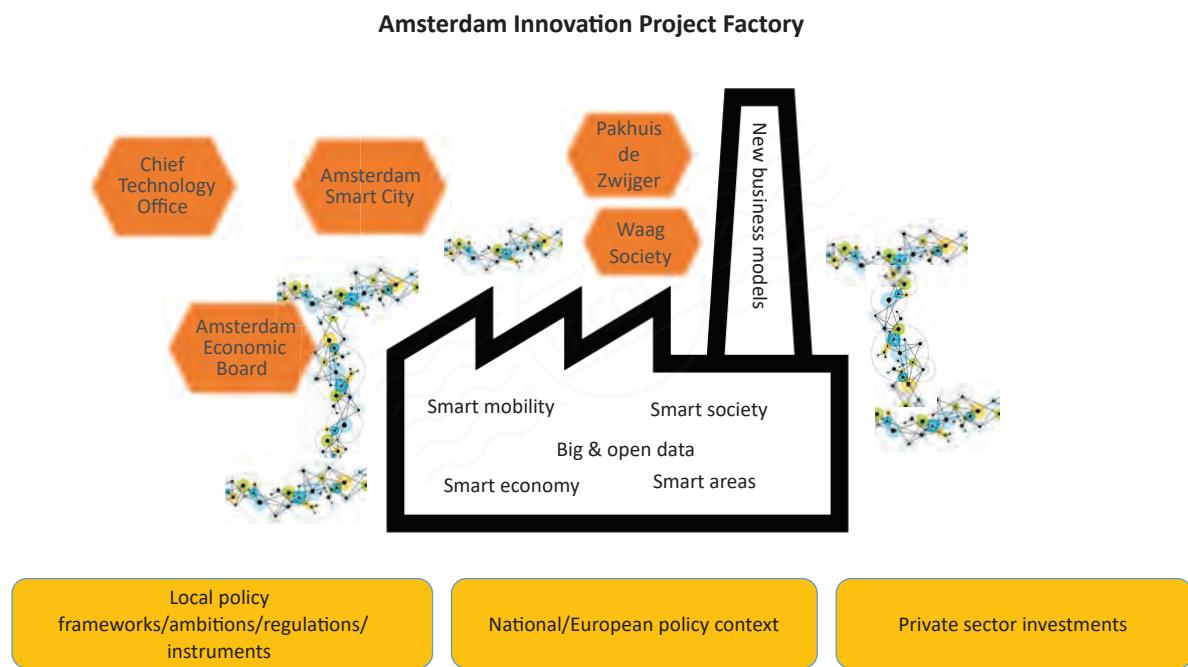


Figure 3: Amsterdam Innovation Project Factory

- **The Amsterdam Economic Board**¹¹ is a public-private organisation with the mission to enhance the prosperity and well-being of the Amsterdam Metropolitan Area. Its members are leaders from regional businesses, knowledge institutes and government authorities. The Board focuses on five key urban challenges, all of them linked to smart city topics: 1) promoting the circular economy; 2) enhancing digital connectivity and data-driven innovation; 3) enhancing healthy ageing; 4) promoting sustainable mobility and 5) creating a more adaptive and appealing labour market. The board organises all sorts of events and network meetings, helps to connect people and organisations in the quadruple helix to build consortia and realise these ambitions, and influences policy agendas in the region.

9 <https://amsterdamsmartcity.com/network/chief-technology-office>

10 <https://startupinresidence.com/amsterdam>

11 <https://www.amsterdameconomicboard.com/english>

- **Pakhuis de Zwijger**¹² is an important cultural platform that unites change makers in Amsterdam and the surrounding region. It frequently organises debates on a variety of smart city related issues (such as privacy, data protection and civic involvement) and has become an important clearinghouse for meeting, knowledge sharing and idea formation.
- **Waag Society**¹³ is a leading institute working at the borderline of art, science and technology. In its research activities, it explores emerging technologies with a focus on digital (but also biotech and cognitive) sciences, and how they interact with society. It also organizes events and trainings and participates in a numerous experiments and pilot projects.

Many other organisations participate in or initiate projects: corporations, startups, schools, research groups, social entrepreneurs, NGOs, etc. They are represented by the colourful network in figure 3. There is also an interesting variety of tech communities, such as Appsterdam (app developers), or Internet-of-things Sensemakers (a group that discuss new IoT developments and their implications) that initiate new projects, often linking technology with societal goals.

At the bottom of the figure, we find three more ‘foundations’ of the innovation factory: local policy frameworks, the national/European policy context, and private investments. We have summarized them below.

Local policy frameworks: Amsterdam has put in place an array of specific measures and policies. In the field of sustainability, they are summarized in the policy plan ‘sustainable Amsterdam’, adopted in 2015.

- Renewables: Increase the generation of renewables by 20% per citizen and reduce energy use by 20% per citizen compared to 2013
- Clean traffic: Have motorized traffic as clean and emission-free as possible by 2025, by increasing electric transport and creating an environmental zone in the heart of the city
- Promote the circular economy: The ambition is to separate 65% of domestic waste for reuse by 2020
- Mitigate climate change, notably making the city more waterproof

These ambitions have taken shape in many projects and measures, acting as catalyst for a large number of green projects in the city. But also in other realms, the city has set specific goals as well, some of which were mentioned in our discussion of the Amsterdam Economic Board.

National and European policy ambitions and programmes are drivers for smart city projects; the Europe 2020 programme¹⁴ put a strong emphasis on R&D, climate change and energy transition. In a special report, EC¹⁵ (2013) provides an overview of the generous EU smart city funding options

12 <https://dezwijger.nl/over-ons/about-us/>

13 <https://www.waag.org/en>

14 http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/index_en.htm

15 EC, Using EU funding mechanism for Smart Cities, Report of Smart Cities Stakeholder Platform, Finance Working Group (2013) <https://eu-smartcities.eu/sites/all/files/Guideline-Using%20EU%20fundings%20mechanism%20for%20smart%20cities.pdf>

for 2014-2020 (EC 2013). The Horizon 2020 program provides for 18,5b euro subsidies for clean energy, green transport and climate actions, implying significant funding opportunities for smart-city related research (most of it to be conducted in collaboration with local authorities and companies). For innovative smart city projects, public funding is often a very important lifeline, either because they have an experimental nature (with uncertain outcomes and future revenues) or because they serve a social or environmental goal.

Several smart city projects in Amsterdam depend(ed) on funding from these European or national project funds.

Finally, the **private sector** is heavily investing in smart city technology and solutions, and is a key driver in many projects (hence the many private partners in Amsterdam Smart City). On the one hand, they may do so from a CSR (corporate social responsibility) perspective, or because company owners and managers are intrinsically motivated to do so. But there also is a strong business case: clients increasingly ask for clean and smart products and services, so the smart city market itself is big and fast-growing. Tech multinationals like IBM, Cisco, Schneider, Google, Siemens or Philips have discovered the potential of smart city technology as significant business opportunity, and offer all sorts of solutions such as smart grids, energy-saving street lighting, optimization systems for waste collection, big data analysis to improve decision making, camera systems to enhance safety, traffic flows, and urban dashboards. Deloitte (2015)¹⁶ expects the global smart cities market to grow from US\$400 billion to US\$1.5 trillion by 2020. To explore and exploit new business opportunities, many multinationals have set up city-centric business units (e.g., Cisco's 'smart&connected communities', IBM's 'smarter Cities'). Moreover, these companies engage in local smart city pilot projects and partnerships to test or demonstrate innovations in real-life contexts. It's not just a big business game: there is also a large and growing number of start-ups in the wide field of smart city solutions.

Amsterdam Smart City

In 2009, the Amsterdam Smart City Programme was initiated by some public and private organisations. They created a dedicated multi-stakeholder platform organisation: Amsterdam Smart City (ASC).

Technology is not central in its approach, although the testing and implementation of smart city technologies has been integrated into most projects. Initiatives for new projects may come from the city administration, corporates, SME's, start ups, NGOs or citizens. Since 2009, ASC has developed into a platform with over 150 project partners active in more than 100 innovative projects across several themes, including energy, mobility, and circular economy. On its community website, members of the smart city community can add new projects.

16 Deloitte, Smart Cities, not just the sum of its parts, Monitor Deloitte (2015)

https://www2.deloitte.com/content/dam/Deloitte/xe/Documents/strategy/me_deloitte-monitor_smart-cities.pdf

ASC has two types of partners: programme partners and project partners. The programme partners sit on the board, and provide staff to the ASC organisation. As of 2015, there are eight strategic partners: the City of Amsterdam, the Amsterdam Economic Board, Alliander (energy grid company), KPN (telecom/ICT), Arcadis (natural and built asset design and consultancy firm), PostNL (logistics), Amsterdam ArenA (stadium) and Amsterdam University of Applied Sciences. Each core partner pays an annual fee and commits human resources to the organisation: they have a dedicated officer at ASC, and have a three-year renewable commitment.

The Amsterdam Smart City team consists of a core secretariat, plus the representatives from its key partners. Every two weeks, they come together to discuss the latest concepts, questions and calls for innovation.

ASC assumes several roles:

- **First port of call for innovative project ideas.** Actors in the city who want to start a smart city project can submit their idea to ASC. For example, the district council of Amsterdam Southeast was looking for ways to make a square more liveable, and called on the ASC to assemble a partnership to make it happen: the Smart Light project was born (chapter 3).
- **Network broker.** The ASC secretariat provides access to a wide variety of potential project partners (public or private). It is the spider in the web in Amsterdam's smart city ecosystem. It organises many local and international events where projects are presented and discussed, where people exchange experiences and knowledge, and where new networks and project ideas are born. Its community website invites members to exchange and learn from each other.
- **Connector between urban stakeholders.** The partners of ASC see and meet each other frequently, and this gives rise to fast and unexpected joint initiatives and innovations. Members of the community are invited to share updates, news etc. on the website.
- **City branding.** Over the years, Amsterdam Smart City has built a good reputation at home and abroad. Having the 'ASC stamp' helps to direct attention for the project and generate interest. Moreover, projects are promoted via ASC's much-visited website and the events it organises.
- **Process facilitator and trusted third (independent) party.** Innovative smart city projects typically involve partners with different backgrounds. It is a challenge to bring the right partners together, and assemble a strong result-oriented and efficient team. ASC has learned to be an enabler and facilitator in this process. It is experienced in playing this game, and guides new projects through the early stages (after which it has to run on its own).



3

PROJECTS IN THE ENERGY THEME

Daniel van den Buuse and Willem van Winden

Introduction

Energy is a key theme in relation to smart cities: approximately 75% of energy consumption and greenhouse gas (GHG) emissions originate from cities and metropolitan regions. In the next decades, continuing urbanization will intensify energy use in cities, thereby increasing the amount of GHG emissions originating from cities even more. Hence, moving towards smarter, more sustainable cities on a global scale is an important transition. A range of energy projects is being developed by ASC partners, and are characterised by the implantation of smart city technologies and collaboration between public and private partners, often as part of an urban living lab.

Energy transition is a key theme on the local, national and European levels, and this reflected in a large number of policy frameworks and accompanying funding opportunities. The Horizon 2020 program provides for 18,5b euro¹⁷ subsidies for clean energy, green transport and climate actions, implying significant funding opportunities for urban actors. On the national level, an 'energy agreement'¹⁸ was signed in 2013 between over 40 organisations, including the energy industry, employers organisations, environmental organisations and the government. They agreed to reduce energy use by 1,5% per annum, and reach a reduction of 100 petajoule by 2020. Moreover, they committed to an increase of renewable energy generation to 14% in 2020 and 16% in 2023. This deal will give a significant boost to new

¹⁷ EC, Using EU funding mechanism for Smart Cities, Report of Smart Cities Stakeholder Platform, Finance Working Group (2013)
<https://eu-smartcities.eu/sites/all/files/Guideline-Using%20EU%20fundings%20mechanism%20for%20smart%20cities.pdf>

¹⁸ <http://www.energieakkoordser.nl/doen/engels.aspx>

energy-related smart city projects. On top of this, the Amsterdam region formulated its own ambitions, as outlined in chapter 2.

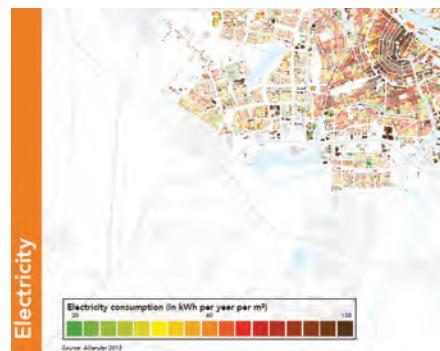
For the analysis in this section, four energy projects are selected: Energy Atlas, Smart Light, Climate Street, and Sustainable Neighbourhood. All are characterised by the collaboration of multiple ASC partners, development and implementation of technology-enabled solutions to energy use in the city, and a focus on economic, social, and environmental value creation. Based on an internal evaluation, these projects are selected because they best represent the character of the energy projects component of ASC.

3.1 ENERGY ATLAS

Introduction: It all starts with baseline data

The city of Amsterdam has the ambition to reduce its CO₂ emissions by 40% in 2025 and 75% by 2040 compared to the 1990 level. This requires a transition from fossil fuel-based energy generation and consumption to the adoption of less carbon-intensive energy technologies. To make that happen, it is crucial to have insight into which solutions are best suited to each part of the city. An important first step is to have detailed, local-level data about the use of energy across the city at present. As Bob Mantel, project manager with the city administration's DRO Physical Planning Department, puts it: 'if we want an energy transition, we first and foremost need detailed baseline information about energy consumption and generation. But we did not have that, at least not in an accessible format'. Several public and private partners, including municipal departments, utilities, and grid managers, worked together to open up and share their data on energy, water and sewage use in Amsterdam. In 2014, after two years of work, the Energy Atlas was presented: a visually attractive, interactive and easy-to-use product, accessible online for everyone.

During the course of the project, tools and applications to identify opportunities for energy savings were integrated into the Atlas, allowing detection of which sustainable energy solutions have the highest potential in which part of the city, and where they should be tested first. This is of great importance to various stakeholders in the city. As project leader Bob Mantel says: 'It helps to quickly detect and test business cases for sustainable solutions.' In a similar fashion, Stefan Mol, manager at Waternet (the water utility), sees clear added value in using the atlas for day-to-day consulting activities: 'With the Energy Atlas, we can actively search potential customers who we can help to improve the efficiency of their energy usage'. Insight into energy use in cities at the local-level is therefore a relevant starting point in selecting the geographic location in the city with the most potential impact for testing or implementing technological solutions contributing to energy transition in the city. Readily available online and openly

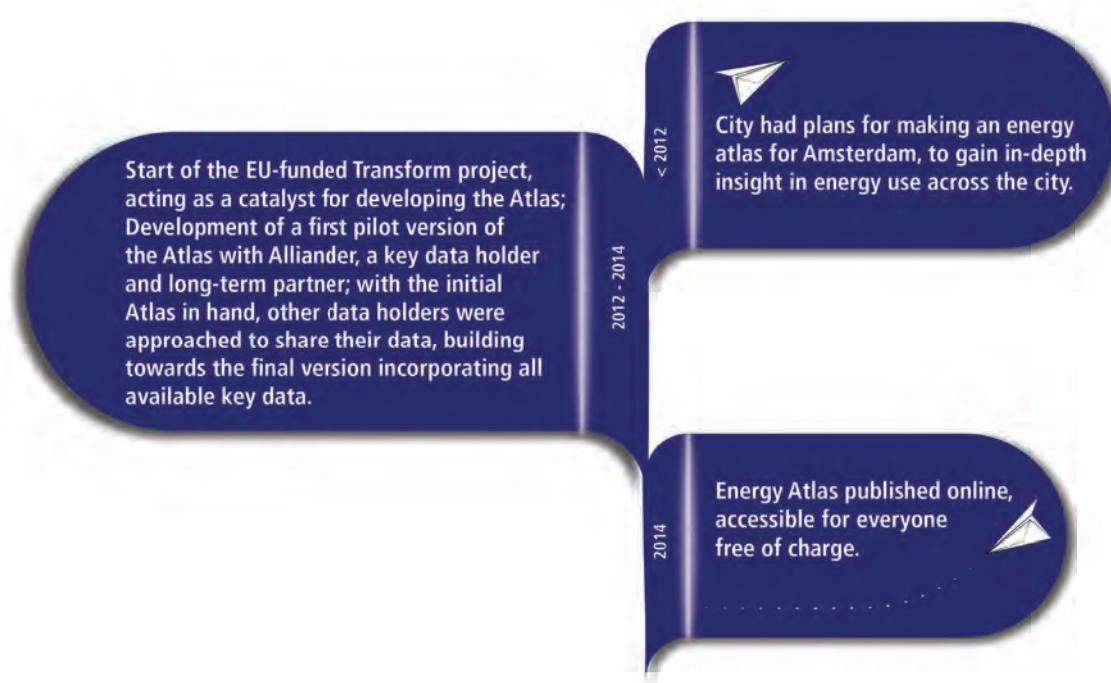


Source: City of Amsterdam, department of Urban planning and Sustainability

accessible for all stakeholders, the Energy Atlas almost immediately drew the notice of various (inter) national parties, and the promise – and challenges – of developing a national energy atlas are under discussion. The rationale for developing the atlas, the collaboration between partners throughout the process, the potential for upscaling and replication, and lessons learned from developing the Energy Atlas in Amsterdam are discussed in this section.

Rationale: Why create an Energy Atlas?

Creating a unified and detailed overview of energy use and production in the city seems inevitable for any city that takes its energy transition seriously, but it can be difficult to achieve in practice. At least, that is what many cities including Amsterdam have discovered. There is a lot of data available on energy provision and usage, but it sits with many actors, both public and private: the traditional energy suppliers (utilities selling gas, electricity), water suppliers, and infrastructure/grid companies. In recent years, the situation has become even more complicated, with new players entering the field, and more renewables being generated locally.



Providers face many barriers to sharing and making their data public on an open platform. Data is collected in different formats; some organisations are competitors and do not want to disclose valuable and sensitive information; many have their own mapping projects, in which only parts of all energy streams are mapped. Furthermore, legal issues can make sharing difficult: data on individual users are subject to privacy rules, and for security reasons, utilities are reluctant to publish the location of critical infrastructure.

From its inception, the project to develop an Energy Atlas for Amsterdam had to tackle these issues and managed to deliver a unique product: an interactive map containing all available information concerning energy use and infrastructure in Amsterdam. In the early stages of developing the Energy Atlas in Amsterdam, a prototype of the atlas was created in collaboration between the city administration and one partner and key data holder: Alliander. As Bob Mantel says of this stage: 'As the city of Amsterdam, we had a need to have insight into more detailed and refined energy data in the city, specifically on energy usage and potential. We approached Amsterdam Smart City partner Alliander with the question whether they could potentially deliver this data, which for them is also an innovation process, and from that point on we worked together: we started with the development with some initial maps, which received very enthusiastic responses internally at the city administration as well as externally. With these initial cards, we then approached other organisations with key energy data, asked them to join the project. Six to seven parties agreed to participate, and we then started to develop the Energy Atlas as it is today.'

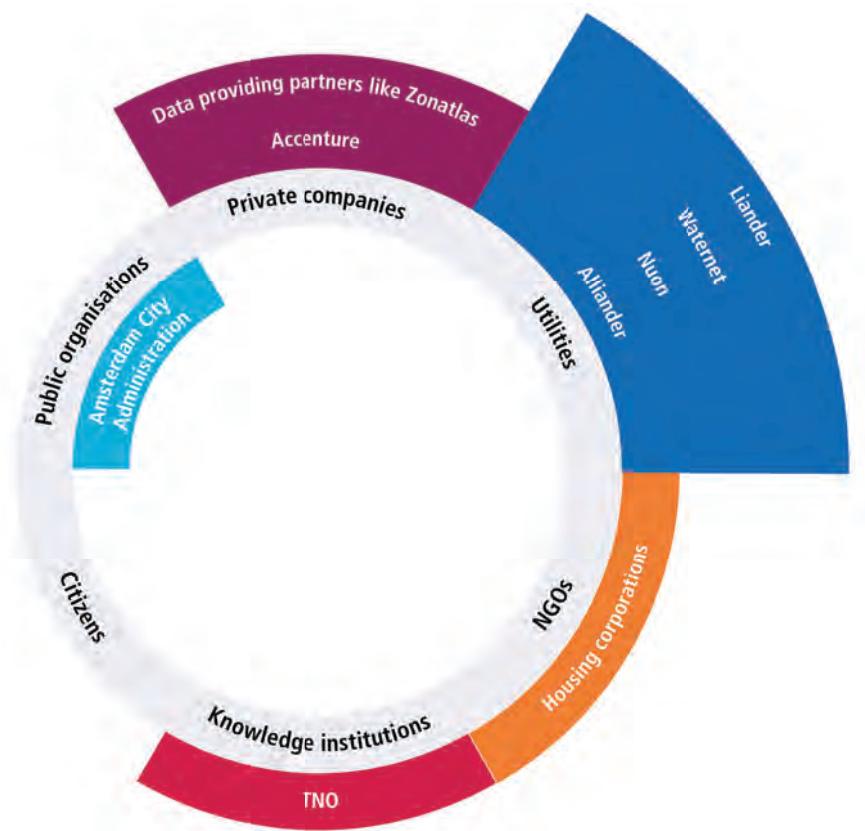
The selection of Alliander, also a strategic partner in Amsterdam Smart City, was a deliberate one: 'Alliander clearly has very important data, and because we have such a longstanding relationship with them, we could find the opening to develop the initial maps'. In the final version of the Energy Atlas, information is attractively and systematically visualised in interactive charts, graphs and maps to show differences in a wide array of performance indicators, including the energy usage throughout Amsterdam as well as the opportunities of generating renewable solar and wind energy in different areas. The Energy Atlas shows data on electricity, water, and sewage/wastewater on the level of the building block, for all of Amsterdam.

The Amsterdam Energy Atlas is unique in that it uses real usage data, rather than predicted data or averages. This is one of its advantages over similar maps created in New York and Hamburg (which inspired Amsterdam) that rely on estimates. However, data in the atlas is still static and is not updated regularly or showing real-time energy usage. Furthermore, the data has been mapped in a way that information on weather, solar power, roof steepness and predicted shadowed areas can be used to determine the efficiency of solar panels in areas. Visualisation of highly specific local-level energy data for individual buildings, complemented with tools and applications to analyse the impact of measurements taken by the city administration as well as by individual stakeholders, create the opportunity to visualise different scenarios, and optimize the process of searching for and selecting the best place in the city to experiment with or test specific solutions. This even applies to other energy-related Amsterdam Smart City projects: the mobility project Vehicle2grid, also uses the Energy Atlas to test where their value proposition will have the most impact in the city.

The partnership: City in the lead, utilities providing the data for free

The idea to develop an uniform energy atlas with all energy data aggregated into one set of maps was not new; the ambition had long been there to create one. However, the participation of Amsterdam in a European funded project TRANSFORM was a major step forward in developing the tools and applications of the Energy Atlas, to enhance its functionality and usability. In TRANSFORM, which ran between 2012 and 2015, Amsterdam, Copenhagen, Genoa, Hamburg, Vienna and Lyon collaborated with each other and other partners to improve their cities' policy and programs to lower carbon emissions. The project provided for financial resources (around €500k, matched by market parties in the project), that were mainly used for marketing and technical support, after the initial maps had been created: 'For this project

in Amsterdam, applied for EU funding. For developing the Energy Atlas itself, relatively little EU funding was used. For the application and dissemination of the Energy Atlas, such as building mathematical applications to perform calculations with the available data, and telling the story of the Energy Atlas to other cities in the program, EU funding was mainly used'. It helped to get the relevant local partners around the table to create something together. With the city administration in the lead, Energy Atlas was a project-based public-private collaboration between the city and three utilities (Alliander, Nuon, Waternet), TNO, AFWC (Federation of Housing Corporations in Amsterdam), and the Delft University of Technology.



The city administration, with Bob Mantel as project leader, had a leading and facilitating role in this project: they organized the process, developed the technology platform with a partner in the initial stages, and brought the data providers on board. The Atlas fitted perfectly in the cities' ambition to speed up the energy transition and reduce CO₂ emissions. The utilities and the housing corporations agreed to provide their data without at no charge, as long as the platform would be open and would not reveal energy use of individual clients. It was a challenge for the partners to find a way to cluster information on clients in such a way that it would be impossible to trace back individual use. A key success factor was that the partners kept believing in the project and in the value it created; there was enthusiasm throughout all stages of the project, and the parent organisations backed it. What also helped was that the partners came from the semi-public sector (rather than being solely market players); they were willing to put effort in the project without expecting short-term monetary returns. The team had to be creative in responding to the risks associated with publishing the exact location and use of key infrastructure. Waternet, for example, balked at publishing information on its key trunks. The GIS (Geographic Information System)

team proposed showing which buildings are near a large trunk, rather than showing the trunk itself, which turned out to be useful in opening up their data without compromising their concerns regarding the sensitivity of their data. By the end of 2014, after two years of work, the atlas was ready to be published.

A relatively small cash investment was required for the creation of the atlas; most of the efforts were in-kind contributions by the partner organisations that were committed to the product and saw its long-term benefits for themselves. The Amsterdam Smart City organisation spread the word about the Energy Atlas, acting as a strong brand to put the Energy Atlas on the map for the city of Amsterdam. In other words, it let the world know it existed.

User involvement

Who are the users of the energy atlas, and to what extent were they involved in the concept's development? First of all, the creators of the energy atlas were also the users. Each partner in the project partnership was interested in having more detailed insights into energy use, in order to detect 'low hanging fruit' for energy-saving interventions. Other types of users (citizens, consultancies that might use the atlas for their services) were not involved.

Value of the project: A fast check for quick wins

Creating a unified energy atlas brings benefits on several levels and adds value for several partners. For most of the partners, it is an instrument that helps them make better-informed decisions on where to invest in energy-saving projects, or alternative energy solutions. For example, it helps Waternet to discover where it might be useful to deploy cold/heat solutions (ideally, a location near a cold trunk). For the city, the atlas is a tool to find out quickly where to act to facilitate the energy transition. It also helps to rationally select the best energy solutions for a particular area. For example, the city held a seminar on the energy future of 'Centrum Eiland' (in the city centre), where the Energy Atlas was able to weigh alternative technology solutions.

A small Amsterdam-based brewery named De 7 Deugden wants to become more sustainable. The brewery uses a lot of energy for cooling and heating, and asked Waternet to check if there is a way to use less. Waternet used the atlas to make a first rough water and energy scan to see whether the cooling might come from sources nearby (drinking water trunks, lakes, canals, rivers). Based on that, a refined solution was developed. 'The map makes it much easier to quickly understand how buildings can improve on their energy efficiency. However, in the end it does require more detailed research in order to provide more specific advice. This also means that it becomes easier to contact potential customers', according to Stefan Mol of Waternet.

The atlas proves to have commercial value for market players. Some consulting companies have started using the atlas and its data to advise their clients on energy solutions, by integrating their smart city technology offerings into the energy atlas, and visualise impact scenarios of investing in specific sustainable energy-related technological solutions. For example, Joost Brinkman, Accenture's Lead Sustainability Services Benelux, mentions the opportunities of integrating the atlas in its consultancies: 'we are in the early stages of exploring how we can use the atlas in our services.... For example, a city could provide data in a large file, which we could upload in our software to display an energy atlas for that city,

as well as add functionalities such as simulations. A possibility could be to offer this as a 'software as a service', where an annual fee or fee per entry could be paid...this is work in progress'. The use of available data to develop business cases for companies that consider investing in renewable energy or energy efficiency technologies, based on data of real energy use across the city, therefore has clear economic promise in addition to environmental value through the lowering of carbon emissions.

Potential for upscaling: An energy atlas for other cities and regions?

The creation of the atlas for Amsterdam can be considered a great success. It is a unique product, internationally unrivalled, especially because it gives up-to-date information on a wide variety of energy consumption and production in the entire city. Nevertheless, the project faces several impediments in regard to expansion and replication.

In The Netherlands, Amsterdam was the first city with a full-fledged and unified energy atlas. Many other Dutch municipalities and utilities expressed an interest in having similar product, and the Dutch national government saw opportunities to create a national version. In 2016-2017, parts of the Amsterdam Energy Atlas will be provided nationwide. This project was initiated by the Ministry of Infrastructure and the Environment, Alliander and the city of Amsterdam, supported by more than 20 cities in The Netherlands. This is a complex operation, requiring substantial resources and the participation of a large number of data suppliers, in addition to the involvement of more layers of governing bodies at the national, provincial, and city levels. Moreover, the national approach competes with a large number of local and regional open data initiatives that are being developed.

Bob Mantel underlines the potential economic value of Amsterdam's early experience: 'upscale the Energy Atlas to other cities in the Netherlands potentially involves half of the total development costs in Amsterdam'. Process and product knowledge from Amsterdam is being transferred to other cities that are also developing an energy atlas: technology, data types, how to move data from each source into an open data platform, platform characteristics to optimize its usability and relevance to all stakeholders in the city, etc.

Will the Energy Atlas remain relevant? A key challenge for the Energy Atlas is to keep it up to date, ideally with real-time data, instead of only using static data from one specific moment in time. For this to happen, the data suppliers must be willing to continue to dedicate resources to feed the platform with data. Furthermore the platform will need resources to keep it technically up to date. Many of the data will be updated: the City of Amsterdam continues to receive most energy data from the large suppliers and commits to publishing it on the atlas. However, some relevant data is lacking, which might lead to suboptimal results, conflicting situations, or missed synergies.

Key insights in Energy Atlas

- This project illustrates that EU funding can be a catalyst for a project's takeoff. It helped to free up resources, share experiences with other cities, and gain exposure.
- These type of open data project only work if data owners see benefit in sharing data and find ways to protect privacy. Making data available was a prime factor in the project; it depended on mutual trust among the partners, and a good relationship between partners (the city and Alliander) for developing the initial atlas.
- The role of the city administration in collecting all city-level data from various data holders (including public, semi-public and private partners) was central to the development of the atlas. While public and private sector collaboration in the context of smart city projects is often highly relevant, in this context in which various data owners are expected to share sensitive data in terms of privacy and public safety, the leading and facilitating role of the city administration in building the ecosystem of partners around this project was important.
- The project's success was positively influenced by the city government's experience with GIS systems. The Energy Atlas could draw from many databases and maps. Lacking such concrete knowledge can be a hindrance to other cities that are developing an energy atlas.
- In hindsight, the city administration took a large role in the project, and might have outsourced more work (such as the technical aspects of the platform development) to a specialised ICT player. This could have accelerated the project in its early stages.
- Replication in other cities is complicated because of different contexts, partnerships, data formats; however, it has potential in terms of developing an integrated energy data map for the city.
- For any similar project to succeed, a relatively small but very committed team of participants is needed, with backing from their parent organisations. Participating organisations must clearly see the added value and be ready to share their data with others, in the broader context of contributing to energy transition, without expecting direct monetary return. Inherently, such projects need an individual or organisation to move the project forward and guide the process, especially when many actors are involved.

VALUE OF THE PROJECT		POTENTIAL FOR UPSCALING
Economic value		Roll-out
<ul style="list-style-type: none"> - Atlas is a decision support tool for the partners - It offers potential energy cost savings based on energy data - The open tool can be deployed by service companies to advise clients 		
	Ecological value <ul style="list-style-type: none"> - Integrated block-level energy data provide insights for energy-efficient interventions 	 Expansion <ul style="list-style-type: none"> - Possible expansion of the geographical region to the entire Amsterdam metropolitan region - Scope for adding functionality: Real-time energy data, sewage data
	Social value <ul style="list-style-type: none"> - Team members support the national government in developing a national energy atlas - Potential for replication in other cities, taking into account city-specific availability of usage data 	 Replication
KEY INSIGHTS <ul style="list-style-type: none"> - The open data solution offers the scope for discovering specific energy-saving solutions; this service can be commercially viable (e.g., 'software as a service'). - Data owners must see benefits in sharing data and find ways to protect privacy. - Replication in other cities is complicated because of different contexts, partnerships, and data formats; however, it has potential in terms of the concept of developing an integrated energy data map for the city. - Making data available was a key factor in the project; it depended on mutual trust among the partners and a good relationship between key partners (the city and Alliander) for developing the initial atlas. - EU funding can be a catalyst for a project's take-off. - The project's success was positively influenced by the city government's experience with GIS systems. 		

3.2 SMART LIGHT

Introduction: An internet-of-things approach to light in cities

Can technology help to make public spaces more liveable and hospitable at different times of the day? The Smart Light pilot project tries to answer these and other questions on the Hoekenrodeplein, a busy square near the Amsterdam ArenA. The project is developed in the district of Amsterdam Southeast. For the Smart Light project, smart lampposts were installed, whereby the lighting can be adjusted for a range of situations via remote operation or sensors, helping to improve security while conserving energy. For example, lighting can be dimmed or adjusted according to the weather and time of day, and coloured lighting can control the flow of traffic and pedestrians. The ambitions of the commercial project partners KPN, Cisco and Philips go even further: they see Smart Light as a new step in learning how technology can facilitate interactions between people and their urban environment, with a major potential for upscaling beyond the project at Hoekenrodeplein. ‘Smart light really has a business case, and we are very interested in exploiting it. It may be the start of an “internet of things” movement which will spread throughout all big cities’, says Pim Stevens, the project leader from KPN. The upscaling potential is also a reason for partner Cisco to be part of the project. As Bas Boorsma, Cisco’s Internet-of-Everything Lead for Northern Europe says: ‘Smart lighting is so important because it has a major upscaling potential and offers a wide range of opportunities beyond light, in example through integration of wifi in lampposts. It is possible to create integrated, hybrid solution in cities’. While upscaling potential and the added economic for the partners involved, and environmental value through energy efficiency gains, seem to be fairly obvious, challenges are still manifold.

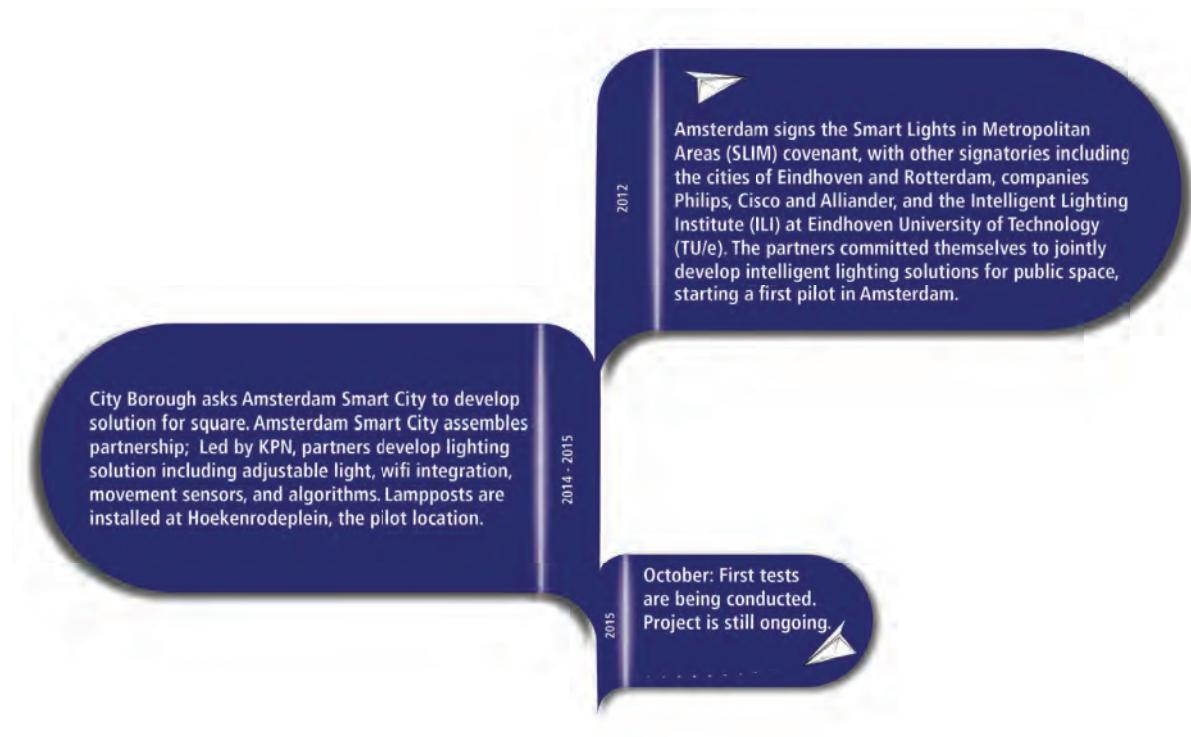


Source: Photo by Schlijper.nl

Rationale: The benefits of smarter lights

The project started with a local request: the city borough of Amsterdam Southeast had been investing for some years to revitalise one of its central squares: the Hoekenrodeplein. It is next to the Amsterdam ArenA railway station, the heart of a busy urban area with a stadium, cinema, concert halls, retail outlets, and many office buildings. The city borough’s leaders want to turn this place, which has had a somewhat bad reputation for safety during the 1990s and early 2000s, into a square where visitors and inhabitants can safely congregate, linger, and spend some money. They believed that lighting was at least part of the solution: ‘what if you could adapt the light intensity according to the situation at any given moment (number of people present, weather conditions, etc.)?’ One of the city managers contacted the Amsterdam Smart City organisation to hear what would be possible and if a project team could be assembled. After some negotiations in the ASC board, it was decided that KPN would take up the challenge and lead a team of three partner companies (Philips, Cisco and Alliander).

The Smart Light project fitted neatly into a bigger programme that started in 2012: the Smart Lights in Metropolitan Areas (SLIM) covenant, signed by Amsterdam's alderwoman Carolien Gehrels. The other signatories were the cities of Eindhoven and Rotterdam, the companies Philips, Cisco and Alliander and the Intelligent Lighting Institute (ILI) at Eindhoven University of Technology (TU/e). The partners committed themselves to jointly developing intelligent lighting solutions for public space. Now the moment had come to start the first pilot in Amsterdam.

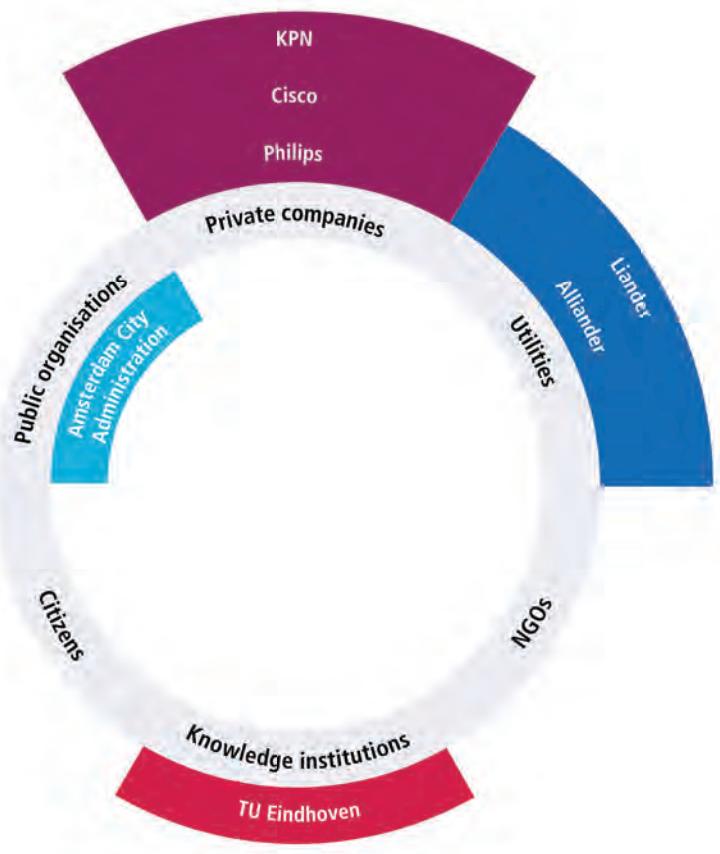


How does it work? On the square, four posts have been installed, each equipped with lamps that can emit light of varying intensity and colour, movement sensors, cameras, and wifi connectivity. They are connected with a glass fibre network. The lighting can be controlled (with algorithms that use sensor data or by remote control) to the prevailing conditions in order to save energy and improve security. Moreover, colours are used to nudge the movement of people. The hardware is installed, first tests were done in October 2015, and the project was officially opened on 1 February 2016.

The partnership: Firm-specific expertise pooled into a smart light pilot

The pilot project is run by four partners (full members of Amsterdam Smart City). KPN (a telecom provider) has assumed the project lead, and has assumed responsibility for wifi installation, the cameras, and the data storage/management. Cisco initiated the project, co-defined the concept's functionality with the City of Amsterdam, and orchestrates the partner ecosystem. Philips provided the light system. Alliander joined to track this projects' scope for energy and CO₂ reduction (an important parameter for the client). The City Borough of Amsterdam Southeast is the client. A PhD student from TU Eindhoven developed and tested the algorithms that determine the intensity of the light on the square.

The partners offered a reduced rate (cost price only), partly because they saw it as an investment with significant learning potential, and partly because they are committed to conduct these types of projects as leading partners in Amsterdam's Smart City organisation. The Amsterdam Smart City organisation was particularly important as the client's first port of call to see if its ideas were practical. Furthermore, thanks to its partner structure, ASC was able to quickly build a mixed team that could do the job. After the pilot, Amsterdam Smart City's role has been to promote the project and disseminate its results and outcomes.



In this partnership, multinational firms are clearly in the lead, each bringing its own knowledge and expertise. In deciding to join a project, economic potential as well as potential for scalability are important considerations. As Bas Boorsma of Cisco remarks: 'how do you decide as a firm which pilot project or proof of concept to invest in? Long-term return on investment is clearly important. For us, only doing pilot projects is not very relevant anymore: it is ok to invest money in a project, but it has to have a clear potential to generate money and be scalable beyond the pilot. We want other partner organisations to invest as well. We want to be sure the technologies and innovations that we are developing at present, can be integrated in the project'.

Furthermore, in a public-private collaboration, Boorsma points out that commitment of the city administration is crucial: 'As incubator of innovations, Amsterdam has always had a very good culture, and it is relatively easy to get a pilot or project started (...) but we want to make sure we work on a project that has support from the city as a whole, not only one department. There is no point to start a project with the backing from only one department in the municipality if you know you need broader commitment further down the line... this means in this respect that city administrations have

to think about how to organize themselves'. The fact that within Amsterdam Smart City, over a dozen departments of the city administration are partners at the project level, and that the initiative is backed by the full city administration at the strategic level, establishes legitimacy for private organisations to invest in smart city projects.

User involvement

Who are the users of this project, and how were they involved in its setup? The main user of the project is the borough of Amsterdam Southeast. They will use the data and the technology to improve the safety and atmosphere at the square. But two other types of 'users' can also be identified: people who happen to be on the square (and are thus directly affected, consciously or not): residents, tourists, commuters, or any other city dweller. In fact, the word 'user' is inadequate; most people will be nudged by the project, not use it. The smart light system records their presence and nudges their behavior. Other users are entrepreneurs/business people (shopkeepers, hotels and restaurants) located at the square. These groups were not explicitly involved or engaged in the development of the project.

Value of the project: A safer and better square

The client, of this project, the city administration, hopes and expects that this project will make the square safer and more attractive. This is good for the local population, but also for visitors and commuters (there are many of them in the area), and consequently might lead to higher turnover for the local businesses on the square. The assumption, which is still untested, is that smart lighting will help to establish these goals. Besides, due to the energy efficiency potential of smart light solutions in comparison to traditional lighting, the project should contribute to cities' CO2 emission reduction ambitions.

KPN, the project leader, considers the pilot project as a learning and innovation exercise that might yield interesting insights that can be applied elsewhere. The company sees substantial new business for itself in the emerging internet-of-things: developing new value adding services based on a smart use of information from many sources in an integrated and synergic way. As project manager Pim Stevens puts it: 'Lighting is not new; cameras and wifi are not new either. New is the data that we will generate, and how we can use and recombine that to create the right type of light on that square.' In a similar way, the project fits into Cisco's internet-of-things solutions for smarter cities, thereby having clear strategic value for the firm's products and services as a whole: 'the great thing about smart light is that the business model is so strong, and has so much potential (...) scalability should be a key criteria on all levels of the project: the architecture, the technologies and solutions, but also in terms of regulation. It is key to do your homework and be well-prepared and aware of all aspects related to scalability'. While the development stage of the project is not advanced enough as of yet to have a definitive idea of scalability potential, it is clear that when this small project is successful, the partnership will be able to offer a similar solution to other parts of Amsterdam and to other cities, and to other project developers or landowners looking for these types of solutions.

In the longer run, KPN and Cisco see clear opportunities for new interfaces between citizens and their city environment, in which technology plays a prominent role. 'Imagine someone leaving the Mediamarkt store (close to Hoekenrodeplein) around 12PM, walking back to his car. He might receive a message on his phone through the wifi connection in the area saying 'what about having a lunch right across the street for a very good price', in a place that he probably likes. Of course only with consent, and all

privacy secured', says Pim Stevens of KPN. Bas Boorsma or Cisco, describes a similar opportunity related to tourism in Amsterdam's museum district, whereby a wifi-integrated smart light solutions could make it easier for the hundreds of tourists visiting Rijksmuseum, Van Gogh Museum or Stedelijk Museum to find their way to nearby shopping areas. The project exemplifies the development and testing of an innovative smart city solution to learn about its impact and potential (whereby the innovation lies predominantly in the integrated combination of all components into one solution, and not in the individual components themselves), in a small, designated area.

Potential for upscaling: IoT solutions for public spaces

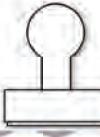
The project started as a pilot, but has potential to be expanded to adjacent areas, or replicated in other boroughs or cities. This potential was recognised by the partners from the beginning and was one of the reasons why they engaged without asking monetary returns beyond recovering the production costs. Expansion plans have already been made; when successful on Hoekenrodeplein, the geographical area will be enlarged to include a nearby shopping centre and a residential area and perhaps even more. In the upscaling process, the pressing issues (which also holds for similar ones that collect data about citizens) are predominantly privacy-related and centred on data protection. Citizens are not involved in the testing of the technology in the current project, but they must be confident that information pertaining to them is handled lawfully.

Replication of this concept entails challenges, especially near stadiums or concert halls with many people and unpredictable situations. The project leader says: 'Near the stadium, you can suddenly have thousands of people and perhaps some havoc. In such a critical event, will our data generate the right light to mitigate the situation? Will the emergency services be informed properly by our system, can we see that in our dashboard and can they monitor things with the cameras that we put in place? Now I am telling you what the system should be able to deliver on the longer run.' Learning from various stages in this current project could save a lot of time in the upscaling process, as Bas Boorsma identifies looking back on the (rather long) evolution of the project: 'we first started to think about this concept four years ago, and it was only a year later that we found a location. But we (Cisco) and KPN were not ready to collaborate at that point: we had to think about how to design the business architecture first, as well as how we would achieve scalability. Also, privacy and security concerns should be integrated earlier in the development process, especially how this should be built into the design. Also, adopt a network paradigm in the development, and understand that you need an ecosystem of other partners for the development (...) and think about the motivations of all partners at the table: are they there with the same ideas and vision?'

The solution developed in Amsterdam, when successful, can possibly be applied elsewhere. If it works, and the issues above are addressed properly, other cities might show interest in adopting similar smart light solutions. Potential clients are cities (through the city administration), but they are subject to European public procurement legislation, so KPN and its consortium partners will compete with other suppliers in an open tender. Also, commercial clients might include project developers or other landowners, interested in the solutions.

Key insights in Smart Light

- Leaders of all partners had signed the Smart Lights in Metropolitan Areas (SLIM) covenant back in 2012. This prior commitment made it easier to start up the Smart Light project.
- A demanding client helps. The client, the city, wanted to pay for the solutions and has clear goals and ambitions: make the square safer and more attractive and reduce CO2 emissions. So, it is not technology-driven but arises from a social and environmental need.
- The project fitted in the core strategies of the commercial partners, and helped to keep them committed even if the project took a long time to realise. Project leader KPN considered the project as an important learning tool in its internet-of-things strategy, as did Cisco.
- The project would have benefitted from the involvement of users or affected people (retailers on the square, visitors) earlier in the project. The project partners have set all the specifications of the projects without using the first-hand knowledge and insights of frequent users of the square or the companies/retailers in the area. Although such stakeholders could be integrated later into the project, input in an earlier project stage could be important in the design.
- The project lacks a concrete evaluation framework with preset metrics to measure success. All partners have particular interest related to the hardware, software, or data deriving from the project, but clear outcomes on the basis of which the project can be called successful are lacking.
- This project has potential to scale up, but this can raise issues such as ownership over the concept/product developed in the project in which multiple commercial partners collaborate. Upscaling can be quicker with a proof of concept in hand (developed through a pilot project), as well as a business architecture and a partner ecosystem.
- The design process of the consortium can be put into question. All partners are committed partners in ASC, and thanks to the ASC partnership all project partners were able to act quickly and respond to the question of the client. However, to what extent have other players (start-ups, other companies, knowledge institutes) had a chance to collaborate? And once a full-scale smart light solution is developed in the project, which firms or bundle of firms have ownership over the solutions to further commercialise it?

VALUE OF THE PROJECT	POTENTIAL FOR UPSCALING
Economic value	Roll-out
<ul style="list-style-type: none"> - The project is instrumental in exploring the economic potential of Internet of Everything applications/ functionality in public spaces - Project might yield energy savings - An increased attractiveness of the square might translate into higher real estate values 	<ul style="list-style-type: none"> - An integrated and well-functioning lamppost might be sold on the market 
Ecological value	Expansion
<ul style="list-style-type: none"> - CO2 reductions - Energy savings 	<ul style="list-style-type: none"> - Plans to expand into a square on the other side of the station (near the Amsterdam Arena) while adding functionality, such as commercial offerings via Wi-Fi integration 
Social value	Replication
<ul style="list-style-type: none"> - Making the square safer and more attractive 	<ul style="list-style-type: none"> - Replication potential: Offering similar solutions in similar areas in Amsterdam or elsewhere and/or selling the solution to local governments or project developers 

KEY INSIGHTS

- Leaders of all partners signed the Smart Lights in Metropolitan Areas (SLIM) covenant in 2012, which made it easier to start up the Smart Light project.
- A demanding client helps. In this case, the client (i.e., the city) wanted to pay for the solutions and had clear goals and ambitions—namely, make the square safer and more attractive and reduce CO2 emissions.
- This project underscores the potential for city-wide open data platforms.
- The project would have benefitted from involving users (retailers on the square, visitors) earlier in the project.
- The project should have a concrete evaluation framework with pre-set metrics to measure success.
- Upscaling beyond the pilot phase has clear potential, but can raise issues such as ownership of the concept/product developed in the project in which multiple commercial partners collaborate.

3.3 CLIMATE STREET

Introduction: Working towards a more sustainable shopping street

How can a shopping street be made more sustainable? There are many options and possibilities. The Climate Street project was launched to turn a busy urban street into a living lab and showcase: the Utrechtsestraat, a long retail street that extends southwards from Amsterdam's city centre. In this 'climate street', retailers were invited to apply a broad range of technologies and concepts that would reduce energy use or waste. Also, experiments were set up in the field of waste collection, logistics, and innovative street lighting. For technology companies and utilities, the street was an interesting urban lab where they could test new products and services that could later be scaled up. This worked in some cases, for example in relation to energy efficiency. Quby, a start-up involved in the development of the display, tested a display in the Climate Street project and sold it to Eneco (a major electric utility), which is now marketed nationwide as 'Toon' and that has sold over 100,000 energy displays to date. Some aspects of the program proved even more difficult to realize. The project's aim was to realize CO₂ reduction and environmental saving in (shopping) streets in Amsterdam. It was a struggle, however, to keep the project running without continuing government support after the pilot phase: in 2012, the project ended, mainly due to a lack of ownership and substantial incentives and benefits for the retailers.

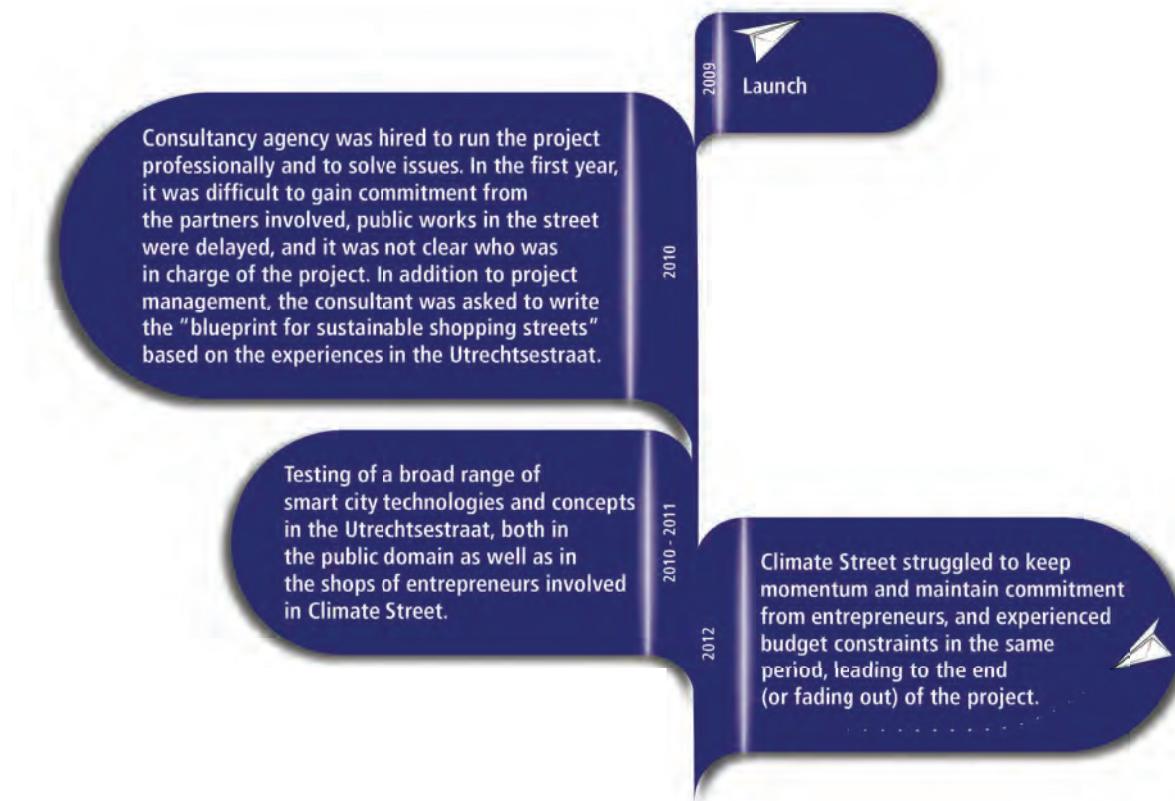


Source: Amsterdam Smart City

Rationale: Many energy-efficiency solutions tested simultaneously in one street

Retail streets are vital parts of the city. At the same time, they are sources of pollution and CO₂ / NO₂ emissions, and heavy users of energy. There is considerable scope for improvement, and many technologies are available or being developed. What often lacks is collective and integrative action to overcome inefficiencies. In logistics, for example, each retailer has its own suppliers, leading to many traffic movements and half-empty lorries entering and leaving the street every day. Is it possible to coordinate this better? But there are many other promising areas: energy savings from smarter street lighting, smart meters and displays, and smarter ways of waste collection. Instead of targeting one issue, the project integrates a large number of energy-related challenges into one project, with the involvement of many stakeholders. Over the course of the projects, sustainability initiatives were carried out in three distinct but related fields. First, they were involved in carrying out energy scans, to map the saving potential of the entrepreneur in relation to lighting, heating and cooling. Second, smart meters

were installed to measure energy consumption, which in combination with smart energy displays, were able to provide feedback on energy consumption and give personal energy-saving tips. Third, smart plugs that automatically dim or shut down unused appliances and lights were installed. Outside stores and restaurants in the public space, several energy saving initiatives were also developed: sustainable street lighting using energy-saving lamps with the option to dim at night when no one was around were installed, solar-powered lighting combined with energy-saving lighting was installed at tram stops, and initiatives related to water and waste were installed. Logistics provided another opportunity for energy savings, whereby logistical processes were optimized through clustering, and waste was collected using electric vehicles from a single provider, thereby minimizing CO₂ emissions.



The project started small, when Gansewinkel, a waste collecting company, adopted the street as a pilot site for new types of waste collection, using electric vehicles. After some successful tests, a local entrepreneurs' collective and the waste company contacted ASC to explore what other actions could be taken to make the street more sustainable. Together, they assembled an alliance of partners to develop an integrative concept for a sustainable high street that could serve as an example for other high streets across the country.

The project started June 1, 2009, just ahead of a large public infrastructure maintenance program in the street, that could help to realize the ambitions. The city administration was one of the partners initiating the project and was largely responsible for its funding. The project ran until late 2012 with a total budget of just over EUR 315.000.

The partnership: A plethora of stakeholders and interests

The project's steering group consisted of eight partners including representatives of the city and borough administration, representatives from the cities' thematic programmes on climate and energy and air quality, and the street manager. Various private partners participated as well, interested in testing new energy technologies (including JC Decaux, L.A.J. Duncker BV, Philips, Tauw, Van Gansewinkel, TNT, Vodafone, Ziut). Moreover, approximately 40 entrepreneurs located in the street participated. The project had a rough start. It was hard to gain commitment from the partners; the public works in the street were delayed, and it was not clear who was in charge of the project. In June 2010, one year after the launch, a consultancy agency named C30 was hired to run the project. C30 was also charged with writing a 'blueprint for sustainable shopping streets', based on the experiences in the Utrechtsestraat, as a source of inspiration of other retail streets.



The partners had different roles and interests. The city departments saw the pilot as a unique lab to learn how to work with local retailers and show them how to adopt clean technologies. They were the main funders of the programme, and helped to set the right conditions for realising urban innovations: permits, solving legal issues, access to civil officers with the right skills and competences. The retailers initially saw opportunities to save costs, or otherwise improve their businesses. For the other participating companies, this was a unique lab to test their new products and concepts in a real-life setting.

The project's leadership relied on the street manager (appointed and paid by the city) to involve the retailers. The street has a large number of retailers, with very different backgrounds and interests, and varying levels of commitment to the project. The street manager's help was crucial in selecting the 'right' retailers to join particular test groups. She personally knew most of them, and they trusted her. In the words of Vivienne Bolsius, the project leader: 'She knew in advance who would probably be enthusiastic to join a test panel. Our collaboration was very valuable'. Nevertheless, it was never easy to involve the retailers. For them, the benefits of the projects were often marginal – such as a slight decrease in the energy bill. And in some cases, the benefits accrued to the real estate owners, not the retailers (most of whom are renting space in the building). At the same time, many of them were very annoyed by delayed streetworks and renovations – with substantial revenues foregone – and the trust in the municipality eroded. In 2010 the project almost collapsed due to the lack of commitment and a lack of clarity as to who was in charge.

What technologies were tested, and how were they selected? In some cases, the project management team approached companies they knew has something to offer; in other cases, companies approached ASC asking if they could test their product in Climate Street. Vivienne Bolsius mentions that many market parties were interested in participating in Climate Street: 'there were a lot of different businesses behind the different concepts and sub-project developed as part of Climate Street (...) you see a lot of new concept being developed, as start-ups but also within larger corporations'.

User involvement

Who are the users in the project, and how are they involved? The main users in this case were the retailers in the street who adopted and tested the technologies. They were fully part of the project, and had influence on the type of projects that were being developed. Their involvement was intermediated by the street manager, the bridge between the retailers and the technology companies that wanted to test solutions and used the feedback of the retailers to improve their solutions. Thus, the street became a living lab with live customer feedback. There was, however, no systematic way of collecting and processing feedback.

Value of the project: Reducing environmental impact

From the start, the project's main goal was to reduce environmental impact: increasing energy efficiency gains, and reducing CO₂ and NO₂ reductions in a central shopping street in Amsterdam. Reductions in CO₂ emissions and energy use were achieved for a range of subprojects developed within Climate Street. For example, CO₂ reductions were achieved through adoption of green energy and installment of solar panels, and the installation of more energy-efficient light in the street. Other solutions, such as the energy

scan, smart meters, and energy displays, were designed to create and spread awareness of energy use and potential energy savings. Many other planned solutions with potential for CO₂ reductions, were never completed.

In addition, financial value was created for the participating retailers and entrepreneurs in the street, although the financial benefits from taking part were marginal: some of them have seen small reductions of their energy bills. For firms engaging in the project, a real-life setting for testing innovative solutions to realize energy efficiency gains was made available, although quantifying the value created for each firm is hard. An example of value creation for firms in this respect is the smart energy meter developed and tested by Quby, which was an important integrated part of the Climate Street project, and was later sold to Eneco, and marketed nationwide.

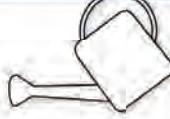
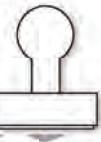
Potential for upscaling: Replication elsewhere?

The Climate Street was envisioned as a permanent lab, a platform for all sorts of experiments that would enhance sustainability. Starting up the Climate Street as a lab went well: the partners were excited, many test projects saw the light under the strong leadership of ASC. But it turned out very hard to keep up the momentum, and in the end, the project faded out. After two years, the project ran out of money: the municipality and borough were not prepared to commit to permanent funding. By then, a closing event was launched, to show what had been achieved and to celebrate the successes. The message to the local retailers and the other project partners was clear: from now on, the project had to be self-sustaining. That, however, has not happened. The project is over, and Climate Street is no more. No organisation was willing to take over leadership beyond the project phase. This lack of ownership and commitment begs the question: to what extent can the project be replicated successfully elsewhere? Given the context of this project, the entrepreneurs involved, the characteristics and sustainability challenges relevant to this street, and the technologies that were applied in 2010 and 2011, the project would have to be modified and adapted for replication elsewhere. However, in terms of process knowledge developed throughout the project, and establishing commitment amongst so many entrepreneurs and organisations, from this project has tremendous potential for learning. As a legacy, the partnership wrote a 'blueprint' for the Climate Street, describing the technologies applied, and lessons learned. Someday it may serve as inspiration for other retail streets with similar ambitions.

For the service and technology providers, the experiments yielded valuable lessons and insights for their individual companies. In some cases, there was upscaling. Again, the best example is the energy display Toon, developed by Quby and later Eneco, which was tested in this street and brought to the Dutch market.

Key insights in Climate Street

- Managing a pilot project with a very large group of stakeholders with partly diverging interests is very challenging and difficult, and can lead to diminishing stakeholder commitment.
- A very broad approach (in this case, simultaneously testing many smart city technologies and concepts for energy-efficient solutions), creates ambiguity about what the project stands for.
- It is important to clearly define the role of each partner, and communicate this role internally.
- Partner commitment and ‘project ownership’ must be ensured and made explicit: it must be clear from the beginning who has the leadership role.
- Without substantial (financial) incentives/benefits, it is difficult to keep the retailers interested and involved, and keep momentum going throughout the project.
- Technological innovations for energy efficiency are very dynamic and subject to change: what can be considered an innovative technology (such as a smart energy display in the case of Climate Street) at one point in time, can be considered mainstream a couple of months later, or be replaced by a more favourable alternative.
- Due to the unique character of each area and the diversity of stakeholders, it would be difficult simply to replicate the project without a lot of preliminary analysis and people management.
- Climate Street had an abundance of stakeholders and interests. In such a complex project, it is essential to define the role of each partner from the outset, make all commitments explicit, and define leadership on the longer run.
- It is essential that the project leader is up to date on the latest and most suitable technologies on the market at any point in time, to make sure the technology best suited for the specific conditions in which it is applied is selected.

VALUE OF THE PROJECT		POTENTIAL FOR UPSCALING
Economic value	Roll-out	
<ul style="list-style-type: none"> - For the retailers: Reductions in energy costs (marginal) - For the tech companies: Testing ground for new products and/or services 	<ul style="list-style-type: none"> - Quby, a start-up firm, successfully tested a smart energy display (named "Toon") on Climate Street. The firm was acquired by big utility (Eneco), that sold more than 100,000 displays. 	
<ul style="list-style-type: none"> - Energy efficiency as well as CO2 and NO2 reductions by applying sustainable technologies and services 	<ul style="list-style-type: none"> - Expansion 	
<ul style="list-style-type: none"> - Initial commitment and enthusiasm by stakeholders on the street to achieve more sustainability 	<ul style="list-style-type: none"> - Replication 	
KEY INSIGHTS		
<ul style="list-style-type: none"> - Managing a pilot project with a very large group of stakeholders with partly diverging interests is extremely challenging and difficult to manage and can lead to diminishing stakeholder commitment. - A very broad approach (in this case, testing many smart city technologies and concepts for energy efficiency solutions simultaneously) creates a lack of clarity on what the project stands for. - It is important to clearly define the role of each partner and communicate this role internally. - Partner commitment and 'project ownership' must be ensured and made explicit; who is taking on the leadership role must be clear from the beginning. - Without substantial (financial) incentives/benefits, it is difficult to keep the retailers interested and involved or keep momentum going throughout the project. 		

3.4 SUSTAINABLE NEIGHBOURHOOD

Introduction: Citizens and insight in their energy use

Can citizens be persuaded or convinced to use less energy? Could technology help to raise awareness on current usage levels and make savings? These were the questions to be answered in the Sustainable Neighbourhood project, a pilot project (2009 – 2011) in the Geuzenveld neighbourhood in the western part of Amsterdam, now part of Amsterdam Smart City's urban living lab New West. Smart meters and displays were to be installed, so citizens could see in detail how much energy they used, and the data collected on energy

use behavior would be collected throughout the project. The idea sounds simple, but getting started was harder than expected. 'It was difficult to get everything organized. We had to approach each and every individual household. Especially cultural differences proved to be a barrier', says Charlotte Meuwissen, project leader.

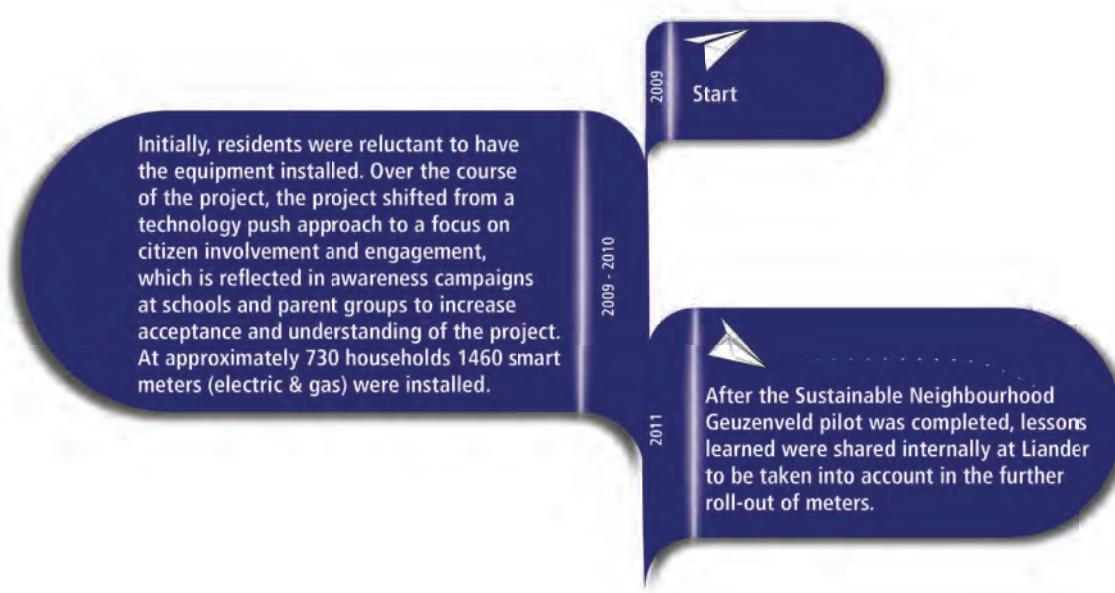


Source: Accenture

Rationale: Energy efficiency gains on a household level

In Amsterdam, as in many other cities, there is still a large stock of poorly insulated houses, with high energy consumption and CO₂ emission, entailing high cost for the tenants/owners and society. How to address this issue? A number of partners (the main ones being housing corporations, the grid company, the city administration, and Amsterdam Smart City), led by grid company Liander, teamed up and developed a pilot scheme to find out how energy consumption could be reduced using smart meters. Such smart energy meters – relatively new at the time of the project, but mainstream today – can generate detailed information about energy use of each household appliance. The project partners assumed that if citizens are more aware of the amount of energy they were using, they would modify their behavior and use less. The project leaders' plan was to provide about 500 houses dating from the 1950s (in a mixed multicultural neighbourhood) with such smart meters, and to install displays that give feedback on energy consumption and offer customised suggestions for savings based on the information provided. In addition, citizens would be informed and helped through information and education campaigns. The project would help to gain experience and knowledge of how to organize the process of supplying citizens with smart energy meters for Liander. The project goals included finding blind spots and potential problems in the installation of the meters in each household; gaining experience in working collaboratively with partners and in communicating with citizens, finding ways to make this process run efficiently; and testing data communication between the smart meters and the network.

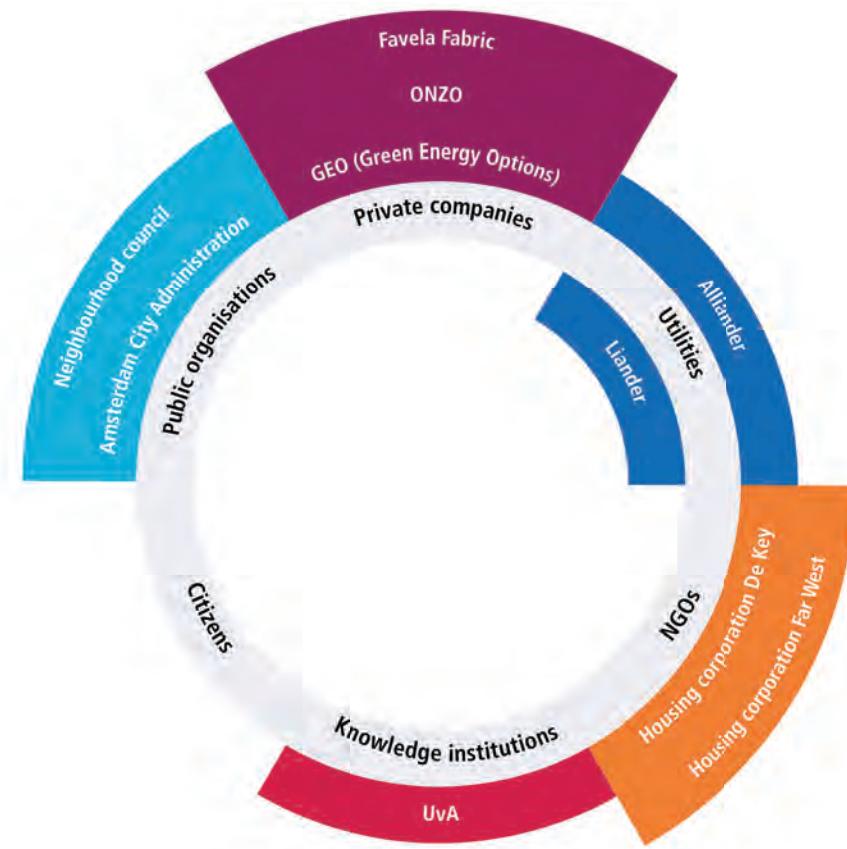
That was the theory, but in practice, things were more complicated. For a start, Liander experienced delays in installing the smart meters due to technical problems and because not all homes had been renovated by the housing corporations (as Liander had assumed). Moreover, many inhabitants were skeptical about the meters. Community meetings were held to inform the citizens but still it was difficult to citizens to install the smart display, even though it was free. The project team had a hard time reaching citizens. Traditional mail was unsuccessful, and when team members went door to door to introduce the display and explain how it worked, many residents refused to speak to them. Those who did open their doors were not easily convinced that the device would be useful. In the end, only 60 of the 150 that were available were installed in the neighbourhood. The quality of the data generated by them was therefore insufficient to draw sound conclusions.



Nevertheless, the project was successful in the sense that it helped to increase awareness in the neighbourhood about energy use and climate change (one of the key objectives of the project). Faced with low and slow adoption, heavy delays in roll-out and communication problems, the partnership decided to refocus the project. The objective remained the same, but rather than nudging people to adopt technology, the partnership now tried to start the conversation and the dialogue in the community, on energy and climate change, and what citizens could do about it. For this, the partnership set up an 'activation programme' that ran in parallel to the installation of meters and displays. The project team hosted discussion evenings, where residents could raise issues about energy and climate, and Wednesday afternoons where mothers discussed how to save energy at home. Visits were organized to the waste treatment company where inhabitants could see how 'their' waste was being transformed into energy that powers the city's tramways. The project ended with a large party with 300 inhabitants attending, where an 'experience book' with all the lessons learned was presented to the alderman.

The partnership: Towards triple helix involvement

In total, nine partners were involved in the project: two housing corporations (FarWest, and de Key), two technology partners (providers of the display and feedback software, Green Energy Options en Onzo), the city (Department for Climate & Energy), the neighbourhood council (New West district), the grid company (Liander), the University of Amsterdam, and a company that enlisted residents in the process (Social Business Consultancy Favela Fabric). The displays were supplied by two English companies, at a discount. They considered the project as a way to test their product and a first step to gaining access to markets outside the UK.



Liander provided project leadership after the startup stage (taking over from Amsterdam Smart City). The company could have done the project on its own, but was very happy with the services of Amsterdam Smart City. First, the network helped to kick-start the partnership: they took the lead at the inception of the project, they assembled the partnerships quickly (thanks to their access to players in Amsterdam and beyond), and raised the project's profile through its marketing and PR tools. Then they enriched the project: ASC suggested doing more with the data than the project would generate, and recruited the University of Amsterdam as its knowledge partner in this undertaking.

With nine partners, the partnership had to organize the dialogue with the citizens and adopt a unified approach. Many of the partners had their own communication channels and contact points with citizens. For citizens, it was not always clear which partners actually represented 'the project', and sometimes project partners caused confusion by sending conflicting messages. Liander was in charge

of communication with the citizens. But it turned out that very few people actually knew about the grid company and did not understand its role. Moreover, Liander had little experience communicating with citizens.

User involvement

This project taught its participants some important lessons about user involvement. Initially, citizens were targeted by the project leadership to have smart meters and displays installed. They were approached as 'clients' who would receive a product for free and gain benefits such as better insights into their energy bill. But the citizens had second thoughts, they felt threatened, it was not clear to them who approached them, and they proved unwilling to have the devices installed. They were not convinced of the value proposition. Technology push clearly failed. The awareness campaigns at schools proved much more successful in increasing awareness on energy issues, and helped to create a more receptive climate for the adoption of the devices.

Value of the project: Learning how to approach citizens

The project represented a value proposition with interesting aspects for all the partners involved. For the project leader, Liander, the project touched on its core business. It started the project to test new smart grid technology (meters and display) in a real setting. The Geuzenveld area seemed a logical place to start; Liander had already begun the roll-out of smart meters in the area, and this project offered an opportunity to get more out of it. Grid companies like Liander are facilitating a new energy landscape with many local (durable) energy sources, different energy pricing models, and rely much more on data and software in their operations. Household-level data are key to advancing the technology, and firms like Liander are eager to learn how to collect these data. 'We wrote an internal report on the project to share experiences, including key lessons learned, how to approach citizens effectively, what works and what doesn't, etcetera... in these next project, it was predominantly the approach we used in Sustainable Neighbourhood of how to connect with citizens and engage with them that was adopted'.

The English suppliers of the displays had a direct commercial interest in participating: testing their display, and learning how to operate in mainland European markets. Their active role in the partnership, however, was limited. The city participated because the project was assumed to address CO₂ reduction. It was a chance to learn how technology could nudge citizens to consume less energy, and the lessons might be applied elsewhere. To organize the community activities (meetings, educational activities) the partnership hired a specialised company, Favela Fabric, and shared the costs.

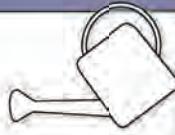
Potential for upscaling?

The project was never designed to be scaled up. It was rather set up as an experiment to test new smart meters and displays, and to learn how technology could nudge people to reduce their energy consumption. Many general lessons were learned during the project (see below) that might be applied in similar situations, but only to a limited extent, because, as the project leader Charlotte Meuwissen put it, 'Every city or neighbourhood is different, and requires a unique approach'. Contextual factors at the city-, neighbourhood- and household-level are very important factors determining the success of projects in which citizens are so involved. As such, learning which 'soft' approaches are the most effective (education programmes, visits, involving households) to nudge behavior is can be a key learning experience in upscaling the mainstreaming of smart meters.

Evidently, the issue of gaining insight in energy usage and potential opportunities for more efficient energy use at the household level is highly relevant for any city wanting to reduce its CO2 emissions. Key in upscaling a similar project, is having the grid operator (in this case Liander) and city administration in the partner consortium to install the smart meters and collect data, as this ensures the further roll-out of smart meters beyond the pilot project.

Key insights in Sustainable Neighbourhood Geuzenveld

- The choice of the pilot location matters. The project was conducted in a complicated neighbourhood, under the assumption that 'if we can do it here, we can do it anywhere'. But in fact, the many complications and difficulties severely slowed down the project, and in the end, technology adoption remained very low. Thus, if the aim is to test new technology, starting in a difficult neighbourhood is probably not the wisest way to do it.
- In this project, citizens were confused by contradictory or confusing messages.
- Projects like this need a strong communication strategy, and project partners must co-ordinate their messages to the inhabitants and speak with one voice; information must be shared systematically within the project team.
- It helps when the lead communicator has the trust of the community. In this project, the project leader, Liander, was largely unknown to the target group.
- It turned out that in a neighbourhoods like this, 'traditional' door-to-door communication (information letter, folders) is not effective to inform people about a project, let alone to convince them to participate. The same goes for personal door-to-door campaigns by project teams. It was more worthwhile to engage the community by organizing educational programmes for schoolchildren or to promote the project at community events. Charlotte Meuwissen notes: 'We were physically present in the neighbourhood a lot of the time, to make sure citizens were familiar with the initiative (...) it took a lot of time and effort to engage with citizens'.
- A third key lesson is that rolling out new technology like this requires the citizens to be involved in the process from the start. Community 'activation' must come first. In this project, rather than starting with installing meters and pushing citizens to use the displays, it would have been better to start with awareness campaigns and 'bottom up' discussions and activities; if people see why technology might be relevant, they might become more willing to adopt it. Familiarity takes away fear or skepticism, and leads to better ways of rolling out the technology. Citizens will naturally resist technology push if they don't see the financial benefit of having it, or if they have no other intrinsic motivations.
- Community activation/engagement is an art. Partnering with experts (in this case Favela Fabric) can be beneficial when a project depends on citizens' adoption of technology
- For similar projects in the future in other places, a more systematic and scientific approach should be adopted to test assumptions, and analyse more thoroughly what does and does not work, and to what degree awareness of energy use is created and behavior is affected. Although data on household energy usage was collected and monitored amongst households that agreed to participate in the project for several months (to analyse the degree to which the smart meter affected energy use), but in the end the collected dataset was too small to measure impact. It would be recommended to collect data more systematically for a significant number of households (for which compliance from each household is needed), especially when the project is a testing ground for large-scale implementation of smart meters in the city.

VALUE OF THE PROJECT		POTENTIAL FOR UPSCALING
Economic value	Roll-out	
<ul style="list-style-type: none"> - Testing smart meters and displays to prepare for roll-out - Finding blind spots and potential problems in the implementation process of the meters - Test data communication between the smart meters and the network 	<ul style="list-style-type: none"> - Results of the project help further install smart meters in households - Sales of energy displays 	
<ul style="list-style-type: none"> - CO2 reductions - Energy savings 		
<ul style="list-style-type: none"> - Citizen engagement and participation 		
KEY INSIGHTS		
<ul style="list-style-type: none"> - Choosing a 'difficult' neighbourhood to test equipment can complicate the pilot project. - Communication with residents should be streamlined, both formally and informally, among project partners to avoid noise and mixed messages. - Community activation and citizen engagement must start immediately from the earliest project stages, rather than pushing a new technology without a prior awareness campaign. - Partnering with experts on citizen participation (in this case: Favela Fabric) can be beneficial when a project depends on citizens' adoption of technology. - Project data must be collected systematically to draw conclusions and analyse effects; the collection process must be built into the project from the start. - Learning potential for the pilot study in this context: experience working collaboratively with relevant partners, gain experience in communicating with citizens, and find ways to make this process run efficiently. 		



PROJECTS IN THE MOBILITY THEME

Wieke Schrama and Willem van Winden

Introduction

Mobility and transport are important in increasing the attractiveness and competitiveness of cities. The mobility sector fuels economic development and a better quality of life in cities. Challenges in city mobility are reducing congestion, improving accessibility, reducing traffic noise and improving air quality.¹⁹ These challenges require not only changing the urban transport system, but also imply changing the behaviour of both the organisations and the public. Moreover, cities differ in their structures and problems, which is why planners, entrepreneurs and politicians must handle these challenges within the context of what is suitable.

Amsterdam faces challenges in mobility growth in and around the city, as the city is growing in numbers of visitors, citizens, and jobs. The historic city centre and the canal system, dug in the 17th century, were obviously not designed for 21st-century mobility and traffic flows. 'The city is overflowing with the increasing transport of cargos resulting from for instance internet trade and the increasing numbers of participants in road traffic', Professor Ploos van Amstel states.²⁰ City distribution and logistics, reverse logistics opportunities, automated transport, vehicle-sharing opportunities, and electric mobility are amongst the fields of interest of city entrepreneurs. In collaborative efforts many organisations partner up in smart mobility initiatives. About 50 to 60 projects are underway in the field of smart mobility, from

19 EIP-SCC (2013), *European Innovation Partnership on Smart Cities and Communities - Strategic Implementation Plan*, <https://eu-smartcities.eu/sites/all/files/SIP.pdf>

20 W. Ploos van Amstel, Amsterdam University of Applied Sciences (Personal interview, 15th of January 2016).

bike-sharing initiatives to electric cargo transport solutions.²¹ Amsterdam Smart City (ASC) provides the network platform which lists and connects these smart mobility projects, and which helps initiatives to contact people and organisations to get support and publicity.

A smart city should be easily accessible to visitors and residents, while providing room for commercial transport essential for the city economy. Two of the evaluated smart mobility projects address commercial transport in Amsterdam: Cargohopper and Mokum Mariteam. Two other selected projects – REloadIT and WeGo Fleet Mobility – propose smart and innovative ways to share (electric) vehicles. Each evaluated mobility project is characterised by a collaboration among organisations in the Amsterdam region. Each of the four projects faces its own challenges in upscaling and each has a clear focus on economic, social, and environmental value creation.

4.1 CARGOHOPPER

Introduction: Electrifying last mile city transport

Cargohopper helps to reduce heavy and polluting goods traffic in the centre of Amsterdam by 'electrifying' the last mile and the bundling of shipments onto an electric freight vehicle that has the features of a 'road train' with separate carriages. The Cargohopper vehicle is designed for city logistics. It delivers shipments to businesses in the city's central area where no gasoline trucks are allowed. The shipments are bundled by address into separate carriages, allowing efficient delivery to businesses in the same area. Although long, the road train is agile and narrow enough to drive through historic alleys. When it stops to make a delivery, most other vehicles can go around it.

Not only the design of the vehicle is smart; so is the underlying distribution system. Goods from different shippers arrive at a depot site in Duivendrecht

(just outside the environmental zone of Amsterdam), and from there, the cargo is shipped into the city centre. All incoming cargo is re-bundled and to provide the most efficient routing, the end user's address is used as the bundling logic. By capturing partial lots and bundling them to address and house number, only full loads move into the inner city. Shippers can deliver their goods at the depot six days a week, and goods are delivered on time the same day in Amsterdam. Today, Cargohopper is also present in Enschede. The project in Amsterdam is expanding its business and its fleet of vehicles.

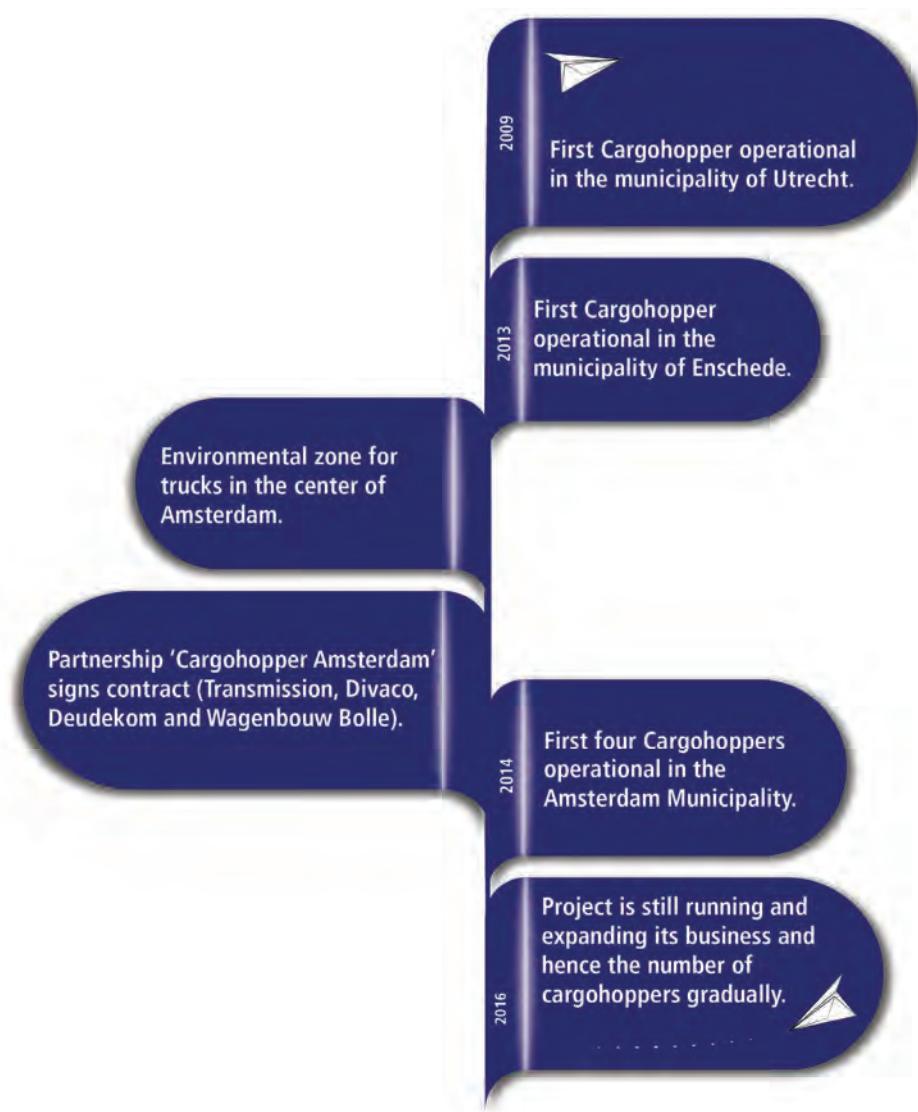


Source: Cargohopper Amsterdam

21 W. Ploos van Amstel, Amsterdam University of Applied Sciences (Personal interview, 15th of January 2016).

Rationale: A showcase as well as a business case for sustainable city freight transport

Commercial transport is important for the city economy, however transporters both contribute to and suffer from congestion.²² Moreover, too many commercial vehicles are powered by gasoline and alternative fuels are underused. Facing these challenges, an entrepreneur, Jaques van der Linden, initiated the first design of the CargoHopper in the city of Utrecht. While on holiday abroad he observed a tourist train and thought that Utrecht would be a perfect model for city transport. Upon his return, he talked with other entrepreneurs, but started the project by himself. His rationale for designing the CargoHopper road train backboned by a smart distribution system is to reduce traffic flows in the city centre. Additionally, the partnership showcases new city distribution solutions and facilitates a change in public perception. The project should prove the viability of a business case for sustainable freight transport in restricted environments, such as city centres. Another noteworthy point is that the initial project did not rely on public subsidies.

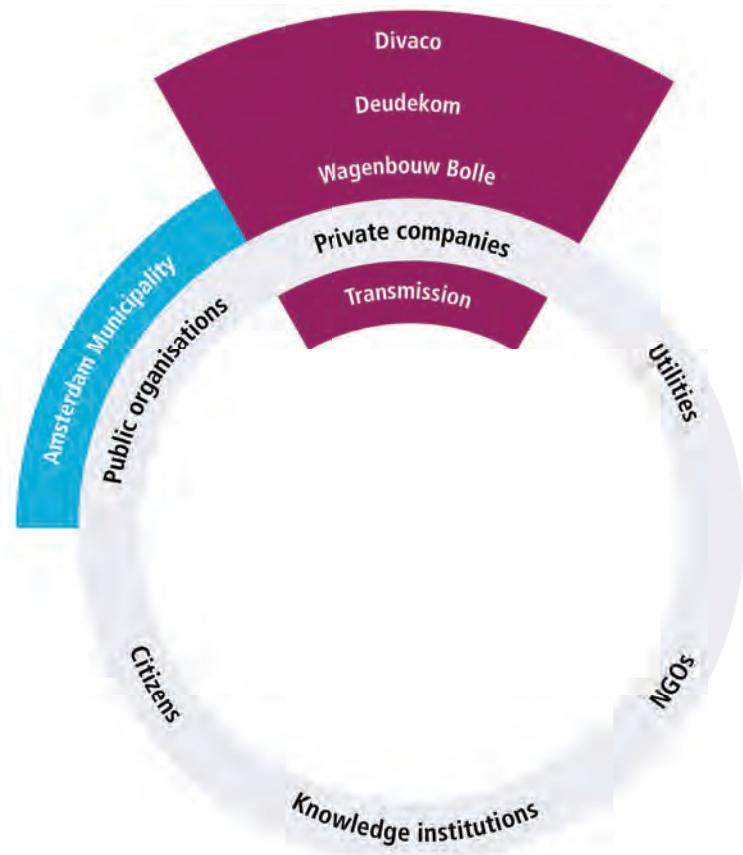


22 EIP-SCC (2013), *European Innovation Partnership on Smart Cities and Communities - Strategic Implementation Plan*, <https://eu-smartcities.eu/sites/all/files/SIP.pdf>

Cargohopper's goal is to deliver goods with clean and smart vehicles to (historical) city centres, relieving the pressure on road traffic and road space. However, a healthy business case can only be created when the electric freight solution is not significantly more expensive than competing city transport modes. Transition to sustainable city transport only happens when there are no extra costs. In the case of Cargohopper, environmental restrictions fuel the innovative solution.

The partnership: Private companies partnering up to create cleaner city logistics

The Cargohopper project is the initiative of Utrecht-based entrepreneur, Jacques van der Linden. He invested in the project because he saw a clear business case. Van der Linden is the director of Hoek Transport, one of the partners in Transmission Group. Within three months the first prototype of the Cargohopper was operational in streets of Utrecht. When the project earned the 2009 Nationale Stedelijke Distributie Award, a subsidy for smart mobility solutions, it was able to finance the development of a second prototype.



The partnership in the city of Amsterdam

Following the establishment of an environmental zone in the city centre, a new Cargohopper partnership was created in Amsterdam in 2013. The partnership consists of different partners from those in the cities of Utrecht and Enschede. Transmission Group is the main partner in the Amsterdam partnership. It is a large company comprising 17 independent transport and distribution companies in the Netherlands and Belgium. Transmission added its planning software, used at the detachment point in Duivendrecht, to the partnership.

As Cargohopper in Amsterdam had to be adapted to the layout of Amsterdam, the project faced challenges in designing a prototype (with regard to, for instance, battery range). Another important step was finding a suitable depot site from which the shipments can be delivered in the city centre using Cargohopper. With the help of Divaco Benelux, a builder of electric vehicles and Wagenbouw Bolle, a carriage building company, Cargohopper was tailored for Amsterdam. Deudekom, a storage and (house) moving company is the facilitator of the depot site in Duivendrecht, where the shipments are re-bundled. In the partnership, transport companies and local governments work together. The City of Amsterdam allows Cargohopper to operate within the environmental zones and outside of the time windows of the congested city centre, for the delivery of goods. Additionally, the City of Amsterdam partially subsidised the development of the first electric vehicle. The launch of the environmental zone was an important milestone, as it implies a competitive advantage for Cargohopper. Bert Rozendaal, press secretary of the project, made the following comment: 'Pilots will stay pilots unless specific supporting regulations enable sustainable initiatives to be competitive, especially in mobility projects'.²³ Today, four Cargohoppers are operational in the city of Amsterdam, two new Cargohoppers with promising features, are now being built.

User involvement

The users in this project are the customers and business partners. Not only shippers and transport companies are Cargohopper's customers, also city entrepreneurs and local businesses can utilise the projects' services as reverse logistics are explicitly featured.

Transmission has many clients and consequent parcels to ship into the city centre. This enables the project to create the mass needed for the project to expand. The project certainly aims to involve other logistics providers, hence the neutral name 'Cargohopper'. However, it appears to be a challenge to unite them in one common last-mile solution.

Value of the project

Cargohopper adds economic value for its key founder, Transmission, in several respects. First, a growing segment of clients ask for shipments to be 100% emissions free to meet their corporate social responsibility goals. Thus, the Cargohopper model is central in winning these environmental-aware clients. Second, it increases efficiency: by capturing partial lots and bundling them by address and house number, only full loads move into the inner city in electric trucks. Third, the value for Transmission will increase once environmental restrictions are tightened: it gives them an advantage over transporters who did not invest in clean solutions. And finally, the project created substantial positive publicity for the company. The project indirectly creates economic value for the city: it helps, in a small way, to make the city cleaner and more attractive.

Cargohopper enables city transport 100% emissions free, thus reducing pollution and noise. By bundling shipments by address from different transporters it is possible to let only fully loaded Cargohoppers start their itinerary. Enabling reverse logistics is one of the next aims of the project, which helps the city tackling the congestion problem.

23 B. Rozendaal, Rozworks (Personal interview, 4th of February 2016).

Cargohopper contributes to the internal mobility of the city (tackling congestion). The Cargohopper is soundless and moves around unobserved.

Potential for upscaling

The Cargohopper project has mainly 'Expansion' and 'Replication' upscaling possibilities.

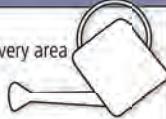
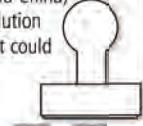
The Cargohopper has several technical limitations (in terms of cargo, maximum speed and maximum range) and is best suited to short distance, low speed operations. The operating range is 75 km, thus the area to be delivered to is limited to the capacity of the vehicle. Enlarging the cities' environmental zone would increase business opportunities. Adding other logistics firms to the partnership would make sense, but is problematic: they prefer to use their own depots and data systems.

Adding other logistics firms to the partnership has proven difficult as these firms prefer to use their own depots and data systems. For instance, think of a wine vendor using the Cargohopper for a daily delivery of one pallet of bottles of wine in the city centre. He would have two considerations before using the Cargohopper. Firstly, the vendor would rather deliver the wine himself, in order to make sure everything is delivered properly and on time. Secondly, as gasoline fuelled delivery is not fully restricted, and potentially cheaper, the business case for using the Cargohopper must be very clear.

Cargohopper Amsterdam is a replication case itself. Cargohopper started in Utrecht and is also present in Enschede. In Utrecht and Enschede, the partnership consists of different partners than those in Amsterdam. Replication is context-sensitive, as the city layout and regulations dictate the conditions. Other countries have showed their interest in the Cargohopper solution.

Key insights in Cargohopper

- Cities differ in their structures and specific mobility issues, which is why planners, entrepreneurs and politicians must handle these challenges differently and within suitable context. This makes the replication of such projects complicated: The solution must be adapted to the city layout. In the case of Cargohopper it was clear that in each city, the design, the users, and the partnership were different. Another interesting point is that in electric cargo solutions, the city size is a key determinant for the business case.
- Local government regulation, such as setting up a restrictive environmental zone in the city centre, or dispensation from specific transport regulations, is important for projects in order to be able to compete. Strict environmental regulations, such as environmental zones or vehicle load restrictions, are an important trigger for sustainable innovation. A healthy business case can only be created when the electric freight solution is not significantly more expensive than traditional city transport. A transition to sustainable city transport only happens when there are no extra costs. In the case of Cargohopper, environmental restrictions fuel the innovative design of the vehicle. Furthermore, they form the preconditions for further expansion possibilities in other areas of the city.
- It is a challenge to involve more logistics providers in one common last-mile solution, as vendors, shippers and other transport companies tend to choose for the cheapest solution or rather keep their deliveries in their own (trusted) network.

VALUE OF THE PROJECT	POTENTIAL FOR UPSCALING
Economic value	Roll-out
<ul style="list-style-type: none"> Clients ask for shipment to be 100% emissions free to meet their corporate social responsibility goals 	
<ul style="list-style-type: none"> City transport 100% emissions free By bundling shipments from different transporters by address, it is possible to let only fully loaded Cargohoppers start their itinerary Enabling reverse logistics is one of the aims of the project 	<ul style="list-style-type: none"> The operating range is 60 km; thus, the delivery area is limited to the capacity of the vehicle Enlarging the cities' environmental zone would increase business opportunities Adding other logistics firms to the partnership is problematic as they prefer to use their own depots and data systems 
<ul style="list-style-type: none"> Increase internal mobility of the city (tackling congestion) The Cargohopper is soundless and moves around unobserved 	<ul style="list-style-type: none"> Cargohopper Amsterdam is a replication case itself as Cargohopper started in Utrecht and is also present in Enschede In Utrecht and Enschede, the partnership consists of different partners than those in Amsterdam Replication is context-sensitive, as the city layout and regulations dictate the conditions Other countries (e.g., Switzerland, Germany, and China) have shown an interest in the Cargohopper solution The project in Utrecht has ended, as the project could not maintain its competitiveness 
KEY INSIGHTS	
<ul style="list-style-type: none"> Replication is complicated because the context of the city matters: The electric solution must be adapted to the city layout. City size is a determinant for the business case. Local government regulations, such as setting up an environmental zone in the city centre or dispensation from specific transport regulations, are important for enabling projects to compete. Strict environmental regulations are an important trigger for sustainable innovation. Involving more logistics providers in a common last-mile solution is challenging. 	

4.2 MOKUM MARITEAM

Introduction

Using the canals in Amsterdam as an alternative for transportation by road, Mokum Mariteam deploys electric cargo ships. These ships transport goods to local businesses using the city's historic transportation mode: shipping over water. The city of Amsterdam approximately has 25% navigable waters. The canals were dug in the 17th century to accommodate goods transport. Today, the canals are mainly used for leisure purposes.

Five private companies joined forces in 2007 to build the first electric cargo vessel of the partnership, designed especially for sailing the Amsterdam canals. The vessel has some unique features. At 20 meters long and its 4.25 meters wide, it is larger than other electric boats. It is solely electrically driven, by 260 batteries, and does not use any fossil fuels. Moreover, the vessel enables reverse logistics: it can bring deliveries into the city and take waste and final residual out.²⁴



Source: Photo by @photodam

The vessel is named *City Supplier* and is created using all partners' core competencies and knowledge. It has its own crane on board making loading and unloading a simple task. It also is equipped with the 'eco-cassette': a press system compressing the waste into smaller lots. These features make this mode of transportation an efficient alternative to road transport. Showcasing possibilities for smart and clean distribution over water, the aim is to reduce the number of trucks in the city centre and thus improve the air quality.

Rationale: Why was it started and by whom?

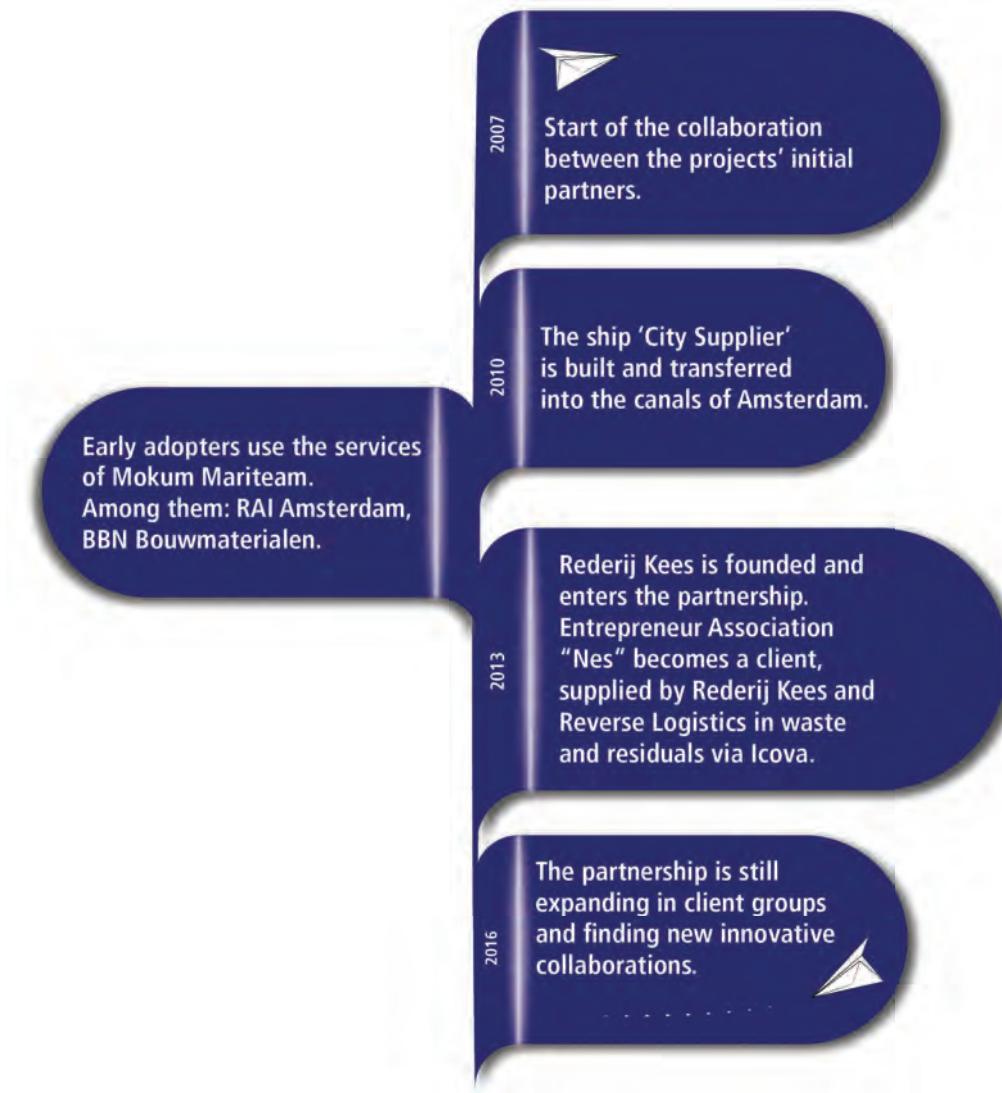
As stated in the *Introduction*, Amsterdam faces many challenges in mobility growth, leading to problems with air quality, congestion, traffic noise and accessibility.²⁵ Amsterdam sees the transport of goods by its canals as one way to reduce truck traffic. The city has stated its ambitions regarding canal transport and other topics, in a 'Water Vision Document 2040'.²⁶ The organisations pioneering in the use of this mode

24 C. Gerritsen, Icova (Personal interview, 10th of February 2016).

25 W. Ploos van Amstel, Amsterdam University of Applied Sciences (Personal interview, 15th of January 2016).

26 Gemeente Amsterdam (2015) (Concept) Watervisie Amsterdam 2040: een ruimtelijk-economisch perspectief op het gebruik van water met een uitvoeringsagenda tot 2018, Amsterdam: Gemeente Amsterdam.

of transport think the City's ambitions are backed neither by resources nor by concrete plans.^{27,28} In this project, the collaborating organisations were moving faster than the city's ambitions.



In 2007 the plan 'Vracht door de Gracht' (freight through the canals), was initiated. In that period, city sustainability became more important than ever. Icova envisioned a future in which freight transport by road would become increasingly difficult as the city continuously tightened the restrictions.²⁹ Organisations were brainstorming ideas to face the challenges. When thinking about employing smarter links between differing modes of transport, one suggestion was to use Amsterdam's historic transport mode: shipping over water.

27 C. Gerritsen, Icova (Personal interview, 10th of February 2016).

28 J. Morren, Rederij Kees (Personal interview, 8th of March 2016).

29 C. Gerritsen, Icova (Personal interview, 10th of February 2016).

The plan was presented to other organisations that might want to form a partnership to build the vessel. Canal cruise companies were especially interesting because of their knowledge of operating by waterways. This expertise could be combined with, for instance, Icova's knowledge of road transport and waste management. In this project, the innovation was a result of combining core competencies of the collaborating organisations, the people working in the organisations and the subjects and motives that each party brought in. The project has an ideal location near the Amsterdam city centre where it can switch between different modes of transport: the Food Centre of Amsterdam. This is a large wholesale food market, located between the West District and the City Centre. Historically it had inland waterway harbours, and it is easily accessible for larger trucks to offload.

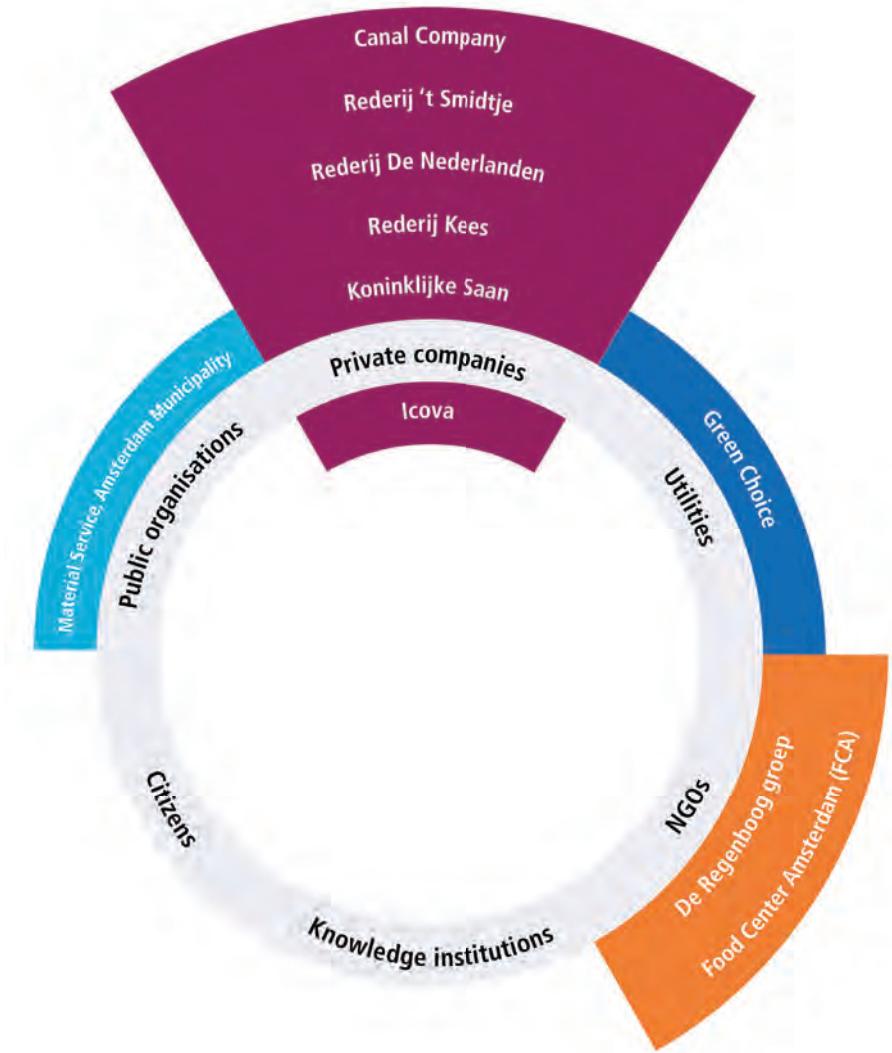
One of the specific goals was to create a healthy business case. The intermodal transport solution the project offers to clients had to be competitive. 'The initiated project had nothing to do with "window dressing", Cor Gerritsen, one of the directors at Icova, states. 'The period of sketching (in itself good) ideas is over. The time is now to actually execute real projects and make things happen'.

The partnership: Enabling innovative collaboration

The project was initiated by Icova, a waste management company dedicated to smart design in multimodal city transport. Icova is part of the European Shanks Group. Icova, Koninklijke Saan (a logistics services provider) and three canal cruise companies started to collaborate in the partnership in 2007. Each partner added its expertise to build the first electric vessel: the 'city supplier': Koninklijke Saan contributed the crane, the canal cruise companies contributed their knowledge of shipbuilding and on operating by waterways, and Icova contributed the waste compressing system. The City Supplier was transferred into the canals of Amsterdam in 2010. The partners are now the owners of the private company Mokum Mariteam, which today operates several electric transportation ships.

The partners are constantly trying to expand the partnership to non-commercial parties. In 2013, Rederij Kees entered the partnership, a social entrepreneur that distributes goods to local businesses using its own electric vans as well as the City Supplier vessel. Together with Rederij Kees, Mokum Mariteam partnered up with the Regenboog Group, an Amsterdam-based foundation committed to actively engaging people who live in (social) poverty. People having constraints to participate fully on the labour market, now can be employed as sailors on the ships. The employees can participate in courses and education. The ultimate goal is to let them move into paid work in a regular company or organisation.

A key element in the expansion of the partnership is the shared vision of new partners on clean city logistics and eliminating waste. As Mokum Mariteam's manager Cor Gerritsen puts it: 'We are constantly combining the strengths of various organisations from various sectors of industries into this project'. The partnership has a strong belief in enabling innovative collaboration which makes the business case continuously stronger.



User involvement

The users of Mokum Mariteam are clients, such as local businesses, or entrepreneur associations. Social entrepreneur Rederij Kees is not only a user of the vessel, but also the operator. The project would like to welcome local governmental organisations located near waterways as clients to use the electric vessels for their provisioning and deliveries.

An example of a user that is very much dependent on the transport by the electric cargo vessels is a local brewery: Brouwerij de Prael. Every day, Rederij Kees ships barley for beer, labels, bottles and crates to the brewery. The possibilities a ship offers over trucks in terms of capacity are especially intriguing for this client, as loading and unloading those amounts of supplies in the middle of the Warmoestraat would block the street completely.³⁰

30 Logistiek.nl (1st of August 2016) 'Vracht door de gracht op losse schroeven'.

Value of the project

The five initiating partners are in a corporation Mokum Mariteam BV which exploits the electric vessels. Mokum Mariteam adds economic value for the collaborating partners. Rederij Kees uses the vessel in its business case distributing goods throughout the city making use of different electric vehicles. City Supplier is one of the modalities. One client of Rederij Kees is Stach Food, a company with many delicatessens in Amsterdam. Stach Food offers freshly baked bread, organic groceries, take-out meals and the like. Stach knows its suppliers in person and consequently also searches city transport that matches its conscious way of operating.

The project was not subsidised by the City of Amsterdam. The collaborating parties see Mokum Mariteam as a CSR gift to the city of Amsterdam, a gift that has proven its economic value by showing a healthy business case.

The ecological value lies in reducing lorry traffic in the city centre, thereby improving the air quality and reducing noise and congestion. The project also displays a smart solution for circular economy using the vessels for reverse logistics (waste and residual flows). Moreover it showcases a smart solution for the collection of waste using the eco-cassette.

Employees working on the City Supplier live in (social) poverty. Rederij Kees actively engages them in participating in society. By doing so, Rederij Kees creates jobs and opportunities for its employees.

Potential for upscaling

The partners believe that innovation rests on the fruitful combination of competencies, motives and beliefs of different collaborating parties. By inviting Rederij Kees into the partnership, the partners showed that innovative collaborations can make the business case stronger. That is why they are always trying to expand the partnership to include non-commercial parties. The project can expand when new clients use the services, making investments in new electric cargo ships viable.

Using electric cargo ships is context-bound: Amsterdam historically has a profound logistic system for transporting through the canals. The Municipality of Utrecht has its own initiative using its canals for transporting: 'the bierboot' which ships beer to local bars and restaurants.

Key insights in Mokum Mariteam

- In this project, innovation was a result of combining the core competencies of the collaborating organisations, the people working in the organisations and the subjects and motives that each party brought in. Innovation rests in the co-operation between the collaborating parties and what connects them.
- The partners in the project are moving faster than the city. The city has ambitions regarding goods transport by the canals, these are yet not concrete and no resources have been invested in them.

VALUE OF THE PROJECT		POTENTIAL FOR UPSCALING
Economic value	Roll-out	
<ul style="list-style-type: none"> - The five initiating partners are in the Mokum Mariteam BV corporation which exploits electric vessels - Rederij Kees uses the vessel in its business case, distributing goods throughout the city by making use of different electric vehicles, and the 'city supplier' is one of the modalities used 		
<p>Ecological value</p> <ul style="list-style-type: none"> - Reduce the number of trucks in the city centre, thereby improving air quality - Smart solution for circular economy using the vessels for reverse logistics (waste and residual flows) - Smart collection of waste using the eco-cassette 	<p>Expansion</p> <ul style="list-style-type: none"> - New clients and investments in new electric cargo ships - New innovative collaborations make the business case stronger 	
<p>Social value</p> <ul style="list-style-type: none"> - Employees working on the city supplier are people who live in (social) poverty; Rederij Kees actively engages them in participating in society - Increasing the city's internal mobility by using modalities other than road transport 	<p>Replication</p> <ul style="list-style-type: none"> - Using electric cargo ships is context bound: Amsterdam has historically had a profound logistic system for transporting cargo via the canals - The city of Utrecht has its own initiative using its canals for transporting: The Bierboot ships beer to local bars and restaurants 	
<h3>KEY INSIGHTS</h3> <ul style="list-style-type: none"> - Innovation rests in the co-operation between the collaborating parties and what connects them. - The partners in the project are moving faster than the city's ambitions. 		

4.3 RELOADIT

Introduction

REloadIT is a project initiated by the Municipality of Zaanstad, a suburb of Amsterdam. In the project, the cars owned by the city are powered by sustainable energy, generated by Zaanstad's own solar- and wind-powered facilities. The project ran from 2013 until 2015 and was a pilot for innovative technology facilitating clean mobility.

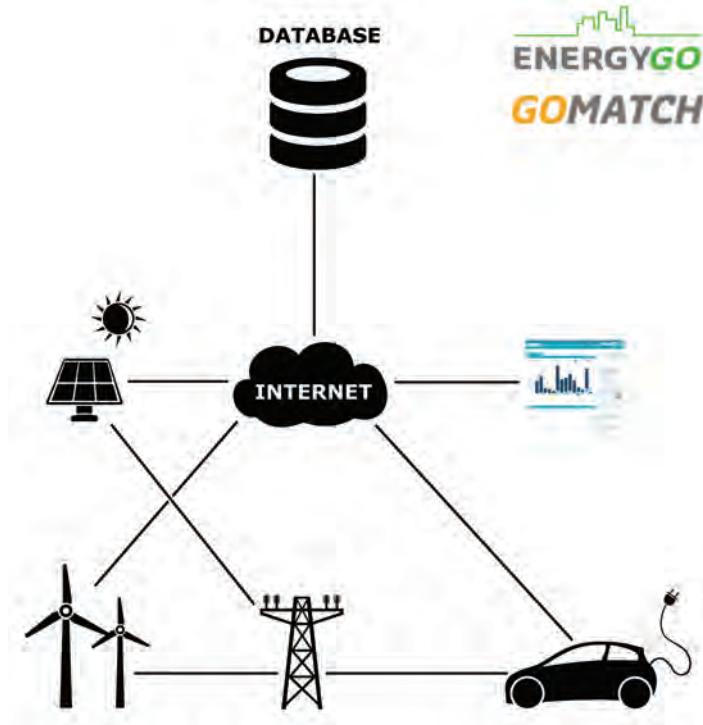
The project's goal was to optimally deploy sources of renewable energy (i.e., two solar panel installations and one wind turbine) for charging 16 electric municipal cars driven by civil servants during business hours. By forecasting electricity production and consumption through an operational smart grid application, the booking system for electric vehicles could be compared to the forecast of the renewable energy production in order to determine the most efficient charging strategy for Zaanstad's electric fleet.

The developed smart grid technology permitted the municipality to optimally use the forecasted solar and wind energy for the propulsion of the electric cars. By analysing meteorological data, the amount of sun and wind was estimated approximately five days in advance. With that data, the operators could predict an estimated supply of solar and wind energy. 'When you have data on future supply, you also need a future demand', Marcel Elswijk, director at EnergyGO explains. EnergyGO invented the reservation software, with which civil servants could plan their itineraries. The software could use the itinerary to match the right car (in terms of the percentage of battery charge) to the distance it would have to travel.³¹

Rationale: Why was the ReloadIT project initiated?

The main catalyst for the project was a subsidy from the E-Harbours project, about showcasing smart energy solutions in EU harbour cities, such as Aberdeen, Amsterdam, Hamburg, Malmö and Zaanstad.

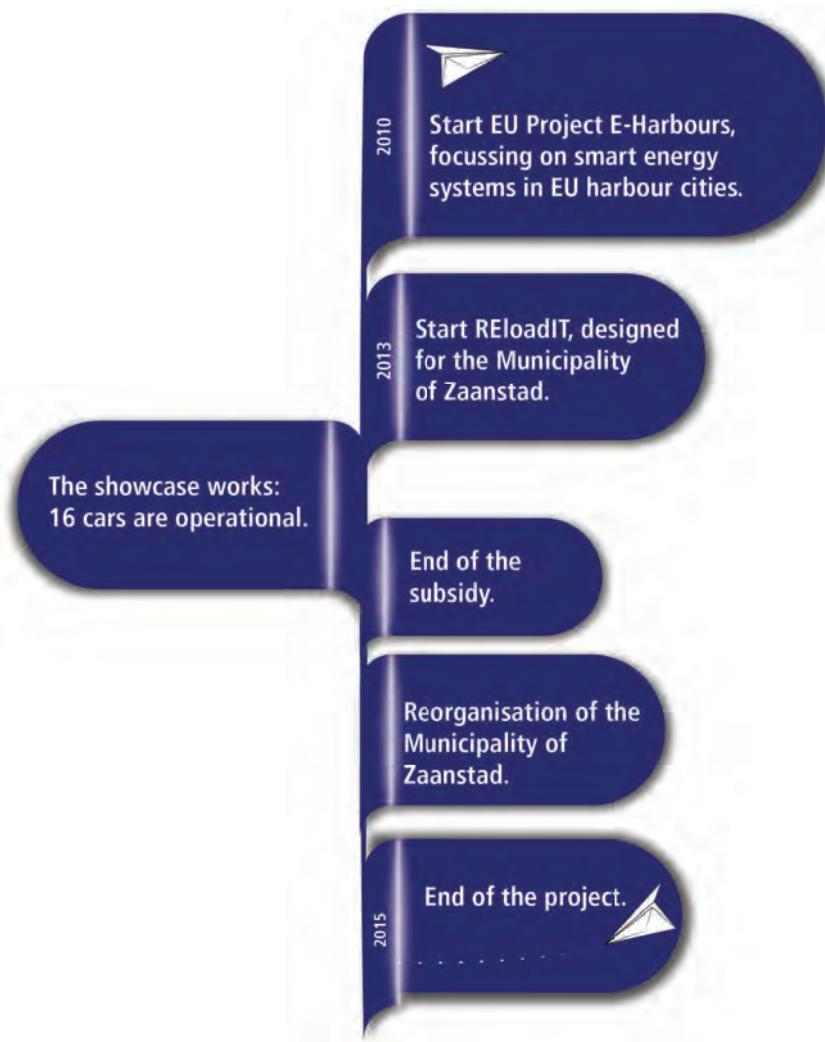
The Municipality of Zaanstad participated in the project because it had energy ambitions: it believed that the reduction, production and innovation in energy is the way forward. The medium size of the municipality's organisation, and its small fleet of only 16 electric cars were an excellent testing-ground for



Source: EnergyGO

³¹ M. Elswijk, EnergyGO (Personal interview, 5th of January 2016).

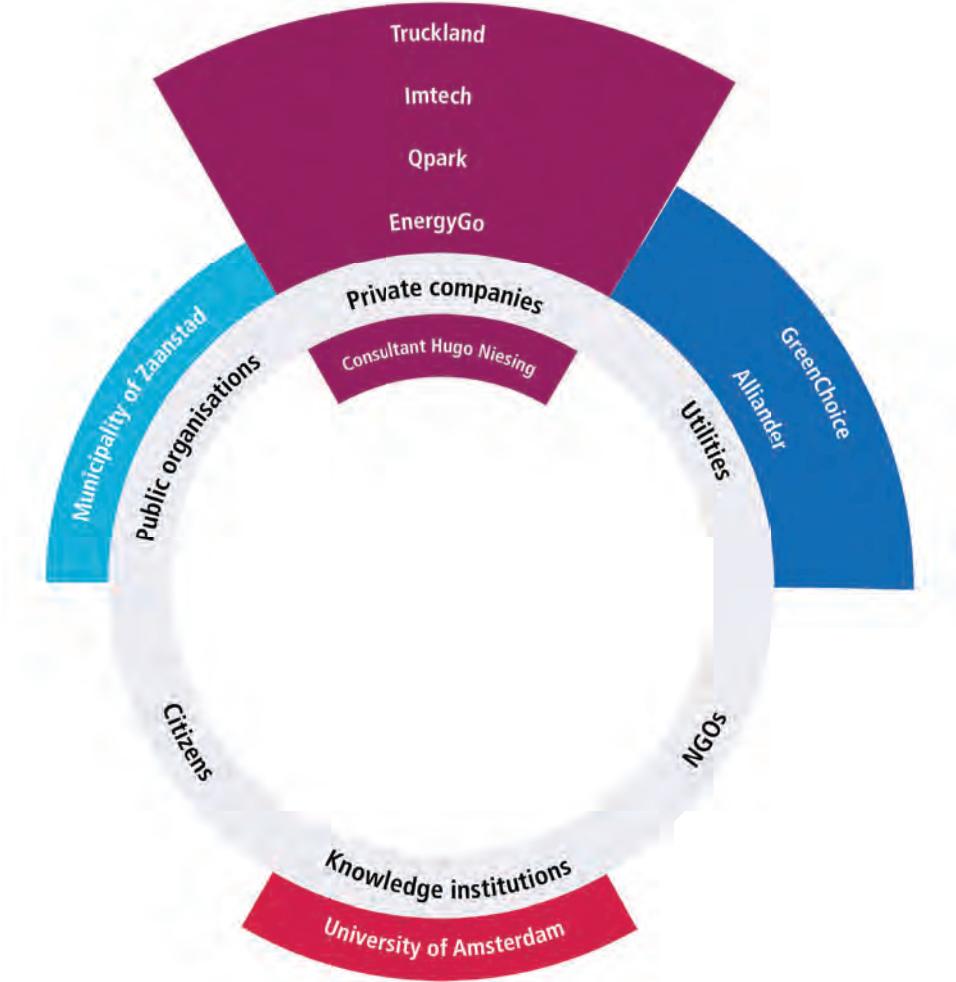
the business case for local supply and demand estimation with renewable energy sources. The itineraries of the cars could be planned, based on the dates and the destinations in the booking data. This made it possible to estimate the demand. As stated in the *Introduction* of this project, the supply of the local renewable energy sources could be estimated based on meteorological data. At that time – 2012 – the project was the only one of its kind.³²



The partnership: Government, private parties and knowledge institutes innovating together in smart grid technology

Subsidised by the E-Harbours project, the Municipality of Zaanstad partnered with technology provider EnergyGO to design the IT infrastructure needed for the REloadIT project. The resulting system, named Go Match forecasted both power production and consumption. EnergyGO already had knowledge on smart grid technology from other projects that it elaborated on to develop the system for the ReloadIT project. The new technology was not open source: EnergyGO invested in the project, expecting to sell it to other cities at a later stage.

32 H. Niesing, Resourcefully (Personal interview, 4th of February, 2016).



With the help of a legal and finance specialist, Gerrit Buist (University of Amsterdam), an innovative energy contract was drafted, which gave the legal possibilities to make the project happen. The initial goal of the project was to physically charge the cars with locally generated energy. However, when this appeared not to be possible the generated energy had to be sold back to the grid. The cars still needed to be charged so the GreenChoice company was selected as partner to deliver the green energy virtually instead of physically.

ReloadIT commenced with a conference in March 2013, won the Alliander DSO Innovation Award 2013, and the project started with a great deal of fanfare. However, less than a year later, the pilot ended when the Municipality of Zaanstad cut its budget and reorganised. Temporary contracts of 13 qualified team members were not renewed, and the project team fell apart. After that, the project froze. 'The project stopped because of lack of support from the organisation, not only because the subsidy ended.'³³

³³ H. Niesing, Resourcefully (Personal interview, 4th of February, 2016).

EnergyGO found it hard to sell their matching software system to other clients. It either was too early for other clients to adopt it, or potential prospects had their own research and development initiatives underway. Despite all this, all partners did obtain important new knowledge and insights, resulting in new initiatives. The body of knowledge on smart grid technology grew because of ReloadIT.³⁴

User involvement

At first the project team decided that the project would be a ‘communications project’. ReloadIT was originally developed as a showcase, to show to a larger public that differences can be made in the energy market. However, as the project became more and more about the technical aspects, that larger public became more difficult to reach.

Within the organisation of the Municipality of Zaanstad, employees from different departments were appointed to participate. Once the system was set up, the employees were enthusiastic to use it.³⁵

Value of the project

The anticipated business case would be viable when saving energy costs by charging the batteries of the electric cars as much as possible at low energy tariffs. The project demonstrated the possibility for economic value through forecasting and adapting to renewable energy sources and managing the demand side: the percentage of cost reduction of the energy bill, by exploiting the flexibility within a process.

The project highlighted the viability of the smart grid application: linking local energy production and consumption. It furthermore was able to showcase the maximal use of the available renewable energy (three or four solar energy systems and an optional (virtual) wind turbine) to charge the electric cars.

The project proved that the state of charge of each electric car is sufficient for the next planned travel. The calendar containing travel times, travel distance, and time the battery has to be fully charged were all taken into account.

Potential for upscaling

The software company, EnergyGO, expected to roll out the smart grid flexibility software to market. The software was not open source. The rollout did not go as planned: it either was too early for other clients to adopt the technique, or potential prospects had their own research and development initiatives.

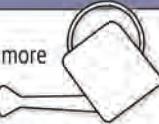
Potential for expansion would require the addition of energy sources and energy users to the network. However as the project declined, the potential stayed with the 16 electric cars. Another expansion possibility would be adding more flexible energy consumers, or adding more renewable sources of energy.

34 M. Elswijk, EnergyGO (Personal interview, 5th of January 2016).

35 H. Niesing, Resourcefully (Personal interview, 4th of February, 2016).

Key insights in ReloadIT

- Participating in the EU project was the catalyst for innovation, creating the initial idea for the project.
- Less successful projects can generate the knowledge base for further stakeholder collaboration on local energy production and consumption.
- Early-stage technologies are difficult to roll out to market.
- Small municipalities are feasible as testing grounds for new projects due to ‘short lines’ in the organisation.
- When key players in organisations are withdrawn from projects due to reorganisations, it is difficult for the project to proceed.
- The technology was ‘pushed’, and the showcase project showed the feasibility of smart grid flexibility solutions. However for these projects to roll out to market, behavioural change is needed.

VALUE OF THE PROJECT	POTENTIAL FOR UPSCALING
Economic value	Roll-out
<ul style="list-style-type: none"> - Saving energy costs by charging the batteries of electric cars as much as possible at low-energy tariffs - It showcased the possibility of economic value by forecasting and adapting to renewable energy sources (the supply side) while managing the demand side; the economic value is the percentage of cost reduction of the energy bill by exploiting the flexibility within a process 	
<ul style="list-style-type: none"> - Showcasing the viability of the smart grid application: Local energy production and consumption - Maximising the use of available renewable energy (three or four solar energy systems and an optional [virtual] wind turbine) to charge electric cars 	<ul style="list-style-type: none"> - Potential for expansion included adding more energy sources and energy users to the network; however, as the project declined, the potential stayed with the 16 electric cars 
<ul style="list-style-type: none"> - Showcasing that each electric car's state of charge is sufficient for the next planned travel, taking into account the schedule of travel times, travel distance, and time the battery has to be fully charged 	<ul style="list-style-type: none"> - Replication would be the case when other cities implemented the same system 
KEY INSIGHTS	
<ul style="list-style-type: none"> - Participating in the EU project was the catalyst for innovation, creating the initial idea for the project. - Less successful projects can generate a knowledge base for further stakeholder collaboration on local energy production and consumption. - Early-stage technologies are difficult to roll out into the market. - Small municipalities are feasible testing grounds for new projects due to 'short lines' in the organisation. - When key players in organisations withdraw from projects due to reorganisation, it is difficult to proceed with the project. - The technology was 'pushed', and the showcase project showed the feasibility of smart grid flexibility solutions. However, to roll these projects out to market, behavioural change is needed. 	

4.4 WEGO CAR SHARING TECHNOLOGY

Introduction

The City Administration of Amsterdam introduced a car-sharing scheme for its (large) vehicle fleet in 2014. For this project, the City partnered with a start-up firm called WeGo Car Sharing Technology. One of the services WeGo offers, is a software platform, tailored to the City's needs. WeGo's technology assists the users (in this case, civil servants) to share vehicles belonging to the City's fleet. This project shows how a City Administration can support a startup company by acting as launching customer.

WeGo offers a vehicle sharing and planning platform that enables organisations to manage their fleets in a smart way, by encouraging employees to share vehicles and by gathering data from the cars.

The value for the corporate client rests in acquiring a higher mobility performance with less vehicles.

Making use of WeGo's 'mobility management', organisations can see exactly who is driving where, when and which company vehicle. The driven kilometres are administrated automatically. With the WeGo technology and software, it is possible to monitor and facilitate company vehicles 24/7. On the user side, the WeGo application enables employees to find out where a company vehicle is located and whether it is available. They make an online reservation. The 'smart box' in the vehicle tracks necessary information and permits employees to unlock the car using their smartphones.



Source: WeGo

Rationale: How was the idea for WeGo fleet mobility originated?

WeGo started in 2011 in Amsterdam West as a start-up offering a peer-to-peer car sharing platform that allowed non car owners to rent cars from car owners in their neighbourhood. Now, WeGo focuses on the business to business (B2B) market, designing car-sharing solutions for corporate vehicle fleets.

WeGo was founded by Dan Leahy, who gathered subsidies from the DOEN Foundation and the City District of West to start a pilot in peer-to-peer car sharing. The focus was to obtain commercial success whilst serving environmental and social goals. WeGo developed and equipped the cars with 'smart boxes'. It also invested in developing a reservation management system. At that time, competitors such as SnappCar also gained market share in peer-to-peer car sharing.

The unique selling point is the 'smart box'. The box enabled users to use their smartphones to lock and unlock the cars, eliminating the problem of keeping track of keys. Developing this selling point came with considerable R&D investments. In 2012, Toy Hertogh became CEO, and WeGo decided to introduce its services in the B2B market. The smart box and the software platform are of interest to organisations because employees can easily share their vehicles by using their smartphones. The system also generates data from the cars that helps to utilise the vehicle fleets more efficiently.

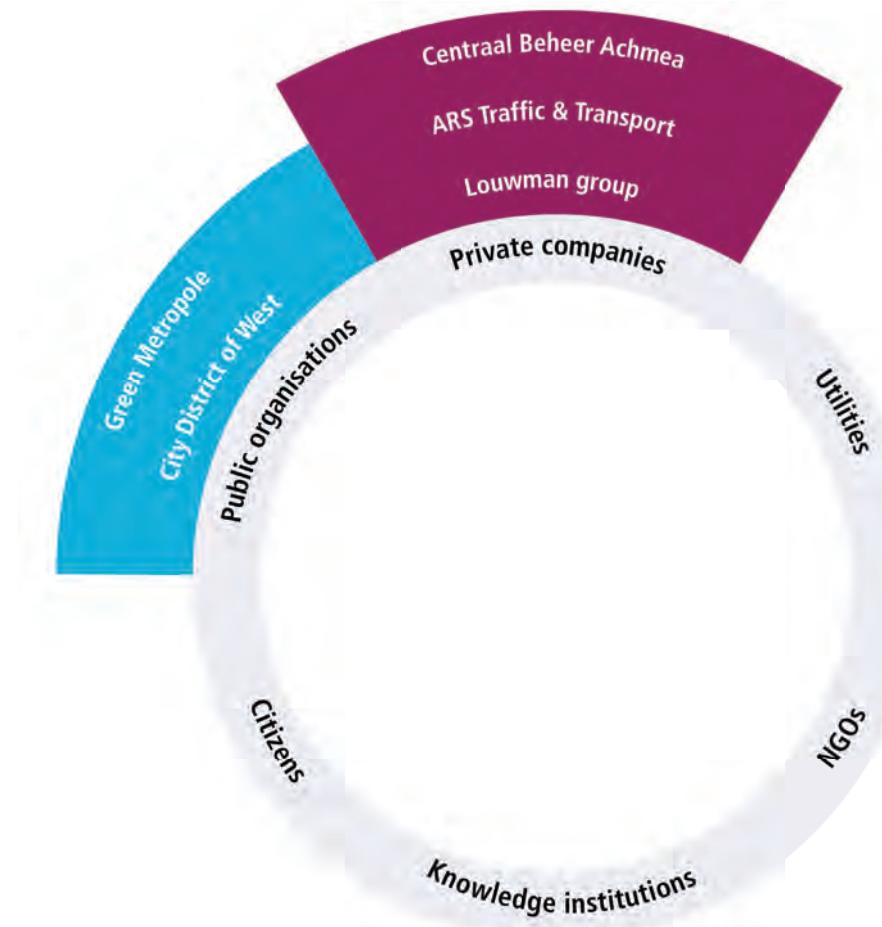


The Dutch island of Terschelling started to use WeGo's products and services in 2014, developing a car-sharing pool for residents. Also in that year, WeGo was contracted for providing the fleet management platform for the city administration of Amsterdam.

The partnership

WeGo began its operations as an Amsterdam based start-up whose starting capital came from a private investor and subsidies from the DOEN foundation and the City District of West. In 2015, there was a change in the partnership, when Louwman Group and ARS Traffic & Transport invested in WeGo.

The Louwman Group is one of the largest automotive distributors in Europe. It has a considerable network in importing car brands, retail, parts supply, leasing and finance. By taking a share in WeGo, Louwman wanted to develop new mobility management services for its clients. ARS is a traffic and transport technology provider, which hosted the WeGo software from the day it became a partner in WeGo in 2015. The DOEN Foundation still is a minority shareholder. The City District of West is no longer a partner.



After a public tender, the city administration of Amsterdam selected WeGo as its fleet management partner. This gave WeGo a substantial boost and publicity. It also had implications for WeGo moving on to the next business life cycle phase in which it could professionalise its operations. Partnering with ARS traffic and transport gave WeGo the capacity and software expertise to manage such large vehicle fleets as that of City Administration of Amsterdam.

User involvement

WeGo's services simplify the sharing of vehicles. Cars can be reserved online and unlocked with a smartphone. During the itinerary, the system tracks and records relevant data that organisations can use to manage their shared cars in a more efficient way.

The users of WeGo's services are peer-to-peer car sharers, employees, and organisations. The City Administration of Amsterdam acted as launching customer for this project. A few years ago, the City began centralising its fleet management. Its vehicles had previously been managed by single districts and individual communal organisations. Managing a larger centralised fleet raised questions on the efficient employment and smart use of the vehicles. That is why the City released a public tender. Providing services for the City Administration's large and diverse vehicle fleet gave WeGo the opportunity to upscale its business, acquire new knowledge and innovate with the client.

The end-users of the fleet management services are the employees. In the City Administration of Amsterdam, the users are municipal civil servants. Amsterdam started with a pilot of 22 pooled cars. The civil servants had learn to change their behaviour and become accustomed to shared vehicles. Once they were familiar with the new working methods, employees were enthusiastic.

Value of the project

WeGo has a viable business case for the peer-to-peer car sharing market, as well as for the fleet management market. Clients of WeGo are able to operate with a smaller vehicle fleet. This reduces maintenance, parking and purchasing costs. WeGo charges these clients for each smart box and for setting up the software platform. A monthly fee per car and a monthly fixed fee for the platform are also assessed.

WeGo is a commercial project that has a positive social and environmental impact. Many large organisations have fleets that sit unused and garage spaces that sit empty. WeGo offers a solution. In the City of Amsterdam, fleet mobility reduces the number of vehicles in the city centre. Moreover, employees are making more informed choices on their planned car usage. Because WeGo is tracking the cars and is generating data from them, the system is ideal for the usage of electric company cars, as it can monitor each car's state of charge. This reduces the client's CO2 emissions.

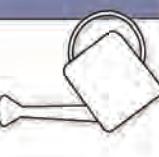
Potential for upscaling

The initial software and products that WeGo offered its peer-to-peer car sharing customers were rolled out to a corporate market. Corporate clients received a customized app which is similar to the app that consumers use. When the shift in the partnership occurred, and the new investors (ARS and Louwman Group) entered the partnership, WeGo was able to roll out its products and services to larger clients. ARS had the experience and capacity needed to manage larger fleets. Louwman had the network to reach a larger clientele.

The two proof of concepts (the island of Terschelling and the City Administration of Amsterdam) helped WeGo to upscale in a technical way, because the larger clients forced WeGo to develop and innovate its software. Partnering up with ARS and Louwman enabled WeGo to upscale in a commercial way. WeGo is moving into the next phase in the business life cycle in which it is professionalising its operations. Moreover, the business propositions for serving different types of clients are becoming clearer.

Key insights in WeGo fleet mobility

- Scaling up requires different competencies aside from setting up new technologies and concepts. Partnership with ARS offers the operational competences needed to roll out WeGo's products and services to market, and to organisation-clients with larger fleets to manage.
- Governmental organisations such as the Amsterdam Municipality can act as launching customers for start-ups, giving them the opportunity to upscale their business, to acquire new knowledge, and to innovate together.

VALUE OF THE PROJECT		POTENTIAL FOR UPSCALING
Economic value		Roll-out
<ul style="list-style-type: none"> - Viable business case for B2C market - Viable business case for B2B market in car planning and fleet management 	<ul style="list-style-type: none"> - The initial software and products WeGo offered its B2C customers were rolled out to a corporate market - Business clients receive a customised app similar to the app consumers use - Partnering with ARS enables WeGo to roll out its products and services to larger clients because ARS has the experience and capacity needed to manage larger fleets 	
<ul style="list-style-type: none"> - Reducing clients' CO2 emissions - Same mobility performance with fewer vehicles 	Expansion	
<ul style="list-style-type: none"> - Reduce the number of vehicles in the city - Many large organisations have car fleets that sit unused for much of the time and garage spaces that sit empty 	Replication	
KEY INSIGHTS		
<ul style="list-style-type: none"> - Scaling up requires different competencies from setting up new technologies and concepts. Partnering with ARS offers the operational competences needed to roll out WeGo's products and services to market as well as to organisational clients with larger fleets to manage. - Governmental organisations such as the Amsterdam Municipality can act as launching customers for start-ups, giving them the opportunity to upscale their business, acquire new knowledge, and innovate together. 		



5

PROJECTS IN THE CIRCULAR ECONOMY THEME

Egbert-Jan van Dijck and Inge Oskam

Introduction

The concept of the circular economy has received increased attention in the development of smart cities. A key issue is the effective use of raw materials and the reduction of waste to a minimum; a complete circular city generates zero waste. Circular economy is a high priority by numerous local authorities and organisations and the Dutch government. The Amsterdam metropolitan area aspires to be the leading region in 2025 with smart solutions for the limited availability of resources: scarce materials are not used or are used much longer and more efficient.³⁶ The waste ambition of the Amsterdam City Administration is to increase the separation rate of small domestic waste from 30% in 2016 to 65% in 2020³⁷. They have created a vision and roadmap for a circular design of the construction supply chain and of the organic waste streams, aiming at material reduction of 500.000 tons per year in construction waste and 900.00 tons per year of organic waste, equivalent to a 5,5% reduction of the yearly CO2 emissions of Amsterdam³⁸. In 2016, the Dutch government presented a nationwide program for the circular economy,

36 Amsterdam Economic Board, Roadmap Circulaire Economie (2016) <https://www.amsterdameconomicboard.com/app/uploads/2016/09/Roadmap-Circulaire-economie-september-2016.pdf>

37 Gemeente Amsterdam, Duurzaam Amsterdam, agenda voor duurzame energie, schone lucht, een circulaire economie en een klimaatbestendige stad (2015) <https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/agenda-duurzaamheid/>

38 Gemeente Amsterdam, Amsterdam Circulair, een visie en routekaart voor stad en regio (2015) <https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/agenda-duurzaamheid/circulaire-economie/onderzoek-amsterdam/>

showing an ambition to be completely circular in 2050, with a 50% reduction of use of primary resources (e.g. minerals, fossil fuels and metals) as milestone in 2030.³⁹

In recent years many initiatives were started in Amsterdam to experiment with sustainable technologies and new working methods to contribute to the transition towards a circular city, some involving ASC partners, others not. Before 2015, Circular Economy was not a focal theme for ASC and was therefore not explicitly addressed. Other initiatives fulfilled a role as connector for projects related to a circular economy. Green Metropole, a three-year EU-funded programme (2012-2014), initiated by the Amsterdam Economic Board, was developed to create a platform supporting entrepreneurs in the metropolitan area to create business with their sustainable innovations. Part of Green Metropole was a project called Biobased Connections. Its aim was to strengthen the biobased cluster and circular economy by connecting private and public partners in the Amsterdam metropolitan area.

For the analysis in this section, four projects were selected: De Ceuvel, WASTED, Fair Meter, and Locally Grown Paint. All are characterised by collaboration between public and private partners as well as non-governmental organisations, and focus, besides environmental value, on economic and social value creation. The projects cover different areas of the circular economy concept as developed by the Ellen MacArthur Foundation. De Ceuvel and Locally Grown Paint focus on the biological cycle, closing loops with materials based on renewable resources; Fair Meter and WASTED focus on the technological cycle, reusing technical materials (e.g. plastics and metals). De Ceuvel and WASTED look at new uses of city waste, where Fair Meter and Locally Grown Paint are dedicated to developing a circular product from scratch.

5.1 DE CEUVEL

Introduction: A lofty village with a mission

A group of young architects came up with the idea to search for an area where they could live and work together in an environmentally sustainable way. This eco-friendly place should become an inspirational area for all kinds of creative and entrepreneurial individuals. During their search they found a under used area in Amsterdam North called De Ceuvel.

De Ceuvel site is a former ship wharf with heavily contaminated soil. Considering the circumstance that area is polluted forced the initiators to create a solution for constructing buildings and pathways. They came up with the idea to use houseboats placed on land in such a way that the buildings don't touch the ground. They are now characteristic for the area. It is a lofty village with a mission. The villagers consist of a mixture of architects, creative artists, entrepreneurs, sustainability experts, volunteers and visitors. The mission is to create a place where creativity and sustainability meet. The aim is to develop a place where at a village level regenerative technologies are tested and demonstrated for full recycling of local resources, as pilot for SchoonSchip, the development of a floating neighbourhood. As Jeroen Apers, one

³⁹ Government of The Netherlands, Nederland Circulair in 2050, rijksbreed programma Circulaire Economie, publication of the Ministry of Infrastructure and the Environment (2016) <https://www.rijksoverheid.nl/documenten/rapporten/2016/09/14/bijlage-1-nederland-circulair-in-2050>

of the founding architects, puts it: 'De Ceuvel is a breeding place, and as such a workplace for artists and creative entrepreneurs who want to live in an environmental sustainable way and support the circular economy'. The local authority supports initiatives and a front-office Creative Breeding Grounds is established to guide citizens who are interested in similar undertakings, and did so for De Ceuvel. An important part of the area is a 'cleantech playground', described as 'a living lab exploring how clean technologies can be most effectively integrated into the built environment'.

Amsterdam Municipality decided to assign the area for a certain period to the group of architects and co-funded the project.

Rationale: Why was it started and by whom?

The choice to stay in an urban or rural area is crucial to the kind of lifestyle an individual wants. The urban area is a great place to live comfortably, but not without challenges. It can be difficult to find an affordable place in the centre of a city, especially one like Amsterdam. Next-generation citizens have to overcome several barriers in addition to finding housing before they are settled. Additionally, young entrepreneurs have to find a flexible and affordable workspace. A growing awareness of environmental issues motivates them to explore new ways of living and working.

Along the waterfront an area used by the shipbuilding industry polluted by heavy metals and oil has been abandoned. It could be a prohibitively expensive for the City of Amsterdam to clean this area. For that reason, Amsterdam Municipality held a competition in 2012 for the temporary development of the area of the former wharf. The rules were very strict: no digging in the ground for a foundation, sewer and gas pipeline. A group of architects and Metabolic developed a plan and based on the report for a Cleantech playground they were awarded the site for a minimum of 10 years. De Ceuvel officially opened in the summer of 2014.

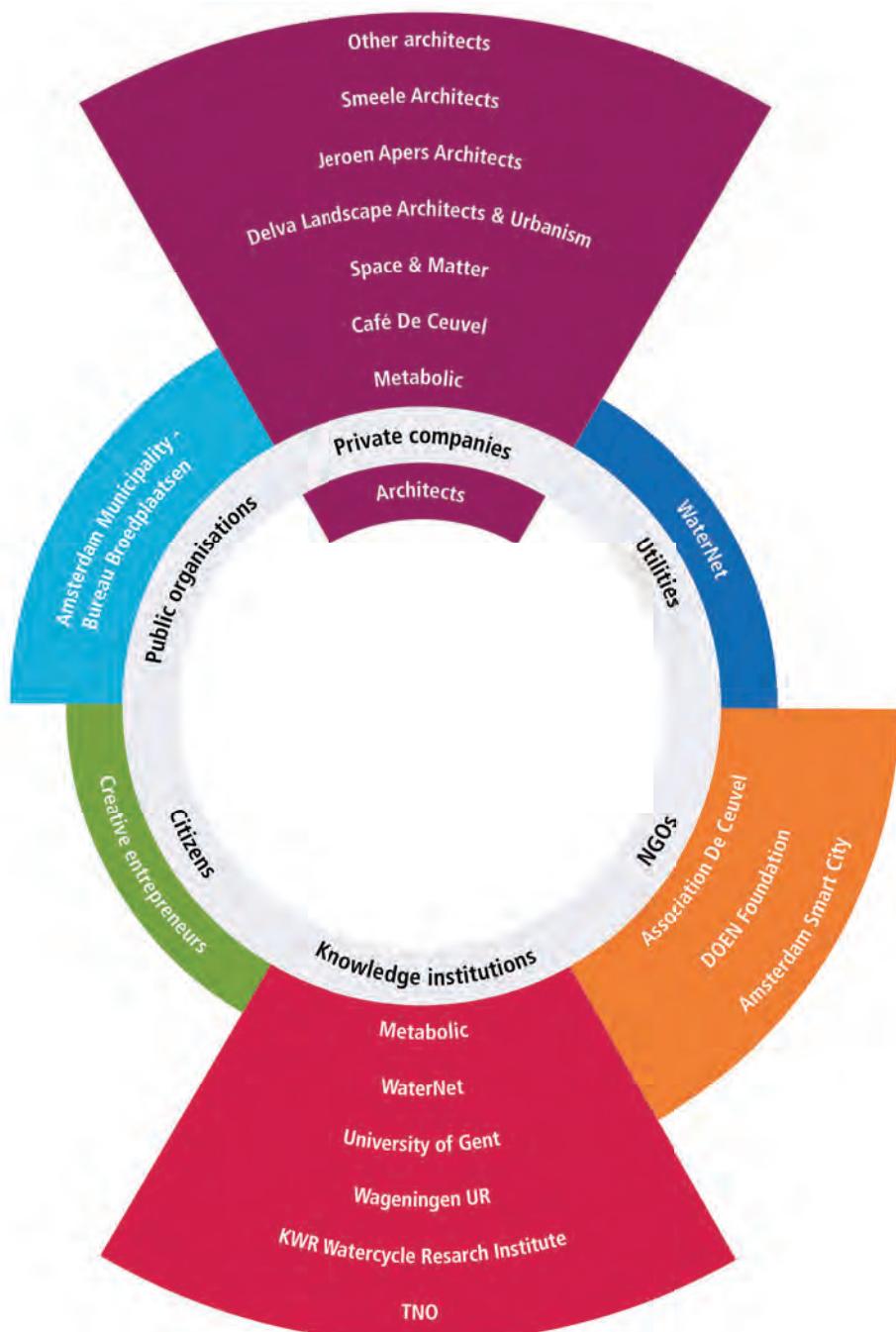


Source: Photo by Martijn van Wijk



The Partnership: A combination of private companies and knowledge institutions

First and foremost, the strong partnership between the founding (or development) partners – creative artists, entrepreneurs, designers, and sustainability experts – provided a solid foundation for this project. A wave of entrepreneurship developed along the way. The project attracted attention and the partnership was able to build an active community. A combination of users, volunteers, researchers and entrepreneurs, kick-started the project. As one of the architects explained: ‘The volunteers are the driving force behind this project. The energy for volunteering is enormous and this project was not successful without all those people’.



Secondly, local government is a strategic partner, according to Cynthia Mooij, sustainability expert from Metabolic. The support, review meetings and financial help of the local authority and front office Creative Breeding Grounds played an important role. The project was funded by the city through a €250,000 start-up grant and a €200,000 bank loan that it guaranteed. Those funds paid for materials, plants and some of the professional services required to make De Ceuvel a reality.

Thirdly, volunteers were a welcome addition to the partnership; they did the work that the funding could not cover. From the beginning, visitors became involved. Some of them volunteered by contributing physical labour and performing other tasks. Without the hours invested by both volunteers and project partners the project would not have been able to succeed.

Finally, universities like the Ghent University and Wageningen University & Research center used the Cleantech playground for their research. Design and development of the Cleantech playground was led by Metabolic.

User involvement: A continuing spiral of activity

In this project we established four groups of users. The first group of users are the creative artists and architects that initiated De Ceuvel and use the area as their workplace. The second group are the knowledge partners that are developing the Cleantech playground, such as Metabolic, utilities and knowledge institutions. For these parties the project is an unique opportunity to collaboratively test and demonstrate new regenerative technologies. The third group consists of volunteers who are indispensable to the project. Finally, De Ceuvel is frequented by a diverse group of visitors ranging from Amsterdam's citizens to tourists and interested professionals from abroad. They come to the site to taste the creative atmosphere and to draw inspiration from the circular experiments. Some of the visitors are so impressed that they volunteer and become part of the community.

Value of the project: More than decontamination of subsurface soil sites

The local government funds creative breeding grounds projects, like De Ceuvel. One of its goals is to enable creative people to find an affordable workspace. For that reason, the workspace is available only to a restricted group of people and the prices per square meter are capped. Educational programs are offered at cost and therefore the organisation can make revenue in limited ways. At the same time, individual enterprises located at de Ceuvel are able to develop their own businesses and their financial revenues are not capped. According to some of the entrepreneurs, growth of creative business and new collaborative partnerships between entrepreneurs is established.

Another aspect is that the economic value of the area itself will increase during the period of 10 years because of the efforts to develop and test different clean technologies. Efficient (re) use of materials will contribute to the economic value of the project and all partners involved. It is not clear if the project is financially self-sufficient. According to Cynthia Mooij, the former Program manager, 'There isn't an effective business model in place'.

In contrast to the economic value, the environmental value is much greater. Several interesting programs have been created in close collaboration with research centers from different universities. For example, De Ceuvel started a collaborative study with Ghent University and DELVA Landscape Architects on the cultivation of plants that help to clean contaminated soil by accumulating pollutants, or do not absorb

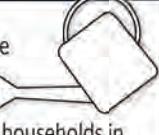
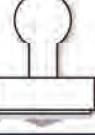
any pollutants from contaminated soil and can thus be used safely. Wageningen University joined this program, and started a study of mushrooms because of their use in remediation of different types of pollutants. One of the goals is to hand over a cleaner area to the local government after 10 years, when the project is finished, by purifying what had been contaminated soil, reusing discarded houseboats, closing cycles by extracting energy, water and nutrients from local waste, using solar power, and testing local regenerative technologies and evaluation of the implications.

Potential for upscaling: A stepping-stone in the transition to a circular district

Specific technologies developed and tested in the project have potential for upscaling. The future objective is to share the results of the study, started by De Ceuvel in collaboration with Ghent University, DELVA Landscape Architects, and Wageningen University on the cultivation of plants and mushrooms that help to clean contaminated soil by accumulating pollutants, with the new residents of Buiksloterham. Working methods and technologies will be used for Schoonschip, a project consisting of 46 floating households. The Amsterdam Municipality plans to transform Buiksloterham into a circular residential district based on experiences of De Ceuvel. Working procedures, partnerships and lessons learned may be replicable.

Key insights: Creativity meets sustainability, a good combination

- The joint ambition of creative entrepreneurs with respect to sustainability was a major driving force for the project, as was the enthusiasm of volunteers and the public.
- Involving knowledge partners, for example Metabolic and universities, is important for innovation to thrive.
- Technologies that proved feasible in one place do not guarantee future adoption by prospective users (inhabitants and entrepreneurs in Buiksloterham).
- Support and advice on, for example, business models and financing issues is very welcome.
- It is important to start with a good basis and arrangements for the community-building, taking into account that it is an evolving project involving the entrance of new participants and changing goals in different phases.

VALUE OF THE PROJECT	POTENTIAL FOR UPSCALING
Economic value	Roll-out
<ul style="list-style-type: none"> - Growth of creative business and new collaborative partnerships between entrepreneurs - Increasing the value of the area - Efficient (re)use of materials - Testing decentralised regenerative technologies 	<ul style="list-style-type: none"> - Potential for specific technologies developed and tested in the project 
Ecological value	Expansion
<ul style="list-style-type: none"> - Purifying heavily polluted soil - Reusing discarded houseboats - Closing cycles by extracting energy, water, and nutrients from local waste - Using solar power - Testing decentralised regenerative technologies and evaluating the implications 	<ul style="list-style-type: none"> - Working method and technologies will be used for SchoonSchip, a project developing a sustainable floating neighbourhood consisting of 46 floating households in Amsterdam - The Amsterdam Municipality plans to transform the whole neighbourhood Buiksloterham into a circular residential district based on De Ceuvel's experiences 
Social value	Replication
<ul style="list-style-type: none"> - Community building - Inspiring visitors and each other - Education and awareness 	<ul style="list-style-type: none"> - Difficult specific context; working procedures, partnerships, and lessons learned may be replicable 
KEY INSIGHTS	
<ul style="list-style-type: none"> - It is important to have a good basis from which to start. - Make clear arrangements for community building. - In an evolving project, new participants become involved and goals can change in different phases. - Creative entrepreneurs with a joint ambition with respect to sustainability were a major driving force for the project, as was the enthusiasm of volunteers and the public. - Involving knowledge partners (e.g., Metabolic and universities) is an important factor to ensure that innovation thrives. - Technologies that proved to be feasible do not guarantee future adoption by prospective users (inhabitants and entrepreneurs in Buiksloterham). 	

5.2 WASTED

Introduction: A low technology-enabled social innovation project

WASTED is a local pilot project around stimulation of public awareness of our global plastic waste problem. It started in Amsterdam North and received a lot of national and international attention. A neighbourhood laboratory for plastic waste upcycling, building blocks of the plastic waste, and open source documents are the most tangible results of this project. WASTED made it possible to implement a programme like this anywhere in the world. Three activities are developed and tested: WASTED Educational Program, WASTED Reward System and WASTED Lab.

CITIES Foundation, an Amsterdam-based NGO specialised in local solutions for global urban problems, started this project in 2015. A previous CITIES project, Farming the City was already paying attention to waste, food waste and packaging material. A research study on plastic waste management and the government waste policy was the starting point for the next project, WASTED. With support from City District Noord, Fred Foundation and Doen Foundation, this alternative waste management system started its first phase. According to Marije Ebbers, manager of Fred Foundation, this is a way to show citizens that they are part of the problem and to stimulate them in a positive way to close the loop and be part of the solution. Local entrepreneurs are involved in the project, as are local schools and cultural organisations.



Source: CITIES Foundation

The waste ambition of the City of Amsterdam is a 30% separation rate in 2016, a 65% separation rate in 2020, and a 90% separation rate in 2032. Waste policy and management are seen as important pillars of a circular economy⁴⁰. The ultimate ambition is a waste-free city. City District Noord, is one of the organisations that financially supported this pilot project in its first year. In 2016, the financial support was withdrawn. For that reason, WASTED started a campaign to generate new social and financial capital so that it could continue the project.

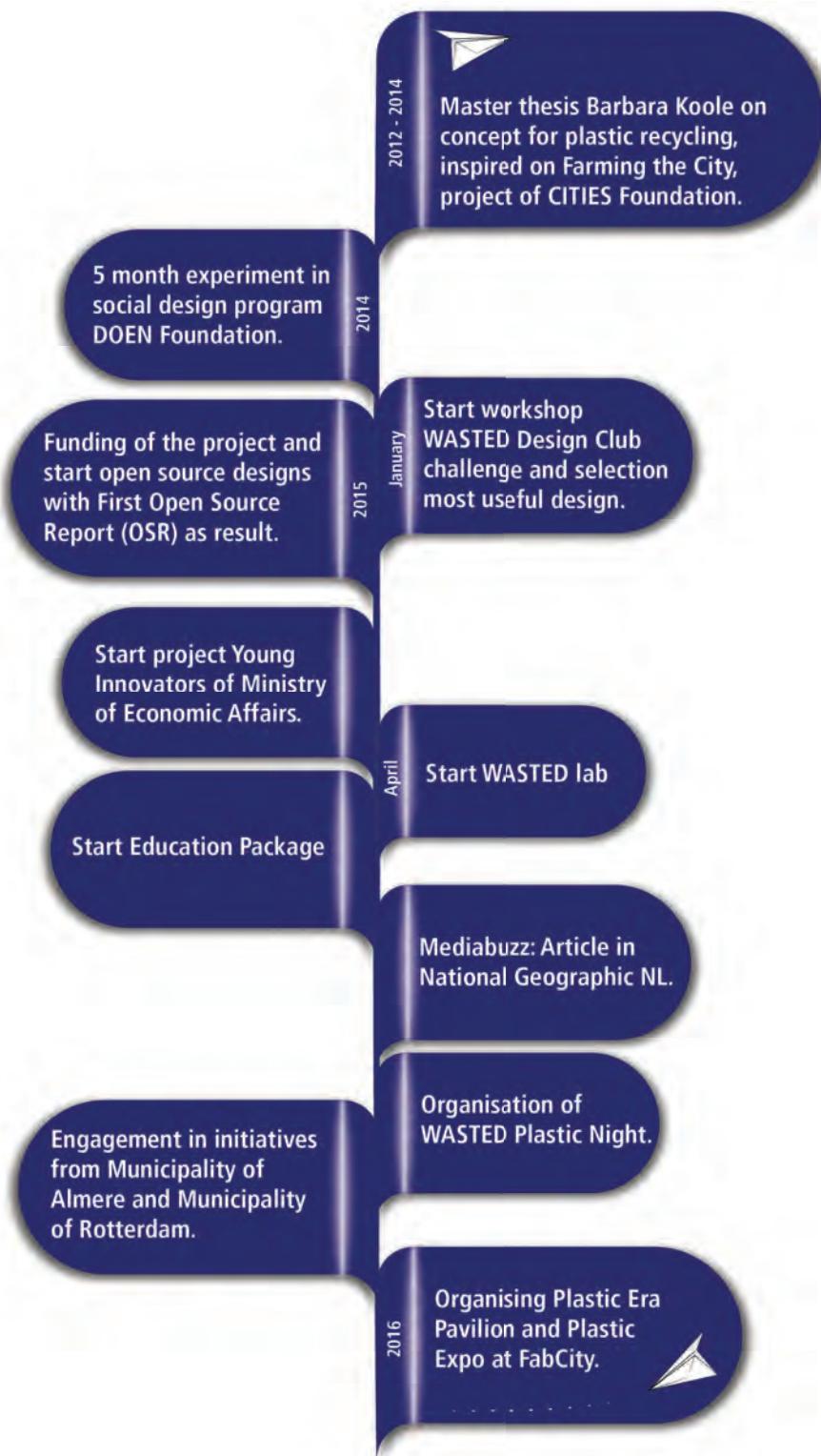
Quite apart from the fact that it is unclear if WASTED can start the second pilot, Marije Ebbers emphasizes one of the unexpected outcomes: 'This project has put CITIES and WASTED on the map of the plastics industry. We are a new voice in the plastic dialogue. Big players are interested in our vision and accepted us as a partner in their network, as did the different Ministries that are involved'.

Rationale: Why was it started and by whom?

Francesca Miazzo, the managing director and co-founder of CITIES Foundation, and Barbara Koole are the initiators of this CITIES project. Both had participated in Farming the City. One of the research findings was that the main focus lies on behaviour and awareness and not technological solutions. They proposed starting a low technology-enabled social innovation project using a simple technology to engage citizens, stimulate public awareness of our global plastic waste problem and change behaviour at a local level.

40 Report 'Towards the Amsterdam Circular Economy', City of Amsterdam.

WASTED started as a five-month pilot (April to August 2015): localising the plastic cycle and giving new value to plastic waste on a local scale. For this project the choice was made to start in a socioeconomically disadvantaged neighbourhood of Amsterdam. Local residents have on average low income, low education, and low participation on the labour market. It was important to keep the whole process as simple as possible. Given the financial constraints of the project, the obvious choice of setting was a low-tech environment.



WASTED Lab is a local laboratory where a small group of people can fabricate plastic objects, a WASTED Block. To encourage local citizens and entrepreneurs to collect plastic waste, WASTED started its own reward program with a new local currency. It's a community-focused, plastic-valued exchange between local citizens (WASTED Neighbours) and local business or a cultural organisation (WASTED Friends).

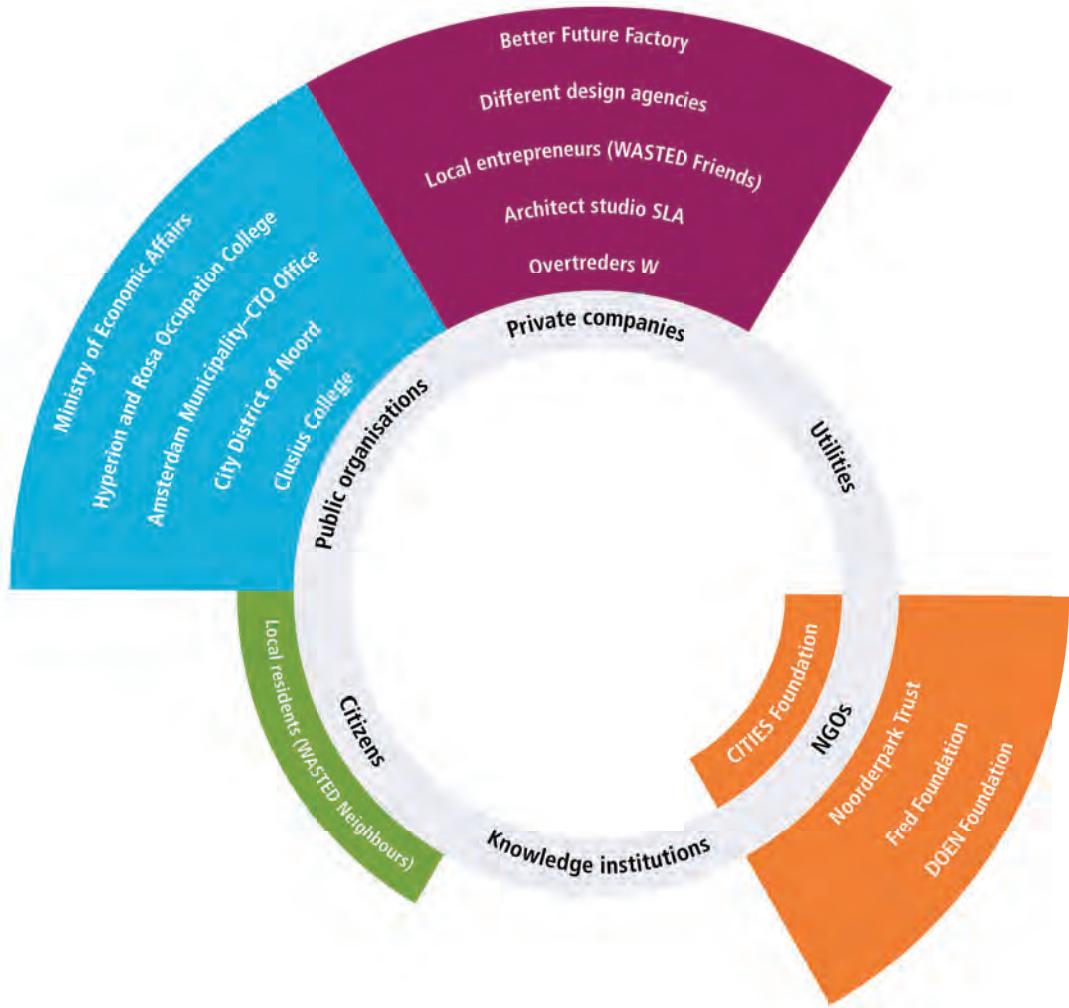
WASTED contacted City District Noord, asked for permission to start the project in the district and applied for a subsidy for their reward programme. The waste ambition of the city administration was the main reason for granting both the permission and the subsidy. Still, there was scepticism. According to Eric van den Beuken, city district director, there are two sides to every waste problem. 'Firstly, collecting and separating plastic waste is something that is done behind the front door. Secondly, the question what to do with collected waste is the other side of the coin. In my opinion, that is the real challenge. Different kinds of collected plastic need various treatments'. As a result, a waste management system has to be more specific and therefore the challenge only becomes bigger. 'There is no such a thing as one kind of plastic that can be processed to, for example, all kind of plastic furniture for public places. Especially in Amsterdam, the standards are high and all kind of stakeholders involved. All with their own opinions and demands,' insists Eric van de Beuken. In his opinion the project will be successful when local residents and entrepreneurs are more aware of the waste problem and understand that changing their own behaviour is the only solution.

The partnership: Roles of various stakeholders in the project

Being a neighbourhood laboratory for plastic upcycling, most of the partners are found locally. At the start Cities Foundation worked closely with Fred Foundation, another NGO acting as an in-kind contributor and provided WASTED management services during the construction phase. Different design studios, for example SLA Architects and DUS architects, were involved in development of the technology and the design of the envisioned physical product. Later on the Better Future Factory participated in the development of the WASTED Truck.

WASTED Reward program was supported and funded by City District Noord. The main reason to support this project was the goal of WASTED to stimulate public behaviour and awareness of the issue of global plastic waste problems at a local level. Although plastic waste is not the main waste problem in Amsterdam, City District Noord was positive from the start of the project. The question they are interested in is, if it is possible to motivate people to separate their waste and reach a higher level of sorting waste. Another question they are interested in is whether it is possible to develop a financially sustainable business model for a non-profit initiative like WASTED. Effective business planning is critical to an entrepreneurial company's long-term success and its ability to raise capital and grow. According to Marije Ebbers: 'They all work enormously hard to kick start this new project. At the same time, they have to develop a financially sustainable business model. It is not easy to achieve all these things together, and it can be an obstruction on their road to success'.

Locally, there are two partnerships: WASTED Neighbours, and WASTED Friends. Thirty-two local businesses participate as WASTED Friends in the WASTED Reward System, offering deals and discounts to 680 citizens (WASTED Neighbours) who are participating in exchange for WASTED Coins. Together, they are building a new local currency that gives new value to plastic waste.



An important partner is Noorderpark Trust, a creative, innovative neighbourhood enterprise stimulating local residents and artists to organise and implement activities in and around Noorderpark in Amsterdam-Noord. As Barbare Koole points out: 'The team needed to work closely together with Noorderpark Trust and Clusius College to establish a effective network in the neighbourhood. They know everyone around here'.

In the Plastic Value Chain Agreement, WASTED works with the Ministry of Infrastructure and the Environment after the City of Rotterdam became interested in their project and invited WASTED to join its future policy lab. WASTED is a now a partner and WASTED Educational program is used in the schools in Rotterdam.

City of Amsterdam, Section Waste is a partner in operational collaboration on waste collection. After the numbers of WASTED Neighbours increased, there were not enough volunteers to collect the plastic waste anymore. The City of Amsterdam then collected the bags. After the publication of the decision of the City District Noord which relates to the discontinuance of the financing of WASTED, parties agreed to continue offering plastic waste collection.

User involvement

Two main user groups can be distinguished in this project: local residents (WASTED Neighbours) and local entrepreneurs (WASTED friends). Education of young citizens is a great opportunity to change behaviour and raise awareness within families.

Value of the project

The purpose of this project was to raise awareness and change the behaviour of local residents and businesses, what we consider to be social value. The project gained a lot of publicity and international attention. But the impact of this project on the local society is not clear. Less than 1% of the total population of Amsterdam-Noord (over 90.000 citizens) is registered with WASTED. The interaction between local residents and local entrepreneurs in the context of environmental sustainability has probably grown through the use of WASTED coins. There is an educational program for children used by schools but the results are unclear. Nevertheless, according to the City District, initial social goals have been met because it promoted awareness of a part of the population and social cohesion.

The intended ecological value is the increase percentage of recycling of plastic waste, but the effect is limited. As of this writing (August 2016) around 8500 kilogrammes of plastic waste in more than 7000 bags have been collected during the whole project. The impact of this project on the local natural environment is unknown. As Eric van den Beuken, stated: 'Plastic is not the most important residual waste. The local government is interested in the outcome of the project where it comes to change behaviour and increasing awareness'. According to the City District, initial ecological goals have not been achieved. The separation rate is not higher and the costs of separation are not lower.

As mentioned before, there are three activities: WASTED Educational Program, WASTED Reward System and WASTEDLab. Their shared ambition is to have all three activities self-supporting and financially viable. According to WASTED, the Educational Program has reached this status. Local schools have the budget and the desire to partner with WASTED. Their WASTED Reward System is not yet self-supporting and was funded by the City District. Through the savings system local residents receive an incentive to collect plastic waste.

The WASTED coins they receive can be used for services and discounts at local shops and restaurants. WASTED Friends attract more clients or visitors because WASTED Neighbours have to spend their WASTED Coins. WASTEDLab itself is not yet self-supporting and was also funded by the City District. One of the questions is if it is possible to produce not only blocks but also other (design) products that can be sold for a higher price in order to fund their own activities.

Potential for upscaling

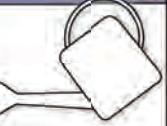
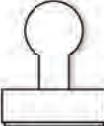
From the perspective of City District, a small-scale project like WASTED must have the potential of upscaling, and its business model has to be self-sufficient. According to Barbara Koole, the manager of WASTED, they have not paid much attention to developing a sustainable business model. Starting, constructing and implementing the project itself was the main challenge. The partners have taken the first steps to make the project financially possible.

Potential for rollout is limited to this neighbourhood because of context sensitivity. Otherwise it would probably be difficult to interest more local residents in the program. This program started in a socioeconomically difficult neighbourhood of Amsterdam whose residents were low income, poorly educated and likely to be unemployed. They didn't have their own local currency. It's not sure how a project like this would fare in a neighbourhood where local residents have high income, more education, and high participation in the labour market, especially when they have their own local currency and regular waste collection.

WASTED is testing whether expansion to other city districts is possible. According to Barbare Koole: 'A neighbourhood survey has been started in City District Oost with a different setting (other demographics and entrepreneurs, existing local currency) to explore the possibilities. Quite simply, it is not possible to accept an invitation to start a program like WASTED in another city without a neighbourhood survey'. The initiative is already being copied in New Zealand. The City of Rotterdam started with the implementation of WASTED Education program. Cities like Almere, and Barcelona are also interested.

Key insights in WASTED

- A launching customer for the products made out of the plastic waste, for example city councils, could strengthen the project. This may help to create a viable business case, although it will involve concessions regarding functional and esthetical requirements.
- The project is very context-sensitive. Demographics, existing collection methods, willingness of entrepreneurs to participate and presence of a local currency may vary and require modifications of the concept when expansion or replication is considered.
- It is an appealing idea that has drawn a substantial amount of national and international attention. This resulted in an unintended shift of focus at different times in the project.
- Technological knowledge and knowhow on product development was underexposed at the start of the project. It would have been better to incorporate this into the project earlier.
- The project has a focus on the collection and reuse of plastic waste and creating a cleaner and socially more connected neighbourhood. It does not explicitly address prevention of waste.

VALUE OF THE PROJECT		POTENTIAL FOR UPSCALING
Economic value		Roll-out
<ul style="list-style-type: none"> - Through the savings system, local residents receive an incentive to collect plastic waste; the WASTED coins they receive can be used for services and discounts at local entrepreneurs, generating extra traffic and economic value 		<ul style="list-style-type: none"> - Potential for roll-out is limited to the specific context of this neighbourhood due to context sensitivity 
<ul style="list-style-type: none"> - Increased percentage of recycling of plastic waste, but effect is limited thus far 		<ul style="list-style-type: none"> - Expansion to other city districts seems possible; a pilot has been started in another city quarter with a different setting (other demographics and entrepreneurs, existing local currency) to explore the possibilities 
<ul style="list-style-type: none"> - Awareness of residents, change of behaviour - Community building between local residents and local entrepreneurs - Education of schoolchildren - Building and sharing open source knowledge 		<ul style="list-style-type: none"> - The initiative is already being copied in New Zealand - Cities such as Almere and Barcelona have also shown interest 
KEY INSIGHTS		
<ul style="list-style-type: none"> - A launching customer for the products made out of the waste, for example city councils, could strengthen the project. This could help create a viable business case, although it will involve concessions regarding functional and esthetical requirements. - The project is very context sensitive. Demographics, existing collection methods, entrepreneurs' willingness, and the existence of a local currency may vary and require adjustments to the concept when expansion or replication is considered. - This very likeable concept has attracted a lot of attention and publicity, both nationally and internationally, resulting in an unintended shift of focus at different times in the project. - Technological knowledge and knowhow of product development were underexposed at the start of the project. It would have been better to incorporate this knowledge in the project early on. - The project focuses on the collection and reuse of existing plastic waste and the creation of a cleaner and more socially connected neighbourhood. It does not explicitly address the prevention of waste. 		

5.3 FAIR METER

Introduction: A double shot at sustainability

In the transition towards an environmental sustainable society, smart meters play an important role. Alliander and Waag Society initiated the Fair Meter Initiative, to explore the possibilities of developing a more sustainable alternative for the smart meter. As Hans Nooter, CSR manager at Alliander, explained: 'We have the obligation to introduce a smart meter in the light of the energy transition. But the meter itself is not sustainable. Let's introduce a fair smart meter'.

Thus, in this project the roll-out of smart meters was combined with the ambition to make the new smart meter as fair as possible, using materials derived from socially responsible sources, and by using circular design principles, in which materials and resources form the basis for a new production cycle. Therefore, it is a double shot at sustainability. In 2013, the Green Deal Fair Meter was signed between government and project partners, with the aim to develop a fair meter that takes into account all aspects of a business case to be operationalised and exhibited for a timely roll-out.



Source: Alliander

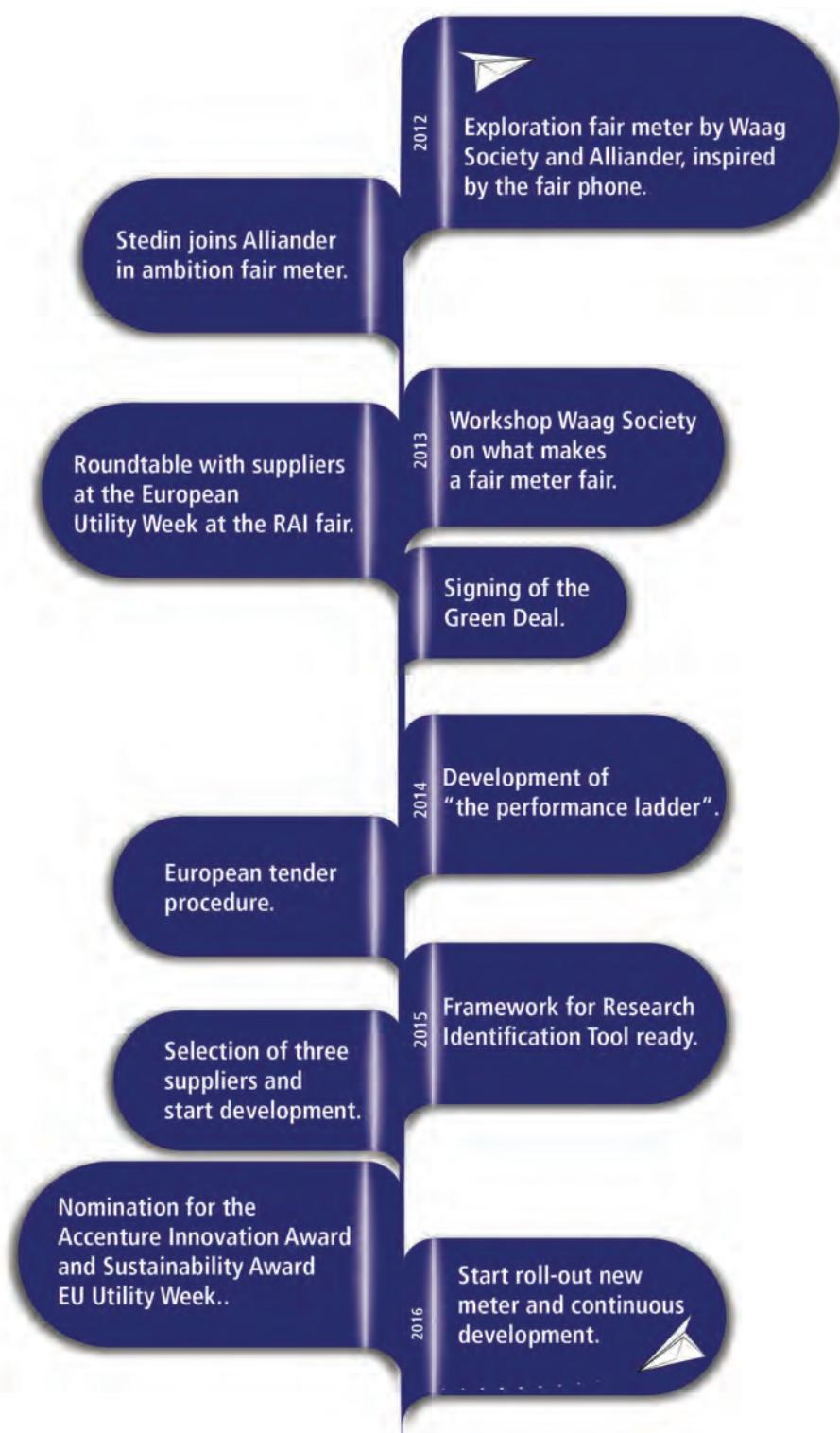
Smart meters are at the top of the energy network company's agenda, because the EU plans to replace at least 80% of electricity meters with smart meters by 2020. The assignment for the Dutch energy network companies is to provide 8 million households and SMEs with smart meters, from 2016. It is an instrument to advance the objectives of the European Union to reduce emissions and annual household energy consumption in the EU countries. From a customer's perspective, smart grids and smart meters open up the possibility to respond to prices and sell excess energy to the grid and therefore save money on their energy bills by consuming less energy in higher price periods. Although the introduction of smart meters is an important step towards establishing an energy transition, there is a downside. A smart meter is an electronic device that consists of rare earth minerals mined in countries where there is no concern for the environment or for social rights and where vulnerable people work in poor conditions. These mines may be exhausted within several decades to a century, if the extraction of ores continues to increase.

The aim of the project is to produce an eco-friendly smart meter, 100% fair, using materials derived from socially responsible sources and to use circular design principles, in which materials and resources form the basis for a new production cycle. The result is a world premiere: roll-out of a (more) fair smart meter on a very large scale, development of fairer public procurement rules, a Resources Identification Tool and a Performance Ladder.

Rationale: Why was it started and by whom?

The project started in line with another project called Fair Phone initiated by Waag Society, an institute for art, science and technology and a pioneer in the field of digital media. In 2013, during European Utility Week in the Amsterdam RAI, a group of people from Alliander, Waag Society and FairPhone worked together during a bootcamp on the 'concept of fair', 'the fair chain' and 'empowering consumers'.

The findings provided the input for roundtable discussions on Circularity, Energy, Data and Chain transparency. Marleen Stikker, managing director of Waag Society, and Hans Nooter proposed translating words into action by signing a letter of intention, and so it happened.



Stedin joined Alliander and started the development of a proof of concept to document evidence that this product or service can be built and distributed with the intention to show CSR and deliver a more sustainable smart meter. One of the tipping points was the signing of the Green Deal in November 2013. At that moment the informal network was formalised in a mutual network programme. Signing partners were Alliander, Stedin, Cogas, The Waag Society, Amsterdam Smart City and Metabolic, a system consultancy and cleantech development firm in Amsterdam.

A lot of work had to be done. The supply chain had to start moving in a ‘more fair’ direction. The energy network companies themselves together with specialised firms worked hard to mobilize the necessary resources to prepare a European tender. The scope of the tender was the development, testing, production and delivery of smart electricity and gas meters for the Dutch market. And aiming at a lean and transparent supply chain of development, testing, production, logistics and support processes where every step of the chain adds optimal value based on excellent performance. A special part of the tender is the sentence ‘the contracting entity wants a partnership, therefore part of the tendering procedure is the request for a roadmap, a plan to realise cost improvements, smart meter innovations, supply chain innovations, customers’ demands and innovations in relation to a fair meter’. To create the value chain collaboration within the Green Deal Fair Meter and securing the concept of ‘Fairness’ in the tender, technical assistance of Copper8, a specialised firm, is used in the operation of the programme. The results to date are a first version of the performance ladder, which will be elaborated on in collaboration with the European Smart Metering Industry Group (ESMIG), the integration of fair in the tender and further substantiation of the pilot projects. According to Hans Nooter: ‘The Fair meter is example of a step-by-step process. The only way to innovate the existing technology and the path towards sustainability is to take small steps. The big leap towards a 100% fair and circular smart meter has not yet been taken’.

The partnership: Enthusiasm and intrinsic motivation is key

The assignment for the Dutch energy network companies to provide consumers with a smart meter did not include the obligation to introduce a fair smart meter. Due to the enthusiasm and intrinsic motivation of influential individuals who care about CSR, the project Fair Meter is a fine example of a successful partnership. At the same time, a project like this calls for a broader partnership. For that reason, Cogas joint the partnership and signed the Green Deal. Afterwards Delta Network Company, Westland Infra and Enduris broadened the group of energy network companies. Hans Nooter emphasised the wider range of partners: ‘Over time it has become a multi-stakeholder project focusing on sustainability of the smart meter supply chain’. In a smart meter the supply chain includes around 3000 suppliers, from the mining company where the scarce natural resources are mined, to the factories where products are assembled. Most of the suppliers in the supply chain are private companies. They will play an important role in complying with the demands with respect to the sourcing of the materials and supervising how the fairness criteria are being met by their suppliers.

In collaboration with Metabolic, Ministry of Transport, Public Works and Water Management, and Copper8, a Resources Identification Tool has been developed. According to Waag Society: ‘This tool follows from the discussions about a resources passport or label and aims to show what materials are present in the smart meter, where these materials originated, under what circumstances and by which means. The tool aims to assess the smart meter on four areas that are closely linked to the Fair Meter

performance ladder⁴¹. Suppliers have been analysing all the materials and components in their smart meters, and are trying to find replacements for all those they believe might not have been acquired or produced in a transparent, sustainable, circular and fair way, for instance if they exploit child labour or come from mines in war zones in Africa.

Partners' roles can change over time. For example, Amsterdam Smart City is one of the organisations that signed the Green Deal. Reinoud Wissenberg, CSR manager at Stedin, mentions: 'The role of partnership of Amsterdam Smart City evolved from a real partner into a sympathizer', because the controlled experimental rollout of one thousand fair meters pointed out to be impossible. The suppliers are asked to deliver something they don't have on the shelf. It is a new concept and for that reason the energy network companies asked in the tender for a partnership and an innovative attitude from the suppliers. To ensure quality and stability the tender is assigned to three suppliers.



41 <http://waag.org/nl/news/green-deal-presents-report-resources-identification-tool>

User involvement

Households and SMEs are important as the end-users of the fair smart meter. As Waag Society points out: 'A 100% fair meter can only be achieved through close cooperation between consumers, suppliers and producers, knowledge institutions, and the government'⁴². The users, households and SMEs, were not involved in the project until the first fair smart meters were distributed.

Value of the project: Value is a matter of perception

A smart meter in itself provides economic and ecological value. With smart meters, consumers can adapt – in time and volume – their energy usage to energy prices throughout the day, saving money by consuming more energy when it is least expensive. But an important issue is the adoption of the smart meter by consumers. As Reinoud Wissenberg notes: 'The fact that we install a fair smart meter does not automatically result in saving money'. Smart grids can help to better integrate renewable energy. When coupled with smart metering systems, smart grids reach consumers and suppliers by providing information on real-time data on energy generation and consumption, bringing supply and demand closer together and stimulating efficient use of renewable energy.

Focussing on the fair meter that is being developed, the ecological and social value is evident. The social value of this project is based on using less conflict materials and by doing so creating an incentive for improvement of labour conditions at mining and material production. One of the results of this project is that suppliers in the smart meter chain are developing a sense of urgency when it comes to sustainability, by making circularity and CSR a bigger factor in the tender. As Hans Nooter observes: 'We are asking our suppliers to deliver solutions that are not on the shelf. They have to move forwards. The chain is starting to move.'

Economy of scale will lead to the creation of new environmentally friendly standards, because of the size of the rollout of the smart meter. Important aspects of the development of this meter are a resources label, tracking all materials throughout the supply chain and circularity of the product and process.

The notion of circularity focuses on life cycle design, maximizing use of secondary raw materials in production, minimizing residual waste and maximizing second-life applications. Reduction of raw material usage is a step towards a more sustainable metering, as is reuse of materials by recycling old meters and circular design of new ones. Because of the economy of scale, there is also economic value in developing a fair smart meter. The partners want to develop all aspects of the fair meter concept into a business case. Their goal is to showcase, develop and operationalise the concept in a way for the rollout of the fair meter to take place in good time. Additionally, the energy network companies are able to design new business models and develop new services around a new energy transition model.

For the energy network companies, the value of the project is also high in another sense. Hans Nooter says: 'The underlying objective behind the development of a fair smart meter is to learn how to organise innovation and to implement change at a firm level and at a higher level. What are the important factors and how are they affecting the whole chain?' They are able to use the experience and lessons learned in this project in new projects where sustainability and social responsibility are high on the agenda.

42 <https://waag.org/en/project/fair-meter>

Potential for upscaling: A self-fulfilling prophecy

In the Fair Meter project the upscaling potential is evident. The new smart meter is being rolled out nationally in the next few years, and will have optimally reached 8 million households and SMEs. But the fair meter is not 100% fair yet. Suppliers will continue development; the ambition is to work from a proof of concept towards 100% fair in the future. Precisely when the partners will be able to implement a 100% fair meter is uncertain, making it hard to assess the actual progression of fairness in smart metering nationally.

The project also has expansion potential. The energy network companies are broadening the scope of the Fair Meter project towards for example cables and transformers, aiming to implement fairness and circularity in the procurement of these products as well. Also the knowhow on developing fair and circular products developed by the suppliers can be implemented in other innovation projects they may start in the future.

In respect to replication, the Fair Meter project is an example of how to incorporate circularity and social corporate responsibility in tendering for various products, regardless of application area. The Resources Identification Tool and performance ladder can be used as an example for other projects to assess fairness and circularity and give an impulse to sustainable innovation. Direct replication of the project in other countries may be difficult, because of the Netherlands' context of energy companies and the way in which the government has promoted smart metering.

Key insights in Fair Meter

- The project is an inspiration nationally and internationally for the incorporation of fairness on a large scale. The project has drawn a lot of media attention and invitations to international conferences.
- The enthusiasm of CSR managers of the main partners is crucial. CSR managers of Alliander and Stedin accepted the challenge with people from Waag Society to move from words to action.
- Sustainable procurement is possible. The integration of fairness in the tender has led to a successful tendering process and the assignment to three different suppliers who are committed to delivering a more fair smart meter based on a partnership innovation program.
- Attention to corporate social responsibility and circularity within corporates drives sustainability in the whole value chain. The Dutch energy network companies have appointed CSR managers and they are intrinsically motivated. In the supply chain, extrinsic motivation and rewards can simulate thoughts of corporate social responsibility and circularity.
- It is very difficult to make a product fair when its developers do not know what the status quo in fairness is and when there is no control mechanism for labour conditions, for instance.
- The management of the innovation process is a challenge, especially in respect to extending the network. The challenge for companies will be to try to get more effective integration of innovation and supply chain processes.

VALUE OF THE PROJECT		POTENTIAL FOR UPSCALING
Economic value		Roll-out
<ul style="list-style-type: none"> - Economy of scale, because of the size roll-out of the smart meter 		<ul style="list-style-type: none"> - A new smart meter is being rolled out nationally, but is not 100% fair yet - Suppliers will continue development; the ambition is to work from a proof-of-concept towards 100% fair in the future 
<ul style="list-style-type: none"> - Reduction of raw material usage - Reuse of materials through recycled old meters and circular design of new meters 		<ul style="list-style-type: none"> - The partners are broadening the scope of the project to include, for example, cables and transformers - Knowhow developed by the suppliers can be implemented in other innovation projects 
<ul style="list-style-type: none"> - Using fewer conflicting materials, thereby, for example, improving labour conditions during mining and material production 		<ul style="list-style-type: none"> - The fair meter is an example of how to incorporate circularity and social corporate responsibility in tendering - The RIT tool and performance ladder can be used as an example for other projects 
KEY INSIGHTS		<ul style="list-style-type: none"> - Without the enthusiasm of the main partners' CSR managers, the project would not have been initiated. - Involving knowledge partners (e.g., Waag Society) is an important factor to ensure that innovation thrives. - Sustainable procurement is possible. - The Green Deal with the government has helped put fairness in the tender. - It is important to postpone the moment of official tendering as long as possible because it ends deliberation opportunities with and among suppliers. - Collaboration between suppliers should be part of the tender to prevent suppliers from not wanting to work together once the contract is awarded. - Circular economy and corporate social responsibility should be a bigger factor in the tender. - The project is an inspiration nationally and internationally for incorporating fairness on such a large scale. - It is very difficult to make a product fair when you do not know what the status quo in fairness is and when there is no control mechanism for labour conditions, for instance. - Managing the innovation process is challenging, especially with respect to extending the network in a timely manner, involving stakeholders throughout the process, and keeping the energy high (internally and externally). 

5.4 LOCALLY GROWN PAINT

Introduction: A shared value initiative of a family-owned business

This project is initiated by a family-owned business. Their aim was to produce an environmentally sustainable paint, to reduce the organisation's CO₂ footprint and at the same time to stimulate the local circular economy. The two owners of this family business are future-minded and their interests are broader than their own business and village. Every year, they try a new project. In 2014, they asked themselves: 'How can we contribute to a healthier and safer world?' They came up with the idea to produce eco-friendly sustainable paint based on linseed oil, locally instead of abroad. By creating locally grown paint they not only reduce the organisation's CO₂ footprint and stimulate the local circular economy but they also make it visible and tangible to the user.

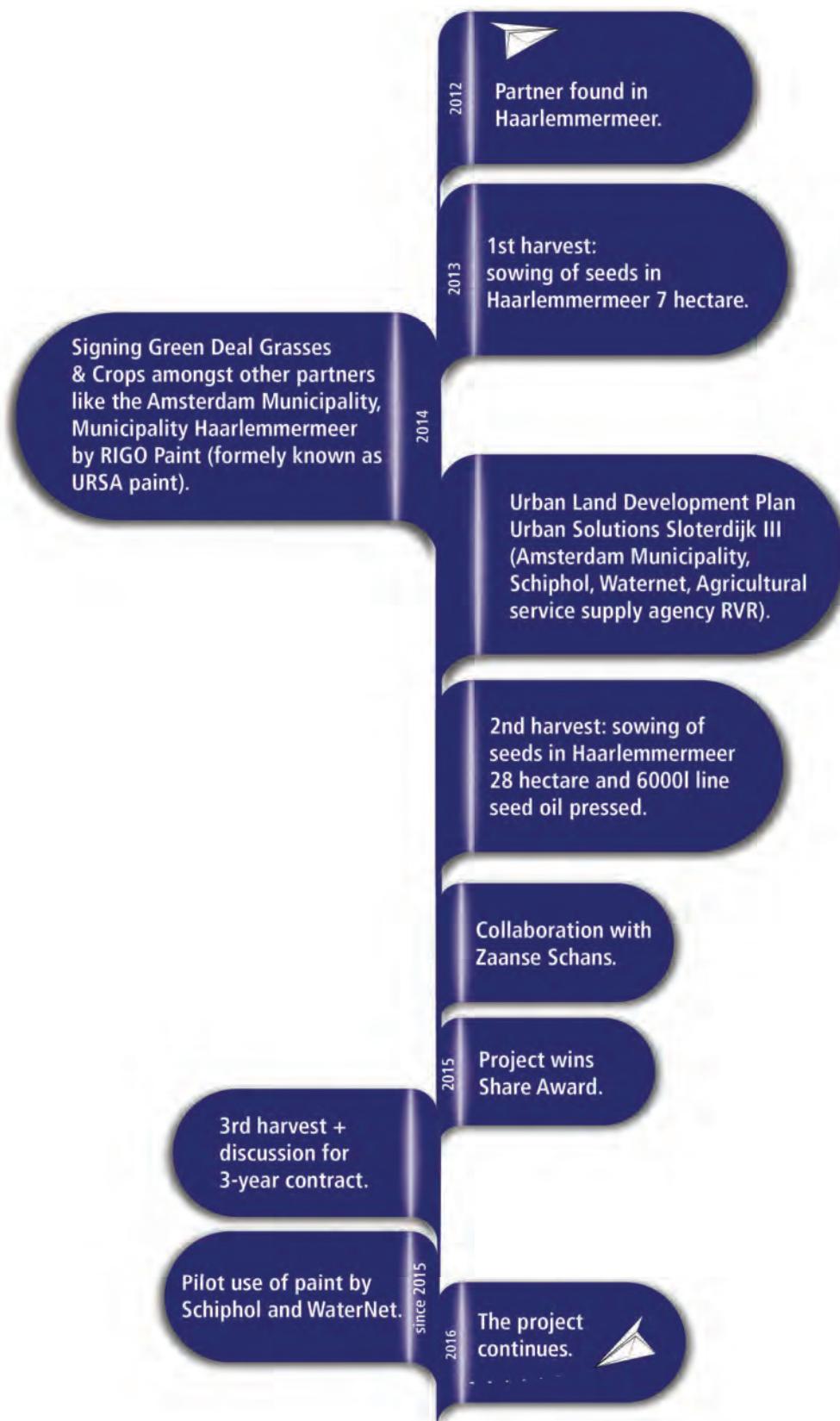
The company is aware of the problems that the paint and coating industry has created. Petrochemical (or solvent-based) paint and acrylic (water-based) paints are widely known to contribute to air pollution and health problems. Furthermore, the process of manufacturing

results in significant energy use and waste. RIGO Paint started a circular economy project and developed a technical innovation of an artisanal product, a linseed oil based paint that is 100% environmentally friendly. The progress in durability is enormous. The guidance from most manufacturers of petrochemical and acrylic paint is to repaint every three to five years. Paint that is based on linseed oil lasts decades. However, transport was an issue. Linseed oil paint is based on flax and hemp seeds, imported from Russia and Canada. Rigo Paint realized that transport had to be minimised and came up with a multifaceted solution: Locally Grown Paint. The crux of the project is that local wasteland and uncultivated ground are used to cultivate flax and hemp to produce linseed oil and at the same time provide added value to the landowners. For example, a safer environment for air traffic at and around Schiphol Airport. Locally Grown Paint is first and foremost LOCAL. In the words of Machiel van Westerhoven: 'We were searching for a way to produce a linseed oil based paint – instead of petrochemical paint or acrylic paints – and to be able to show it to the industry and public. Today we can point at the fields around us and say: This is where the paint grows!'



Source: RIGO Paint

Rationale: Why was it started and by whom?



The two owners of RIGO-paint, a family-owned business, got a great idea while sitting on a bench in their garden. Why not produce more locally? As one of them explained: 'The reason why we are starting a new project like this is because our energetic commitment to a sustainable world. We trust our sense of entrepreneurship'. They started their project Locally Grown Paint in collaboration with some private partners like Schiphol Airport and public partners like the City of Amsterdam, City of Haarlemmermeer, and Waternet (the water utility company for the Amsterdam area) with the intention to experiment, create and show the world their own locally grown linseed oil paint. They won the SHARE Award in 2015 because RIGO was able to shorten the logistic supply chain drastically and stimulate the local circular economy.⁴³ The project was supported by the Biobased Connections project of the Amsterdam Economic Board, part of the Green Metropole, a three-year EU-funded programme to support sustainable entrepreneurs and to initiate new projects. The support was not financial, but when RIGO-paint was looking for local land to cultivate flax and hemp, Biobased Connections introduced RIGO to partners such as Waternet and Schiphol.

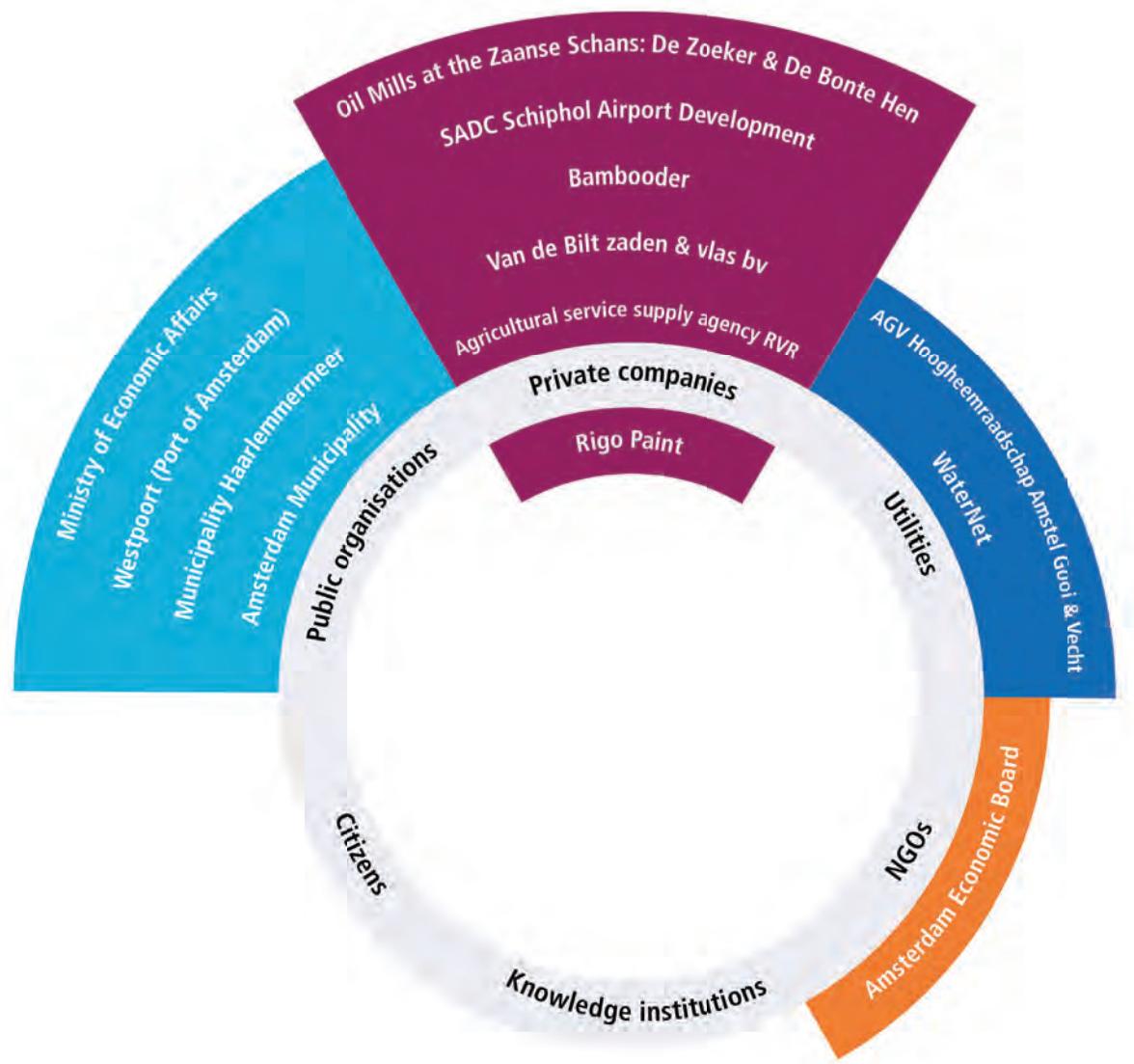
An interesting aspect is that family-owned businesses proved to be more crisis-resistant than other firms whose ownership and operational management are not in the hands of family members. One of the reasons is that business owners are more future-minded and they see leadership as stewardship. They have a long-term strategy and handle it with care. RIGO-paint is an excellent example.

The Partnership: Intrinsic motivation to collaborate and take risks

One of the characteristics of this project partnership is that private companies comprise the majority of the partners. They are representatives of the whole value chain for the production of linseed oil paint, from the landowner and the agricultural service supply agent to the launching customers. Mark Nijhuis, researcher at Waternet, one of the utility partners, agrees: 'One of the lessons learned is that you have to look at the whole value chain right from the beginning, to involve all those parties, and there are more parties than it might seem at first glance. Start together, give it a try for a year, and take a risk together'. The common denominator is developing awareness for the concept of shared value: 'corporate policies and practices that enhance the competitiveness of a company while simultaneously advancing social and economic conditions in the communities in which the company sells and operates'.⁴⁴ All private companies need an earnings model providing an economic foundation. But they accept the fact that economic revenues should be seen as a first layer to complement the shared value earnings model. The partners in this project show that intrinsic motivation, willingness to invest in a good cause, and an entrepreneurial attitude are indeed crucial elements. The project did not depend on grants or other external funding. In the case of Locally Grown Paint, public partners are involved in an unconventional way. Two of three public partners, and utility partner Waternet, are landowners. Only the Ministry of Economic Affairs stayed in a governmental role.

43 <http://www.sharehaarlemmermeer.nl/share-award.html>

44 Michael Porter and Mark Kramer, "Creating Shared Value," Harvard Business Review, January–February 2011.



User involvement

On the one hand, users were not initially involved. On the other hand, three key partners are now launching customers: Schiphol Airport, WaterNet and Zaanse Schans. In line with their commitment to the cause, linseed oil based paint is used in different projects. For example, one of the reference projects is the restoration of a weaver house at de Zaanse Schans, near the oil mills that are used for oil pressing.

Value of the project: Local

Firstly, RIGO Paint is strengthening the circular economy position by producing sustainable paint for the same price as paint that isn't produced locally. Secondly, landowners create an additional economic value through prevention of costs by good allocation of (temporary) uncultivated ground. Thirdly, Zaanse Schans is offered a healthy economic model for preservation of cultural heritage. Finally, job creation in the region (now and in the future) is another example of economic value.

The social value of this project is based on building a collective framework of beliefs and values, which provide the basis of activities towards the ecological impact of its activities and products. The contribution to Locally Grown Paint is a visible example of the employer being committed to wellbeing and prosperity of employees and users. An additional benefit to the community is a safer environment for air traffic at and around Schiphol Airport.

From an ecological point of view, decreasing the CO2 footprint of the value chain by reducing transport intensity of activities is a step towards a more environmental sustainable society. For a company like RIGO Paint it is easier to supervise the entire production process and to optimise the process if possible. As mentioned before, linseed oil based paint is 100% environmentally friendly and the progress in durability is enormous (linseed oil lasts decades).

Potential for upscaling: High potential in different ways

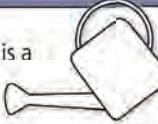
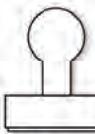
The ambition of RIGO Paint is to develop a prosperous and sustainable business model based on the balance between economic, social and ecological value and earnings. Creating shared value has become mainstream and is linked almost seamlessly with the role of stewardship in family business, but upscaling is a necessity.

Potential for upscaling is high by expanding the number of local land used. The partners are looking for a continuation of the partnership for several years. This use of local wasteland is a source of inspiration for other eco-friendly crop projects.

The local production working method is highly replicable. In Switzerland, a client of RIGO is now copying the local production in collaboration with local farmers.

Key insights: Stewardship is leading true entrepreneurs

- Family-owned businesses have a long-term vision and feel a strong responsibility for next generations. This was the thriving force to start this pilot project. These kind of projects do not rely on grants, 'Green Deals' or the like.
- The local industry value system can be reorganised in a sustainable way, but all stakeholders should benefit in some way.
- It is quite possible to grow eco-friendly crops and produce raw materials in a high density populated area through the use of local wasteland and/or uncultivated ground.
- Open book keeping assists in the pilot phase with the balancing of costs and revenues between partners, aimed at a valuable business case.

VALUE OF THE PROJECT		POTENTIAL FOR UPSCALING
Economic value		Roll-out
<p>Varies by partner, for example:</p> <ul style="list-style-type: none"> - Rigo: Strengthening circular economic position by producing sustainable paint for the same price that stands out for its local production - Landowners: Prevent costs through the effective allocation of (temporary) uncultivated ground - Zaanse Schans: Healthy economic model for the preservation of cultural heritage 	<ul style="list-style-type: none"> - High potential by expanding the number of local grounds used; partners are looking to continue the partnership for several years 	
<p>Ecological value</p> <ul style="list-style-type: none"> - Building of a collective frame of beliefs and values provides the basis for activities towards the ecological impact of its activities and products - Decrease of CO2 footprint of the value chain by reducing transport - Local production makes it easier to supervise the whole production process 	<p>Expansion</p> <ul style="list-style-type: none"> - This approach of using local wasteland is a source of inspiration for other eco-friendly crop projects 	
<p>Social value</p> <ul style="list-style-type: none"> - Being responsible for employees' and users' well-being and prosperity - Creating awareness of sustainability among employees and users - Job creation in the region, now and in the future 	<p>Replication</p> <ul style="list-style-type: none"> - The local production working method is highly replicable; indeed, a client of Rigo is currently copying the local production in Switzerland in collaboration with local farmers 	
KEY INSIGHTS		
<ul style="list-style-type: none"> - Proof of concept: Family-owned businesses have a long-term vision and feel a strong responsibility to the next generations (stewardship). - These kinds of projects do not depend on grants, 'Green Deals', etc. - The local industry value system can be reorganised in a sustainable way. - All stakeholders should benefit in one way or another. - It is quite possible to grow eco-friendly crops and produce raw materials in a high-density populated area by using local wasteland/uncultivated ground. - During the pilot phase, open bookkeeping assists in balancing costs and revenues between partners to achieve a valuable business case. 		



6

KEY INSIGHTS ACROSS SMART CITY PROJECTS

Inge Oskam and Willem van Winden

Based on our evaluation and cross-case analysis of 12 Amsterdam smart city projects, we derived key insights on the level of initiating, developing and executing smart city projects. We identified eight topics: project scope and focus, partnership, ownership and leadership, user involvement, value of the project, business model, technology, and upscaling potential. In this chapter, we describe for each topic the similarities and differences, between projects and among the three domains: Energy, Mobility and Circular Economy.

The partnership should fit the project scope and must be open to new input

When evaluating the partnership we distinguished six types of partners: public organisations (e.g. the city administration), private companies, utilities, non-governmental organisations (e.g. associations), knowledge institutions and citizens (see chapter 2). Based on the evaluation of these partnerships we arrived at several valuable insights.

Smart city projects show a broad diversity in partnerships, varying from fairly simple to highly complex, encompassing both small and large organisations, and a great variety in the type of partners.

Some projects we analysed, were run by a small number of partners (Cargohopper and WeGo are good examples). In other projects, such as De Ceuvel and WASTED, the partnership was not only large, but also complex with many partner types involved. Salient here is the prominent role of NGOs in the Circular Economy projects, both as initiator and as facilitator or as supporter.

The city administration can play different roles in smart city projects, from initiator to facilitator, from financer to customer.

In the Energy projects we analysed, the city administration was always a participant, often as initiator. In contrast, the Mobility projects are dominated by private partners, who were also their initiators. In these projects was the involvement of the city administration desired by the partnerships, for example as launching customer. It was a challenge though, to get them involved. WeGo was the only project in which the city administration was a launching customer. In the Circular Economy projects the city administration was more of a facilitator, offering uncultivated grounds for Locally Grown Paint, organising the waste collection in WASTED and funding the development of breeding place De Ceuvel.

Triple helix partnerships are not vital to integrate and develop new knowledge in smart city projects.

Only three of the twelve projects had a triple helix partnership: De Ceuvel, Smart Light and REloadIT. In the other projects we evaluated private companies, NGOs and for instance civil associations innovated together and were able to generate the required knowledge themselves.

A partner ecosystem should not be fixed or inward-looking, but rather be open for new partners to enter when the project asks for new/different competencies or when it enters a new stage in its development.

With the project Mokum Mariteam the business case benefited by extending the partnership with complementary partners at the right time during the life cycle of the project. New partners can bring innovation to the project, but not all projects allow this. For Mobility projects, such as CargoHopper, it was difficult to involve new partners because transport companies are reluctant to use their competitors' IT systems. In contrast, most Circular Economy projects had quite open partnerships, receptive to new partners with fresh insights, without the risks of competition between old and new partners.

Formal collaboration agreements are not always necessary; this depends on the goal of the project and the knowledge that its partners bring.

In the Energy and Circular Economy projects the collaboration was not enshrined in legal agreements, as was the case in the more commercially driven projects in the Mobility domain. For CargoHopper and Mokum Mariteam, new legal entities were developed. In the case of De Ceuvel a civil association was established.

The project scope and focus should be clear and shared by all partners involved

Although most Amsterdam smart city projects had a fairly strong focus, a few insights in respect to scope and focus can be derived from the evaluation.

When smart city projects have multiple partners, it is vital that each partner is explicit and transparent about its intended ambitions, objectives and expectations for participating in the project.

During the project these ambitions and interests should be re-evaluated and shared. If necessary, the scope and focus should be modified accordingly.

It is important that a smart city project be developed with sufficient attention to the scope of activities that will be integrated into the project, and that the focus is clear for all project partners.

Some Energy projects failed to pay attention to the scope and focus of its activities, making it hard to manage and keep stakeholder engagement throughout the project. The Climate Street project, for instance, suffered from a scope that was too broad and undefined. By the same token, the purpose of the Sustainable Neighbourhood project was never quite clear: was it the installation of smart meters in homes (as said by the citizens) or was it about creating awareness of energy consumption (as stated by the project manager)? As Bram Sieben from Alliander (involved in multiple projects) puts it, “too often, in the early stage, projects are about everything: energy, water, environment. You keep talking and involving people, but you end up nowhere”. In the development process, it is essential to move quickly from a broad scope to a specific one.

A consistent focus throughout the project provides direction to smart city projects; a change of scope can prove necessary though, and should be a conscious and shared decision by all partners.

Staying focussed can be difficult when confronted with unexpected setbacks or interesting opportunities along the way. WASTED had a clear scope (creating awareness for separating and collecting plastic waste), but evolved into three separate projects and suffered from the large international attention which became a distraction from the core activities. In the Cargohopper, Mokum Mariteam and WeGo projects, there was a clear business case at the start, making the scope very clear and precise. The focus in these projects did not change during the course of the project, although at WeGo the target group changed from business-to-consumer to business-to-business.

Projects benefit from clear ownership and committed project leadership

Who owns and feels responsible for the project, even in difficult times? Is it one of the partners, a combination of partners or the partnership as a whole? And what is the effect of clear ownership and project leadership, or the lack thereof? From the evaluation we derived the following insights.

A key success condition is that the partners involved must agree that this project is valuable, and commit resources to it accordingly (co-financing, charging for products or services at cost, or committing in-kind hours).

Moreover, all partners must have clear incentives to participate, especially the citizens or end users who are expected to be part of a partnership. In the Climate Street project for example, the entrepreneurs, predominantly retailers that were the prospective end users, were not really committed to the project. They did not have to invest in the project, but they did not have much to gain from it. The benefits of installing smart plugs, meters and displays in terms of energy savings (on which the project critically depended) were very marginal, and thus many of the entrepreneurs lost connection to the project. In this project the entrepreneurs felt no sense of ownership. When the subsidy ended, so did the project, because there was no one with an interest in continuing it.

Most projects thrive by having one partner that can clearly benefit from the project: as owner of the project, he or she feels responsible for the process and its outcomes, takes initiative when the project struggles and is often also the project leader.

Sustainable Neighbourhood, Fair Meter, WASTED, Locally Grown Paint, Cargohopper and Mokum Mariteam all had a private partner in the lead that invested in the project and felt responsible to make it a success. Energy Atlas is a good example of joint ownership by an entire partnership: every partner had something to gain by the project and the participants enjoyed the commitment of their managers. Even after the subsidy had ended, the project continued.

While seemingly fairly obvious, the need for a highly committed project leader that connects all partners continuously throughout the process and drives the project forward proved is crucial in all projects.

Projects clearly benefit from having a distinct leader, which can be a private partner, utility partner or NGO. Leadership was strong in most Circular Economy and Mobility projects, where the initiator was also the driving force throughout the whole project. With some of the Energy projects, the ownership of the project was shared, making them harder to manage. A precondition to success is to have a project leader, ideally from one of the partners involved in the project, that has the power, interest and incentives to overcome difficulties and keep things going, and that has the capacity to manage a multi-stakeholder team.

Good stewardship can be an important reason to start a project, but is not necessarily felt throughout the whole organisation.

Especially the projects working towards a circular city, showed that stewardship was an important reason to start the project. A sense of stewardship on the part of at least one of the partners was very important to initiate Fair Meter, Locally Grown Paint and De Ceuvel, where social responsibility was an overarching goal. It does become a challenge when the project needs to be scaled up by other people in the organisation, something that arose at, for example, the Fair Meter project.

User involvement is a multi-layered and ongoing process

In most smart city definitions, citizens are considered to be the key users and should be the main focal point for the smart city technologies that are being developed. In the projects we evaluated, we rarely found evidence of this. Citizens were never really central and seldom an official part of the project partnership. The evaluation of Amsterdam smart city projects shows there are more (end) users to a smart city project than just citizens and there are several dimensions key to successful user involvement.

There are many different use types in smart city projects, in addition to active and passive users.

The projects evaluated show a large variation in use types: users as clients (as in the commercially driven Mobility projects), users as citizens (who do not have to buy the product but who are confronted with and influenced by it as in Smart Light) and users as employees (as in REloadIT and WeGo). Users can be active users (as in most Mobility projects) and can be passive users (as in the Smart Light project). Project

partners can also be users, as was the case with the Energy Atlas project, making it easier to involve the users throughout the course of the project.

The degree to which user involvement is necessary depends on the type and goal of the project.

It is important to clearly define the degree of user involvement that is necessary. A well-defined approach to user involvement is crucial for projects that directly affect the personal lives of citizens. In B2B projects, involving users is equally important, as we saw in WeGo, but is less complex, especially when a launching customer is part of the partnership. In such cases, a distinction should be made between the city administration as launching customer and the users: the civil servants actually using the new smart city. In other cases user involvement may be of less importance because the project focusses on, for example, technological feasibility.

Different user types have to be approached in different ways.

The approach to user involvement also depends on the goal of the project. Creating awareness requires a different approach from changing behavior or testing user acceptance for a new solution prior to upscaling. For projects that focus on creating awareness it is important to connect with a partner that can reach or build communities. In the Sustainable Neighbourhood project this was considered a crucial partner, for without its skills the project would have failed.

When and how to involve users requires careful consideration before starting the project.

Innovation studies suggest that users must be involved from the beginning of the project. However, in most of the projects we analysed, users were not involved until much later in the process, if at all. Often assumptions were made about what citizens wanted or needed, without being thoroughly verified by consultation with those citizens. Moreover, many mistakes were made in determining the way of involving users in the project. Direct mail and phone calls did not have the desired effect in the Sustainable Neighbourhood project. The awareness campaigns at schools turned out to be far more effective to increase awareness among households. The same approach worked well for the WASTED project; through educational programs the families of the young school children were reached and became WASTED Neighbours.

Engagement of (prospective) users and community building is a complex process requiring more time and effort than was usually envisioned at the start of the project.

After an experimental phase a new phase starts requiring thorough preparation of the communication with new members of the growing community. Hiring external expertise to guide this process can be a major success factor, especially for projects with technology-driven solutions. Telling the story of the project and communicating with end users is equally important: in any project, there must be clear rules and delegation of tasks among partners concerning external communication (with citizens and other stakeholders).

Value of the project needs careful consideration and evaluation

What value do projects generate? How can this value be assessed and measured? From the analysis of the Amsterdam smart city projects, several aspects appear to be relevant for smart city projects.

Value creation can be defined at both the project- and the partner-level. In other words: for whom is value created, and to what degree is this mutually beneficial for the partners involved?

Determining what value is created at the level of the project as a whole, as well as at the level of each individual partner, can help build commitment amongst partners in working towards a common goal. This is essential at the start of the project, but can also benefit from re-evaluation at pivot points throughout the life cycle of the project.

The added value of the project can be assessed in economic, social and environmental terms. All projects evaluated show value in all three aspects, although the distribution varies considerably per theme.

Balancing commercial benefits against societal benefits is key for any energy-related project developed as part of a smart city program or network, and adds legitimacy to the project. The Mobility projects, often initiated by a private partner, are generally commercially driven, with environmental value as a fundamental that is to be demonstrated. The Circular Economy projects are socially and environmentally driven with the aim to innovate, demonstrate and inspire. Economic value is discernible, but has not yet resulted in a clear viable business case.

Impact measurement is underexposed in smart city projects.

In our evaluation, we found that value is hardly ever measured in the projects, neither at the beginning of the project as a baseline nor at the end of the project when there should be an attempt to quantify the yield of the project. Impact measurement starts at the beginning of the project with defining what kind of value the partnership envisions to develop and for whom. During and at the end of the project, monitoring and evaluation is necessary to determine whether the project is indeed creating this value. Measuring and quantifying value is extremely difficult though, and smart city projects could benefit from a more qualitative approach when quantification is not possible.

Also unexpected value can be a valuable outcome of smart city projects, even from projects that are considered to have failed.

An example of unexpected value that can strengthen the project is the synergetic effect created through a new partnership. Sometimes a project can create new knowledge or insights that, after the project has ended, appears to be very valuable. The idea of the REloadIT project was to connect local energy supply and demand. The project failed, but the idea is currently being elaborated on a much larger scale. So even a project that at first sight seems to have failed, can prove to be very valuable because of unexpected side effects or because the project showed that, for example, a smart city technology is not feasible in a particular context.

Creating a viable business model is key to continuation and upscaling of the project

The evaluation of the Amsterdam smart city projects makes clear that timely attention to the development of a viable business model is key for continuation of the project and implementation of the results.

Especially projects that depend on external funding or subsidy need to determine from the outset how they will generate sufficient value and revenue streams to be able to continue the project after the subsidy is ended.

The evaluation of the projects does not give a clear-cut view on how to finance smart city projects.

Some of the projects would not have been able to start or evolve without funding from the city administration or a subsidy. Examples are WASTED, and De Ceuvel. A subsidy can also help to build new partnerships, as was the case in REloadIT where the new partnership was the basis for a large knowledge base that is still considered very worthwhile. Nevertheless, many of the projects evaluated are executed without any funding or financial investments, other than the in-kind contribution (mainly man-hours) by the project partners. Climate Street is such a project that did not require investments but made use of an in-kind contribution of the project partners. In the case of in-kind contribution, transparency can be an important precondition, for example by open book keeping and squaring expenses afterwards, as was done in Locally Grown Paint. Large financial investments have been made only in the Mobility projects. The project partners invested extensively, but were also the ones that stood to benefit directly from the project results.

The clearer the business case and business model, the easier it is to find follow-up financing possibilities.

The Energy and Mobility projects developed business models and business cases that are quite clear and viable, possibly because of the maturity of the technologies in these themes. The partners started the projects with a business model in mind, including how they will create a continuous revenue stream from the project once implemented and scaled up. The business model and especially the revenue model for the Circular Economy projects need further development, though. Often these projects struggle to come up with a viable business model that can create a pivot point for an autonomous continuation of the project, as is the case in WASTED. When testing technological feasibility in a pilot project, as was the case in Smart Light, creating a viable business model is less relevant while each partner has its own knowledge development goals in the project. Although here also, the clearer the business case and business model, the easier it is to find follow-up financing possibilities.

Translating sustainable and social value into continuous revenue streams is difficult, but important to increase the possibility of successful upscaling.

Some projects create sustainable or social value that is very worthwhile for the city or the neighbourhood, but is difficult to translate this value into financial gains for the project partners. Examples are the purified soil of the former wharf that De Ceuvel will deliver and the Smart Light project that makes the area where the lights are implemented safer and more enjoyable for visitors who want to linger. It could be interesting to explore how these kind of values can be translated into actual revenue streams to increase the possibility for successful upscaling.

Technology itself is not the problem; it is the way technology is used and integrated

Technology plays a role in almost all smart city projects, although our evaluation shows that it is not always innovative high-tech knowhow that is involved. It can also concern knowhow on more traditional techniques that is implemented in a new way to create economic, environmental and social value.

The projects we evaluated show that combining existing technologies through new partnerships is what is truly innovative.

Availability of technological solutions is not a hindrance.

A shared opinion amongst interviewees has consistently been that availability of technological solutions is never an impediment in smart city projects: there is always a start-up or multinational that can develop and deliver the technological capabilities needed. When starting a smart city project it is important though, to have access to new technological knowhow, for example of internet of things, and the capabilities to integrate these within the project.

Many smart city solutions fail because they overlook (or underestimate) the reluctance of people and organisations to change their behaviour and routines: the human-technology interaction.

The technology solution may be brilliant but if people don't see the value, it won't be implemented. Human-technology interaction is therefore a subject that needs more attention when setting up smart city projects. Depending on the goal of the project, this can concern creating awareness, changing behaviour or enlarging acceptance of new solutions with the user groups.

Using, analysing and sharing data can play an important role in smart city projects and requires careful preparation.

This was especially true for Energy Atlas, where sharing and visualising data was the main objective of the project. In this particular project the partners were willing to provide the data free of charge. Privacy is a big issue in smart city projects that depend on data and especially where it concerns personal data of citizens or other users. It was a key challenge for the partners of Energy Atlas to make sure it was impossible to trace back data to individual clients.

Upscaling is a multi-layered process and cannot prosper without sharing knowledge

For upscaling we make a distinction among three types: rollout, expansion and replication (see chapter 2). Overall, it is very hard to have clear-cut or readily available answers about upscaling, given the unique contextual factors in which each project is developed. As noted earlier, upscaling is a multi-layered process. From the analysis of the Amsterdam smart city projects, several dimensions appear to be key in upscaling smart city projects.

Each project shows its own upscaling potential depending on the type and goal of the project; distinguishing roll-out from expansion from replication is very helpful.

Possibilities for rollout largely emerge from living-lab projects (such as Climate Street and WeGo), where companies can test beta versions of new products/solutions. Other projects, such as Energy Atlas, can grow by adding new partners, or by enlarging the geographical area where they are applied (expansion). The replication potential of projects is often limited because the project's success is highly context-sensitive. Replication can also be complex because new contexts might often require the establishment of new partnerships. Possibilities for replication exist, though, at the level of working methods, specific technologies or tools, but variations among contexts should be taken into consideration.

Upscaling should be considered from the start of the project and not solely at the end.

A lesson from our analysis is that upscaling should be considered and discussed at the start of the project. What kind of upscaling is envisioned? What parts of the project will have potential for upscaling, and what partners do we need to scale up the project as desired? Scaling up requires competencies aside from developing and testing new technologies and concepts.

With respect to upscaling, attention is also needed for sharing knowledge and experiences between projects and with cities and organisations that are also initiating smart city projects.

The outcome of a successful project might inspire others to start their own project, but it is the lessons on how the partnership was built, the project was organised and business models were created that will increase the success rate of smart city initiatives.

CONCLUDING REMARKS

Willem van Winden and Inge Oskam

On the level of the ecosystem we have some key insights from our evaluation of Amsterdam smart city projects: on the context that Amsterdam provides, the role of the Amsterdam Smart City platform and on sharing knowledge and experiences among projects.

Amsterdam's size and culture favour smart city collaborations

Amsterdam's scale and culture is such that it is easy for potential project partners to find each other. The bigger players in the city know each other, often personally. Moreover, there is a high density of meeting places and occasions (conferences, meetups, seminars etc.) where new projects ideas are born, and where people from various backgrounds meet.

Amsterdam Smart City: From project leader to community manager

The Amsterdam Smart City (ASC) platform is an important connector in this respect. Since 2008, it has evolved from a prominent player to a facilitator of the smart city community in the Amsterdam region. In its early days, the organisation took a strong leading role in projects. In one of its first high-profile projects which received international attention, Climate Street (about making a street more climate-proof), it took the initiative, it organised the process, and it assumed the project leadership. This "heavy touch" was gradually abandoned. It was expensive, claiming much of the budget and manpower of the ASC organisation. Moreover, in some projects there was a problem of ownership, with project partners counting too much on ASC to solve problems and get things going. Since its inception, the number of smart city projects has grown dramatically. Currently, in many of them, ASC does not play an active role, and if so, only in a project's start-up stage and then leaves it to the partnership to run it.

Also, compared to the past, more focus is put on the economic viability and sustainability of projects: pilot projects are supported only when there is a business case and/or when there is sufficient scope for upscaling. In addition to value creation for partners, ASC puts more emphasis on the involvement of citizens, communities, or end users: a key success factor for most projects. The evolution of ASC towards a community organiser is reflected in its new website⁴⁵: ASC no longer edits and controls all its content, but rather acts as community manager, allowing community members to post new smart city projects, feedback, project ideas, news, calls etc.

Dealing with interest from other cities

Given Amsterdam's consistently high rankings amongst several smart city rankings, international interest in the solutions tested and implanted in smart city projects in Amsterdam is overwhelming: each year, over 100 delegations are welcomed. Sharing knowledge and experience with other cities is important, according to the ASC staff. As Maaike Osieck, ASC communication manager comments: "We particularly get a lot of questions regarding building a partner ecosystem: connecting multinational firms with smaller innovative, entrepreneurial firms, how to engage with knowledge institutions and public partners, and how to make sure citizen demands are really taken seriously... we are doing this well in Amsterdam". An often-heard comment is that in comparison to other cities, Amsterdam stands out as a city where initiatives are not only driven by the public sector but also are developed from bottom up or in substantial public-private collaboration. To better service incoming visitors, the city opened a Smart City Experience Lab⁴⁶, where several smart city projects are displayed and explained in one room.

Finding alternatives to the term "smart city" projects

Typical of the Amsterdam approach to the smart city is a broad perspective. Urban problems and challenges in all sorts of domains are central, and technology is instrumental. But this evokes the problem of having a "smart city" mean almost anything. How much sense does it make to qualify any project that addresses an urban challenge as a "smart city" project? A more precise terminology would be needed to distinguish among types of projects. Here is a tentative list of options:

- Research and development projects: Here, the aim is to co-develop completely new solutions or technologies. In such R&D oriented projects, the learning process is central, the outcome is less predictable, typically no direct monetary returns are expected, and often knowledge institutes are involved.
- Demonstration projects: Pilot projects might help to demonstrate the technical feasibility of a smart city solution, on a small scale. Demonstration projects help to convince prospective clients or the general public, and generate positive publicity.
- Real-life testing projects: to test a newly developed technology, product or service in a real urban context. These tests give the developer insights about how users interact with the new product, and might provide valuable feedback for further improvement and scaling.

45 <https://amsterdamsmartcity.com>

46 <https://amsterdamsmartcity.com/visit/visit-the-smart-city-experience-lab>

- Local solutions: Projects that offer an innovative solution for a typical local problem or challenge: for example, an unsafe square (as was the case in Smart Light), a polluted site (see case De Ceuvel).
- Scale-up projects: Here, the aim is to scale up a proven solution to a larger part of the city. An example is a current project (not evaluated in our study) to place solar panels on rooftops in the entire city.

Each project type has different success indicators, needs different types of partners, carries a different risk profile and thus deserves its own type of management and support.

Learning from mistakes and learning faster

Our study shows that the availability of technological solutions was not the hindering factor in smart city projects. But there is still a long way to go from a technology/solutions push towards a citizen and end-user centred approach that takes full account of human needs and behaviour. Many projects are struggling with similar questions (we have discussed many of them in this report). Our evaluation confirms that much can be learned from mistakes. Less successful projects often generate a valuable knowledge base for further stakeholder collaboration and new projects. The people who participated in the project take along the knowledge and experience gained to their next project or collaboration, making that project more likely to succeed. Unfortunately, across projects, the useful lessons and experiences that people learn (sometimes the hard way) are shared only in informal and haphazard ways; there seems to be a lack of systematic and deep learning from each other, and from projects elsewhere. Thus, the same mistakes may be made over and over again, and this slows the innovation process.

It may be helpful to set up a more systematic and structured knowledge-sharing platform, where people not just briefly exchange success stories (as happens in many conferences), but rather take a step back, for example in thematic masterclasses and peer review sessions, using comparative analysis. To become smart, cities and their stakeholders need to instil a culture of collaborative learning and experimentation so that they learn faster. Some sort of Smart City Academy would make this possible. We believe that the following four areas are particularly deserving of exploration and knowledge sharing:

- building the right ecosystem of partners, organising the process, and creating commitment and shared value amongst partners with varying interests;
- developing effective approaches to user involvement and community building, taking into account the large variety of user types and the goal of the project;
- acquiring, sharing, analysing and visualising data that is provided and generated by the different partners;
- determining upscaling goals at the start of the project and seizing the upscaling potential at the end, addressing both expected and unexpected project results.

When starting a Smart City project ...

Based on the key insights on the project level, we created a checklist for anyone who considers to initiate or join a smart city project. This checklist contains some questions that we think are relevant to answer before starting a project:

1. **Partnership:** What type of partners do we need from the start? What is the role of the city administration? How can the partnership stay open to new input?
2. **Ownership and project leadership:** What is the commitment of each partner to the project? Who consider themselves the owners of the project? Who will be the project leader?
3. **Goal and prospective value:** What is the goal of the project? What kind of value (economic, social, ecological) will we create by the project? For whom? What will be the value for each partner involved?
4. **User involvement:** Who are the prospected users of the project? To what degree will they be part of the partnership? How will the users be involved? In what stages of the project?
5. **Data science:** What kind of data will we use or generate in the project? How will we analyse, share and visualise this data? And will we protect the privacy of users or clients?
6. **Knowledge:** What is the technology this project depends on? Who will bring in what knowledge? What new knowledge do we expect to create? What is the strategy towards intellectual property?
7. **Financing:** What kind of financing does the project need? What can partners bring into the project? How will we share costs, benefits and risks?
8. **Business model:** How is the project financed? How can the value be translated into value streams? What might be a viable business model for the project?
9. **Impact analysis:** When is the project considered successful? How can we measure the impact of the project? What is the project's baseline?
10. **Upscaling:** Is upscaling relevant for this project? What type of upscaling is applicable? What is necessary for successful upscaling after the project ends?

APPENDIX

INTERVIEW PARTNERS

General focus area for the interviews: project characteristics; partners and collaboration; value proposition, business and financing model; scalability and replicability; tipping points and lessons learned.

PARTICIPANTS' CITY LEVEL

The interviews took place from November 2014 to January 2015.

AMSTERDAM SMART CITY

- Joost Brinkman
- Bob Mantel
- Angelique Meyer
- Maaike Osieck
- Bram Sieben
- Annelies van der Stoep

PARTICIPANTS' ENERGY PROJECTS

The interviews took place from April 2015 to July 2015.

PROJECT ENERGY ATLAS

- Christian Klep, Alliander
- Bob Mantel, Municipality of Amsterdam
- Stefan Mol, Waternet

PROJECT SMART LIGHT

- Bas Boorsma, Cisco
- Pim Stevens, KPN

PROJECT CLIMATE STREET

- Vivienne Bolsius, Amsterdam Economic Board

SUSTAINABLE NEIGHBOURHOOD GEUZENVELD

- Charlotte Meuwissen, Accenture

PARTICIPANTS' MOBILITY PROJECTS

The interviews took place from November 2015 to April 2016.

CARGOHOPPER

- Ron Klein Tiessink, TransMission Almere B.V.
- Walther Ploos van Amstel, Amsterdam University of Applied Sciences
- Bert Rozendaal, RozWorks

MOKUM MARITEAM

- Cor Gerritsen, Icova
- Jan Morren, Rederij Kees

RELOADIT

- Gerrit Buist, University of Amsterdam
- Marcel Elswijk, EnergyGO
- Hugo Niesing, Resourcefully
- Jan Schreuder, Municipality of Zaanstad

WEGO FLEET MOBILITY

- Hans Booij, Municipality of Amsterdam
- Erik Homminga, Louwman Group
- Toy Hertogh, WeGo
- Theo Wassenaar, Municipality of Amsterdam

PARTICIPANTS' CIRCULAR ECONOMY PROJECTS

The interviews took place from December 2015 to March 2016.

DE CEUVEL

- Jeroen Apers, Jeroen Apers architect
- Cynthia Mooij, Metabolic

WASTED LAB

- Marije Ebbers, FRED Foundation
- Barbara Koole, CITIES Foundation
- Eric van den Beuken, City of Amsterdam

FAIR METER

- Hans Nooter, Alliander
- Marleen Stikker, Waag Society
- Reinout Wissenberg, Stedin

LOCALLY GROWN PAINT

- Mark Bokeloh, Bambooder
- Mark Nijman, WaterNet
- Machiel van Westerhoven, Rigo

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Willem van Winden is an urban economist specialised in urban innovation and policy. Since 2008 he works as professor of Urban Economic Innovation at Amsterdam University of Applied Sciences. He has published widely on urban knowledge based development and related topics, in books and international peer-reviewed scientific journals. He is strategic advisor to Urbact, Europe's largest exchange and learning programme promoting sustainable urban development, and Lead Expert of EUnerCities, a network of European cities and universities. He leads a research team that works on collaborative entrepreneurship, inter-organisational business models, campus development, synergy management in clusters, and triple helix collaboration.

Inge Oskam



Inge Oskam works as a professor at the faculty of Technology of the Amsterdam University of Applied Sciences and is co-responsible for the Urban Technology research program. Her area of research is 'circular design & business' focusing on concrete solutions for a circular city. She leads a research team (PhD students and researchers) working on projects concerning for example designing with bio-based plastics, reuse of urban textile and plastics waste in circular products and closing urban organic waste cycles around urban farming initiatives. Important research topics are collaboration in cross-sectoral networks and circular business models to realise these sustainable innovations.

Daniel van den Buuse



Daniel van den Buuse works as a lecturer-researcher at the Business & Economics faculty and Centre for Applied Research on Economics & Management at the Amsterdam University of Applied Sciences, and is an external PhD Candidate at the University of Amsterdam Business School. His research focus is on business strategies in sustainable energy across various contexts, including renewable energy technologies for power generation and smart city technologies for urban energy efficiency. In relation to smart cities, he is particularly interested in public-private partnerships and collaborative business models enabling the implementation of innovative technologies to address urban sustainability issues. His teaching includes courses on business economics, strategic management, and marketing.

Wieke Schrama



Wieke Schrama works as lecturer-researcher at the Business & Economics faculty and Centre for Applied Research on Economics & Management at the Amsterdam University of Applied Sciences (AUAS). Her research focus is on alliances spanning the boundaries between non-profit organisations and businesses and on collaborative entrepreneurship in smart city projects. Next to her work as a lecturer-researcher, Wieke Schrama has performed several interim project leader jobs evaluating the AUAS institute. Her interest in the mobility sector stems from working as a strategy consultant executing research projects in (road) transport, public works and maritime affairs.

Egbert-Jan van Dijck



Egbert-Jan van Dijck is lecturer and researcher Engineering at the Faculty of Technology of the Amsterdam University of Applied Sciences. Previously he has held various management positions within the banking, finance and health care sector. He recently served as a member of the executive board and acting chairman of the Product Development and Management Association Netherlands. He is specialised in leading innovation and change, and business development.

Egbert-Jan is responsible for the graduate program Innovation Management.

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In many cities “smart city” projects are set up, with the aim to use new technologies for improving urban sustainability, quality of life or services. Typically, they are supported by the municipality, and run in partnerships. How to organise such projects successfully? In this study, we analyse a number of smart city projects in Amsterdam, in their wider context, from a managerial angle. We focus on the following questions: How do organisations with different agendas, collaborate on smart city projects? What challenges do they face? What kind of value is created? How are risks and returns shared, and how are users involved? What is the upscaling dynamic of smart city solutions, if any? How can smart city projects be managed professionally? And what is the role of the Amsterdam Smart City platform? Our study provides fresh insights in current practices and lessons learned across a broad range of smart city projects in Amsterdam.

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