

January 2020

Author:
Leon Kapetas
UIA Expert



The Urban Lab of Europe !

The RESILIO project: Journal N° 1

Project led by the City of Amsterdam



Image © Metropolder.company



**CLIMATE
ADAPTATION**



The RESILIO project

RESILIO is Amsterdam's new project aiming to develop a network of innovative and smart rooftops. The aim is to develop blue-green roofs that store water to reduce flooding and maintain a healthy soil water content, improve building insulation and regulate local micro-climate. This is all done while the roofs provide opportunities for urban biodiversity, amenity and recreational space. What makes water management smart is the water storage layer that is underneath the soil and paved areas of the roof. This layer is slim enough to avoid structural problems to the roof but is thick enough to accommodate enough water to reduce flood risk locally from regular and extreme flood events (up to 60 mm/h). The layer typically stores 60 mm (with provision to 100 mm if needed). A full layer of water is beneficial for the vegetation that can cope with longer periods of droughts and heat. It reduces heat stress through evapotranspiration. If a substantial of extreme rainfall is predicted, the layer can be discharged through the smart valves connected to the DSS. Thereby enough volume can be created to store the forecasted rainfall event and no (extreme) discharge to the public sewerage system is necessary. What makes the system even smarter is it can anticipate rainfall events through forecasting (this is done remotely) and empty the roofs pro-actively to a certain level (using operating rules) to be able to store more rainwater from the coming storm. The ICT system optimises operation through the collective knowledge of water storage across the system.

Four building roofs with a total area of 8,000 sqm are being converted (retrofitted as seen in Figure 1) as part of the scheme. These are social housing corporations building blocks located in areas prone to flooding. Amsterdam has opted to work with the social housing corporations as they own a significant percentage of the existing building stock. Additionally, 2,000 sqm of roofs on private ownership buildings will be retrofitted as part of a grant scheme. A successful implementation combined with a good business case for upscaling (see section 3.7) will mean a significant opportunity for impact.

RESILIO was born as an evolution and a scaled-up version of the first blue-green roof (Polderdak) which was installed in the summer of 2013 as an alternative way to store water on the Oldschool Zuidas (coop od De Dakdokers, Green Business Club

Zuidas, Municipality of Amsterdam and Waternet). Another example expanding knowledge was SmartRoof at Marineterrein, a scientific experiment that showed the cooling power of water retaining green roofs as well the enhanced biodiversity. An exciting time-lapse video showing the exciting construction process, as well as the technical characteristics of the project can be found [here](#).

Most importantly, RESILIO is a perfect example of a multidimensional solution that contributes to city, regional and national policy support. To name a few, RESILIO contributes to the [Climate Adaptation City Deal](#), the [National Climate Adaptation Strategy](#) (NAS, 2016), the [Delta Plan for Spatial Adaptation](#) which is the policy agreement of all government levels to enhance local adaptation plans and the [Environment & Planning Act](#). It also contributes to policies with specific objectives, such as the “Municipal Sewerage Plan 2016-2021”, the “Vision for Public Space” and the cities “Green Agenda” that sets a specific target of adding 50,000 m² of rooftop green space via subsidy schemes.

Roof system

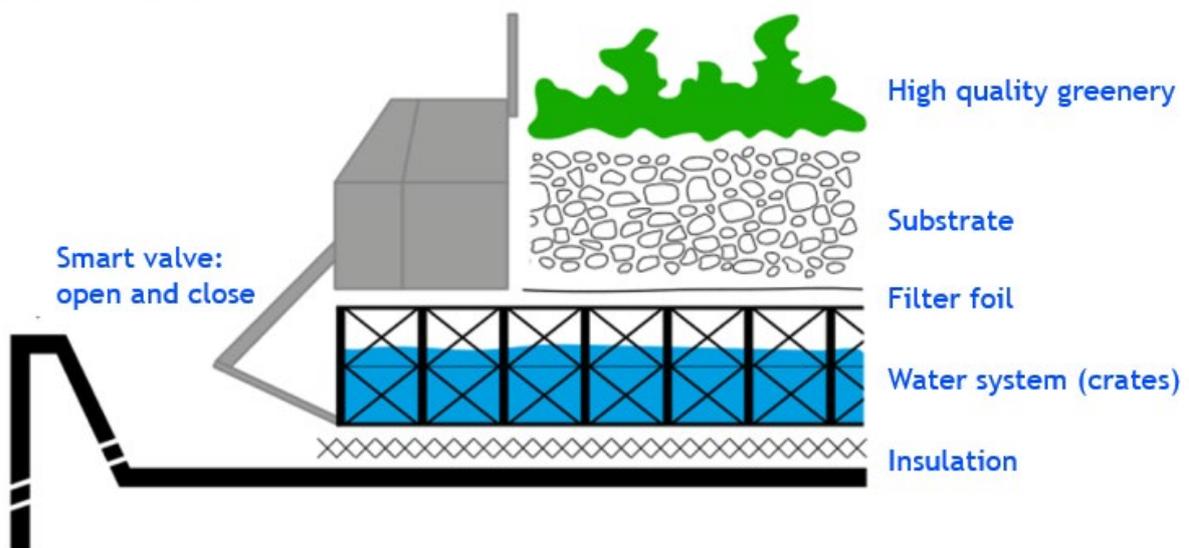


Figure 1 Schematic representation of a blue-green roof (Resilio, 2019).

The Implementation Partners

From its inception at a pre-UIA-application stage, RESILIO aimed to design a project that involves all relevant partners that are needed to deliver the multi-benefit infrastructure of BG roofs. The project therefore involves the local government authority (Municipality of Amsterdam), Waternet - the watercycle company of Amsterdam, technology experts, building owners (the housing associations), scientific partners and social engagement experts. Table 1 provides basic information on the partnership. In addition, the project engages with a wider network of stakeholders that can benefit from the project or the project can benefit from them.

Table 1. Partners of RESILIO and key activities (list is not exhaustive).

PARTNER	ROLE
Amsterdam Municipality	Lead Urban Authority and Project Coordinator
Waternet	Amsterdam's water-cycle company, closely linked to the Municipality
Rooftop Revolution	Community engagement and promotion of RESILIO
MetroPolder	Company developing the technical solution and smart flow control system
Amsterdam University of Applied Sciences (AUAS)	Business case development
Institute for Environmental Studies, Vrij Universiteit	Hydro-meteorology, ecosystem services analysis
Consolidated	Management, maintenance and renovation of flat and pitched roofs.
Stadgenoot	Social Housing Corporation – building owner of roof intervention
De Alliantie	Social Housing Corporation – building owner of roof intervention
De Key	Social Housing Corporation – building owner of roof intervention

Table of Contents

1. EXECUTIVE SUMMARY	6
2. INTRODUCTION	8
3. PROJECT STATUS	10
4. CHALLENGES	11
4.1. Leadership for implementation	11
4.2. Public Procurement	11
4.3. Organizational arrangements within the urban authority	12
4.4. Participative approach for co-implementation	13
4.5. Monitoring and evaluation	14
4.6. Communication with target beneficiaries	14
4.7. Upscaling	14
5. CONCLUDING REMARKS	16

1. EXECUTIVE SUMMARY

Addressing implementation challenges in Amsterdam's interventions of innovative smart blue-green roof systems

Like any innovative infrastructural project, RESILIO's approach to multifunctional roofs does not come without challenges in its implementation. The aim of the present journal is to describe the main implementation challenges to stakeholders, target groups, other city practitioners and authorities, policy- and decision- makers as well as the wider audience. These are summarised in Table 2. Some of these challenges have not yet been fully experienced, as the project has just entered its second year after a period of contractual and cross-organisational partnership agreements. However, these challenges are anticipated for the near future.

For this reason, they are also reported in order to explore their timeline:

- When are they manifested?
- How severe is their impact on the project's development?
- Why did they occur?
- What does the city do to deal with them?

The project has a large number of partners which brings the necessary multi-discipline expertise. However, it can be challenging to integrate their work. The work packages are designed to enhance this integration. The risk that arises as a result is that delays experienced in the work of one partner can have knock-on effects on other partner's work progress. Procurement is a good example: a small delay in the cost estimation has resulted in a construction delay and, by

extension, implementation and testing of the technology in the field.

The Municipality has been proactive in addressing the cross-departmental collaboration challenge. The deputy mayor has created a horizontal policy instrument for projects in the area of Climate Adaptation. All departments whose contribution is required on such projects meet under this umbrella.

The City will develop an upscaling plan in the forthcoming period as, at the moment, there are no specific upscaling targets. To support the upscaling process, Amsterdam is looking to build a robust financial business case. This is closely linked to the cost and benefits analysis (CBA) that examines the beneficiaries across the range of multiple socio-environmental benefits. For instance, the water company, Waternet, is a major beneficiary as RESILIO infrastructure will reduce flooding and flood damage costs. By extension, a business case for smart blue green roof can include Waternet along with the housing associations. The current challenge is to link the CBA to the upscaling scheme. The project will soon open the grant scheme for RESILIO roofs at buildings of private ownership. This will provide new insights on the challenges and opportunities of working with different target groups. Part of the expected challenge is engaging effectively with private owners.

The communication campaign has been working on engaging with specific target groups but also the wider audience. The Innovation lab to

be inaugurated in spring, as well as the mobile (on a bike) model of RESILIO moving in the city and the social media campaigns are active in this front.

The following sections describe in more detail the broader context of urban innovation (see Introduction), the project status and present the analysis of the key challenges.

Table 2. Characterising RESILIO’s implementation challenges

Challenges	Current Relevance	Challenge Level	Key Observations
Leadership for implementation	High	Low	<ul style="list-style-type: none"> • Large number of partners • Change of personnel • Signed agreement on collaboration and communication protocol
Public Procurement	High	Low	<ul style="list-style-type: none"> • Cost uncertainty • What procurement will look like past UIA (see upscaling)
Organizational arrangements within the urban authority	Medium	Low	<ul style="list-style-type: none"> • Policy instrument created on Climate Change Adaptation to bring together relevant department • Planning, Health, Open Space departments engaging under this umbrella
Participative approach for co-implementation	Medium	Medium	<ul style="list-style-type: none"> • Silo-type work structure avoided through intertwined WP structure • The CBA needs to support the upscaling • The CBA needs to connect to the procurement process • There is a need to bring the CBA at the forefront of the project to build the business case
Monitoring and evaluation	Low	High	<ul style="list-style-type: none"> • Minor delays in the project advancement • Uncertainty in cost affects the budgeting in procurement for the first roof at the De Key building
Communication with target beneficiaries	Medium	Low	<ul style="list-style-type: none"> • Multiple communication media exploited (moving model on bike, website, social media) • Innovation lab to be ready in spring to engage with the housing association building residents and wider public • Presentation of the project at the Amsterdam International Water Week
Upscaling	Low	High	<ul style="list-style-type: none"> • No clear targets yet • No business case built to support it • Grant scheme to go public to engage with private owners through the construction of 2,000 sqm of RESILIO roofs. • Aiming to identify 3 cities to transfer project and learn from their constraints/opportunities

2. INTRODUCTION

Urban authorities comprise **elaborate organisational schemes** that are designed to operate **efficiently, reliably and reproducibly** in order to meet **specific objectives** that are set in their **policy agendas**. This is particularly true for urban infrastructure (e.g. energy, transport, waste, water management): its systems must be robust, cost-effective and deliver the service they were planned for. As a result, when a good solution to a problem is found then Cities will stick to it for a while.

This is the case for hard-engineered drainage infrastructure (i.e. pipes) which has been the paradigm for the last 70 years for cities across the world, including Amsterdam. Piped systems have been quite successful in dealing with the specific policy objectives to protect people and businesses from flooding as well as safeguarding public

health from risks relating to wastewater (see “Drained City” in Figure 2).

However, hard infrastructure solutions can lead to technical lock-in and offer a single-only service compared to more scalable and softer greener solutions. As climate change brings new challenges (impacts of droughts and changing rainfall patterns) and people live in much denser urban environments than in the past (with less biodiversity and less quality public space), it is becoming apparent that Cities have different drivers and pressures than 70 years ago. These drivers are addressed by renewed policies that set out new objectives. As a result, urban infrastructure today requires serious rethinking. Brown et al.¹ beautifully describes the succession of service delivery functions and infrastructure that cities have developed to respond to different socio-political drivers (see Figure 2).

⁵⁵ Brown R.R., Keath, N. and Wong T.H.F (2009) Urban water management in cities: historical, current and future regimes. Water Science & Technology – WST. IWA Publishing. 59.5.

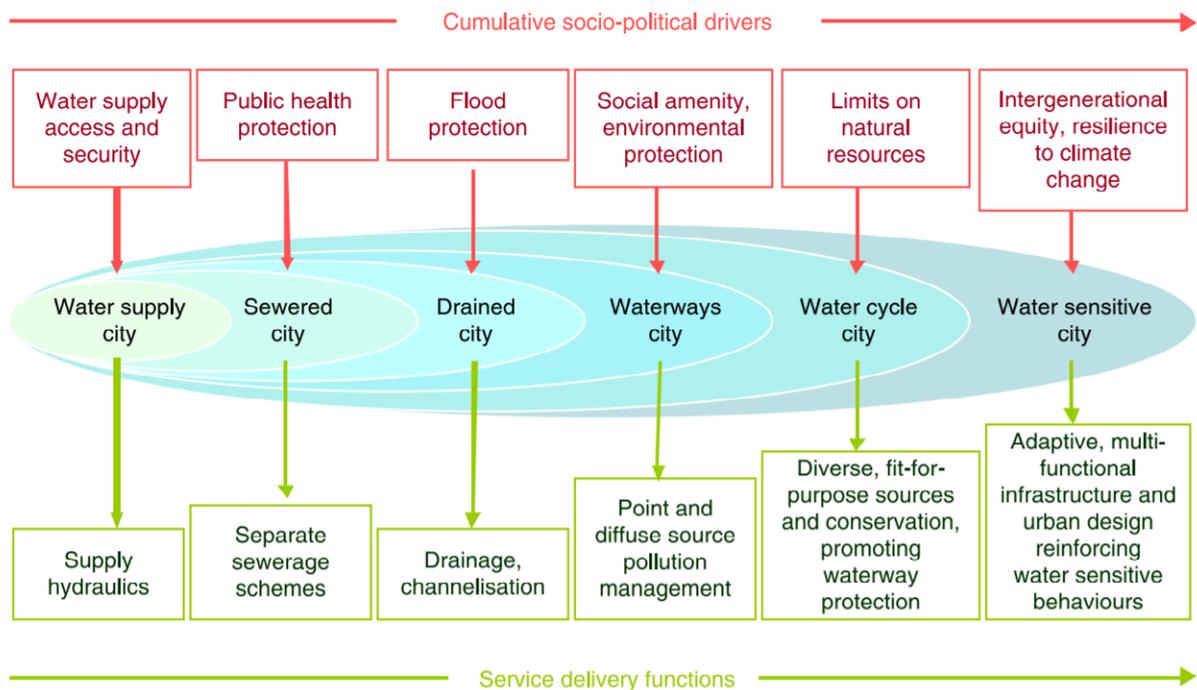


Figure 2. How changing socio-political drivers change the expected delivery functions of urban water infrastructure, giving rise to different city-types with respects to water resources management.

Most European cities today fall under the “Drained Cities”, or at best the “Waterways Cities”, classification. Through RESILIO Amsterdam takes a step forward towards becoming a Water Sensitive City. It recognises the need for climate change and urban densification adaptation as well as the multi-functional potential that Blue-Green infrastructure offers and plans interventions that address today’s challenges. A new challenge is arising: from a discharge oriented urban fabric (“Teflon city”) towards a “Sponge city” that can balance the extremes in rainfall and droughts locally.

While this is ambitious, it is challenging in that it requires a **change of paradigm from “hard grey” to “blue-green” engineering solutions**. These solutions have received limited testing and they have uncertain contribution towards meeting the

policy objectives that they are meant to address. One could say this is essentially what urban authorities detest as they are accountable to citizens.

UIA’s financial support is designed specifically to overcome this, inherent as described, resistance to innovation and move away from business-as-usual traditional water infrastructure. However, several other challenges are expected during the implementation of the project. Some challenges relate to organisational arrangements and leadership, others with technical challenges and integration of the solution, and others to communication with and participation of stakeholders. The following section describes these challenges in the context of RESILIO, some of which are already making their appearance in these early stages of the project.

3. PROJECT STATUS

The project has completed one year since its kick-off and had carried out an initial review of the contract between the UA and UIA. After a small initial delay, the project's partners met at their steering group to accelerate the work and the project is now firing all cylinders. MetroPolder is finalizing the construction and exhibition of the ICT system of smart Blue-Green roofs in the Innovation Lab, which will be delivered in spring 2020. The Innovation Lab will serve as the experimentation site for innovation around the blue green roof system upgrades (EPC and Customisation to existing roofs). The Lab will also serve as a demonstration centre of RESILIO where the communities can experience a physical model of the system and will be a space for interactive and informative events. Further the lab will be connected to the academic partners' (AUAS and VU) curricula so that tutors can design interactive coursework for students using the lab and its data for relevant studies. The Free University (situated at the Zuidas, native site of the

Amsterdam Blue-green roofs) also carries a new Blue-green roof on its Main Building, created to commit to its water obligations at the Zuidas development and as a research site for students and staff.

The UA has initiated the procurement process of the first roofs. The planning is showing a slower delivery of De Key roofs and the procurement of the roofs for De Alliantie and Stadgenoot are ahead. The housing association will communicate the works plan to the building residents and contractor companies will bid for the construction according to the procurement specifications (see section 3.2).

There have been a few changes in project personnel which has caused some delays. However, according to project management, the project aims to catch up within a year. The problem that arises according to the management is that a compressed procurement leaves less room for learning curves.

4. CHALLENGES

The following sections discuss in detail the main implementation challenges of RESILIO. In this context, the purpose of this reporting is:

- (i) to identify what types of problems can arise in such innovative projects,
- (ii) to reflect on them and ultimately

(iii) to develop a response to them.

It is also beneficial for the external readership, particularly policy- and decision-makers, so they know what to anticipate when engaging with similar infrastructural endeavours and plan accordingly.

4.1. Leadership for implementation

The Urban Authority is the project manager and needs to secure the commitment and conditions for a fruitful collaboration. This is not easy considering the large number of involved partners in RESILIO. To date, there has been effective cross-sectoral cooperation among partners (as stated through personal communications). This has been possible thanks to the pre-agreed project management structure which is supported by a “project manual and agreement” on the terms of cooperation and communication within

the project but also with external stakeholders/ interested parties.

Some disruption has been caused by changes in personnel in three cases (for the UA at the communications department, for Waternet at the project management level and for VU with regards to the research associate). All three partners are currently working to address this challenge either through new hires or internally through the allocation of human resources.

4.2. Public Procurement

When a municipality moves away from the traditional way of running any of its operations, immediately there is some uncertainty with regards to procedures. This applies also to technical works. RESILIO introduces a piece of infrastructure that addresses a new service with new specifications. This can be challenging even in cases where innovation is embraced at all management levels.

Effectively, contractors have little flexibility on the what they will deliver. Most flexibility is included in the “green” component of the roof rather than the “blue”. Yet, the bidding process allows them to include details on their technical approach and requested budget.

Luckily, in the context of UIA, the public procurement process was already tied to the detailed designs by Metropolder. The documents for the procurement are ready at the time of writing this Journal and they clearly describe the

While constructions in RESILIO are done through a tender process, this is not the case for standard roof works at the housing associations. These are covered by long-term maintenance contracts. There is therefore a very clear difference in the business model followed in the two cases. This issue will need to be addressed in the business case for upscaling.

A question that arises then is “how will a housing association procure roof works in 5 years from now, once the project has been completed?”. There is a misconception that Waternet is a beneficiary hence should pay for a large part of both the CAPEX and OPEX. Waternet’s project manager highlights that the company is publicly owned and the beneficiaries are citizens themselves. As Waternet is funded through bills and taxes, any change in its balances is likely to be reflected there.

In addition, the city wants to avoid a lock-in or monopoly solution with Metropolder as far as hardware is concerned. This is one of the upscaling objectives. However, any installation should be linked to the centralised decision support system (DSS) through the Application Programming Interface (API). This is because the smart roofs need to remain interconnected.

Another issue that requires special attention if Amsterdam wants to see the solution scaled up is extending the delivery of benefits of roofs beyond just providing protection from stormwater. This is particularly topical and a matter of discussion in the municipality. Competing uses should be valued and opportunities for multifunctionality too. For instance, the installation of solar panels

locks-in the use of the roof for many years to come.

In contrast to today’s maintenance models, future models (whether maintenance or construction based) will need to add value in the fields of climate change adaptation and mitigation, biodiversity and amenity. The CBA and business models designed by the academic project partners should shed light on how smart procurement and partnerships make room for such social return of investment.

Finally, the cost of an entirely new roof to be installed in the De Key building appears to exceed the budget provided by UIA (funds only the blue-green works). This slows down the installation process. Finally, the cost uncertainty of such innovative projects can become another factor limiting the demand for the solution. Large spread in cost estimates is a significant problem in procurement processes for the client. Over time, the market price spread will become smaller and more confidence will be provided with regards to the capital investment. Similarly, knowledge of maintenance costs will increase uptake. At the moment, uncertainty is treated with risk aversion, i.e. results in overestimating the cost of maintenance.

4.3. Organizational arrangements within the urban authority

The Municipality has cleverly created a cross-sectoral policy instrument on Climate Change Adaptation (CCA) where different departments are required to collaborate. This is a horizontal organisation structure that allows promoting the policy. RESILIO is embedded in this instrument. The project received strong support from the deputy mayor for CCA and in fact comprises the **flagship project** in this area.

The Planning department and Health Services department closely collaborate in the project under WP6 where heat reduction thanks to building insulation is studied for its positive impact on health. Moreover, the planning department and Waternet work closely with the Traffic and Open Space department to coordinate the works at the interface between the building and the street level as well as the sewer system. In addition, the Ecology Programme of the

municipality is active within this organisational structure.

Finally, RESILO promotes energy production at the roofs as part of the city’s commitment to become carbon neutral and engage with an energy transition.

4.4. Participative approach for co-implementation

RESILIO aims to integrate between activities through an intertwined Work Package structure (see Figure 3). This means that partners do not work in silos. For instance, as described above, the business case for investment and upscaling is closely linked to the cost-benefit analysis. In turn, the CBA is subject to the service the technical solution offers as well as the value added to residents. Different partners are involved in each and every process.

There is, however, a downside in such interconnected co-implementation projects: if there is a delay in one aspect of the project, then other activities of the project experience the same delay. In this case, for instance, promoting public participation has been delayed until the innovation lab and first roof procurement are ready.

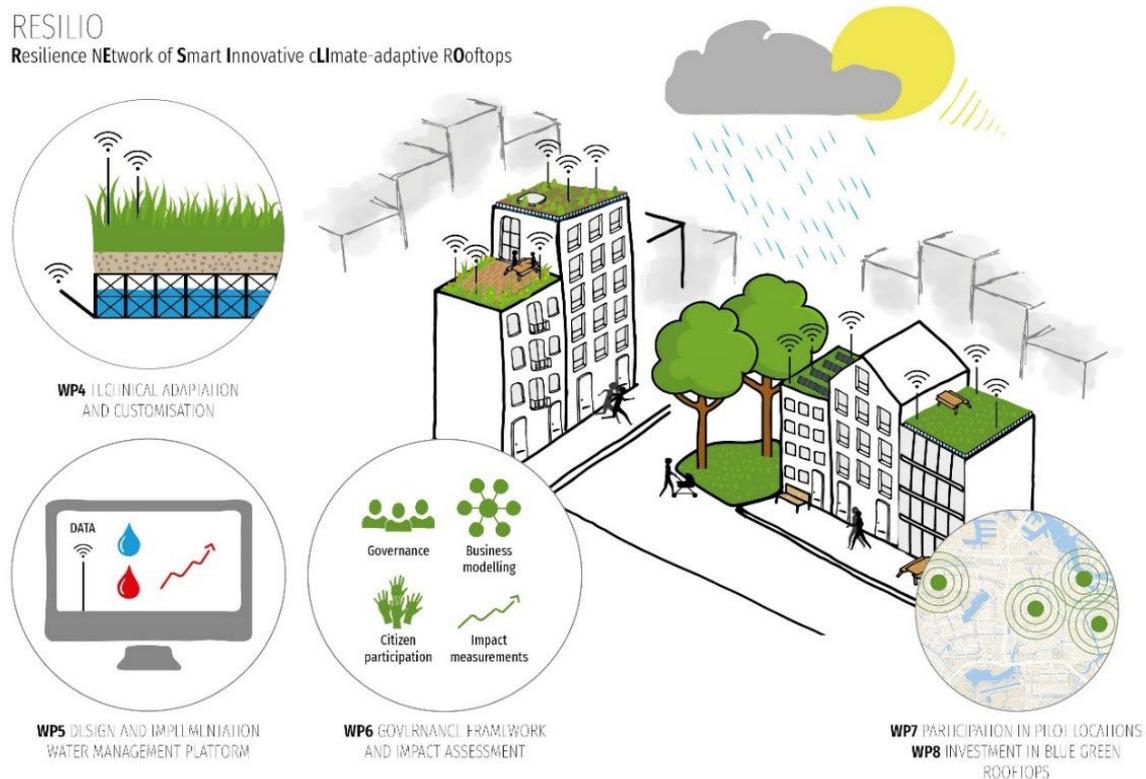


Figure 3. Schematic representation of the RESILIO project and its work package structure.

4.5. Monitoring and evaluation

While monitoring and evaluation are processes that find their application at later stages of the project when the construction will take place, some preliminary monitoring findings are available. As mentioned above, cost evaluation has turned out to be complicated. For this reason,

new cost estimates were requested from surveyors.

Additionally, and thanks to the initiative of the project's management, a working group was formed to establish a financial business case that monitors precisely the costs and benefits.

4.6. Communication with target beneficiaries

Despite the fact that the project is still in an early stage, extensive communication materials have been prepared. The project [website](#) is already up and running and visitors can explore the idea and the partnership. In particular, this is informative for the residents in the housing associations where the interventions will take place. In addition, an exciting activity that has given a lot of publicity to the project is the mobile miniature model of the smart blue-green roof that travels in the city sitting on a bike.

Most importantly, the innovation lab will be ready in spring. This is where residents and

students will be able to engage with the infrastructure.

In addition, RESILIO was presented to water and city practitioners at the Amsterdam International Water Week (AIWW) and received extensive coverage and interest. The relationship with AIWW will be maintained as it formed the opportunity to link to other cities.

Last but not least, the European Environmental Agency is composing a series of web articles with Best Practices in Nature-based Solutions and RESILIO has gained a position in it (expected publication, March 2020).

4.7. Upscaling

Although still in the early stages of the project, planning for upscaling means a convincing business case should be built. The project management has expressed its interest in creating a closer connection between the CBA and the Upscaling plan.

Despite the expressed objective of seeing this solution replicated, Amsterdam has not yet defined specific upscaling targets. The financial business case is seen as the major challenge and bottleneck in the attempt to see RESILIO actually scaling up.

In April the Municipality aims to publicize their grant scheme of financial incentive to private

owners (through UIA funding) to adopt the approach for a total of 2000 sqm. This will serve as an opportunity to identify the challenges at a smaller scale with a new stakeholder group.

One key upscaling challenge for the project is the breaking of traditional barriers in water governance. Traditionally the Dutch perspective was a public dominated water governance: the water authorities, municipalities and national government controlled all the infrastructure (canals, pumps, discharge), located in the public domain. For the private owned plots (especially in the urban area a large percentage > 50%) no further hard rules were set.

With the introduction of the private dynamic micro-water management infrastructure a large part of the urban catchment area can be influenced under the optimal retention conditions. This requires a new balance on the public-private water governance model. With a holistic perspective on urban drainage / retention / water management, the public water authority can “help” optimise the functionality of the many privately owned retention facilities (blue roofs, rain barrels, cisterns, etc). How this “help” will look like is the challenge: is it without optional, mandatory or enforced? The jurisdiction on this new governance domain is not yet defined.

When it comes to transferability (i.e. the RESILIO approach followed by other cities), there is an expressed ambition to see at least three cities expressing an active interest and seriously engaging with the idea of installing them. The project management is particularly proactive in approaching cities at this present stage so these

cities could provide input on their own constraints and opportunities, whether these arise from climatic, organisational, governance or socio-economic differences. To promote the project to other cities, the project is involved in at least one conference a year. As mentioned above, for 2019, this was the IAWW and it is likely this participation will be renewed for 2020. As part of the AIWW 2019, RESILIO presented the “RESILIO Amsterdam Agreement” (very similar to a Memorandum of Understanding) to express the interest of the Municipality in engaging with interested parties. A 2020 annual conference was scheduled in accordance with the Climate Adaptation Summit October 2020 in The Netherlands. Corona-driven rescheduling challenges the ambitions on the annual conference and the Amsterdam Agreements. In 2021 The AIWW will be adjoined with the RESILIO annual closing conference as a side event.

5. CONCLUDING REMARKS

The present journal article is the first of a series that will follow the journey of the RESILIO project for the next three years and will report the experiences in relation to the seven implementation challenges. The project just passed from the first phase of contractual arrangements between Amsterdam and UIA to the second phase of scientific solution finalisation, procurement preparation, preparation of the cost-benefits analysis and communication. During the first year, as shown in Table 2, the priority has been to agree the terms/protocols of partnership (challenge 1) and the budgeting of the first roof construction (challenge 2). As these challenges are addressed, new ones will become

priority. In particular, in the second year of the project which just started, the project is expected to focus on the “Medium” priority challenges (Table 2). Focus will therefore be given to the integrated approach with particular aim to build a financial business case. This will later support the (currently) low priority of Upscaling. Having said this,

Amsterdam is very well aware that the project needs to be replicable, provide a financially viable example for future uptake. In essence, the aspiration is that this innovative project will one day become common practice.

This is the first journal of a three-year series to follow between 2020-2022 presenting progress and the implementation challenges of RESILIO.

Contact:

Mr Age Niels Holstein, Project Manager of RESILIO (A.Holstein@amsterdam.nl),
Kasper Spaan, Strategic Advisor RESILIO (kasper.spaan@waternet.nl) and
Leon Kapetas (leonkapetas@gmail.com)

Urban Innovative Actions (UIA) is an Initiative of the European Union that provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges. Based on article 8 of ERDF, the Initiative has a total ERDF budget of EUR 372 million for 2014-2020.

UIA projects will produce a wealth of knowledge stemming from the implementation of the innovative solutions for sustainable urban development that are of interest for city practitioners and stakeholders across the EU. This journal is a paper written by a UIA Expert that captures and disseminates the lessons learnt from the project implementation and the good practices identified. The journals will be structured around the main challenges of implementation identified and faced at local level by UIA projects. They will be published on a regular basis on the UIA website.



Urban Innovative Actions

Les Arcuriales
45D rue de Tournai
F- 59000 Lille

+33 (0)3 61 76 59 34
info@uia-initiative.eu
www.uia-initiative.eu

Follow us on **twitter**
@UIA_Initiative
and on **Facebook**.