

Governance Models for Blue-Green Roof Projects

Resilio Deliverable 6.1

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RESILIO DELIVERABLE 6.1

GOVERNANCE MODELS FOR BLUE- GREEN ROOF PROJECTS

Full draft

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1. Introduction

Within WP6.1, the governance of blue-green roofs is the central theme. We focus on the governance of blue-green roofs on multiple levels: the building block level, where a blue-green roof is installed; the neighborhood- and city-level, where individual blue-green roofs are part of a connected system for smart water management; and the systemic level, where the system of blue-green roofs (potentially in different configurations, e.g. combined with solar panels) become more widespread across multiple geographic contexts, potentially even becoming the norm for newly built and/or retro-fitted roofs. In this report we focus on the level of the building block and its associated roof.

Our aim is to develop and test a set of governance protocols for the construction and management of blue-green roofs as well as water and data management. To do so we draw on academic literature regarding the governance of (blue-)green roofs, water governance and more in general collaborative governance as well as interviews with key stakeholders within the RESILIO project. The protocols will outline the conditions in which they are most suitable and the key decisions that have to be taken when developing blue-green roofs. Depending on the conditions of each individual building block, the protocol can be collaboratively developed in the design phase of each new blue-green roof in the RESILIO project. Before discussing the governance we first consider the benefits of blue-green roofs.

1.1 Benefits of blue-green roofs

Scientific literature across various disciplines has provided insights into several aspects of blue-green roofs: the economic, environmental, and social benefits of green roofs (Shafique et al., 2018); the technical performance and system interactions of blue-green roofs (Andenæs et al., 2018; Cirkel et al., 2018; Levinson et al., 2007; Shafique et al., 2016A); and the role of blue-green roofs in urban water management and addressing heat island effects (Lawson et al., 2014; Shafique and Kim, 2017; Shafique et al., 2016B; Voskamp and Van de Ven, 2015). Related to the governance of blue-green roofs, their potential benefits are particularly interesting at the organizational-level (i.e. benefits for the organization which invests in the solution), the building-level (i.e. benefits for the building from having a blue-green roof), and the neighborhood- and city-level (i.e. benefits from having a connected system of blue-green roofs). Shafique et al. (2018) identify several benefits of green roofs, which apply to blue-green roofs as well, based on a survey of scholarly work in this field:

- ❖ **Enhancing urban resilience and water management:** the water storage ability of green and blue-green roofs decreases the chances of flash flooding in urban areas, especially in periods with heavy rainfall to control runoff water.
- ❖ **Positive effect on water quality in urban areas:** Substrates in green and blue-green roofs filter polluting gasses and heavy metals from rainwater, thus enhancing the water quality.
- ❖ **Heat reduction and countering urban heat island effects:** the reduction of surface temperature and countering heat island effects in urban areas provide a cooling effect from green and blue-green roofs, on the building block level as well as for the city as a whole.
- ❖ **Cleaner air in urban areas:** by capturing fine dust particles from the air, green and blue-green roofs have a positive effect on the air quality in urban areas, thus providing health benefits for citizens and increasing the overall livability in the city.
- ❖ **Positive ecological and biodiversity-related effects:** green and blue-green roofs can positively stimulate the biodiversity in urban areas (although this can be difficult to measure), thus having a positive effect on urban ecology.

- ❖ **Potential economic benefits over the lifetime of the roof:** When taking positive externalities of green and blue-green roofs into account, such as their potential contribution in urban water management, effect on the reduction of air pollution, and positive effect on biodiversity, there are potentially economic benefits that have thus far not been captured in existing cost-benefit analysis (i.e. WP 6.5 of the RESILIO project focuses on these issues more specifically).

In addition to the positive externalities identified by Shafique et al. (2018) listed above, a green or blue-green roof which is accessible for building owners and residents also offers aesthetic benefits and the potential to enhance outdoor recreational space, thus improving the quality of living at the building block level. For the blue-green roofs which are realized in the RESILIO project offers additional benefits as well, due to the underlying technological solutions incorporated into the design of the roof. The consortium of partners strives to develop an interconnected system of blue-green roofs which enables decision-making related to water management based on information provided by water- and heat-measuring sensors embedded in the roof structure. As a consequence, water management at the building block, neighborhood, and city level can be executed more effectively than for green roofs. In designing a governance protocol for blue-green roofs in RESILIO, it is key to take such benefits also into account, as they can be important determinants for investment decisions in addition to a 'traditional' cost-benefit analysis.

Despite the benefits, a number of challenges may emerge for parties in taking action to develop blue-green roofs. As in the case of many systemic innovations¹ externalities prevail: the costs and benefits of blue-green roofs are not evenly distributed. Parties required to make major investments such as building owners could possibly only enjoy limited benefits, whilst parties such as water companies and society as a whole, who in the current arrangements would be expected to make limited investments could reap considerable benefits. In addition to changes in institutions at the system level (pricing of resources, regulations), parties will need to collaborate in new ways, taking on new roles, tasks and responsibilities process (Anguelovski & Carmin, 2011; Patterson & Huitema, 2018). Cooperation and coordination between different actors is necessary in achieving such governance innovation (Buijs et al., 2016; Mees & Driessen, 2011; Wolfram et al., 2019).

In the next sections, we will start by discussing how we see governance in RESILIO. Subsequently we will present a theoretical model of collaborative governance. Following this, we will consider a number of possible governance arrangements. In doing so we will combine theoretical insights with interviews with key stakeholders in the RESILIO project, conducted in two rounds (in January-February and in May-June of 2019), to develop a characterization of different types of blue-green roof projects, and a governance protocol which translates these findings into a standardized model to decide on the governance model that is adopted for each individual RESILIO roof.

2. Governance of blue-green roofs

As discussed above, for the realization of blue-green roofs, different types of public and private partners are dependent on each other. Building on the work of Emerson *et al.* (2012), we define

1 We consider these to be radical eco-innovations incurring substantial changes at the production-system level (Kemp and Foxon 2007).

collaborative governance as the processes and structures of policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government , and/or the public , private and civic spheres in order to carry out a public purpose that could not otherwise be accomplished. This definition accounts for the multiple actors involved in decision making, their interactions and the institutional context in which they work.

2.1 Components of a governance model

Emerson *et al.* (2012) have developed a collaborative governance framework, characterized by three nested dimensions: the system context, the collaborative governance regime and the collaboration dynamics between actors (see Figure 1). Structural developments in the system context (e.g. political, legal, socio-economic, economic and environmental influences) can create chances and constraints which, through the agency of actors, can lead to the development of so called drivers and influence collaboration. A further element of structure is represented by the collaborative governance regime, which encompasses dominant rules, norms, principles, regulations and procedures structuring the collaboration of actors. Given the importance of understanding the extent to which the drivers for collaborative governance are present in the RESILIO project and the collaboration dynamics, we will discuss these extensively below.

2.2 Drivers

Emerson *et al.* (2012) suggest that the presence of four drivers will encourage parties to undertake collaboration in the first place. These drivers include:

- ❖ Leadership: a leader to initiate the collaboration and secure resources and support for the collaboration. The leader can be a member of one of the organizations involved or a representative of a trusted third party. Emerson *et al.* (2012) emphasize the importance of the leader's: commitment to the collaborative process, preparedness to remain impartial with regard to the solution selected and the preferences of participants, and preparedness to absorb the high transaction costs for starting the collaboration
- ❖ Consequential incentives: internal (problems, resource needs, interests or chances) and external (situational or institutional crises, threats of chances) drivers. Of importance are the salience to actors, the timing and the realization that ignoring them would lead to negative impacts or missed opportunities. An example of an incentive could be a new funding opportunity.
- ❖ Interdependence: the realization that objectives could not be achieved without the contribution of other parties.
- ❖ Uncertainty: issues that cannot be resolved internally can drive groups to collaborate in order to reduce, diffuse, and share risk.

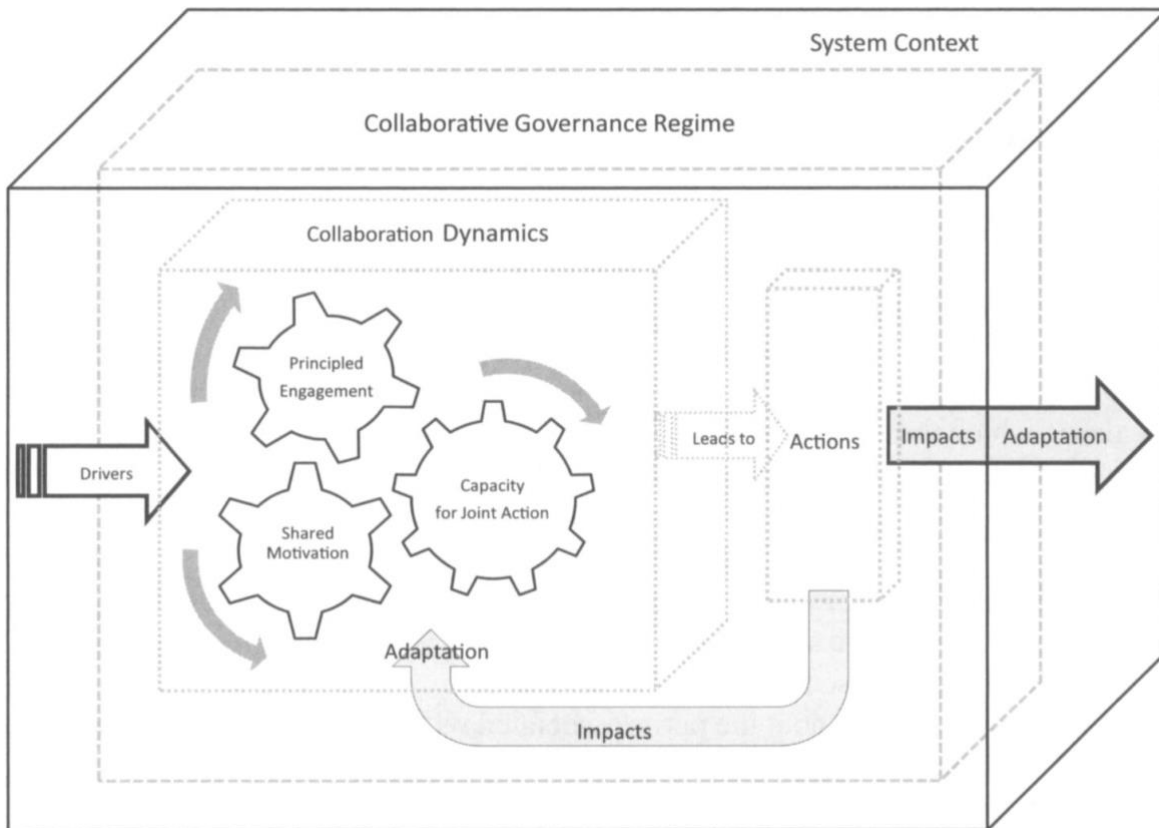


Figure 1 Integrative framework for collaborative governance (Emerson et al. 2012)

2.3 Collaboration Dynamics

Emerson et al. (2012) distinguish three aspects of collaboration dynamics.

- ❖ Principled engagement: this describes a situation where actors with different content, relational and identity objects work across institutional, sectoral and jurisdictional boundaries to solve problems, resolve conflicts and create value. It is considered of central importance to involve the right people and to follow the next four steps iteratively:
 - Discovery: mapping the individual and shared interests, concerns and values.
 - Definition: building shared meaning by explicating shared goals and ambitions; making agreements on language and concepts; clarifying and adjusting tasks and expectations of one another; determining criteria to evaluate information and alternatives.
 - Deliberation: this is more than the aggregation of interests. It includes the studying of interests, listening to the perspectives of others and reaching a well thought-out decision regarding the shared interest.
 - Determination: making decisions about procedures (agenda setting, creating working groups) or content (action points or final suggestions)
- ❖ Shared motivation: this describes the interpersonal and relational aspects of collaboration, or the social capital. Four elements are important here:
 - Trust: arising from principled engagement and further develops as parties collaborate and get to know each other. Contributes to mutual understanding, which contributes to legitimacy and commitment.

- Mutual understanding: the ability to understand and appreciate the differences in others.
- Legitimacy: the confirmation that stakeholders in a collective project are trustworthy and credible, with interdependent interests, legitimizes and motivates the collaboration. Here shared norms and reciprocity are important.
- Commitment: joint orientation towards a shared path making it possible to cross organizational, sectoral or jurisdictional borders.
- ❖ Capacity of joint action: this describes a new capacity of collaborative action that did not exist previously and makes it possible to reach objectives. This is comprised of four cross-functional elements creating the potential for effective action:
 - Procedural and institutional arrangements: procedures, protocols and organizational structures – both formal and informal. These are needed to manage repeated actions over time. These concern the ways of working both within as between organizations.
 - Leadership: several types are needed: sponsor, convener, facilitator, representative of an organization or community, translator of science, technologist. The form that this takes depends on the phase and situation.
 - Knowledge: this concerns shared knowledge which focuses action. This is the result of a process of collecting, separating and sharing relevant knowledge as well as the generation of new shared knowledge.
 - Resources: financial resources, but also time, technical, organizational, logistical and administrative support, competencies for the analyses of implication, expertise etc, power. This concerns sharing these resources to reach the objective of the collaboration.

3. A typology and protocol for governing blue-green roofs

Based on academic literature on blue-green roofs, we identified in Section 1 the positive effects on the building block level, neighborhood level, and city level from investing in blue-green roofs. For each project partner involved in the governance of blue-green roofs, benefits such as enhancing urban stormwater management, improving the air quality and biodiversity, and contributing to urban resilience and climate change mitigation can be important factors taken into account in their decision-making process.

Based on the interviews with key stakeholders (see appendix B for a list of interviewees), we specified two main factors which are central to the decision-making process of partner organizations to design a governance protocol to manage blue-green roofs. First, the way in which ownership of the roof is organized, in relation to the initial investment and total costs over the lifetime of the solution. Second, the way in which the governance is organized throughout the main phases of realizing a blue-green roof (i.e. design, preparation, realization, exploitation, and upscaling). Both are described below:

- ❖ **Ownership:** related to ownership of a blue-green roof, the initial investment to install the roof as well as the total costs of ownership over its lifetime, are taken into account. The total costs of ownership can be financed by a single entity, organization, or individual (i.e. the owner of the roof), thereby adopting a private ownership model; alternatively, it can be distributed amongst a collective of multiple entities, organizations, or individuals which benefit from the project (e.g. water management company, (re)insurance companies), thus adopting a shared ownership model.

- ❖ **Governance:** for governing a blue-green roof, the owner(s) can decide to organize the governance of the roof based on ownership, which implies that the entity with (majority) ownership over the solution decides how the water and data management on the roof is organized. It can be responsible for the water and data management itself, or it can contract a third party do this. Alternatively, the governance can rely on multiple entities or individuals which are stakeholders in and/or beneficiaries (e.g. water management company, building residents), thus adopting a shared governance or commoning approach.

Based on these two factors, we developed a framework which provides a broad generalization of governance models related to blue-green roofs, each with their own characteristics and complexities.

		Ownership distribution	
		Single entity	Multiple entities
Dominant mode of governance	Ownership-based decision-making	<i>Private Model</i>	<i>Shared Ownership Model</i>
	Collaborative decision-making	<i>Shared Governance Model</i>	<i>Commoning Model</i>

Figure 2 Governance models for blue-green roof projects

For each of the governance models in the framework, some specificities are provided below, based on interview findings combined with academic literature on blue-green roofs.

Private Model: individual ownership, governance relies on single organization, entity, or individual

- ❖ **Rationale:** Private ownership and ‘traditional’ cost-benefit analysis with emphasis on economic factors, but positive externalities such as the environmental impact, increased biodiversity, and urban heat island effects (i.e. wider impact on neighborhood/city) can be taken into account by the roof owner. Drivers can potentially be economic (e.g. corporate image building, positioning on the basis of sustainability as part of a corporate social responsibility strategy) or institutional (e.g. preconditions for water retention on privately owned buildings).
- ❖ **Exemplary manifestation:** a corporation invests in a (potentially subsidized) blue-green roof for a new office building, given that it fits the corporate social responsibility strategy of the firm, and it enhances its positioning on sustainability dimensions, e.g. energy efficiency, water management, building-level CO2 emissions (key driver: economic/corporate image); a property developer invests in a (potentially subsidized) blue-green roof on a newly developed building, because water storage per square meter on newly developed buildings is a contractual precondition set by the city municipality (key driver: institutional/contractual).
- ❖ **Factors taken into account:** primarily economic (cost-benefit analysis), environmental benefits may be a determining factor as well.

Shared Governance Model: individual ownership, governance relies on multiple organizations, entities, or individuals

- ❖ Rationale: Private ownership and ‘traditional’ cost-benefit analysis with emphasis on economic factors, but positive externalities such as the environmental impact, increased biodiversity, and urban heat island effects (i.e. wider impact on neighborhood/city) can be taken into account by the roof owner. The governance and day-to-day management of the roof can be collaboratively undertaken by the owners of the roof, or other stakeholders which are connected to the building, thereby organizing the governance of the roof collaboratively (e.g. residents are responsible for maintaining the vegetation on the roof, a water management company is responsible for water management on the roof).
- ❖ Exemplary manifestation: a housing corporation invests in a (potentially subsidized) blue-green roof, whereby residents that rent an apartment from the housing corporation in the building are able to access the roof for recreational purposes, and/or maintaining the vegetation on the roof, and/or actively involved in water management on the roof (key driver: social/livability for tenants)
- ❖ Factors taken into account: economic (cost-benefit analysis) and quality of living for residents (aesthetic), environmental benefits may be a determining factor as well.

Shared Ownership Model: shared ownership, governance relies on a single organization, entity, or individual

- ❖ Rationale: Multiple organizations benefit from a blue-green roof, related to the positive externalities in terms of environmental and social impact, as well as the opportunity to actively manage water through a smart system of connected roofs during wet/dry periods. Given that the benefits from installing a blue-green roof are reaped by multiple actors, a consortium of actors can decide to invest in a blue-green roof collaboratively. Managing water on the roof can be done by the owners of the roof, but it can also be decided to contract a specialized water management company to do this for them.
- ❖ Exemplary manifestation: an association of building owners consisting of individual home owners, collaboratively invest in a blue-green roof to be installed on their building (subsidized or non-subsidized), whereby the governance and day-to-day water management on the roof is outsourced to a specialized water management company, e.g. Waternet in Amsterdam (key driver: environmental impact/consciousness, core business of water management company).
- ❖ Factors taken into account: economic (cost-benefit analysis) and environmental benefits, quality of living for residents (aesthetic) may be a determining factor as well.

4. Commoning Model: shared ownership, governance relies on multiple organizations, entities, or individuals

- ❖ Rationale: Multiple organizations benefit from a blue-green roof, related to the positive externalities in terms of environmental and social impact, as well as opportunity to actively manage water through a smart system of connected roofs during wet/dry periods. Given that the benefits from installing a blue-green roof are reaped by multiple actors, a consortium of actors can decide to invest in a blue-green roof collaboratively. Following a commoning approach to manage existing or new common urban resources, the governance and day-to-day management of the roof can be collaboratively undertaken by the owners of the roof, or other stakeholders which are connected to the building, thereby organizing the governance of the roof collaboratively (e.g. residents are responsible for maintaining the vegetation on the roof, a water management company is responsible for water management on the roof).

- ❖ Exemplary manifestation: a collective of organizations that benefit from blue-green roofs, which could include a housing corporation, water management utility, and insurance company, collaboratively invest in a blue-green roof (subsidized or non-subsidized), whereby residents that rent an apartment from the housing corporation in the building are able to access the roof for recreational purposes, and/or maintaining the vegetation on the roof, and/or actively involved in water management on the roof (key driver: environmental impact/consciousness, social/livability for tenants, core business of water management company).
- ❖ Factors taken into account: economic (cost-benefit analysis), environmental benefits, and quality of living for residents (aesthetic) can all be key determining factors.

As part of developing a governance protocol for each individual roof in the RESILIO project, these generic models can be used as a tool to think about how to organize the ownership and governance of blue-green roofs. It can be specified in more detail, based on building-specific characteristics and the overall purpose of the blue-green roof, using the following governance protocol on the next page.

RESILIO GOVERNANCE PROTOCOL

Draft version 1.0

❖ **General Characteristics:**

- Location:
- Project partners:

❖ **Main benefits (economic, environmental, social):**

- Partner-level:
- Consortium-level:
- City-level:

❖ **Partner responsibilities per project phase:**

- Design phase:
- Preparation phase:
- Realization phase:
- Exploitation phase:
- Upscaling phase:

❖ **Ownership distribution:**

- Investment model (capital investment):
- Cost of ownership (maintenance, insurance):
- Subsidization (if any):

❖ **Governance mode:**

- Mode of governance (private-shared):
- Data management decision-maker(s):
- Water management decision-maker(s):
- Involvement of residents (if any):

❖ **XXXX**

❖ **XXXX**

4. Positions of the project partners

As mentioned above, two rounds of interviews were held with project partners. The first round took place in January and February 2019 to learn more about the contributions of each partner to the project and its expectations and concerns (see Appendix 1 for the questionnaire). The second round was organized in May and June 2019. It was especially focused on issues related to the governance of the projects in the four selected city districts (see Appendix 2 for the questionnaire) and explored the issues to be dealt with in the governance protocols that will be developed for each project. Table 1 gives an overview of the partner organizations interviewed in the two rounds.

Table 1 Partners organizations interviewed for RESILIO WP 6.1

Partner organizations	Round 1 (January-February 2019)	Round 2 (May-June 2019)
City of Amsterdam – Public Space	Jaike Bijleveld	-
City of Amsterdam - Datalab	Jacco Brouwer	-
Waternet – IoT	Laurent Lenne	Laurent Lenne
Waternet - Rainproof	Casper Spaan	
Consolidated	Glen Bosman	Glen Bosman
Ymere	Bas Kalfshoven	-
De Key	Siebe van Doornik en Daniël Duijnhouwer	Daniël Duinhouwer
Stadgenoot	Jonna Zwetsloot	Jonna Zwetsloot
De Alliantie	-	Thomas van der Vlis
Metropolder	Cees-Anton van den Dool	Joost Jacobi
GGD	-	Imke van Moorselaar
Rooftop Revolution	Jan Henk Tigelaar	Jan Henk Tigelaar

4.1 Motivations to get involved

The project partners were first asked about their motivations for getting involved in the RESILIO project. The social housing corporations seemed to a large extent on the same line. De Key is interested because of the innovative character of the project and its potential benefits for residents as well as the available funding for roof renewal. De Alliantie aims to be a frontrunner in terms of sustainability and climate adaptation and Stadgenoot wants to increase the livability in the city, seeing this as broader than the provision of affordable housing only.

Stadgenoot explicitly considers the RESILIO project as an experiment. They hope to get more clarity about the advantages of blue-green roofs and the stakeholders who will benefit through such projects. They are also interested in getting a better insight in the costs involved as well as possible arrangements for distribution of costs for example with regard to the maintenance of the smart valves ('kleppen'). They have concerns about the potential for insulation of a blue-green roof because not all insulation materials can be used on such roofs.

Consolidated aims to be involved in the project as they are cooperating with all social housing corporations with a view to roof maintenance and repair. A major concern for them is that roofs remain leak-proof. They are also interested in the suitability of roofs for various functions and the operation of the smartflow system for roofs. They would like to have access to the water related data collected by Waternet and prefer to have an open data exchange in the RESILIO project.

Waternet's interest in the project is related to the organizational process of digital transformation that it is involved in. They consider the Internet of Things (IoT) with affordable sensors and devices a new way of achieving efficiency. At the level of the RESILIO project, Waternet is engaged in developing a decision making model for dealing with the smart valves 'kleppen' in blue-green roof systems. For them, the major issue is who will decide about the water management based on what considerations. In this context, they stress that the key performance indicators should be defined for the decision making model at the levels of both individual roofs and the system of connected roofs. In addition, they think a milestone planning is needed that focuses on interdependencies between different steps in the project.

Metropolder developed the 'polderdak' concept and has several years of experience with individual blue-green roofs. They are interested in investigating the impacts of a connected blue-green roofs system, especially with regard to hydrological and energetic aspects. With respect to the RESILIO project they will install a smart flow system and will work on optimizing this. Furthermore, they find it interesting to be involved in a consortium with many different stakeholders who each have their own views and interests related to blue-green roofs and to explore how to create win-win situations for all.

Rooftop Revolution's mission is to exploit all roofs and make cities future-proof. They aim to bring nature into the city and tackle health related issues. They favor the creation of rooftop gardens for fruits and vegetables ('dakmoestuinen'). According to them, management of data should be open source, but within the limits set by the privacy regulation. If possible, residents should have access to blue-green roofs and be involved in their management. Rooftop Revolution is responsible for communication and citizen participation in the RESILIO project.

The GGD's interest in the project is limited to the health effects of blue-green roofs. They have not planned to do any measurements, but will collect data by adding questions to RESILIO questionnaires for other purposes.

4.2 Realization phases of blue-green roofs

For the purposes of the project, we distinguish four phases in the realization of blue-green roof projects, including preparation and design, construction, management and maintenance and upscaling. Table 2 gives an overview of how the project partners perceive their involvement in these different phases which will be further explained below.

Table 2 Perceptions of project partners about involvement in different phases of the realization of blue-green roofs

	Preparation & design	Construction	Management & exploitation	Upscaling
Stadgenoot	X	X	X	-
De Key	X	X	X	-
De Alliantie	X	X	X	-
Consolidated	X	X	X	-
Metropolder	X	X	X	X
Waternet	X	X	X	X
Rooftop Revolution	X	X	X	X
GGD	-	-	X	-

Preparation and design

All interviewed project partners, except the GGD, see a role for themselves in the first phase of preparation and design. According to the interviewees, arrangements should be made about the preferred type of roof, the technical specifications for the procurement procedure, access to roofs, and levels of participation by residents.

The social housing corporations have agreed to follow a joint procurement procedure and to ask for tenders from their usual roof partners ('dakpartners'). Together with their roof partners, Consolidated and Metropolder, they need to formulate the technical specifications for the procurement procedure.

The construction of each roof will consist of a new roof covering, the blue-green part and the smart system. This will be all the responsibility of the roof partner. Metropolder offers in principle three different options for blue-green roofs: optimal water buffering, optimal green, and optimal cooling. With regard to the roofs, decisions have also to be made about the type of planting and whether solar panels should be an additional option.

Another point of discussion is the accessibility of roofs for residents. The social housing corporations do not see this as a realistic option for the building blocks involved in the project. However, they are willing to consider whether other of their properties would qualify for access of citizens.

Participation with residents could also be an issue. The social housing corporations have different ideas about this than Rooftop Revolution. De Key and De Alliantie prefer to keep communication with residents in their own hands.

Rooftop Revolution would like to go a step further, stressing that it is important to already look ahead to the stage of managing the blue-green roofs and hence make arrangements for the division of responsibilities and costs related to management and maintenance of the technology, the hardware, and the green layer.

Risks in this phase of preparation and design as identified in the interviews may occur at different levels. They could be related to the suitability of the existing construction of buildings. Currently, calculations are made to be able to make proper estimations. Risks could also stem from mixed ownership of roofs which could make it difficult to agree on design and construction of a blue-green roof. Furthermore, a condition of the RESILIO project is that the roof stays in possession of the same owner for at least five years. Otherwise, the costs need to be reimbursed. However, this may not be realistic in practice, certainly not in situations with Associations of Homeowners (VvE's).

Construction

Similarly as for preparation and design, all interviewed project partners, except the GGD, see a role for themselves in the phase of construction. Consolidated emphasized that there is a need for good arrangements between the partners responsible for the roof construction and the planting. According to Metropolder, all partners need to be informed about the planning in order to be able to make their own plans. Rooftop Revolution confirmed this by adding that a proper planning detailing who does what and when is necessary and suggested to have a manager at the location.

Risks may relate to unforeseen problems when something goes wrong. Anticipation to such risks may include arrangements about emergency procedures. Additional risks could relate to permits, rules and regulations, insurance issues, and other works in the neighborhood and should be excluded as much as possible in advance. Furthermore, problems with insulation could be an issue, especially with a view to the risk of condensation indoors.

Management & exploitation

Similarly as for the two previous phases, all interviewed project partners, except the GGD, see a role for themselves in the phase of management and exploitation. Metropolder will take responsibility for the blue component, especially the smart flow control. They are also willing to advise about the green aspect but in the end they see this as the task of roof gardeners ('dakhoveniers') that are paid by the social housing corporations.

Arrangements between the partners should be made about the control of the water flows based on the decision model as proposed by Waternet as well as data management. De Key would like to have a clarification about the large amount of data generated by Waternet and who will have access to these data. For example, what will happen with the system after the project is finished? Will Waternet keep collecting data?

According to Consolidated, the roof partners will be responsible for the maintenance of the roofs, including the planting. This is seen as a considerable task because the valves ('kleppen') in the roofs have to be kept open. Metropolder emphasized that arrangements need to be made about the maintenance contracts especially for the period after the RESILIO project has finished.

For Stadgenoot, it is important is to make good arrangements with external parties. They will make arrangements with their roof partners similarly as they did for their green roofs. The smart part is the unknown factor that they want to have more information about. They expect that Metropolder and Waternet will help clarifying these costs.

Upscaling

Unlike for the previous stages, several project partners, notably the social housing corporations and Consolidated, do not see a role for themselves in the upscaling of blue-green roofs, at least not yet. They are of the opinion that it is too early to commit to upscaling. They would first like to know more

about the actual impacts of blue-green roofs and the associated costs of these projects in term of management and maintenance.

Metropolder hopes that if the RESILIO project has positive results in terms of dealing with flooding and other water nuisance, it will provide the opportunity to realize similar projects in other European cities. As incentives for upscaling they suggest to introduce covenants for new urban districts and reduction of water levees for those who take measures for water storage.

5. Concluding remarks

This deliverable explored options for governance models and protocols for blue-green roof projects from a theoretical perspective as well as based on the opinions of the stakeholders involved in the RESILIO project. The main theoretical models identified are based on dimensions of ownership distribution and dominant modes of governance, including the private model, the shared ownership models, the shared governance model, and the communing model. At this stage, it is too early to determine which model will be the most appropriate for each of the four city districts involved in the RESILIO project. First, arrangements need to be made between partners about various aspects related to the stages of project preparation and design, construction, and management and exploitation. However, hopefully the analysis provides several building blocks for starting discussions on key issues such as the responsibility for data and water management and distribution of costs among partners.

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Appendix A: Questionnaire for first round of interviews with project partners

- 1) Wie ben je wat doe je?
- 2) Wat verwacht je van het RESILIO project?
- 3) Hoe zie je jouw rol?
- 4) Welke lessen uit eerdere projecten zou je willen toepassen / fouten willen voorkomen?
- 5) Wie zijn belangrijke stakeholders, en waarom?
- 6) Welke kansen / ambities zie je en welke risico's?

Appendix B: Questionnaire for second round of interviews with project partners

Wij proberen zicht te krijgen op jouw beeld van de gewenste invulling van het governancemodel op de daken in de Oosterparkbuurt evenals de opschaling. Bij een governancemodel gaat het om welke stakeholders worden betrokken, verdeling van verantwoordelijkheden (o.a. leiderschap), verkrijgen en verdelen van middelen, ontwikkelen van gezamenlijke kennis, formele en informele regels van de samenwerking. Wij richten ons op drie fases: de voorbereiding en ontwerp van het dak, de aanleg daarvan en de exploitatie en beheer. Daarbinnen richten wij ons op drie aspecten: het dak zelf, het water en de data. Ter afsluiting willen wij het over de opschaling van blauw-groene daken hebben.

Inleiding

- 1) Wat is de motivatie van jouw organisatie om aan Resilio mee te doen? Wat denkt die er aan te hebben? (verwijs naar eerder interviewronde)
- 2) Hoe moet volgens jou de daken in de Oosterparkbuurt uitzien wat betreft: inrichting van dak, dataverzameling en watermanagement?

Vorbereidings-/ontwerpfase

Het voorbereiden en ontwerpen van het blauw-groene dak inclusief dataverzameling en watermanagement

- 1) Over welke onderwerpen zouden volgens jou afspraken moeten worden gemaakt in het governance-protocol omtrent de voorbereidings-/ontwerpfase?
- 2) Hoe zie je de rol/verantwoordelijkheid van jouw organisatie en andere (Resilio-stakeholders, bewoners, externen) tijdens deze fase met betrekking tot:
 - De aanleg van het dak
 - De instrumenten met betrekking tot dataverzameling (met betrekking tot verschillende soorten data en instrumenten)
 - Het verzamelen en beheer van het regenwater
- 3) Welke risico's bestaan er volgens jou in deze fase voor de betrokken stakeholders?
- 4) Wat zijn uitdagingen/kansen die je in deze fase ziet die geadresseerd moeten worden om de aanleg van de daken in de Oosterparkbuurt/Resilio een succes te maken?

Aanlegfase

De aanleg van het dak inclusief instrumenten (watermanagement en data)

- 1) Over welke onderwerpen zouden volgens jou afspraken moeten worden gemaakt in het governance-protocol omtrent de aanlegfase?
- 2) Hoe zie je de rol/verantwoordelijkheid van jouw organisatie en andere (Resilio-stakeholders, bewoners, externen) tijdens de aanleg van:
 - Het dak?
 - De instrumenten om data te verzamelen?

- Het verzamelen en beheer van het regenwater?
- 3) Welke risico's bestaan er volgens jou in deze fase voor de betrokken stakeholders?
 - 4) Wat zijn uitdagingen/kansen die je in deze fase ziet die geadresseerd moeten worden om de aanleg van de daken in de Oosterparkbuurt/Resilio een succes te maken?

Beheer/exploitatie

- 1) Over welke onderwerpen zouden volgens jou afspraken moeten worden gemaakt in het governance-protocol omtrent de beheer-/exploitatiefase?
- 2) Hoe zie je de rol/verantwoordelijkheid van jouw organisatie en andere (Resilio-stakeholders, bewoners, externen)
 - Bij het beheer-/exploitatie van het dak?
 - Bij het management van water op het dak?
 - Bij het verzamelen en delen van data?
- 3) Welke risico's bestaan er volgens jou in deze fase voor de betrokken stakeholders?
- 4) Wat zijn uitdagingen/kansen die je in deze fase ziet die geadresseerd moeten worden om de van de daken in de Oosterparkbuurt /Resilio een succes te maken?

Opschaling

- 1) Hoe kijk je aan tegen de ontwikkeling van blauw-groene daken na Resilio (opschaling)
- 2) Wat is jouw visie/ambitie met betrekking de opschaling van blauw-groene daken qua gekoppelde daken als het mainstream maken ervan op het niveau van de stad?
- 3) Welke rol zou jij/jouw organisatie erin kunnen/willen spelen?
- 4) Wat zijn kansen/uitdagingen die je bij de drie fases ziet bij het opschalen van blauw-groene daken (zowel bij gekoppelde daken als het mainstream maken van een blauw-groene daken?)

Sluiting

- 1) Wat vind je samenvattend de belangrijkste onderwerpen die de partners in het governance-protocol moeten regelen?
- 2) Wat is het belangrijkste aspect op gebied van governance waar wij op moeten letten?
- 3) Zijn er naar aanleiding van dit interview nog onderwerpen die je hebt gemist?

- 4) Heb je misschien suggesties wie we nog meer kunnen interviewen? Wie zijn belangrijke mensen/afdelingen binnen jouw organisatie qua governance/opschaling?