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# Introducción a las Soluciones Basadas en la Naturaleza en la política urbana como estrategia de adaptación

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Estudio de Caso: “Rotterdam Multifunctional Roofs”

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## Resumen Ejecutivo

En el contexto del cambio climático y de la acelerada urbanización que se hacen evidentes a nivel mundial, la falta de planificación y de infraestructura adecuadas enfrenta cada vez más a las ciudades con los efectos del estrés urbano e incrementa su vulnerabilidad frente al cambio climático. Es en respuesta a los principales retos urbanos, que las medidas de adaptación y mitigación del cambio climático se hacen más evidente entre los intereses sociales, económicos y gubernamentales para alcanzar un desarrollo sostenible y lograr ciudades resilientes.

Esta investigación destaca las Soluciones Basadas en la Naturaleza como una opción a ser considerada por las políticas climáticas de las ciudades, centrándose en su potencial para la adaptación al cambio climático, al ofrecer múltiples beneficios que se desprenden del uso eficiente de los ecosistemas y sus servicios; y explora los obstáculos para su aplicación, según una revisión exhaustiva de bibliografía y el análisis empírico a partir del estudio de caso de la ciudad de Rotterdam.

En los Países Bajos, el municipio de Rotterdam implementa el programa *Multifunctional Roofs (2019-2022)* como parte de su estrategia de adaptación al cambio climático, el cual promueve la refuncionalización de los 18,5km<sup>2</sup> de cubiertas planas en desuso, y apuesta al uso de SBN como estrategia para mejorar el rendimiento energético y ambiental de los edificios existentes.

De la identificación y evaluación de los principales retos para el diseño, comunicación e implementación de las SBN como parte de las políticas urbanas, este análisis destaca su potencial para la adaptación de la infraestructura y, al mismo tiempo, pone en evidencia la necesidad de profundizar en los modos de aplicación, para avanzar sobre un marco de pensamiento sistémico y sistemático que considere los contextos locales y las necesidades específicas, los múltiples servicios ecosistémicos presentes en ellos, y reconozca las motivaciones e intereses de las diferentes partes interesadas.

Palabras clave: impacto del cambio climático en ciudades, soluciones basadas en la naturaleza, green retrofit en edificios, techos multifuncionales, medidas de mitigación y adaptación, infraestructura resiliente.

## **Abstract**

In the context of climate change and the accelerated urbanization that is evident worldwide, the lack of adequate planning and necessary infrastructure increasingly confronts cities with the effects of urban stress and increases their vulnerability to climate change. It is in response to major urban challenges that climate change mitigation and adaptation measures are becoming more evident among social, economic, and governmental initiatives to achieve sustainable development and resilient cities.

This research highlights Nature-Based Solutions (NBS) as an option to be considered for city climate policies, focusing on their potential for climate change mitigation and adaptation by offering multiple benefits from the efficient use of ecosystems and their services, as opposed to the use of traditional grey infrastructure; and explores the barriers to their implementation, based on a comprehensive literature review and empirical evidence from a case study analysis.

In the Netherlands, the municipality of Rotterdam implements the Multifunctional Roofs program (2019-2022) as part of its climate change adaptation strategy, which incentivizes the repurposing of the 18,5km<sup>2</sup> of disused flat roofs and supports the use of NBS as a strategy to improve the energy and environmental performance of existing buildings.

This analysis identifies and evaluates the main challenges in the design, communication, and implementation of NBS as part of urban policies, and highlights the opportunities for NBS to be used in infrastructure adaptation. At the same time, it also brings to attention the challenges faced in the implementation of NBS and provides recommendations on how to overcome these challenges. This includes the need to deepen the understanding of the method of implementation, and to advance on a framework of systemic and systematic thinking that considers local contexts and specific needs, the multiple ecosystem services present in them, and recognizes the motivations and interests of different stakeholders.

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## **Acrónimos**

COP	Conference of the Parties (Conferencia de las Partes)
EbA	Ecosystem based Adaptation (Adaptación basada en los Ecosistemas)
EC	European Comission (Comisión Europea)
GEI	Gases de Efecto Invernadero
IPCC	Intergovernmental Panel on Climate Change (Grupo Intergubernamental de Expertos sobre el Cambio Climático)
RCP	Rotterdam Climate Proof (Rotterdam a Prueba del Clima)
SBN	Soluciones Basadas en la Naturaleza
SE	Servicios Ecosistémicos
UE	Unión Europea
UGI	Urban Green Infraestructure (Infraestructura Verde Urbana)
UNDRR	United Nations Office for Disaster Risk Reduction (Oficina de las Naciones Unidas para Reducción de Riesgo de Desastres)
UNEP	United Nations Environment Programme (Programa de las Naciones Unidas para el Medio Ambiente)
UNFCCC	United Nations Framework Convention on Climate Change (Convención Marco de las Naciones Unidas sobre el Cambio Climático)
UN Habitat	United Nations Human Settlements Programme (Programa de Naciones Unidas para los Asentamientos Humanos)

## Sección 1: **Introducción**

### 1.1 Antecedentes de la investigación

La creciente urbanización y el cambio climático están provocando un aumento del estrés urbano. Esto se debe a que las ciudades hacen frente a los desafíos propios de una rápida urbanización, que incluye, entre otros, la disminución de la disponibilidad de tierra y la consecuente competencia por los espacios verdes que se traduce en un incremento del costo del suelo, el aumento de la densidad urbana ([ARUP, 2014](#)), la contaminación del agua, del aire, y la escasez de recursos esenciales (agua y alimentos) y, al mismo tiempo, deben resistir a los eventos meteorológicos cada vez más extremos y frecuentes, como lluvias extremas, inundaciones, sequías y olas de calor ([Bozovic et al., 2017](#)) provocadas por el cambio climático. En este contexto, la escasa planificación, construcción y adecuación de la infraestructura impacta directamente en la calidad de vida urbana. En tanto sigan aumentando las emisiones de gases de efecto invernadero (GEI), estos eventos se harán más agudos y frecuentes, generando la necesidad de contar con una infraestructura resiliente al cambio y la variabilidad climática, de manera de favorecer el bienestar de las comunidades que habitan en las ciudades.

Uno de los mayores desafíos que enfrentan las ciudades es el de adaptar su infraestructura al contexto socioambiental actual. Bajo la premisa de desarrollo sostenible y bajo en carbono, las ciudades cuentan con una de las mayores oportunidades para colaborar en la mitigación del y adaptación al cambio climático. Los planificadores urbanos y los gobiernos locales se encuentran trabajando para buscar alternativas frente a estos retos ([ARUP, 2014](#)), y son cada vez más conscientes de los beneficios sociales, ambientales y económicos que la naturaleza puede aportar a la creación de ciudades habitables. Muchos reconocen que la introducción de las SBN en las agendas climáticas es un mecanismo clave para aliviar las presiones urbanas y lograr beneficios en múltiples aspectos. Logrando conservar y aumentar las reservas de capital natural, siendo adaptables y contribuyendo a la resiliencia general de los paisajes. ([Kabisch et al., 2017](#))

Entre las ciudades que han avanzado en la incorporación de las SBN a los programas urbanos, se destaca la ciudad de Rotterdam en los Países Bajos, que ha explorado, con su programa *Multifunctional Roofs*, el uso de SBN en la adaptación de edificaciones (*green retrofit*). La experiencia en el uso de SBN en programas de adaptación de infraestructura ha mostrado resultados que exceden lo meramente constructivo, fomentando la cohesión social, al incluir aspectos tales como participación ciudadana, la autogestión, entre otros. Por ello, es

imperativo reconocer la necesidad contar con una infraestructura que sea costo-efectiva, que promueva la infraestructura como servicio, que sea resiliente frente al cambio climático y contribuya al desarrollo de metas sociales y ambientales.



## 1.2 Planteamiento del tema

### 1.2.1 Pregunta de investigación

¿Por qué las Soluciones Basadas en la Naturaleza son consideradas una estrategia superadora al despliegue de infraestructura gris en cuestiones de adaptación y mitigación del cambio climático en las ciudades?

¿De qué manera las Soluciones Basadas en la Naturaleza pueden incorporarse de manera eficiente en la política urbana de adaptación (*green retrofit*) de edificios existentes?

### 1.2.2 Objetivo general

El objetivo de esta investigación es evaluar el alcance de las Soluciones Basadas en la Naturaleza como instrumento para la adaptación y mitigación frente al cambio climático en las ciudades; y analizar el caso de Rotterdam para identificar las oportunidades y desafíos en el diseño, comunicación e implementación de las SBN como parte de la política urbana.

### 1.2.3 Objetivos específicos

- Relacionar el crecimiento poblacional y la densificación urbana con la aceleración de la crisis climática.
- Advertir los principales problemas que enfrentan las ciudades como consecuencia del cambio climático.
- Especificar el rol que cumple la infraestructura gris en el desarrollo de las ciudades.
- Distinguir entre medidas de mitigación y medidas de adaptación.
- Comparar la infraestructura gris, con la infraestructura verde e híbrida, y relacionarlas con el concepto de “infraestructura resiliente”
- Analizar el concepto “Solución Basada en la Naturaleza” y su relación con otros conceptos análogos. Examinar origen y objetivos.
- Examinar oportunidades y desafíos en el diseño y ejecución de las SBN; e identificar los beneficios e impactos para los distintos actores implicados.
- Establecer como caso de estudio el programa de Rotterdam, *Multifunctional Roofs*

(2019-2022).

- Determinar su relevancia como medida de mitigación y adaptación para la ciudad de Rotterdam. Sintetizar sus características principales, objetivos y alcances.
- Contrastar el material bibliográfico con los testimonios de informantes clave, recolectados a partir del método cualitativo de entrevistas. Descomponer la información en las tres etapas de desarrollo de las SBN (planificación, comunicación y ejecución)
- Identificar aciertos y limitaciones en el uso de las SBN como parte de política de adaptación.

### 1.3 Enfoque analítico y metodología

A fin de dar respuesta al interrogante de cuál es el alcance de las SBN como medida de adaptación y mitigación al cambio climático, y cómo se pueden incorporar a las políticas urbanas, se hizo necesaria inicialmente la recolección de información relevante basada en la revisión exhaustiva de la literatura, reportes, publicaciones y estadísticas sobre SBN. Luego del análisis teórico y conceptual de las SBN, se prosiguió con el análisis de información relacionada a adaptaciones edilicias y los avances del *green retrofit* en el ámbito de la construcción. Por último, se hizo foco en el programa municipal de Rotterdam, *Multifunctional Roofs (2019-2022)*, como estudio de caso instrumental ([Stake, 1999](#)) con el propósito de entender cuáles son las oportunidades y desafíos del *green retrofit* como parte de la política de adaptación de las ciudades. Para ello, se seleccionaron informantes clave y se llevó a cabo un proceso de entrevistas de investigación (estandarizadas no programadas), donde se contrastó la literatura con los datos empíricos de la experiencia del entrevistado.

La entrevista estandarizada no programada es considerada dentro de la categoría de entrevistas cualitativas de investigación, y se caracteriza por: 1) la estandarización del significado de una pregunta que requiere formularla en términos familiares al entrevistado, 2) no hay una secuencia de preguntas satisfactoria para todos los entrevistados, y 3) es factible conseguir la equivalencia de significado para todos los entrevistados, a través del estudio de estos y la preparación de los entrevistadores, de modo que se hagan y ordenen la preguntas a medida de aquellos ([Denzin, 1970, como se citó en Valles, 1999](#)). Esta clase de entrevista permite alcanzar respuestas detalladas y exhaustivas, si se siguen directrices predeterminadas. En este caso, las entrevistas se estructuraron en tres etapas, 1) planificación y diseño, 2) comunicación y difusión, y 3) ejecución e impacto, lo que permitió entender las motivaciones

de los diferentes actores, las oportunidades y dificultades en cada etapa, y consideraciones pertinentes a cada parte involucrada.

Cinco informantes clave participaron en las entrevistas para esta investigación. Se los contactó por separado a través de correo electrónico, personales e institucionales, y de LinkedIn. Se contactó inicialmente a 13 personas, de las cuales 5 contestaron y fueron las participantes de la entrevista para la presente investigación. Se les proveyó, previo a la entrevista, con una guía de preguntas para que tuvieran conocimiento de los temas a tratar y pudieran proveer la mayor especificidad en sus respuestas.

Los entrevistados se consideran esenciales en la representación de los diferentes actores involucrados y pueden categorizarse de la siguiente manera: a) el municipio de Rotterdam, b) los actores intermedios/alianzas c) el usuario final.

Entrevista Tipo	Nombre	Relevancia	Fecha
A	Paul van Roosmalen	Program Manager - Multifunctional Roofs	04/05/21
B	Pamela Logjes	Líder de proyecto - Rooftop Revolution <sup>1</sup>	23/04/21
B	Esther Wienese	Fundadora – DakenDiva <sup>2</sup>	28/04/21
C	Guido Zeck	Dueño de una cubierta verde construida mediante el retrofit de un departamento en la ciudad de Rotterdam	07/05/21
C	Desiree de Bar	Dueña de un jardín verde en un edificio nuevo en la ciudad de Rotterdam	23/04/21

Los formatos de entrevista utilizadas y las transcripciones de las entrevistas se encuentran en los [Anexo 1](#) y [Anexo 2](#).

#### 1.4 Contribución teórica y relevancia

Esta investigación es relevante en su potencial contribución al entendimiento de las SBN como estrategia práctica y no solo conceptual para la mitigación del y adaptación al cambio climático. El estudio de caso contribuye a la ponderación de las irregularidades o

<sup>1</sup> Rooftop Revolution es una fundación independiente que actúa como asesores, supervisores de procesos e intermediarios en proyectos de techos sostenibles.

<sup>2</sup> Esther Wienese fundó su compañía con el fin inspirar a los ciudadanos de Rotterdam sobre las oportunidades de uso en los tejados. Con el apoyo de la municipalidad, lleva adelante junto con Rooftop Revolution una prueba piloto en cuatro barrios de Rotterdam para estudiar las posibilidades que existen de nuevos usos en los tejados.

incongruencias que se revelan al contrastar la literatura con fenómenos individuales, organizacionales, sociales y políticos; y a una serie de recomendaciones generales con la intención de mejorar el diseño de planes y programas públicos locales que incorporen SBN y, en particular, para el *green retrofit* de edificaciones.

El término “*green retrofit*”<sup>3</sup> es utilizado en esta investigación para referirse a la adaptación sostenible de un edificio existente para hacerlo energéticamente más eficiente, mejorar su relación con el ambiente y que sea sostenible para el futuro; despejando cualquier confusión que pueda generarse a partir de la palabra “*green*” y el uso de SBN. La acción de *green retrofit* puede incluir reformas mayores o menores, y diversas aproximaciones, en un intento de reducir la huella de carbono del edificio y de sus futuras operaciones. Las SBN como elemento de análisis de esta investigación, es una de las tantas soluciones que pueden utilizarse como instrumento para el *green retrofit*.

La finalidad de este análisis no es la de generalizar a partir del caso de Rotterdam, sino demostrar que las conclusiones pueden ser aplicadas a otros contextos, o utilizadas por otros ([Simons, 2011](#)) mediante su adaptación a las características particulares de cada caso. De este análisis pueden extraerse ideas valiosas, en cuanto a instrumentos de gobernanza y de política dirigidos a la mitigación y adaptación al cambio climático para otras ciudades.

## 1.5 Estructura del estudio

A fin de presentar el análisis realizado, este trabajo se estructura de la siguiente manera: La Sección 2 contextualiza el impacto del cambio climático en las ciudades, identifica sus principales retos socioambientales y de infraestructura, y destaca la importancia de avanzar con políticas de mitigación del y adaptación al cambio climático que prioricen el aprovechamiento del capital natural. La Sección 3 introduce el concepto de SBN, sus principales objetivos, y las oportunidades y desafíos mencionados a nivel teórico conceptual. La Sección 4 presenta el programa *Multifunctional Roofs* de Rotterdam como estudio de caso, y exhibe hallazgos sobre el programa basados en los testimonios de los entrevistados. Finalmente, la Sección 5 presenta conclusiones, y sintetiza las recomendaciones más importantes para continuar desarrollando las SBN como instrumento de política climática local.

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<sup>3</sup> *Green retrofit* es definido por el U.S. Green Building Council (USGBC) como:

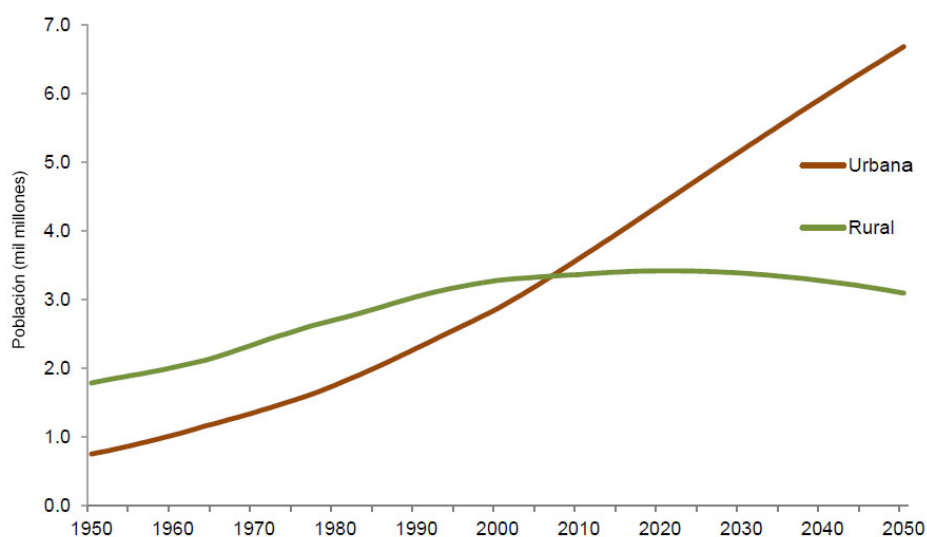
cualquier tipo de mejora en un edificio existente ocupado total o parcialmente para mejorar el rendimiento energético y ambiental, reducir el consumo de agua y mejorar el confort y la calidad del espacio en términos de luz natural, calidad del aire y ruido, todo ello de forma que resulte económicamente beneficioso para el propietario. Fuente: ([Al-Kodmany, 2014](#))

## Sección 2: Las ciudades frente al cambio climático

### 2.1 La naturaleza del problema

#### 2.1.1 El proceso de urbanización

Las Naciones Unidas (2019) define como urbanización al proceso socioeconómico que transforma el ambiente construido, convirtiendo asentamientos antes rurales en urbanos, al tiempo que se desplaza la población de las zonas rurales a las urbanas, alterando sus estructuras demográficas y sociales. Una de las principales consecuencias de la urbanización es el aumento del número, la superficie y el tamaño de la población de los asentamientos urbanos (ver Figura 1 en la que se muestra la evolución de la población urbana y rural a nivel mundial). La urbanización está determinada por la planificación espacial y urbana, así como por las inversiones públicas y privadas en edificios e infraestructura. Una proporción cada vez mayor de la actividad económica y la innovación se concentra en las ciudades, que se convierten en centros de transporte, comercio, información e innovación.



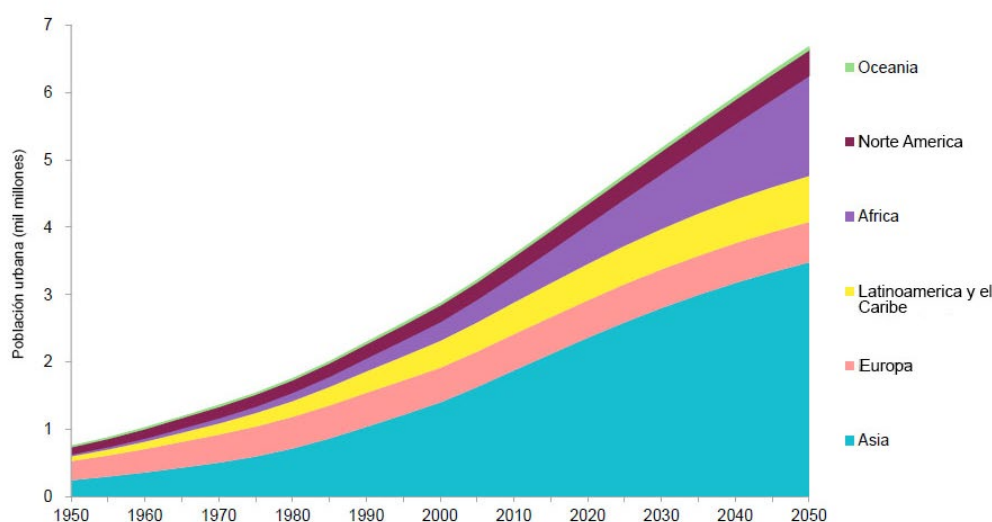
**Figura 1**

*Proyecciones sobre población urbana y rural en el mundo, 1950-2050*

Fuente – (UN, 2019)

El grado o nivel de urbanización suele expresarse como el porcentaje de población que reside en zonas urbanas. En la práctica, la urbanización se refiere tanto al aumento del porcentaje de población que reside en zonas urbanas, como al crecimiento asociado al número

de habitantes, al tamaño de las ciudades y a la superficie total ocupada por los asentamientos urbanos. Según las Naciones Unidas, menos del 2% de la superficie de la Tierra es ocupada por ciudades, y en el año 2018 ya concentraban el 55% de la población mundial. En 1950, el 30% de la población mundial era urbana, y para 2050 se prevé que el 68% de la población lo sea. Según las cifras obtenidas del reporte *World Urbanization Prospects 2018* (UN, 2019), la continua urbanización y el crecimiento global de la población mundial añadirán 2.500 millones de personas a la población urbana para 2050, el 90% de las cuales se concentrarán en Asia y África. La población urbana mundial se acerca ahora a los 4.200 millones de personas y se espera que alcance los 6.700 millones en 2050, de acuerdo con la información que se muestra en la [Figura 2](#) a continuación.



**Figura 2**

*Proyecciones sobre población urbana en el mundo según regiones geográficas, 1950-2050*

Fuente – (UN, 2019)

### 2.1.2 Las ciudades frente al cambio climático

Desde el inicio de la Revolución Industrial en el siglo XVIII, las GEI crecieron persistentemente. El abrupto freno de las actividades económicas y humanas a nivel global en 2020, como consecuencia de la pandemia de COVID-19, supuso una demostración fidedigna del impacto humano en la atmósfera (Facultad de Ciencias Biológicas UC, 4 de mayo de 2021). Las concentraciones de CO<sub>2</sub> han aumentado en un 40% desde la era preindustrial debido, en primer lugar, a las emisiones derivadas del uso de combustibles fósiles y, en segundo lugar, a

las emisiones netas derivadas del cambio de uso del suelo. Las sustancias y los procesos naturales y antropógenos que alteran el balance energético de la Tierra son impulsores del cambio climático. ([IPCC, 2013](#))

De acuerdo con UN Habitat ([UN, s.f.](#)), las ciudades consumen el 78% de la energía mundial y generan más del 60% de las emisiones de GEI. Los edificios y la construcción representan en conjunto el 36% del uso final de energía en el mundo (calefacción, refrigeración, iluminación y uso de electrodomésticos) y el 39% de las emisiones de GEI relacionadas con la energía, si se incluye la generación de energía. De mantenerse esta tendencia, las ciudades estarán expuestas a una mayor variabilidad climática y a fenómenos meteorológicos más agudos y frecuentes, como el aumento de la temperatura global, severas sequías e inundaciones, que pondrán a prueba su resiliencia y la de su infraestructura.

De acuerdo con estimaciones del Programa de las Naciones Unidas para el Medio Ambiente (UNEP, por sus siglas en inglés), la intensidad energética por metro cuadrado del sector de las edificaciones y la construcción debe mejorar en promedio un 30% hacia 2030, respecto del 2015, para poder alcanzar las metas globales establecidas en el Acuerdo de París<sup>4</sup> ([UNEP, 2017](#)). En este contexto, las acciones de *green retrofit* presentan una de las mayores oportunidades de mejora, ya que la optimización de la eficiencia energética en edificaciones existentes puede proveer hasta el 55% de la reducción de GEI necesaria para alcanzar los objetivos mencionados. ([C40, 2020](#))

### 2.1.3 Principales impactos en las ciudades

Las ciudades son, por tanto, impulsoras del cambio climático y, al mismo tiempo, están cada vez más expuestas a sus efectos. A escala mundial, se prevé que el cambio climático provoque un aumento significativo del nivel del mar y cambios en la frecuencia, la intensidad y los patrones espaciales de la temperatura, las precipitaciones y otros factores meteorológicos ([IPCC 2015](#)). Durante este siglo, los escenarios de cambio climático proyectan que las regiones urbanas tendrán que hacer frente y adaptarse a un aumento de los fenómenos extremos

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<sup>4</sup> El Acuerdo de París tiene como objetivo evitar que el incremento de la temperatura media global del planeta supere los 2°C respecto a los niveles preindustriales y busca, además, promover esfuerzos adicionales que hagan posible que el calentamiento global no supere los 1,5°C. De esta manera, el Acuerdo recoge la mayor ambición posible para reducir los riesgos y los impactos del cambio climático en todo el mundo y, al mismo tiempo, incluye todos los elementos necesarios para que se pueda alcanzar este objetivo.

En cuanto a las sendas de reducción de emisiones a medio y largo plazo, se establece la necesidad de conseguir la neutralidad de las emisiones, es decir, un equilibrio entre las emisiones y las absorciones de GEI en la segunda mitad de siglo.

Fuente - ([Gobierno de España, s.f.](#))

Ver [subsección 2.2](#) para más información sobre el Acuerdo de París.

([Rosenzweig et al. 2011<sup>a</sup>, como se citó en Kabisch et al., 2017](#)). Es probable también, que los impactos negativos de los extremos climáticos afecten a la salud humana y la infraestructura crítica, como el transporte y el suministro de agua. ([McCarthy et al. 2010; Rosenzweig et al. 2011<sup>a</sup> como se citó en Kabisch et al., 2017](#))

### 2.1.3.1 Efecto en la temperatura urbana

La evolución de las temperaturas urbanas se debe tanto a los cambios climáticos a gran escala como a la urbanización en curso ([Fujibe 2009, como se citó en Kabisch et al., 2017](#)). La temperatura urbana depende del desarrollo global, pero en general se encuentra altamente influida por fenómenos como la isla de calor urbana (UHI, por sus siglas en inglés) que se considera un problema inherente a la urbanización. Según [Taha \(1997\)](#) hay tres parámetros de la urbanización que tienen una relación directa con la UHI, 1) el aumento de las superficies oscuras, como el asfalto y el material de los tejados con un albedo bajo<sup>5</sup> y una alta admitancia<sup>6</sup>, 2) la disminución de las superficies con vegetación y las superficies abiertas permeables, como la grava o el suelo, que contribuyen a la sombra y a la evapotranspiración y 3) la liberación del calor generado por la actividad humana. Estos factores no se distribuyen por igual en toda la ciudad y, por tanto, algunas zonas experimentan el UHI en mayor grado; por ejemplo, aquellas con un alto grado de urbanización y pocos espacios verdes. ([Kabisch et al., 2017](#))

### 2.1.3.2 Efecto en la hidrología urbana

Debido al aumento del nivel del mar, y el incremento previsto de la frecuencia de las tormentas de viento y las marejadas, las inundaciones costeras se estiman que aumentarán ([Nicholls, 2004 como se citó en Kabisch et al., 2017](#)). En 2005, las pérdidas promedio sufridas por las 136 mayores ciudades costeras del mundo ascendían a unos 6.000 millones de dólares al año. Para 2050, se espera que estas pérdidas alcancen al menos a 52.000 millones de dólares anuales, y hasta 1 billón de dólares anuales si el cambio climático y la subsidencia<sup>7</sup> del terreno empeoran significativamente ([Hallegatte et al. 2013, como se citó en Browder et al., 2019](#)). Los

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<sup>5</sup> Albedo: es la radiación que refleja la superficie terrestre y la devuelve a la atmósfera.

Fuente: ([The Weather Channel, 23 de diciembre de 2017](#))

<sup>6</sup> Admitancia: es la característica que presenta una superficie de recibir calor del aire o suministrar calor hacia el aire bajo variaciones cíclicas de temperatura. En clima cálido húmedo se buscarían materiales con baja admitancia.

Fuente: ([Revista de Arquitectura, enero-diciembre de 2010](#))

<sup>7</sup> Subsidencia: hace referencia al hundimiento paulatino de la corteza terrestre, continental o submarina.

Fuente – ([Enseñanza de las Ciencias de la Tierra, 2009](#))



ecosistemas costeros como los manglares, los arrecifes de coral y las dunas de arena pueden actuar como amortiguadores frente al aumento del nivel del mar, así como contra los peligros naturales que traen consigo vientos intensos, lluvias o fuertes mareas. Sin embargo, a nivel mundial, estos ecosistemas están en peligro debido al desarrollo costero, la pesca insostenible, la contaminación marina y de cuencas hidrográficas, o el estrés térmico provocado por el cambio climático, y la intervención humana directa. ([Browder et al., 2019](#))

En las ciudades densas, las superficies impermeables<sup>8</sup> generan grandes volúmenes de escorrentía que pueden provocar inundaciones y contaminación del agua. El aumento de los eventos de alta precipitación significa que el actual sistema de drenaje urbano, que fue diseñado para un determinado nivel de población, consumo y precipitaciones, superará su capacidad con mayor frecuencia, provocando pérdidas económicas, mayores inconvenientes e incluso la pérdida de vidas humanas. ([Semadeni-Davies et al., 2008, como se citó en Kabisch et al., 2017](#))

#### 2.1.4 El riesgo de fracaso de la infraestructura gris

Tradicionalmente, las sociedades entendían que su bienestar y el desarrollo económico dependía de ecosistemas sanos ([MEA, 2005; Gartner et al., 2013, como se citó en Browder et al., 2019](#)). Sin embargo, las soluciones para la provisión de servicios básicos han sido, por ejemplo, proporcionar agua potable y segura a través de embalses, plantas de agua y plantas de tratamiento; proteger a las comunidades de inundaciones y tormentas costeras mediante la construcción de diques y malecones; asegurar el agua para riego de los cultivos mediante grandes presas y sistemas de irrigación; y el uso de tuberías y bombas para transportar las aguas pluviales fuera de las ciudades. La infraestructura gris, si bien ha desempeñado un papel importante superando los retos del desarrollo hasta la fecha, no lo ha alcanzado sin afectar los servicios de regulación previstos por los ecosistemas, y los estudios demuestran que continuar operando con este enfoque hoy no es suficiente. ([Browder et al., 2019](#))

Frente a un clima cambiante, las infraestructuras existentes enfrentan cada vez más riesgos de fracaso. Casi la mitad de la población mundial vive ya con escasez de agua, y los desastres naturales afectaron a 96 millones de personas en el año 2017 ([Burek et al., 2016; CRED, 2017, como se citó en Browder et al., 2019](#)). Siguiendo las proyecciones de crecimiento,

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<sup>8</sup> Superficies impermeables se consideran a las carreteras, las calles, las aceras, los techos y, en general, las superficies construidas con cemento o asfalto.  
Fuente – ([Salas et al., 2019](#))

en 2050 estas cifras se verán agravadas, casi el 20% de la población mundial estará en riesgo de sufrir inundaciones, y hasta 5.700 millones de personas vivirán en zonas con escasez de agua ([WWAP, 2018](#)). El aumento de temperaturas globales significa que la infraestructura debe ser más resiliente para hacer frente a sequías e inundaciones cada vez más extremas. ([Browder et al., 2019](#))

Por otra parte, con un incremento sin precedentes en la demanda de espacio para nuevos desarrollos inmobiliarios, los entornos urbanos están tornándose cada vez más densos y construidos principalmente con un enfoque de infraestructura gris. La presión que ejerce la construcción de nuevos edificios sobre el paisaje urbano significa que las superficies duras e impermeables están sustituyendo a los espacios verdes urbanos y a los hábitats naturales. ([Kabisch et al., 2017](#))

## 2.2 La necesidad de mitigación

El 12 diciembre de 2015, en la COP21 de París, las Partes de la UNFCCC alcanzaron un acuerdo histórico para combatir el cambio climático y acelerar e intensificar las acciones necesarias para perseguir un futuro sostenible con bajas emisiones de carbono a nivel mundial. El Acuerdo de París se basa en los principios de la Convención y hace que todos los países tengan una causa común para emprender esfuerzos ambiciosos para combatir el cambio climático y adaptarse a sus efectos, con un mayor soporte a los países en desarrollo mediante la provisión de medios de implementación como el financiamiento y la disponibilidad de tecnologías. Como tal, consolida una nueva etapa en el esfuerzo climático mundial.

El objetivo central del Acuerdo de París es reforzar la respuesta mundial a la amenaza del cambio climático evitando que el aumento de la temperatura mundial en este siglo supere los 2°C con respecto a los niveles preindustriales y procurando proseguir con los esfuerzos para limitar aún más el aumento de la temperatura a 1,5°C (UNFCCC, 2016). El reporte del IPCC *Climate Change and Land Report 2019* afirma que todos los escenarios que limitan el cambio climático a 1,5°C dependen en gran medida de los cambios en el uso del suelo que soporten métodos de mitigación, y faciliten la descarbonización de la economía. ([Seddon et al., 2020](#))

La gestión del entorno construido que soporta las actividades humanas es fundamental para lograr la sostenibilidad a largo plazo ([Pearce, 2017](#)). [Mata et al. \(2018\)](#) sostienen que la renovación energética de los edificios existentes es una estrategia necesaria para lograr este objetivo. En todo el ciclo de vida de un edificio, el 80% del consumo energético se produce en

la fase de uso real y no en la de construcción. Por lo tanto, una solución razonable para reducir las emisiones globales de GEI y el consumo total de energía es el *green retrofit* de los edificios existentes. En la actualidad, la mayoría de los edificios existentes sufren problemas como la degradación funcional, el elevado consumo de energía, las altas emisiones y el gran impacto ambiental negativo. Por lo tanto, resulta urgente reducir el impacto de los edificios existentes en el ambiente mediante su adaptación.

La vida útil de la mayoría de los edificios existentes es de 50 a 100 años. Por un lado, la demolición de los edificios supone un enorme desperdicio de recursos y energía, y provoca una contaminación secundaria y daños en el ambiente. Por otro lado, mediante la adaptación, se puede evitar la demolición, reduciendo así la generación de residuos de la construcción y el consumo de nuevos materiales y otros recursos de manera de promover el desarrollo sostenible de la sociedad.

Según el reporte *The Global Status Report 2017* ([UN, 2017](#)), el progreso hacia los edificios y la construcción sostenibles está produciéndose, pero las mejoras aún no están a la altura de un sector de la construcción en crecimiento y la continua demanda de servicios energéticos. Las emisiones de CO<sub>2</sub> relacionadas con los edificios han seguido aumentando en alrededor de un 1% anual desde 2010, y más de 4 millones de muertes al año son atribuibles a enfermedades derivadas de la contaminación del aire en los hogares.

Por lo tanto, para alcanzar los objetivos climáticos será necesario intensificar las políticas para impulsar el cambio y ampliar las acciones en todo el sector de los edificios y la construcción, tanto de las nuevas construcciones como los edificios existentes, considerando que casi dos tercios de la superficie edificada que existe hoy en día seguirá existiendo en 2050 ([Architecture 2030, s.f.](#)). En efecto, de acuerdo con [Architecture 2030](#):

en la actualidad, las renovaciones de edificios sólo afectan al 0,5-1% del stock de edificios anualmente {...} Es necesario aumentar considerablemente el ritmo de las renovaciones de los edificios existentes para incrementar la eficiencia energética, y la generación y adquisición de energía renovable. (s.f)

Escenarios desarrollados por la International Energy Agency, como el Beyond 2C Scenario ([IEA, 2017](#)), proponen una rápida adopción de soluciones altamente eficientes y bajas en carbono para edificios y construcción, incluyendo la aplicación rigurosa y generalizada de los códigos energéticos de los edificios, la renovación a gran escala de los edificios existentes, el despliegue de tecnologías de alto rendimiento y un cambio estratégico en términos de consumo energético por fuera del uso de combustibles fósiles en los edificios.

### 2.3 La necesidad de adaptación

Hasta ahora, la mayoría de los esfuerzos de las ciudades para responder al cambio climático se han centrado en la mitigación del cambio climático (la reducción de las emisiones de GEI) y en menor medida en la adaptación al cambio climático (estrategias a largo plazo para reducir la exposición, la susceptibilidad y mejorar la capacidad de las comunidades a los peligros), ya que estas estrategias implican adoptar un enfoque de precaución y anticipación ([Castán Broto y Bulkeley, 2013, como se citó en Kabisch et al., 2017](#)). Sin embargo, la aplicación de los planes de adaptación es urgente. Los cambios en el clima global son evidentes y los costos sociales, de infraestructura y económicos de la inacción son considerables. ([Bosello et al., 2012, como se citó en Kabisch et al., 2017](#))

La adaptación a los efectos reales o previstos del cambio climático implica una serie de medidas o acciones para reducir la vulnerabilidad de la sociedad y para mejorar la resiliencia frente a los cambios climáticos previstos. Las posibles medidas de adaptación pueden adoptar diversas formas y ser eficaces en diferentes escalas espaciales y temporales, planificadas de forma proactiva o como resultado de impulsos sociopolíticos, como nuevas normas de planificación, la demanda del mercado o incluso la presión social. ([Metz et al., 2007, como se citó en Kabisch et al., 2017](#))

### 2.4 Infraestructura resiliente

Para lograr revertir las proyecciones desfavorables y proteger a la población de las amenazas del cambio climático, es necesario que la infraestructura sea resiliente. El concepto de resiliencia se centra en la creación de sistemas que puedan soportar, adaptarse y salir aún más fortalecidos de los impactos que puedan afectar al sistema en su conjunto, incluidos los causados por el cambio climático. Rumbo a alcanzar los objetivos de desarrollo sostenible (principalmente el objetivo 9: construir infraestructuras resilientes, promover la industrialización inclusiva y sostenible y fomentar la innovación) ([UN Stats, s.f.](#)), la infraestructura debe satisfacer la seguridad hídrica, el acceso equitativo a los servicios urbanos y contribuir a la reducción del riesgo de desastres. Con esta finalidad, la combinación estratégica de infraestructura gris con infraestructura verde, conocida también como infraestructura híbrida, para potenciar su capacidad de adaptación y regeneración, podría aumentar la resiliencia y flexibilidad de los sistemas de infraestructura en un clima cambiante,

al tiempo que asegura la prestación de servicios ecosistémicos (SE) y hacen participes a las comunidades. La [Figura 3](#) compara el rendimiento de las tres clases de infraestructura (gris, verde e híbrida) y destaca la eficiencia de la infraestructura híbrida en aspectos tales como, su viabilidad en el contexto urbano, confiabilidad o fiabilidad, durabilidad, resiliencia, entre otras.

Aspecto	Infraestructura Gris	Infraestructura Verde	Enfoques Híbridos
Viabilidad en el contexto urbano	<b>Alto</b> (ocupa una superficie reducida)	<b>Bajo</b> (pero muy importante y viable en las zonas urbanas peri y regionales)	<b>Alto</b>
Confiabilidad	<b>Medio</b> Estas medidas no eliminan completamente el riesgo Se ha reportado un éxito mixto	<b>Medio</b> Se ha comprobado el rol, pero algunos estudios conducen a resultados contradictorios debido a los múltiples factores que juegan un papel en la determinación de la magnitud de un peligro.  Depende en gran medida del tipo de peligro.	<b>Alto</b>
Estrategia de No Arrepentimiento (no-regret)	Generalmente, son medidas de alto arrepentimiento	Medidas de bajo arrepentimiento	<b>Medio</b>
Durabilidad o resiliencia a largo plazo	Duradero, pero puede resultar en maladaptación	<b>Medio</b> Puede verse afectado por peligros, y los ecosistemas de las ciudades y sus alrededores suelen estar muy transformados y a menudo degradados.	<b>Medio-Alto</b>
Reversibilidad y Flexibilidad	Poca y no son reversibles	<b>Medio</b> Puede ser de alta o baja reversibilidad según el tipo	<b>Medio</b>
Costo-efectividad	<b>Bajo</b> Costes de construcción elevados Depreciación del valor con el tiempo	<b>Alto</b> Las inversiones en infraestructura verde pueden ser mucho menos costosas a corto y largo plazo que las de infraestructura gris.	<b>Medio-Alto</b>
Conservación de la Biodiversidad	<b>Ninguna</b>	<b>Alto</b> Las infraestructuras verdes proporcionan un hábitat natural para las especies.	<b>Medio</b>
Otros co-beneficios	<b>Bajo</b> (pero existen algunos ejemplos de medio a alto, como el suministro de agua y energía proporcionado por los diques fluviales diseñados inicialmente para controlar las inundaciones)	<b>Alto</b> La vegetación proporciona a las comunidades locales servicios ecosistémicos fundamentales, como los que mejoran los medios de vida, la seguridad alimentaria y el ocio, y que pueden aumentar su resiliencia a los fenómenos extremos a largo plazo. De amplia aplicación.	<b>Medio</b> Contribuye a proporcionar otros servicios, como el control de la contaminación y el ocio, pero dependerá del componente de infraestructura verde del enfoque híbrido.

**Figura 3**

*Rendimientos de la infraestructura gris, verde e híbrida para distintos aspectos.*

Fuente – ([Kabisch et al., 2017](#))

El concepto de “servicios ecosistémicos” promovido por Millennium Ecosystem Assessment a principios de la década de 2000, buscaba comprender el valor de la naturaleza

para la sociedad y las múltiples maneras en que la humanidad depende de los servicios que prestan los ecosistemas ([ARUP, 2014](#)). Los SE pueden definirse como los procesos mediante los cuales el ambiente produce recursos utilizados por el hombre, como aire, agua, suelos productivos, alimentos y materiales. Un creciente reconocimiento del valor de los SE y los vastos beneficios socioeconómicos y socioculturales provistos por los sistemas naturales, ha impulsado un cambio en el discurso de la planificación y la política urbana, con el objetivo de integrar estas consideraciones en los procesos de toma de decisiones.

Los ecosistemas y sus servicios pueden proporcionar múltiples funciones regulatorias, como la regulación de las inundaciones costeras y superficiales, la regulación de la temperatura y el control de la erosión. En entornos sanos, los ecosistemas no experimentan estrictamente las catástrofes del mismo modo que son consideradas en el contexto humano. Cuando se habla de los riesgos para los ecosistemas, los ambientalistas tienden a hacerlo en términos de perturbación ([Attiwill 1994; Swetnam y Betancourt, 2010, como se citó en Kabisch et al., 2017](#)). De hecho, la variación climática (por ejemplo, extremos climáticos) y otras perturbaciones han formado parte del funcionamiento de los ecosistemas naturales. Sin embargo, pueden producirse impactos importantes en el ecosistema si las amenazas afectan a un ecosistema degradado y menos diverso como suele ocurrir en las ciudades y sus alrededores ([Alberti, 2005, como se citó en Kabisch et al., 2017](#)). Esto podría traducirse en una disminución temporal o incluso permanente del suministro de los SE necesarios para las ciudades y las zonas periurbanas.

Por tanto, la mitigación del y adaptación al cambio climático en las ciudades y sus alrededores debe tener en cuenta los efectos de la interacción de las infraestructuras construidas y el cambio climático en los componentes ecológicos o biofísicos de los ecosistemas locales y regionales. En la adaptación al cambio climático y la reducción del riesgo de catástrofes, la salud y la función de los ecosistemas urbanos son primordiales para proporcionar servicios eficaces de regulación del clima. En esta línea, muchos autores reconocen que la introducción de Soluciones Basadas en la Naturaleza en la ciudad es un mecanismo clave para aliviar las presiones urbanas y lograr beneficios en múltiples aspectos.

## Sección 3: Soluciones Basadas en la Naturaleza

### 3.1 Introducción a las SBN

Una de las estrategias que viene ganando más fuerza y difusión a nivel global se relaciona con las prácticas inspiradas, soportadas o reproducidas de la naturaleza. Es en favor de alentar esta clase de enfoques que las SBN están emergiendo como: “Acciones para proteger, gestionar de forma sostenible y restaurar ecosistemas naturales o modificados que aborden los desafíos sociales de forma eficaz y adaptativa, proporcionando simultáneamente el bienestar humano y los beneficios de la biodiversidad.” ([Cohen-Shacham et al., 2016](#)) En este sentido, las SBN se destacan como herramientas valiosas para la adaptación de la infraestructura, ya que ofrecen soluciones costo-efectivas a largo plazo, en comparación a los métodos convencionales, al combinar múltiples funciones y beneficios que disminuyen la demanda de recursos mediante el uso eficiente de energía y materiales. ([EU, 2015](#))

Las SBN pueden ser usadas para complementar, sustituir o reforzar la infraestructura gris tradicional, a la vez que provee una mayor resiliencia climática y una serie de co-beneficios ([BID, 2020](#)). Entre los ya comprobados se incluyen, la reducción del riesgo de inundaciones superficiales, de la contaminación del agua y del aire, la mitigación de las UHI, el aumento de la eficiencia de los recursos, así como la provisión de áreas para recreación y la agricultura urbana. Dada su naturaleza, una de las principales ventajas es la baja huella de carbono en su construcción y funcionamiento. Entre otros beneficios, se pueden mencionar el aumento en el valor económico y estético de las propiedades, la creación de empleo, la reducción de los costos de funcionamiento de los edificios y la mejora en la salud y el bienestar de las personas. ([Bozovic et al., 2017](#))

#### 3.1.1 Orígenes

El concepto de SBN fue introducido a finales de la década de 2000 por el Banco Mundial ([MacKinnon et al., 2008, como se citó en IUCN, 2016](#)) y la Unión Internacional para la Conservación de la Naturaleza (IUCN, por sus siglas en inglés) para poner de manifiesto la importancia de la conservación de la biodiversidad para la mitigación y adaptación al cambio climático. La búsqueda de soluciones que trabajasen en conjunto con los ecosistemas, en lugar de depender de las intervenciones convencionales de ingeniería, para adaptarse y mitigar los efectos del cambio climático, al tiempo que se priorizan los medios de vida sostenibles y se



protegen los ecosistemas naturales y la biodiversidad ([Mittermeier et al., 2008 como se citó en IUCN, 2016](#)), dio lugar a la introducción de este concepto en el ámbito global entre los sectores de conservación y desarrollo, antes reconocidos por sus objetivos contradictorios frente a estas cuestiones.

La IUCN sugirió ocho principios que constituyen el núcleo de este concepto:

1. Adoptan normas y principios de conservación de la naturaleza.
2. Pueden aplicarse solas o de forma integrada con otras soluciones (por ejemplo, soluciones tecnológicas y soluciones de ingeniería)
3. Están determinadas por los contextos naturales específicos del lugar y los contextos culturales que incluyen conocimientos tradicionales, locales y científicos.
4. Producen beneficios sociales de forma justa y equitativa, de manera que se promueve la transparencia y una amplia participación.
5. Mantienen la diversidad biológica y cultural, y la capacidad de los ecosistemas de evolucionar en el tiempo.
6. Se aplican a escala de paisaje.
7. Reconocen y abordan las compensaciones (*trade-offs*) entre la producción de unos pocos beneficios económicos inmediatos para el desarrollo, y las opciones futuras para la producción de toda la gama de servicios de los ecosistemas.
8. Son parte integral del diseño general de las políticas, y de las medidas o acciones, para abordar un reto específico. ([IUCN, 2016, pág. 6](#))

### 3.1.2 Principales características

Las SBN son acciones que se inspiran, apoyan o reproducen el funcionamiento de la naturaleza, y procuran ayudar a las sociedades a afrontar de forma sostenible diversos retos ambientales, sociales y económicos. Algunas implican el uso y la mejora de las soluciones naturales existentes para afrontar los desafíos, mientras que otras exploran soluciones más novedosas, por ejemplo, imitando cómo los organismos vivos y las comunidades no humanas hacen frente a los extremos ambientales. Las SBN utilizan las características y los complejos procesos sistémicos de la naturaleza, como su capacidad para almacenar carbono y regular el flujo de agua, con el fin de lograr los resultados deseados, como la reducción del riesgo de



catástrofes, la mejora del bienestar humano y un crecimiento socialmente inclusivo. Por lo tanto, mantener y mejorar el capital natural es de vital importancia, ya que constituye la base para aplicar esta clase de soluciones. (EU, 2015)

Si bien el concepto de "solución basada en la naturaleza" se apoya en otros conceptos análogos (Ver subsección 3.1.3: Otros conceptos relacionados a las SBN), este presenta un conjunto de características distintivas:

Multifuncionales	Se caracterizan por producir múltiples beneficios para la salud, la economía, la sociedad y el ambiente, resultando soluciones más eficientes y rentables que los enfoques mono-funcionales más tradicionales.
Adaptables	Se caracterizan por ser flexibles y regenerativas, lo que les permite enfrentar diferentes fenómenos y acomodarse a las condiciones cambiantes.
Conservan y añaden al capital natural	Mediante la restauración y conservación de los ecosistemas, se prioriza la salud y la disponibilidad de los servicios ecosistémicos.
Favorecen a la resiliencia de los sistemas/paisajes	Las tres características anteriores contribuyen al desarrollo de la resiliencia de un sistema, es decir, la capacidad de hacer frente y seguir cumpliendo la función deseada durante y luego de un evento.

En la práctica, las SBN están orientadas a la acción y hacen hincapié en los enfoques integradores, con participación de los tomadores de decisión y hacedores de política para la creación y gestión de proyectos. Por lo tanto, el concepto se distingue de la conservación más tradicional y descendente (*top-down*), por ejemplo, al priorizar la búsqueda de soluciones que pretenden satisfacer las necesidades de una amplia gama de partes interesadas, alentando el co-diseño, co-creación y co-gestión.

La EC (2015) adoptó el concepto de SBN para su programa de investigación e innovación *Horizon 2020* haciendo foco en las áreas urbanas; a través del cual, se buscan soluciones sistémicas para el desarrollo y la aplicación de las SBN (Somarakis et al., 2019), lo cual requiere la atención a los marcos normativos, los sistemas de planificación e instrumentos económicos. Este último punto ofrece un enfoque holístico, que diferencia a las SBN de otros conceptos, centrándose en la vinculación de los beneficios ambientales, sociales y económicos, manteniendo una propuesta atractiva para las partes interesadas, los responsables políticos y el entorno empresarial.

### 3.1.3 Otros conceptos relacionados a las SBN

[Stephan Pauleit y sus coautores \(2017\)](#) analizan las características de las SBN y su relación con otros enfoques en su trabajo *Nature-Based Solutions and Climate Change – Four Shades of Green*. Se centran en la comparación de conceptos y sus enfoques específicos, como la adaptación basada en los ecosistemas (EbA, por sus siglas en inglés), la infraestructura verde urbana (UGI, por sus siglas en inglés), y, más en general, el concepto de servicios ecosistémicos (SE) y sus respectivos vínculos con el concepto de SBN.

Mientras la EbA se ocupa específicamente de la adaptación al cambio climático mediante el uso de la naturaleza, su enfoque principal está relacionado con la gestión sostenible, la conservación y la restauración de los ecosistemas con el objetivo de proporcionar servicios que apoyen la adaptación de los seres humanos al cambio climático ([CDB, 2009](#), [Munang et al., 2013](#), como se citó en [Pauleit et al., 2017](#)). Como enfoque de planificación, la UGI puede proporcionar una orientación estratégica para la integración de las SBN en el desarrollo de redes de espacios verdes multifuncionales a diversas escalas, y está fuertemente vinculada a la ordenación del territorio, la arquitectura del paisaje y la ecología del paisaje ([Fletcher et al., 2014](#), como se citó en [Pauleit et al., 2017](#)). Por último, los SE son una categorización de la amplia gama de "beneficios que las personas obtienen de los ecosistemas" ([MEA, 2005: V](#), como se citó en [Pauleit et al., 2017](#)). Los SE pueden apoyar la elaboración de políticas para priorizar estrategias y acciones que maximicen los beneficios de las SBN.

En comparación con los demás conceptos, los autores consideran las SBN como un concepto paraguas que abarca características de otros enfoques, pero con una perspectiva distintiva en el despliegue de las acciones en la práctica. Aun así, sostienen que la EbA y la UGI deben considerarse conceptos complementarios y que se refuerzan mutuamente en relación con las SBN. El concepto de SBN puede tender puentes entre la investigación, la sociedad y la práctica para encontrar un entendimiento común y una mejor comunicación de los beneficios de la naturaleza. Una conclusión de los autores es que sigue siendo necesario operativizar los conceptos para llegar de la sistematización a la aplicación.

Esta investigación sostiene que los cuatro conceptos son de amplio alcance, y se encuentran estrechamente interrelacionados, en parte se solapan y en parte se complementan. Si bien el concepto de SBN es el más reciente, es importante destacar que los cuatro pretenden integrar mejor la conservación de la naturaleza en el desarrollo urbano. Además, enfatizan la necesidad de la participación de la comunidad en la gestión del capital natural y, para ello, abogan por la inclusión de un amplio abanico de actores relevantes en la toma de decisiones.

## 3.2 Oportunidades y desafíos

Según el punto de vista de [Bozovic et al. \(2017\)](#), en la actualidad no se aprovechan al máximo las SBN; el enfoque mono-funcional que se les da a estas prácticas, por ejemplo, para dar sombra o detener el escurrimiento de las aguas pluviales, o simplemente por su valor estético, lo considera un desaprovechamiento de los diversos beneficios a las múltiples partes interesadas. [Shahryar Ershad Sarabi et al. \(2019\)](#) remarca el potencial de las SBN para transformar el concepto de "naturaleza urbana" de una barrera real o percibida para el desarrollo socioeconómico sostenible e inclusivo, a un elemento necesario de la planificación y ejecución del desarrollo.

### 3.2.1 Oportunidades y beneficios

Las SBN ofrecen la oportunidad de conscientemente proporcionar múltiples beneficios a las personas que invierten, residen, trabajan o pasan su tiempo en un paisaje determinado. Es importante destacar que la multifuncionalidad, es decir, la capacidad de producir varios servicios simultáneamente en el mismo sitio es, probablemente, el atributo más importante de las SBN en comparación con la infraestructura gris. ([Somarakis et al., 2019](#))

Al analizar los beneficios asociados al uso de SBN hay que tener en cuenta el proyecto/iniciativa específica que se quiere implementar. Cada acción posee varias dimensiones (espaciales, temporales, ambientales, sociales, jurisdiccionales, culturales y económicas) con varios aspectos diferenciales y niveles a considerar. Un ejemplo de los posibles niveles de consideración de los aspectos espaciales puede ser, edificio, distrito, municipio, región; y un ejemplo de los niveles de la escala social podría ser, el individuo, la familia, el grupo y/o una población más amplia.

Esta investigación se vale de la categorización utilizada por el proyecto *thinknature* (perteneciente al programa *Horizon 2020*) ([Somarakis et al., 2019](#)) para referirse a los principales actores involucrados y los potenciales beneficios de las SBN a escala *fin*<sup>9</sup>, local y regional.

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<sup>9</sup> Palabra original en inglés – “Fine”

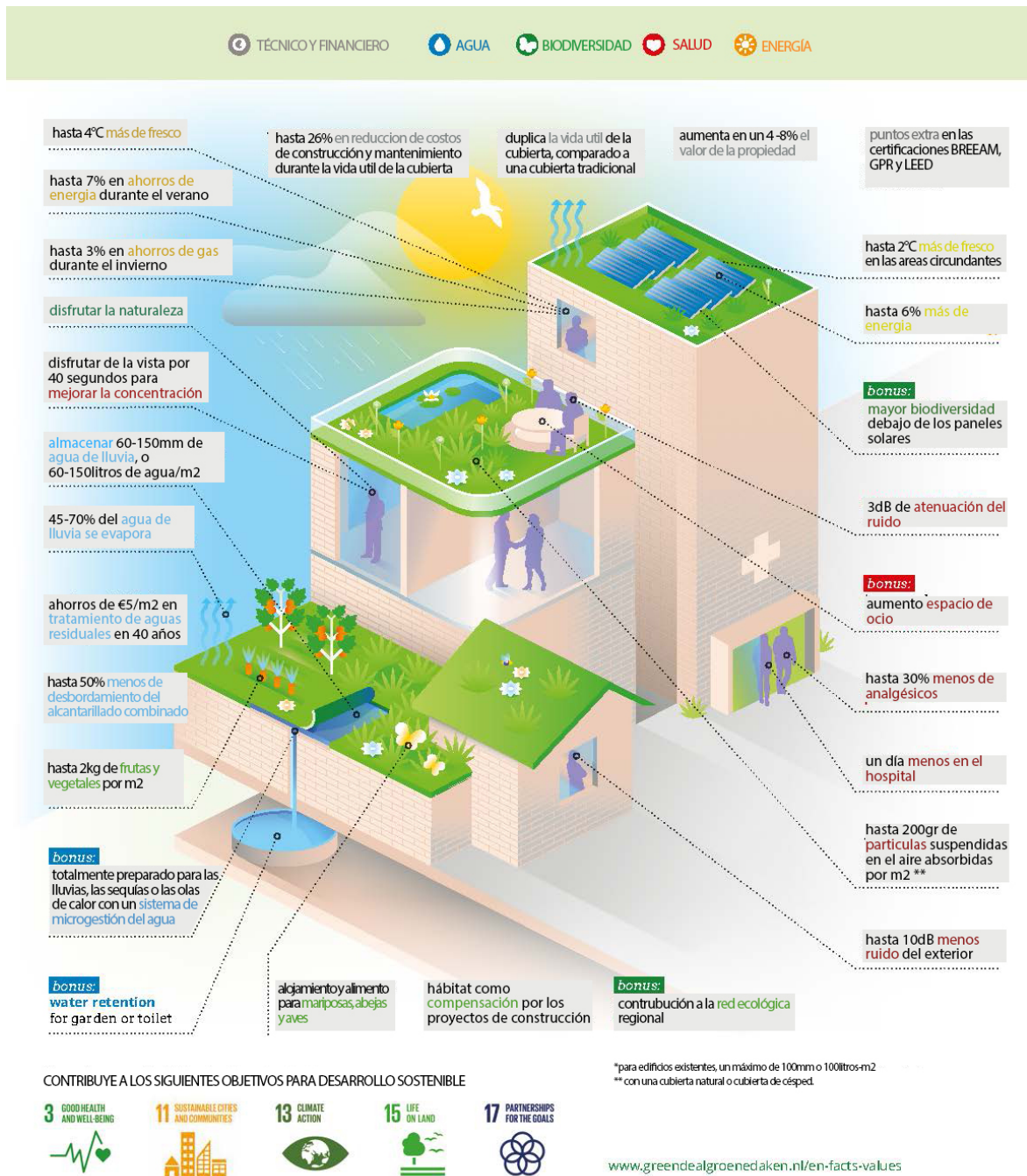
### 3.2.1.1 Escala fina

Los actores en el nivel fino constituyen la categoría más diversa (ciudadanos, propietarios individuales, inquilinos, organizaciones vecinales, etc.), y son los principales beneficiarios de las SBN en las ciudades. El papel de este grupo también varía en los distintos casos, desde los usuarios finales con bajo nivel de involucramiento, hasta los iniciadores de propuestas, por ejemplo, a través de iniciativas comunitarias, con mayor poder de decisión sobre la planificación y ejecución de las SBN. Los actores de la escala fina aportan conocimientos y experiencias contextuales esenciales a las acciones de gestión. Este grupo de actores suele actuar en el nivel de parcelas o elementos individuales de las SBN, como patios, jardines, parques barriales, cubiertas y muros verdes, así como árboles, elementos acuáticos y plantaciones comestibles. ([Faehnle et al., 2014](#); [Mesimaki et al., 2017](#); [2019, como se citó en Somarakis et al., 2019](#))

El reverdecimiento a este nivel puede contribuir a la mitigación de las UHI, a la mejora en la calidad del aire y el control del ruido, a la reducción del riesgo de inundaciones por desbordamientos de desagües y al consumo eficiente de energía en los edificios. Uno de los aciertos más evidentes de integrar espacio verde al ámbito urbano, por ejemplo, a través de la incorporación de vegetación en las superficies de los edificios, se explica por la relación activa y permanente entre el edificio y el clima. A través de la transpiración de las hojas, el aire circundante se enfría, reduciendo la temperatura de la superficie del suelo y disminuyendo el flujo de calor a través del techo. El entorno también se calienta menos porque se retiene menos calor del sol que con una cubierta negra. Si la mitad de las cubiertas fueran verdes, el efecto UHI se reduciría en 2°C. ([E. Oberndorfer et al., 2007, como se citó en Green Deal Groene Daken, s.f.](#))

Según algunos autores, los techos vegetales son potenciales ahorradores de energía, pero el grado de efectividad no está determinado claramente hasta el momento. El impacto depende en gran medida de las condiciones climáticas y del nivel de aislamiento de la cubierta subyacente. En su mayoría, las cubiertas vegetales tienen muy poco impacto en el consumo de energía de los edificios nuevos con altos niveles de aislamiento en la cubierta. Sin embargo, algunas aplicaciones de *green retrofit* utilizando las SBN pueden suponer un ahorro nada despreciable tanto de aire acondicionado como de calefacción en edificaciones existentes. De acuerdo con el análisis de [Kantor \(2017\)](#), los ahorros también son percibidos en la durabilidad de una cubierta vegetal (40-50 años) frente a una convencional (20-25 años). Mientras la radiación UV degenera la capa superior de la cubierta tradicional, esto no ocurre con un tejado

verde. Existen adicionalmente otros beneficios de las cubiertas verdes y azules como se ilustra en la Figura 4 a continuación.



**Figura 4**  
 Beneficios de las cubiertas verdes y azules.  
 Fuente – (Green Deal Groene Daken, s.f.)

En cuanto a la dimensión sociocultural, el reverdecimiento puntual permite un acceso fácil y equitativo a la naturaleza, que es una cuestión básica de igualdad, bienestar y salud. Cada vez existen más pruebas que demuestran que los espacios verdes urbanos pueden ser equigénicos, es decir, que los beneficios para la salud relacionados con el acceso a los espacios verdes pueden ser más fuertes entre los grupos vulnerables ([Mitchell et al., 2015, como se citó en Kabisch et al., 2017](#)). La Dra. Cathy Jordan, especialista en neuropsicología pediátrica, explica que, aunque la naturaleza puede ser buena para todos los niños, es especialmente beneficiosa para aquellos que pueden correr el riesgo de tener peores resultados sanitarios, mentales, sociales o educativos como consecuencia de factores asociados a la limitación de recursos económicos. ([Children & Nature Network, 2020](#))

### 3.2.1.2 Escala local

Los actores de nivel local o meso trabajan a nivel de la ciudad, e incluyen departamentos municipales, juntas de agua y actores locales similares ([Ershad Sarabi et al., 2019](#)). El papel de los actores en este nivel puede variar en diferentes contextos, desde los iniciadores de las SBN, hasta las funciones de control, supervisión y apoyo. Este grupo de actores es esencial en este contexto, principalmente, por su papel en la provisión del marco institucional necesario y en la provisión de apoyo financiero para el desarrollo de las SBN.

Al actuar sobre escala local es posible afectar positivamente la gestión de recursos de la ciudad. El uso de SBN sobre la gestión de agua urbana pueden disminuir el riesgo de inundaciones y mejorar la calidad del agua. Si bien las soluciones de gestión de las aguas pluviales a menudo pueden aplicarse a escala fina, un enfoque a esta escala, por ejemplo, actuando sobre la cuenca hidrográfica, resulta más eficiente para reducir los picos de escorrentía y el riesgo de inundaciones ([Davis y Naumann, 2017, como se citó en Kabisch et al., 2017](#)); además de lograr un sistema de gestión sostenible de las aguas pluviales urbanas. Una solución sostenible consiste en utilizar sistemas naturales para frenar, retener y amortiguar las aguas pluviales y de tormenta, y permitir que se infiltren de forma natural en los cursos de agua. Esto significa que en las zonas urbanas es preciso un mayor equilibrio entre las zonas de vegetación inundable y las superficies permeables para sustituir el hormigón impermeable, el asfalto o las zonas cubiertas. La sustitución de pavimento por jardines de lluvia,<sup>10</sup> como se realizó en la

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<sup>10</sup> En inglés *rain gardens*.



escuela Mt. Tabor Middle School en Portland, es un ejemplo de cómo el drenaje urbano sostenible puede diseñarse para que sea fácil de gestionar, requiera poca o ninguna aportación de energía y sea atractivo desde el punto de vista ambiental y estético. ([Essex County Council, 2014](#))

El uso de cubiertas vegetales, especialmente sobre las grandes cubiertas de los edificios comerciales e institucionales, y en aquellas áreas que no tienen espacio adecuado en el suelo para acomodar fácilmente otros métodos de retención de agua, también ayudan a controlar los impactos de las inundaciones, al reducir el volumen y la tasa de escurrimiento de las aguas pluviales. Además de controlar los impactos de las inundaciones y la calidad del agua en zonas urbanas, ayudan a las cuencas que drenan a los arroyos y otros cuerpos de agua naturales donde el escurrimiento urbano incontrolado puede conducir a la erosión de las orillas de los arroyos y a la degradación de los canales.

En la actualidad, una base de datos cada vez más sólida demuestra el impacto positivo que el acceso a un paisaje de buena calidad tiene sobre la salud y el bienestar de las personas y los efectos negativos de su ausencia. Los árboles y la vegetación urbanos proporcionan servicios de regulación del clima, ya que mitigan el efecto UHI a través de la evapotranspiración y el sombreado, por lo que pueden ayudar a prevenir la morbilidad y la mortalidad relacionadas con el calor ([Chen et al., 2014, como se citó en Kabisch et al., 2017](#)). La literatura señala que el efecto UHI es más significativo en las zonas de alta densidad, con superficies impermeables y baja proporción de espacios verdes ([Oke, 1973; Rizwan et al., 2008, como se citó en Kabisch et al., 2017](#)), mientras que los parques son, en promedio, 0,94K más frescos que las zonas urbanas de referencia durante el día. ([Bowler et al., 2010, como se citó en Kabisch et al., 2017](#))

Otro beneficio de las áreas verdes urbanas y de la rehabilitación de espacios públicos es que proporcionan lugares vitales para la recreación y el ejercicio físico, a la vez que fomentan la relajación, reduciendo la sensación de estrés y mejorando la salud física y mental de las personas. Estudios demuestran que el contacto con la naturaleza ayuda a las personas a recuperarse más rápidamente de las enfermedades, reduciendo las muertes entre 2 y 6 de cada 1.000 entre aquellas personas con estilos de vida más saludables y al aire libre. El uso de SBN, además de estimular la actividad física y promover la cohesión social, supone un beneficio económico considerable. Un informe de la Comisión Forestal del Reino Unido afirma que reducir permanente el 1% de la población sedentaria del Reino Unido resulta en una ganancia económica de hasta £1.440 millones al año, lo que equivale a £800 por persona, en beneficios sociales y en la reducción de los riesgos para la salud. ([Forest Research, 2010](#))

### 3.2.1.3 Escala regional

La implementación de SBN a escala regional se refiere a un proceso de transformación espacial resultante de la expansión de la naturaleza y la restauración del funcionamiento ambiental en los entornos humanos. Según la revisión anual de la UNDRR ([UNISDR, 2015, como se citó en Somarakis et al., 2019](#)), el 87% de las catástrofes naturales en Europa se deben a los efectos negativos del cambio climático, junto con la degradación del entorno natural. Aproximadamente el 60% de todos los servicios de los ecosistemas y hasta el 70% de los servicios de regulación se degradan o se utilizan de forma insostenible ([MEA, 2005, como se citó en Somarakis et al., 2019](#)). Este hecho está relacionado con una serie de actividades humanas, como la sobreexplotación de los recursos o una demanda de los bienes de los ecosistemas superior a la que se puede sostener; los cambios en el uso y la cubierta del suelo, las especies exóticas invasoras y la contaminación.

En este contexto, la presencia de actores involucrados a nivel nacional y regional, mediante la provisión de un contexto institucional eficiente, es necesaria para optimizar la restauración, la distribución equitativa y la gobernanza de los ecosistemas urbanos y periurbanos. En el caso del río Elba y sus afluentes, donde las llanuras de inundación han sido cultivadas durante siglos, se calcula que el 80% de su superficie de inundación está desconectada del río por diques, resultando en severas inundaciones de los territorios aledaños. La restauración y reconexión de la llanura de inundación y la relocalización de diques ([Opperman, 2019](#)), tuvo un beneficio económico total de €1.200 millones producto de la reducción del riesgo de inundación de áreas adyacentes y una relación costo-beneficio de 1:3 ([EU, 2015](#)). En este sentido, la reparación de ecosistemas terrestres degradados, como praderas, tierras de cultivo y bosques, así como antiguos emplazamientos industriales y terrenos baldíos, permite monetizar el valor de un ecosistema urbano sano.

El uso de SBN como estrategia de renaturalización, permite restablecer los biotopos naturales mediante la construcción de corredores entre los ecosistemas fragmentados, mejorar las condiciones de vida de las especies silvestres y aumentar el secuestro de carbono. En los últimos 30 años, los ecosistemas terrestres y de agua dulce han almacenado aproximadamente una cuarta parte de las emisiones de CO<sub>2</sub> generadas por el hombre. Aumentar el secuestro de carbono es una de las principales oportunidades para mitigar el cambio climático. Este reto puede abordarse con métodos que aumenten la biomasa de los organismos vivos, así como con una serie de nuevas SBN, como la bio-secuestación, es decir, el uso de organismos vivos como almacenes naturales de carbono. Por lo tanto, la preservación de las especies originales es una



necesidad urgente, ya que la rápida disminución de la biodiversidad amenaza a los ecosistemas y a las sociedades humanas en todo el mundo. ([Somarakis et al., 2019](#))

### 3.2.2 Desafíos, barreras y limitaciones

La implementación de las SBN tiene lugar en sistemas socioambientales complejos, en donde los distintos elementos están muy interrelacionados ([McPhearson et al., 2016, como se citó en Ershad Sarabi et al., 2020](#)). Las barreras a la aplicación de las SBN tampoco son mutuamente excluyentes, lo que implica que las políticas eficaces deben reconocer las interdependencias entre ellos.

Por lo tanto, la identificación y comprensión exhaustiva de las barreras para la implementación de las SBN es vital para su éxito. [Shahryar Sarabi et al. \(2020\)](#) identifica al menos 15 barreras en su análisis sobre las relaciones e interdependencias para la implementación de las SBN, que deben ser consideradas en el diseño de las políticas que promuevan este tipo de mecanismos para abordarlas a través de la profunda comprensión de los factores subyacentes y sus causalidades.

#### Barreas Políticas e Institucionales

1. Falta de voluntad política y de compromiso a largo plazo.
2. Falta de sentido de la urgencia entre los responsables de política.
3. Aversión al riesgo y resistencia al cambio.
4. Mentalidad de silo
5. Falta de alineación entre los planes a corto plazo y los objetivos a largo plazo.
6. Falta de marcos políticos y jurídicos de apoyo.
7. Falta de recursos financieros disponibles.
8. Complejidad de la propiedad<sup>11</sup>

#### Barreras Socio-institucionales

9. Falta de concientización y apoyo de los ciudadanos.
10. Falta de normas de diseño y directrices para el mantenimiento y la supervisión.
11. Falta de agentes de conocimiento cualificados y de programas de formación.
12. Incertidumbre sobre la funcionalidad y el rendimiento.
13. Percepción de un costo elevado.

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<sup>11</sup> En inglés *ownership*

14. Falta de incentivos financieros.

15. Limitaciones de espacio.

### 3.2.2.1 Barreras políticas e institucionales

Las SBN se distinguen de otras soluciones por ser multifuncionales y, por ello, requieren métodos de planificación intersectoriales que contemplen los diversos intereses de todos los departamentos que se vean afectados por ellas. Al mismo tiempo, su aplicación puede encontrarse limitada por estructuras de poder dominantes que pueden dificultar la adopción de nuevas iniciativas. Se denomina "dependencia del camino"<sup>12</sup> a la actitud de los responsables de la toma de decisiones de optar por experiencias pasadas o conocidas que, a menudo, conduce a la resistencia al cambio. Los agentes de política más conservadores usualmente utilizan infraestructura gris para afrontar los retos y mejorar las zonas urbanas con el fin de estimular el crecimiento económico. Cambiar la conducta de los actores hacia las SBN puede ser un proceso difícil, y romper la "dependencia del camino" requiere establece nuevas prioridades y fomentar el cambio de comportamiento individual y social.

De lo anterior se deriva otra barrera institucional que dificulta la coordinación e integración política, denominada "silos sectoriales" o fragmentación institucional. En concreto, se refiere a los distintos departamentos que suelen trabajar de acuerdo con su propia visión, marcos legales y procedimientos. Dado el enfoque transversal que demandan las SBN, la desconexión entre las distintas áreas de investigación, desarrollo y aplicación de políticas resulta en el desconocimiento sobre las discusiones y los datos disponibles, y refuerza la dispersión de responsabilidades entre los organismos, dificultando la posibilidad de articular un proceso integral de planificación y gestión.

La falta de un marco normativo que contemple los nuevos enfoques basados en la naturaleza también constituye una limitante para su diseño e implementación. La normativa vigente, que se desarrolló a partir de infraestructura gris como la principal, o única, opción disponible para abordar determinados retos, presenta vacíos sobre el diseño y aplicación de las SBN. En otros casos, el principio de protección de los ecosistemas puede no sustentar la normativa, o la legislación puede no abarcar todos los componentes ambientales. En ocasiones, incluso a pesar de las normativas y políticas adecuadas, la naturaleza dinámica de las SBN

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<sup>12</sup> En inglés *path dependency*

genera incertidumbre alrededor de su rendimiento y eficiencia, lo que limita su adopción frente a otras soluciones con resultados predecibles.

En este sentido, las oportunidades de financiación específicas para facilitar la aplicación de las SBN también se ven afectadas por la incertidumbre ya mencionada. Al tratarse de innovaciones relacionadas con sistemas socioambientales complejos, es necesario contar con información exhaustiva sobre su funcionamiento. Sin embargo, la escasez de pruebas sobre la eficiencia de las SBN en las diferentes escalas espaciales y temporales genera desconfianza, especialmente entre los agentes de financiación. Asimismo, muchos de los beneficios asociados a las SBN sólo pueden obtenerse a largo plazo, mientras que los planes de financiación tienden a ser a corto plazo, principalmente en las economías en desarrollo donde los mercados financieros son menos profundos. La dependencia exclusiva de los recursos gubernamentales y municipales para financiar las soluciones ejerce una gran presión sobre estas instituciones, por ejemplo, sobre los municipios que tienen recursos y autonomía limitados para decidir cómo asignar los gastos, y pone de manifiesto la necesidad crítica de explorar más las oportunidades económicas relacionadas con las SBN para fomentar la inversión privada.

### 3.2.2.2 Barreras socio-institucionales

Hasta la fecha, el conjunto de conocimientos sobre la correcta aplicación y mantenimiento de las SBN sigue siendo limitado, y afecta negativamente al nivel de aceptación por parte de la sociedad. Aunque hay varios estudios que demuestran que las SBN suelen ser más costo-efectivas que la infraestructura gris, una percepción común es que la implementación y, especialmente, el mantenimiento de las SBN implica un costo más elevado en comparación a soluciones más tradicionales. En cualquier caso, la percepción de los altos costos y la falta de soluciones técnicamente viables para abordar múltiples desafíos son una barrera para la adopción de las SBN, que precisa de la recolección sistemática de evidencia sobre su rendimiento y del desarrollo de tecnologías alternativas que sean competitivas en el mercado. Contar con una base de datos ampliada afectará positivamente en la oferta de financiación disponible e impulsará un mercado movilizado por la demanda de una línea de negocio diferente a la existente.

Generar una demanda sobre las SBN requiere, como primera medida, del desarrollo de confianza entre los grupos de interés, de la reformulación de procesos que incluyan prioridades compartidas que conduzcan a mantener un objetivo común en el largo plazo, y de flexibilidad para acomodar los cambios dentro del ámbito de la planificación. Sobre este punto, Kabisch et

al. ([2016, como se citó en Kabisch et al., 2017](#)) reafirma que el empleo de enfoques colaborativos de gobernanza para promover la cooperación entre los actores de decisión y los ciudadanos, empresas y sociedad civil, convirtiendo sus demandas en acción, puede ser un instrumento prometedor para reducir las barreras de implementación de las SBN. Sin embargo, no hay que pasar por alto que la participación ciudadana en la planificación urbana y la gestión de los ecosistemas puede requerir de tiempo y fondos, que limitan la aplicación de métodos colaborativos en varias esferas y niveles de gobernanza.

Bajo estas condiciones, algunas ciudades, sobre todo europeas, intentan comprender las motivaciones e intereses individuales para desarrollar políticas que generen mayor aceptación de las SBN. Si bien se está avanzando sobre cómo abordar los retos urbanos utilizando las SBN, es evidente que no existe aún una aplicación habitual o coherente de la política ambiental urbana. Resulta útil entonces entender el caso de Rotterdam, en los Países Bajos, para identificar las lecciones que pueden extraerse de la aplicación de las SBN como parte de la política urbana de adaptación al clima, y las oportunidades que existen para continuar avanzando en la mejora de medidas de mitigación y adaptación al cambio climático que prioricen el capital natural.

## Sección 4: Caso de Estudio

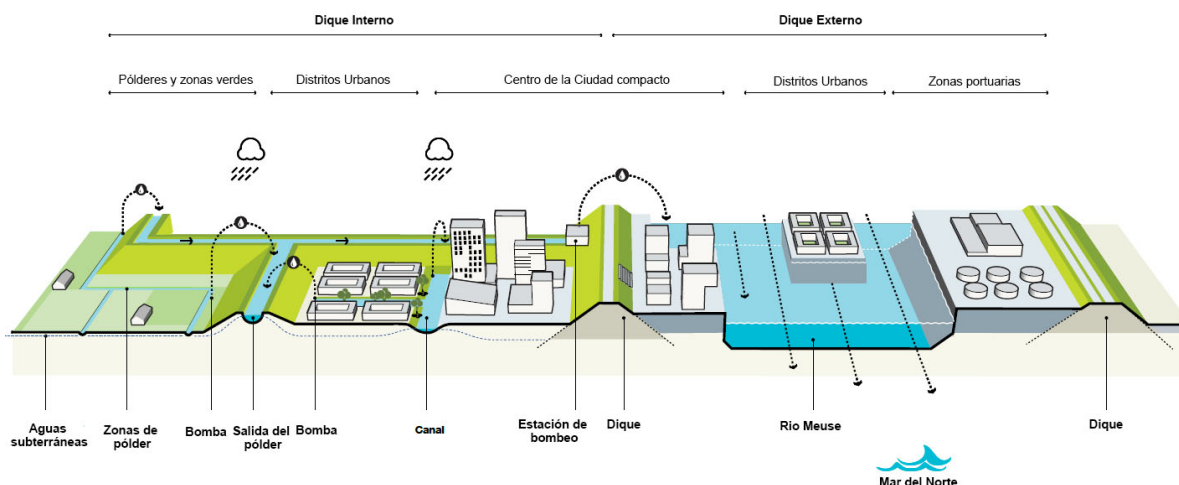
En las próximas décadas, Rotterdam se enfrentará a varios retos para mantener la ciudad habitable y resiliente ([Solutions, 2017](#)). La transición energética, la adaptación al clima y las cuestiones sociales exigen cada vez más atención en la ciudad. Por un lado, las tareas a las que se enfrenta la ciudad son cada vez más complejas, por el otro lado, la presión sobre cada metro cuadrado de la ciudad es cada vez mayor. El municipio solo es propietario parcial de este espacio, y los gobernantes se ven obligados a encontrar nuevas formas de utilizarlo y proveer soluciones a los desafíos que presenta la ciudad.

La participación de los habitantes de la ciudad de Rotterdam en la utilización de más de 18,5km<sup>2</sup> de cubiertas planas para desarrollar techos multifuncionales, es una de las propuestas en desarrollo por el municipio como medida de adaptación al cambio climático, y que resuelve la falta de espacio disponible. El programa *Multifunctional Roofs (2019-2022)* tiene como objetivo optimizar la utilización de las cubiertas para proporcionar soluciones a los principales retos que enfrenta la ciudad, como la gestión del agua y el estrés térmico; y así mejorar la calidad de vida urbana a través de soluciones asequibles para la población. ([Municipality of Rotterdam, s.f.](#))

### 4.1 Contexto

Rotterdam es la segunda ciudad más grande de los Países Bajos y uno de los mayores puertos del mundo; pero es también la ciudad portuaria más baja de Europa, con partes de su delta a casi siete metros por debajo del nivel del mar. Como muchas otras ciudades delta, Rotterdam es altamente vulnerable a los impactos del cambio climático. La subida del nivel del mar y el aumento en intensidad y frecuencia de las precipitaciones influyen directamente en los riesgos de inundación de la ciudad. Si bien desde su fundación la ciudad ha tomado medidas para protegerse del mar y de las inundaciones fluviales, costeras y pluviales (ver [Figura 5](#)), los

expertos señalan que en 2100 los diques actuales ya no serán suficientes según las proyecciones de la subida del nivel del mar. ([Solutions, 2017](#))



**Figura 5**

*Sistema de gestión de agua, ciudad de Rotterdam, Países Bajos.*

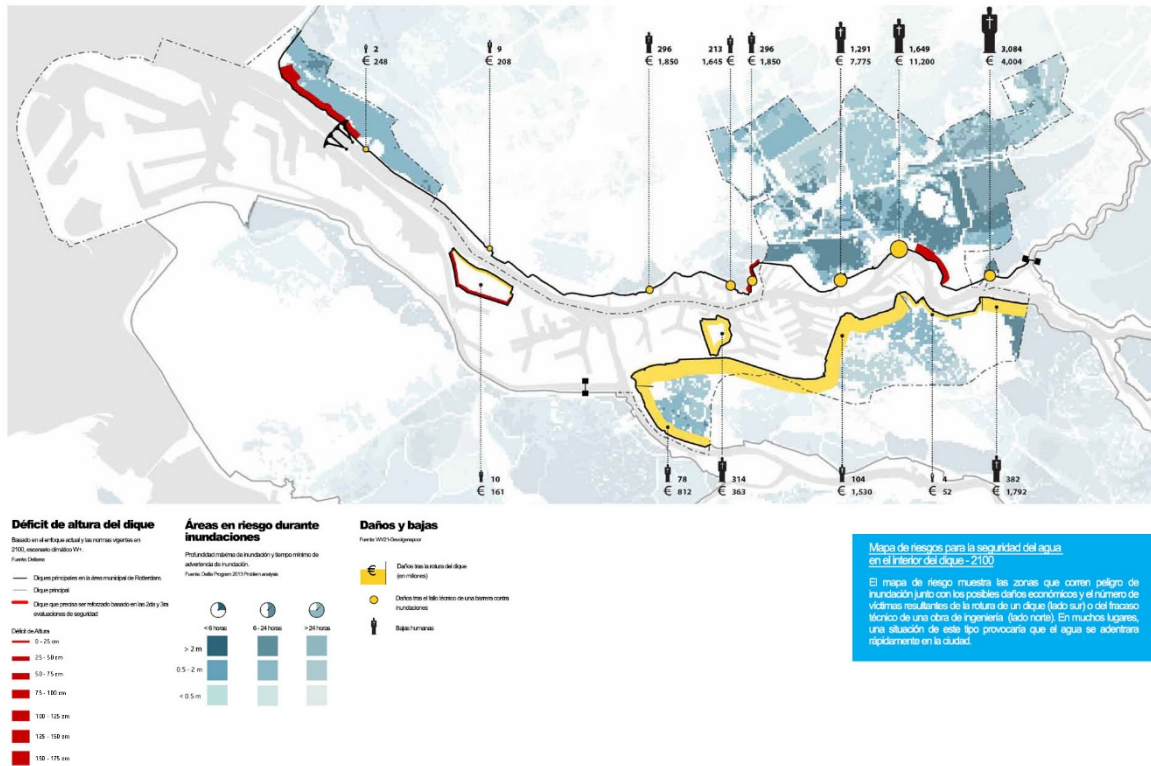
Fuente – ([City of Rotterdam, 2013](#))

Como resultado de su próspera economía y su condición portuaria, se espera que Rotterdam crezca a un ritmo lento pero constante a lo largo de los años<sup>13</sup>. En las últimas décadas, tanto las regiones internas como externas del dique se han ido densificando; por lo tanto, la probabilidad de obtener cifras considerables en víctimas, daños y pérdidas económicas, como consecuencia de una inundación, es elevada. ([City of Rotterdam, 2013](#)) (Ver [Figura 6](#))

<sup>13</sup> La población de Rotterdam en 2021 se estima en 1.012.007 habitantes. En 1950, la población de Rotterdam era de 764.227 habitantes. Rotterdam ha crecido en 1.981 personas desde 2015, lo que representa una variación anual del 0,20%. Estas estimaciones y proyecciones de población provienen de la última revisión de las Perspectivas de Urbanización Mundial de la ONU. Estas estimaciones representan la aglomeración urbana de Rotterdam, que suele incluir la población de Rotterdam además de las zonas suburbanas adyacentes.

El municipio de Rotterdam tiene una superficie total de 325,79 kilómetros cuadrados. La densidad de población alcanza los 3.043 residentes por kilómetro cuadrado.

Fuente - ([World Population Review, s.f.](#))

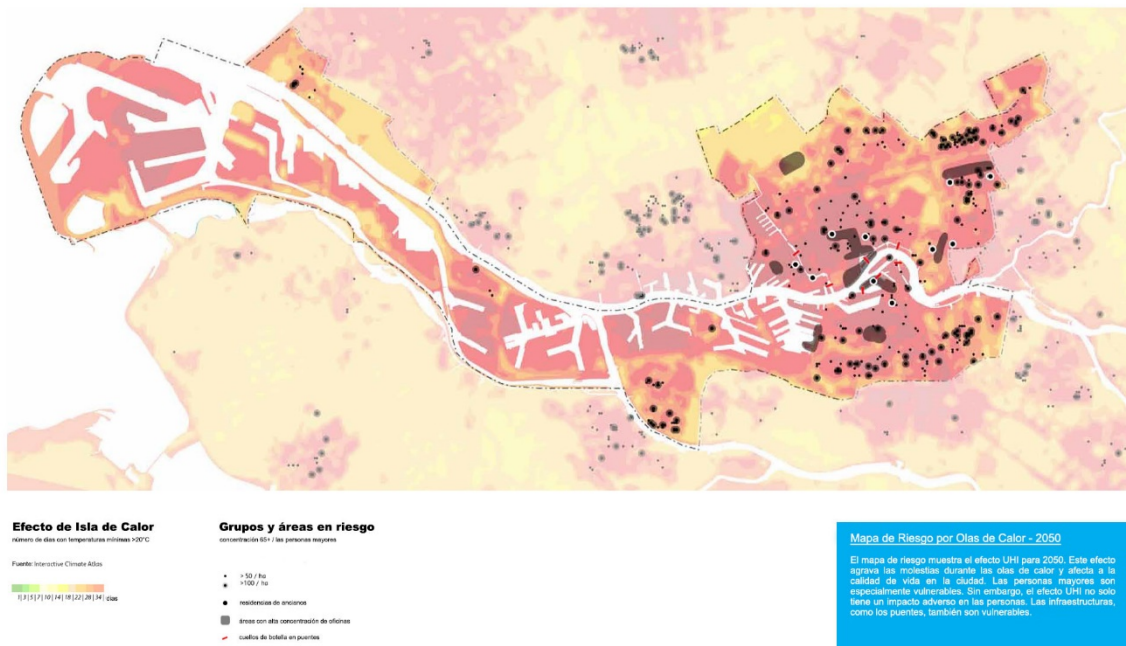


**Figura 6**

Mapa de riesgo de inundación, año 2100, ciudad de Rotterdam, Países Bajos.

Fuente – ([City of Rotterdam, 2013](#))

El estrés térmico es también consecuencia del cambio climático, y los efectos negativos de una ola de calor son más evidentes en una ciudad muy poblada y compacta como Rotterdam. Las investigaciones realizadas han permitido medir una UHI de 7°C más en comparación a sus alrededores rurales ([Solutions, 2017](#)). El efecto UHI es consecuencia de las superficies pavimentadas que impiden la evapotranspiración, las estructuras densas que reducen la velocidad del viento y los materiales de construcción oscuros que absorben la energía solar durante el día y liberan el calor gradualmente por la noche, lo que ralentiza el proceso de enfriamiento del aire. Si esto se combina con el elevado uso de energía, el tráfico, la contaminación atmosférica y la escasa vegetación, las ciudades se convierten en islas de calor locales, provocando problemas en la salud y baja productividad de los trabajadores, mientras que la demanda de energía aumenta para enfriar los edificios. ([Rodgers et al., 2013](#)) (Ver [Figura 7](#))



**Figura 7**

Mapa de riesgo por UHI, año 2050, ciudad de Rotterdam, Países Bajos.

Fuente – ([City of Rotterdam, 2013](#))

## 4.2 Una ciudad *climate-proof*

Para reducir su vulnerabilidad frente a los impactos del cambio climático, Rotterdam ha comenzado a implementar medidas para hacer frente a estos efectos, y alcanzar su objetivo de volverse una ciudad *climate-proof* para 2025. Para ser *climate-proof* la ciudad asume que,

- las medidas adoptadas en Rotterdam deberán asegurar que cada zona específica se vea mínimamente perturbada por el cambio climático y se beneficie al máximo de él, tanto hoy como en las décadas siguientes.
- todo desarrollo espacial de Rotterdam debe tener en cuenta el cambio climático previsible a largo plazo y las incertidumbres asociadas.

Estos objetivos podrán ser alcanzados únicamente con la cooperación y el compromiso de todas las partes que trabajan en y para la ciudad. La ciudad de Rotterdam, los habitantes, las empresas, los propietarios y otras instituciones gubernamentales deberán contribuir según sus propias responsabilidades, objetivos e ideas. ([City of Rotterdam, 2013](#))



#### 4.2.1 Las políticas climáticas en Rotterdam

El primer documento de política urbanística del municipio de Rotterdam data del año 2007 y se denomina el *Urban Vision 2030* ([Municipality of Rotterdam, 2017](#)). En él se ofrecen orientaciones estratégicas, principalmente sobre la retención del agua, que es históricamente la mayor preocupación en materia de adaptación tanto para Rotterdam, como ciudad delta, como para el país en su conjunto. Las consideraciones relativas a la adaptación se abordaron por separado en programas puntuales como *Rotterdam Climate Proof* (RCP) ([City of Rotterdam, 2009](#)) y *Climate Change Adaptation Strategy* ([City of Rotterdam, 2013](#)). La investigación realizada en el contexto de estos programas permite conocer la vulnerabilidad de la ciudad, las amenazas para su funcionamiento y el trabajo específico que debe llevarse a cabo para lograr que Rotterdam sea *climate-proof*. Los objetivos establecidos se focalizan en lograr una ciudad a prueba de clima y crear el máximo efecto económico posible en el proceso. Al aprovechar las oportunidades que ofrece la adaptación al cambio climático, se busca impulsar la economía de la ciudad y el puerto, mejorar el ambiente en los barrios y distritos, aumentar la biodiversidad en la ciudad e incentivar a los habitantes de Rotterdam a participar activamente en la comunidad. ([City of Rotterdam, 2013](#)).

Arnoud Molenaar, responsable del RCP, asegura que Rotterdam está trabajando en la integración de las cuestiones de adaptación al clima en sus programas de mantenimiento de infraestructura y en sus proyectos de ordenamiento del territorio ([Solutions, 2017](#)). De este modo, la ciudad procura vincular las medidas de adaptación a otras ambiciones y prioridades municipales, como la mejora de la salud pública, la creación de nuevos espacios públicos de alta calidad y el reverdecimiento de la ciudad.

#### 4.3 El programa Multifunctional Roofs

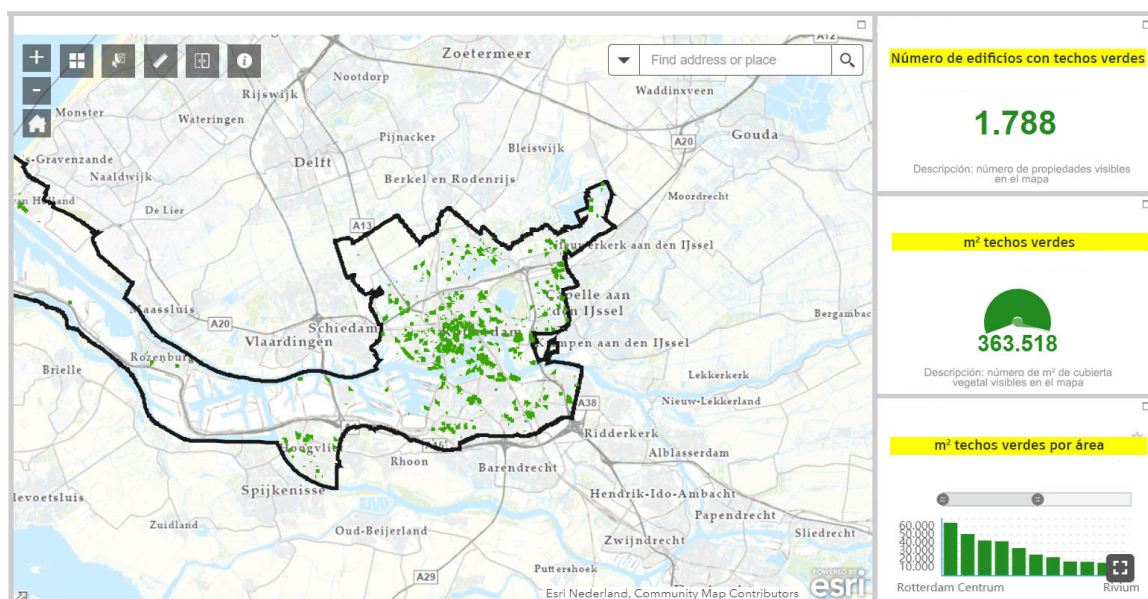
Como parte de su estrategia de adaptación, la ciudad lanzó el programa *Multifunctional Roofs (2019-2022)* ([Municipality of Rotterdam, s.f.](#)) que establece la ambición de convertir en multifuncionales la superficie de cubiertas inutilizadas, agregando un segundo nivel al paisaje de la ciudad, revalorizando los techos y mejorando la calidad de vida de los habitantes de la ciudad.

### 4.3.1 Antecedentes

Luego de la Segunda Guerra Mundial, el centro de Rotterdam debió ser sometido a una reconstrucción debido a los bombardeos que sufrió la ciudad en 1940. Desde entonces, los techos planos predominan en las zonas reconstruidas. Dadas sus características, son planos, de grandes superficies y con alto nivel de compactación, los tejados del centro de Rotterdam son perfectos para su aprovechamiento. Mediante su adaptación, los tejados tienen el potencial de albergar diversas funciones y gestionar simultáneamente varios de los retos que enfrenta la ciudad.

Desde el año 2008, el municipio de Rotterdam otorga subsidios para la construcción de cubiertas verdes con el objetivo de optimizar la función de “esponja” de la ciudad. Esta iniciativa ha convertido al municipio de Rotterdam en pionero, al estimular la construcción de cubiertas verdes para añadir más espacio verde y capacidad de almacenamiento de agua en la ciudad. El resultado de la primera etapa fueron 160.000m<sup>2</sup> de cubiertas verdes. ([Municipality of Rotterdam, 2019](#))

En el año 2018 se registraron más de 360.000m<sup>2</sup> de tejados verdes (ver [Figura 8](#)) y 168.000m<sup>2</sup> de paneles solares en los tejados de la ciudad, a través de los cuales Rotterdam genera 24GWh de energía sostenible. La introducción de paneles solares, además de contribuir a la transición energética y a la reducción de costos de la energía ([Municipality of Rotterdam, s.f.](#)), impulsó la evolución del programa de techos verdes a multifuncionales, tomando un enfoque integral sobre el potencial de las cubiertas.



**Figura 8**

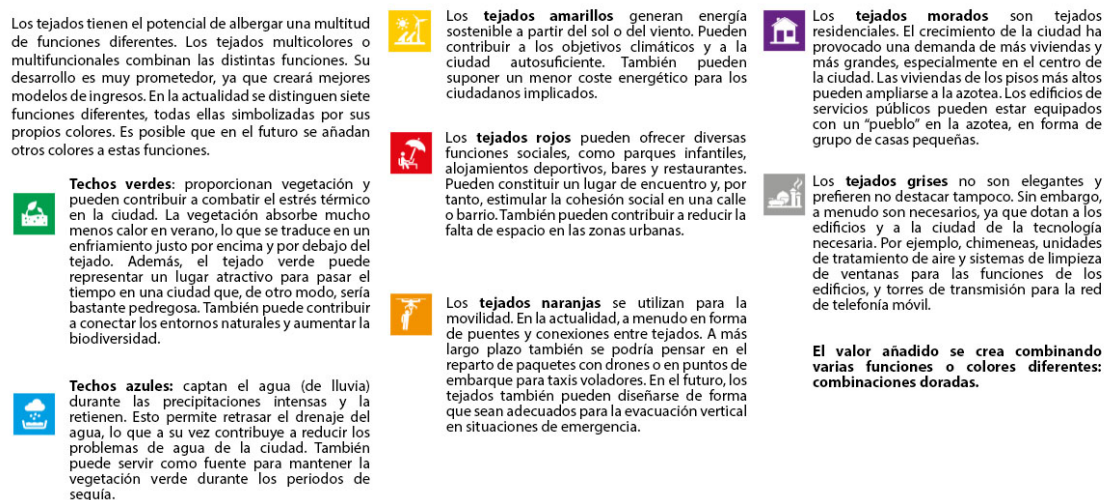
*Mapeo de techos verdes registrados hasta el año 2018, ciudad de Rotterdam, Países Bajos.*

Fuente – ([Municipality of Rotterdam, 2018](#))

### 4.3.2 Objetivos

Con una superficie disponible de 18,5km<sup>2</sup> de cubiertas planas inutilizadas, el programa propone la implementación de siete cubiertas funcionales (azul, verde, amarillo, rojo, naranja, morado y gris; ver [Figura 9](#)) a través de un enfoque holístico, que ofrece valiosos beneficios intersectoriales. Al mismo tiempo, contribuye a la sostenibilidad y viabilidad del centro de la ciudad, abordando los retos relacionados con el agua, el ambiente, las energías renovables, la calidad del aire y la falta de espacio.

Asumiendo un enfoque integral de las cubiertas para maximizar su uso, el programa propone “combinaciones de oro”, es decir, la combinación de varias funciones o colores. Entendiendo que la oportunidad más lógica para el propietario de optar por un techo multifuncional es cuando se construye un edificio nuevo o cuando se planea una renovación o sustitución del tejado, la implementación tiene que estar alineada con el momento de mantenimiento y sustitución de la cubierta. El punto de partida del programa es, por tanto, enlazar con el momento natural de inversión. ([Municipality of Rotterdam, 2019](#))



**Figura 9**

*Siete posibles funciones de las cubiertas multifuncionales*

Fuente – ([Municipality of Rotterdam, 2019](#))

### 4.3.3 Estructura

Los pilares que estructuran el programa son:

- a) Informar: sobre el potencial de los techos. Concentrar los esfuerzos en los residentes del centro de la ciudad.

- b) Inspirar: con ejemplos de proyectos concretos para demostrar el potencial de las cubiertas.
- c) Alentar: a los agentes económicos y a los profesionales que tienen un rol clave en la construcción, la renovación y la gestión/mantenimiento de tejados. Apoyar el desarrollo de nuevos modelos de ingresos que faciliten la puesta en marcha de los propietarios, las asociaciones de propietarios (en holandés: *Vereniging van Eigenaren - VvE*) y los inversores.
- d) Desarrollar un marco normativo y de política: para escalar la aplicación de techos multifuncionales.
- e) Crear una red: para conectar a los actores involucrados, y provocar sinergias entre los diferentes sectores.
- f) Innovar: para aumentar el potencial de uso de los tejados, y lograr mejores funcionalidades y modelos de ganancia.
- g) Influir: en la reformulación de leyes y reglamentos.



**Figura 10**

*Los pilares del programa*

Fuente – ([Municipality of Rotterdam, 2019](#))

Paul van Roosmalen, Program Manager de *Multifunctional Roofs* Rotterdam, explica durante una entrevista la importancia de los pilares en la implementación del programa, y detalla,

It's about informing people and inspiring people and those kinds of things, facilitating. And I think we always will need to do all these things at the same time because people are in a different phase. So, some people are really enthusiastic and just need a little push, maybe some money or just the right way to go. Well, other people, they totally don't understand, and you really have to start building the mindset with them. And that is a constant process. [Se trata de informar a la gente e inspirar a la gente y esa clase de cosas, facilitar. Y creo que siempre tendremos que hacer todas estas cosas al mismo tiempo porque todas las personas están en una fase diferente. Así, algunas personas son realmente entusiastas y solo necesitan un pequeño empujón, tal vez algo de dinero o simplemente el camino correcto. Otras personas no lo entienden en absoluto, y hay que empezar a construir la mentalidad con ellas. Y eso es un proceso constante.] (Entrevista realizada el 4 de mayo de 2021)

El enfoque del programa establece actividades permanentes de comunicación, a través de jornadas informativas, acciones y asesoramiento personal. Se pueden identificar diferentes grupos objetivo, los más importantes son, por un lado, los vecinos, las asociaciones de propietarios y, por el otro, los profesionales que se interesan por los avances técnicos y modelos de negocio. Cada grupo objetivo se lo aborda con un enfoque específico, dado que el nivel de información y los medios para comunicar difieren entre un grupo y otro. Entre los niveles inferiores de la escala (objeto, calle, área, urbano) las acciones son impulsadas a nivel local y se concentran principalmente en los cuatro primeros pilares (informar, inspirar, alentar y desarrollar una política), mientras que los últimos pilares (crear una red, innovar e influir), están determinados por los distintos niveles gubernamentales (regional, nacional, global) y precisan establecer prioridades y fijar el rumbo de la agenda climática. (Ver [Figura 10](#))

#### 4.3.4 Próximos pasos

Son varias las estrategias de gobernanza que el municipio de Rotterdam emplea en el programa *Multifunctional Roofs*, como el suministro de información, los incentivos (subsidios) o la orientación sobre regulaciones, con la finalidad de que los ciudadanos asuman medidas de adaptación. Al mismo tiempo, intenta resolver los problemas de la escasez de espacio urbano, la falta de disponibilidad de fondos públicos, y las normativas y políticas que pueden entrar en conflicto con los objetivos de adaptación urbana.

Hasta el momento, el programa se esfuerza por estimular la inversión privada para animar a las personas a que opten por cualquiera de las siete opciones de cubiertas. En un futuro espera poder hacer una diferenciación de las distintas áreas según el clima específico, el problema puntual y el impacto que se desea obtener. Sobre este punto, Paul van Roosmalen agrega,

Every area has a different demand. When it comes to energy, the same, some areas, we will start heating with rest leftovers from the industrial processes, but others will have to heat all electrical. In all the electrical you would probably want to focus on solar energy on rooftops, while another área you might want to emphasize more the greening or the water storage or the usufruct {...} So we have this idea in our minds but it's very complicated to combine all those demands that the city has, all the issues and put them in one map or one system. {...} So that is what we are building now. {...} So, we have some ideas, but we still have to make it into a complete vision that encompasses the whole city. [Cada zona tiene una demanda diferente. Cuando se trata de la energía, ocurre lo mismo, en algunas áreas vamos a empezar a calentar con la energía remanente de los procesos industriales, pero otras tendrán que calentar todo eléctrico. En el caso de todo eléctrico, probablemente habrá que centrarse en la energía solar en las cubiertas, mientras que en otra es posible que se desee enfatizar más los espacios verdes, o el almacenamiento de agua, o el usufructo {...} Así que tenemos esta idea en nuestras mentes, pero es muy complicado combinar todas esas demandas que la ciudad tiene, todos los temas, y ponerlos en un mapa o un sistema. {...} Así que eso es lo que estamos construyendo ahora. {...} tenemos algunas ideas, pero todavía tenemos que convertirlas en una visión completa que abarque toda la ciudad.] (Entrevista realizada el 4 de mayo de 2021)

#### 4.4 Hallazgos y discusiones sobre el programa

Del análisis conceptual del programa *Multifunctional Roofs* como estrategia municipal para abordar la adaptación de los edificios mediante la refuncionalización de sus cubiertas, y de la valoración de información empírica, obtenida mediante los testimonios a informantes clave vinculados con el programa; esta subsección destaca los hallazgos que se desprenden del análisis de los datos recogidos. Estructurados en tres fases, 1) planificación y diseño, 2) comunicación y difusión y 3) ejecución e impacto, se abren líneas de discusión sobre la

consideración de las SBN como parte de la política urbana. Bajo estas tres fases fueron también realizadas las entrevistas a los informantes clave de acuerdo con las instancias para el diseño, implementación y evaluación de un programa.

#### 4.4.1 Planificación y diseño

Entre los principios que rigen el concepto de SBN (mencionados en la subsección 3.1.1), lograr que sean “parte integral del diseño general de las políticas y de las medidas o acciones, para abordar un reto específico” haciendo referencia a “los contextos naturales específicos del lugar y los contextos culturales que incluyen conocimientos tradicionales, locales y científicos”, es determinante para producir “beneficios sociales de forma justa y equitativa, de manera que se promueva la transparencia y una amplia participación.” ([IUCN, 2016, pág. 6](#))

En este sentido, en el diseño de un programa que responda a las necesidades de la ciudad y, al mismo tiempo, haga uso eficiente de sus recursos, es importante identificar las oportunidades de cada contexto. Es preciso considerar las condiciones locales de cada ciudad y caracterizar adecuadamente los distintos segmentos que la componen, para seleccionar con precisión el mercado objetivo y la estrategia indicada para cada caso. Para la municipalidad de Rotterdam, identificar el valor de sus casi 1.000.000m<sup>2</sup> de cubiertas planas inutilizadas en el centro de la ciudad representó el puntapié del desarrollo del programa inicial que estimulaba la construcción de cubiertas verdes (2008-2016) para hacer frente al problema de gestión de agua de la ciudad. Al mismo tiempo, avanzar sobre dichas superficies implicó involucrarse con los diversos propietarios privados que componen la escena urbana y, por consiguiente, estudiar sus necesidades y demandas que exigen diferentes respuestas. En este aspecto, Paul van Roosmalen comenta sobre la necesidad de la municipalidad de adoptar roles más flexibles, dinámicos y proactivos desde la esfera del diseño e implementación de las políticas;

I think what we are trying to do, and which is relatively new or unique, because we are, as a municipality, very often, we have this very strict idea of what our role should be. Like this inspector of the permits, he always has this list of questions and stamp when everything is okay. And then these kind of co-creation environments, it is not always the same. {...} it is like with relationships between people, I mean, it differs all the time and you have to look at the moment and see what is needed at that time. [Yo creo que lo que estamos tratando de hacer es relativamente nuevo o único, porque, como municipalidad, por lo general, tenemos la idea estricta sobre cuál debería ser nuestro rol.



Como inspector de permisos, que siempre tiene una lista con preguntas y aprueba cuando todo está en orden. Y luego, esta clase de ambientes de co-creación, no es siempre igual. Tal vez es como las relaciones entre personas, {...} difiere todo el tiempo y uno tiene que ver en el momento, y ver que se necesita en ese momento.] (Entrevista realizada el 4 de mayo de 2021)

En este aspecto, el concepto de SBN se distingue de las practicas más tradicionales y *top-down*, por ejemplo, a través de la búsqueda de soluciones que pretenden satisfacer las necesidades de una amplia gama de partes interesadas a través de la acción y, para ello, utilizan enfoques participativos y colaborativos, que favorece el nivel de aceptación por parte de los ciudadanos. Los estudios comprueban que la participación ciudadana durante la etapa de planificación del proyecto permite generar confianza en los procesos que involucran las SBN y ayuda a disipar los potenciales miedos en los ciudadanos que se apropian de dichos procesos. ([Kabisch et al. 2017](#))

Por otro lado, la identificación de las amenazas en la etapa de planificación y diseño es importante para minimizar el riesgo de falla de la política en las siguientes etapas de comunicación y ejecución. En el análisis de caso, la falta de autoridad que tiene el municipio sobre los inmuebles privados para imponer un uso determinado es la principal amenaza, y obligó a las autoridades a asumir un rol de facilitador, para acercar las oportunidades de adaptación a los propietarios. La municipalidad de Rotterdam es dueña únicamente del 30% de área total de cubiertas, y el 70% restante es gestionado por los propios propietarios, compañías y asociaciones de propietarios. Pamela Logjes y Esther Wienese, miembros de Rooftop Revolution y Daken Diva respectivamente, argumentan que la falta de control que tiene el municipio sobre las cubiertas privadas dificulta escalar más rápidamente esta iniciativa. Ambas declaraciones coinciden en que el trabajo en conjunto con entidades independientes facilita el acercamiento con el ciudadano. Dentro de la misma línea, Pamela Logjes opina sobre el rol de la municipalidad;

cannot get so close to the citizens or to the people who own the roofs. So, I think, they want to have an independent organization like Rooftop Revolution to make that connection, and then for people it feels more real. [(La municipalidad) no puede acercarse a los ciudadanos o a los dueños de las cubiertas. Entonces, yo creo, quieren tener una organización independiente como Rooftop Revolution para lograr esa conexión y, entonces, para las personas se siente más real.] (Entrevista realizada el 23 de abril de 2021)



Se ha reconocido que los individuos, las instituciones y los procesos específicos que pueden actuar como mediadores, traductores y creadores de redes entre los diferentes departamentos y sectores son fundamentales para promover, acelerar y ampliar los proyectos con SBN ([Kabisch et al. 2017](#)). Estos agentes de cambio deben ser apoyados y alentados activamente para facilitar y promover el cambio en los paradigmas dominantes en los múltiples niveles de gobernanza.

Las nuevas dinámicas sociales y la evolución de los usos urbanos también precisan de marcos regulatorios que acompañen el cambio. Los vacíos en la normativa y la falta de política clara son mencionados entre las principales dificultades que desalienta la adopción de las SBN. Paul van Roosmalen se refiere al caso particular de las cubiertas multifuncionales, y explica que las cubiertas antes no formaban parte del diseño de los proyectos y, por lo tanto, no son contempladas por los códigos o regulaciones. En este sentido, los cambios de usos y las nuevas soluciones encuentran vacíos en las regulaciones, y donde “there's no regulation, the computer always says No.” [no hay regulación, la computadora siempre dice “No”] (Paul van Roosmalen entrevista realizada el 4 de mayo de 2021). Según comunicaron durante sus entrevistas las representantes de Rooftop Revolution y Daken Diva, “here is a lot to win in regard to policy, rules, laws, to make it easier for people to get started. Because if you want to get started with your roof you come across a lot of difficulties in regard to rules” [hay mucho que ganar en materia de políticas, reglamentación, leyes, para que sea más fácil para las personas comenzar. Porque si quieres empezar con tu cubierta, te encuentras con muchas dificultades en cuanto a las normas.] (Pamela Logjes, entrevista realizada el 23 de abril de 2021) “So people sometimes they get discouraged because they don't know where to start” [Entonces, las personas algunas veces se desaniman porque no saben por dónde empezar.] (Esther Wienese entrevista realizada el 28 de abril de 2021) [Wouter \(2016\)](#) manifiesta que “existe una tendencia a reducir las normas, en lugar de introducir otras nuevas”; en otras palabras, existe una demanda por simplificar el marco normativo, lo que implica revisar ideas, prácticas y actividades conocidas, para acelerar la integración de nuevas soluciones y usos.

Sobre lo expuesto en los párrafos anteriores, la literatura y los testimonios de algunos entrevistados (Desiree de Baar, Pamela Logjes y Esther Wienese) insisten que cumplir con la norma y la intención del propietario, o grupo de propietarios, de utilizar SBN no es suficiente si no se cuenta con el capital y la financiación necesaria. La disponibilidad de financiación es a menudo el factor determinante para la acción. Los instrumentos de financiación tradicional pueden ser difíciles de solicitar, principalmente por que establecen una clara distinción entre los proveedores (es decir, las instituciones financieras y los mercados) y los usuarios de la

financiación (es decir, las empresas y los prestatarios individuales). En este sentido, muchos de los beneficios asociados a las SBN no pueden ser capitalizados por una sola parte u organización, sino que crean externalidades que repercuten en muchos grupos diferentes, lo que da lugar a un problema de derechos de propiedad sobre los beneficios.

De igual forma, el poco reconocimiento del valor de los “beneficios blandos”, como se refirió Paul van Roosmalen a los beneficios cualitativos derivados de las SBN (ej. reducción del estrés), por parte de los actores económicos más conservadores, se debe a la subjetividad del beneficio percibido y a la dificultad de monetizar el valor de la naturaleza y de un ecosistema sano. Según su experiencia, “in business worlds, we forgot about the quality part and we forgot about the value of nature, of the planet and all those things. {...} That money is the only thing that counts.” [en el mundo de los negocios nos olvidamos de la parte de la calidad, y nos olvidamos del valor de la naturaleza, del planeta y esa clase de cosas. {...} El dinero es lo único que importa.] (Paul van Roosmalen, entrevista realizada el 4 de mayo de 2021) La ciudad de Rotterdam, en respuesta a este conflicto, se propuso ponerle un precio al valor de la naturaleza a través del Análisis Costo-Beneficio Social (Social Cost Benefit Analysis), para delinear un caso de negocio que fuera entendido en el lenguaje del mercado, y a su vez, incluyera los múltiples beneficios de las SBN, que hasta entonces habían sido omitidos en los análisis de rentabilidad. La realidad demuestra que, si bien es preferible contar con un sistema económico donde los beneficios sociales y ambientales sean valorados por igual, sigue siendo necesario referirse a los proyectos según el retorno de inversión, y eso es lo que el Análisis Costo-Beneficio Social propone (Paul van Roosmalen, entrevista realizada el 4 de mayo de 2021) Reforzar los argumentos comerciales a favor de las SBN mediante la promoción de los datos sobre la rentabilidad y los múltiples beneficios, dará lugar a nuevos modelos de negocio y financiación con cifras concretas para futuras inversiones.

Otro esfuerzo en la promoción del programa *Multifunctional Roofs*, para desbloquear las inversiones en cubiertas multifuncionales en el sector privado, se reconoce en el uso de incentivos dirigidos. Las iniciativas de política “verde” pueden clasificarse en dos tipos, 1) la legislación reguladora (que obliga a los sectores público o privado a plantar en, sobre o alrededor de los edificios) y, 2) las iniciativas basadas en incentivos dirigidas a promotores y propietarios de edificios ([Xing et al., 2017](#)). Son muchas las ciudades, Rotterdam incluida, donde las cubiertas verdes como medida de *retrofit* no son obligatorias. Si bien existen políticas que tratan de incentivar nuevos desarrollos sostenibles, como los *Nature Inclusive Buildings* (Esther Wienese, entrevista realizada el 28 de abril de 2021) el desafío sigue siendo las

construcciones existentes. Esto se debe, principalmente, a que los costos iniciales de adaptación corren a cargo de los propietarios, mientras que los beneficios se distribuyen entre todos los habitantes de la ciudad. Esta situación se denomina incentivo dividido, cuando las inversiones se ven afectadas por un reparto desigual de los costos y los beneficios ([Bird & Hernández, 2012](#) según se citó en [Wouter, 2016](#)). Frente al incentivo dividido, es preciso estimular a los actores privados para que opten por medidas de adaptación y para ello los agentes públicos pueden asumir cierta responsabilidad compartida mediante la implementación de instrumentos económicos, como: subsidios, impuestos diferenciados o permisos especiales.

Ofrecer un subsidio por metro cuadrado de cubierta verde es un ejemplo concreto y visible de colaboración entre el municipio y los propietarios privados. Cuanto más eficiente sea la cubierta verde, mayor será la probabilidad de que se le conceda un subsidio y más alto será este en términos absolutos. Pamela Logjes se muestra de acuerdo sobre este punto y se refiere al subsidio de la ciudad de Rotterdam (otorgado a quienes cumplen con ciertos criterios de almacenamiento de agua) como beneficioso para ambas partes, porque ayuda al propietario a asumir los gastos y, paralelamente, la municipalidad consigue avanzar en sus metas de adaptación urbana. Asimismo, el incentivo económico es mencionado por la mayoría de los entrevistados (con excepción de Paul van Roosmalen) como decisivo en la consideración de una cubierta verde; y manifiestan que la suspensión de los subsidios no es viable por los próximos años si se quiere avanzar en las prácticas de adaptación de estas características.

Sobre este último punto, es importante reflexionar sobre las diversas motivaciones de los propietarios, y la evaluación del aspecto económico, frente a otras consideraciones, como el impacto ambiental. Sin ir más lejos, Guido Zeck, arquitecto y líder del proyecto de renovación de varios edificios de su cuadra, destaca el valor agregado de su cubierta verde frente a opciones ligeramente más económicas, y relata;

at the end, you could choose {...} similar solutions. But this one, it's a place for biodiversity, for the sewage, for sustainability, {...} It will last better. And this one was ugly, it's it creates city stress, {...} and contributes with the heat effect. [al final, podíamos elegir entre opciones similares, como EPDM. Sin embargo, esta (cubierta verde) es un lugar para la biodiversidad, para el drenaje, para la sostenibilidad {...} Será más duradero. Y el otro, no es estéticamente agradable, contribuye al estrés urbano y a la UHI.] (Entrevista realizada el 7 de mayo de 2021)

Por el contrario, otros testimonios se muestran menos optimistas, y si bien reconocen que los incentivos económicos pueden mejorar las oportunidades de contar con más presencia de

espacios verdes, esto no es determinante cuando existen otras alternativas de *green retrofit* con beneficios a corto plazo, por ejemplo, los paneles solares. En las distintas posturas se vislumbran los tipos de beneficios que son valorados por los individuos, que se ven fuertemente afectados por la percepción que tienen sobre los mismos ([Sanon et al., 2012](#), [Jacobs et al., 2016](#), [Small et al., 2017 según se citó en Giordano et al., 2020](#)). En concreto, las partes interesadas pueden percibir y evaluar los co-beneficios de las SBN de forma diferente. La experiencia de Pamela Logjes describe una realidad muy distinta a la de Guido Zeck y explica;

solar panels are an easier business model to sell, and green or blue roofs are, {...} it is a big investment. And {...} the house owners not always get something back for it in money. Only in, {...} it looks nice, and the roof will last longer, it's cooler in the summer, it's insulation in the winter; so it difficult to explain those values to people. [los paneles solares son un modelo de negocio mucho más fácil de vender, y las cubiertas verdes o azules son una gran inversión. Y los propietarios de las casas no siempre obtienen algo a cambio en dinero. Sólo una mejora estética y una durabilidad mayor, es más fresco en el verano, actúa como aislación en el invierno; pero es difícil explicar esos valores a la gente.] (Entrevista realizada el 23 de abril de 2021)

Por su parte, Desiree de Bar, dueña de un jardín en altura en Rotterdam, reconoce durante la entrevista que, a pesar de su interés por cuestiones ambientales, la principal razón que la llevo a optar por una cubierta verde fue tener como ejemplo la cubierta del DakAkker; de otra manera, no hubiese pensado hacerlo de esa manera, y simplemente hubiese puesto paneles solares (Desiree de Bar, entrevista realizada el 23 de abril de 2021). Valga como ejemplo el caso de Desiree de Baar para destacar el alcance de la comunicación, la importancia de contar con ejemplos y proyectos piloto para superar la resistencia a las SBN ya sea por razones de desconocimiento, intereses establecidos o valores tradicionales.

#### 4.4.2 Comunicación y difusión

Entendiendo que el rol de los agentes de política es cada vez más el de facilitar y apoyar las iniciativas de la sociedad en lugar de forzarlas, es de gran importancia que todos los departamentos sean conscientes de cómo pueden contribuir a la adaptación al clima y cómo pueden apoyarse mutuamente en el desarrollo y la aplicación de políticas. Para esto, tienen que estar alineados y entender cuál es el problema y las posibles soluciones. El trabajo coordinado permite integrar la cuestión de la adaptación en todas las políticas y sectores. Según Esther Wienese la municipalidad adoptó ese enfoque y afirma que;

this rooftop program in Rotterdam is adopted now by five different programs in the city. So, it has to do with energy, sustainable energy, with building, with green and they all work together. And they all meet on the rooftops. [el programa de cubiertas (multifuncionales) en Rotterdam ha sido adoptado ahora cinco programas diferentes en la ciudad. Lo que se refiere a energía, energía sostenible, construcción, reverdecimiento, todos trabajan juntos. Y el punto en común son los tejados.] (Entrevista realizada el 28 de abril de 2021)

[Ershad Sarabi \(2019\)](#) afirma que las alianzas con los actores locales, especialmente los grupos comunitarios, pueden fomentar la confianza y el aprendizaje social siendo factores críticos para la resiliencia socioambiental. Mediante las asociaciones público-privadas (PPP por sus siglas en inglés) se combina la regulación *top-down* del sector gubernamental con la flexibilidad del sector privado.

Es fundamental mantener la comunicación internamente, entre los distintos sectores de la política, como externamente, de manera de presentar con claridad los objetivos y las estrategias que se abordan para captar el interés de la sociedad. Cuando fueron preguntadas sobre los medios de comunicación y difusión utilizados, tanto Pamela Logjes como Esther Wienese coincidieron sobre las campañas como la medida más efectiva para captar nuevos interesados; y hacen énfasis en el esfuerzo constante que significa lograr un cambio de comportamiento. Sobre esto último, Esther amplía sobre la necesidad de contar con más ejemplos o casos de referencia. Los ejemplos prácticos y la educación se consideran fundamentales ([EU, 2015](#)) para facilitar el diálogo e inspirar a los actores de la sociedad a contribuir a la acción climática. Desiree de Baar es un caso real de motivación mediante el ejemplo (la cubierta del DakAkker la inspiró a realizar la suya), pero reconoce que, “it's always hard to reach an audience that is not already interested.” [es siempre difícil alcanzar a un público que no estaba ya interesado.] (Entrevista realizada el 28 de abril de 2021) De manera que, son varios los esfuerzos impulsados desde la municipalidad de Rotterdam y las organizaciones independientes para captar nuevos interesados. Dada su experiencia dirigiendo DakenDiva, Esther Wienese comenta al respecto;

It is important for the municipality; but it's really a big distance from a house owner to this big climate changing challenges. {...} So, the smaller we make it, the closer we bring it to their home, the more motivated they are. [Es importante para la municipalidad; (pero) existe realmente una gran distancia entre el propietario de una casa y estos grandes desafíos del cambio climático. {...} Así que, cuanto más pequeño

sea, cuanto más cerca lo pongamos de su hogar, más motivados estarán.] (Esther Wienese, entrevista realizada 28 de abril de 2021)

El sentido de familiaridad, al que se refirió Esther Wienese en la anterior mención, ha demostrado ser efectivo cuando de competencia entre ciudades se trata. Paul van Roosmalen compartió una anécdota de la ciudad de Rotterdam en donde otra clase de SBN, el *Geveltuin* (según su nombre en holandés o jardín de fachada), fue el protagonista de una competencia a nivel nacional.

We use the fight that we know from sports between the big cities, and also smaller cities have their rival city next to it; and it really works because people start building these things like crazy because it's like being a fan of a sports team. I do this for my city because then we can win. I mean, nobody was winning, except for everybody. [Utilizamos la rivalidad que conocemos de los deportes entre las grandes ciudades, y también las ciudades más pequeñas tienen su ciudad rival; y realmente funciona porque la gente empieza a construir estas cosas (los jardines de fachada) como locos porque es como ser un fan de un equipo deportivo. Lo hago por mi ciudad porque así podemos ganar. Quiero decir, nadie ganaba, excepto todo el mundo.] (Paul van Roosmalen, entrevista realizada el, 4 de mayo de 2021)

#### 4.4.3 Ejecución e impacto

La etapa final de un programa se refiere a la ejecución y a la evaluación del impacto. El comportamiento del programa llevado a la acción está estrechamente relacionado al correcto desarrollo de las dos primeras fases (diseño y comunicación). En primer lugar, debe existir la acción coordinada en la planificación de las SBN, que considere a todas las partes interesadas cuyas prioridades, motivaciones o valores pueden no coincidir, o incluso entrar en conflicto. Luego, la comunicación debe ser permanente y eficaz, ya sea mediante campañas, embajadores del programa, demostraciones de proyectos, etc., con el propósito de transmitir confianza y disipar dudas o incertidumbres sobre la efectividad de las SBN. En concreto, la aplicación exitosa de las SBN depende del correcto desarrollo de las dos primeras etapas y, sobre todo, de la conciencia colectiva sobre la gravedad y la urgencia de la acción frente al cambio climático.

En consonancia con lo anteriormente expuesto, Guido Zeck destaca la estrecha colaboración con la municipalidad y la Autoridad del Agua (en holandés *waterschap*) al momento de iniciar el proceso de renovación de los edificios de la cuadra, y hace hincapié en el trabajo en conjunto con las distintas autoridades como factor determinante en el éxito del

*green retrofit* de varias cubiertas. Además, revela que el proceso no fue sencillo y fue preciso abordar de manera diferenciada a las distintas opiniones que componen el bloque de departamentos; según describe;

{...} in a larger block there is, as always, a more conservative force to deal with and so {...} we cut it in little pieces so people could get a grasp and {...} could get more acquainted with the whole idea of having a green roof. {...} trying by small steps to diffuse fear and taking them {...} along the path into this decision making. And in the end, {...} they are quite happy about it. {...} nobody is against it anymore. [en una cuadra más grande hay, como siempre, una fuerza más conservadora con la que tratar y por eso {...} lo dividimos en pequeñas partes para que la gente pudiera entender, y {...} pudiera familiarizarse más con la idea de tener un techo verde. {...} tratando a través de pequeños pasos de disipar el miedo y acompañarlos {...} a lo largo del camino en esta toma de decisiones. Y al final, {...} están bastante contentos con ello. {...} ya nadie está en contra. (Guido Zeck, entrevista realizada el 7 de mayo de 2021)

De igual forma, las voces más conservadoras también están presentes en la esfera pública, y pueden reforzar la “dependencia del camino.” En ella, los responsables de la toma de decisiones aplican soluciones que les resultan familiares; ya sea impulsados por relaciones de poder, por lo que la elección de la infraestructura está profundamente arraigada a determinados contextos culturales que conforman las prácticas institucionales, o a ciertos sesgos cognitivos, como la falta de conocimiento de los SE que proporcionan las SBN y la falta de percepción de la responsabilidad de la acción ante riesgos climáticos. Las soluciones de ingeniería suelen aplicarse con relativa certeza sobre el tipo y la escala de los beneficios, mientras que las SBN suelen ofrecer soluciones más flexibles a largo plazo con beneficios que podrían no obtenerse cuando se perciban los costos, o dentro de los ciclos políticos o electorales habituales ([Seddon et al., 2020](#)). Es por esta razón que el sistema de medición y evaluación del impacto es importante para generar más confianza en las SBN y en su efectividad.

El impacto de la mitigación y adaptación climática a través de las SBN está determinado por muchos factores específicos del contexto que interactúan y que varían con el tiempo. Estos pueden ser socioeconómicos (por ejemplo, la capacidad institucional para responder a un impacto, incluido el capital humano y financiero para diseñar y ejecutar una intervención), biofísicos (por ejemplo, la frecuencia e intensidad de los peligros naturales) y ambientales (por ejemplo, la variación en la prestación de SE como resultado de los cambios estacionales y espaciales en la biomasa). En este caso, lo que se considera eficiente depende de las

perspectivas y necesidades de los implicados. Sobre los sistemas de evaluación utilizados en la ciudad de Rotterdam, Paul van Roosmalen insiste en la dificultad de medir los impactos cualitativos, pero destaca el avance que significa el Análisis Costo-Beneficio Social en el desarrollo de indicadores cualitativos, y detalla;

some things we can measure, {...} amount of square meters of green and amount of solar panels, and that, you can translate to liters and cubic meters of water. You can calculate how many kilowatt hours of energy. So those kinds of things we can measure and we do {...} It's very hard to measure those kind of things, the quality of life stuff. There' are not very easy ways to measure that. And if you can measure it, it's very hard to find the cause and effect. [algunas cosas podemos medir, {...} la cantidad de metros cuadrados de verde y la cantidad de paneles solares, y esas cosas, se puede traducir a los litros y metros cúbicos de agua. Se puede calcular cuántos kilovatios hora de energía. Ese tipo de cosas podemos medir y lo hacemos {...} Pero, es muy difícil medir otro tipo de cosas, la calidad de vida. No hay formas fáciles de medirlo. Y si puedes medirlo, es muy difícil encontrar la causa y el efecto.] (Entrevista realizada el 4 de mayo de 2021)

Ciertas opiniones sostienen que, incluso si se pudieran determinar métricas razonables, la naturaleza dinámica y compleja de los sistemas socioambientales, hacen que medir y comparar los resultados de las intervenciones en todas las escalas sea extremadamente difícil. Por ello, es poco probable que se encuentren métricas simples y estandarizadas de la eficiencia de las SBN que funcionen a diferentes escalas, o que capten de forma exhaustiva las dimensiones socioambientales ([Seddon et al., 2020](#)). Una solución posible consiste en fijar objetivos claros en la etapa de diseño, y desarrollar indicadores de evaluación y monitoreo que permitan comunicar de manera concreta la efectividad de las SBN mediante la comparativa de los resultados con los objetivos y criterios de rendimiento establecidos.

En la práctica, la necesidad de adaptación de las ciudades no admite excusas para la inacción y obliga a la reflexión sobre la responsabilidad social y la complicidad frente al cambio climático. La plena integración de las SBN como estrategias de mitigación y adaptación a la crisis climática demanda un nuevo enfoque en el pensamiento de desarrollo urbano, dejando de lado el crecimiento económico infinito para reconocer que los flujos de energía y materiales necesarios para el bienestar humano deben permanecer dentro de los límites biofísicos seguros. Desde su perspectiva, Guido Zeck insiste en el cambio de conducta que las sociedades debieran adoptar para empezar a revertir los impactos del cambio climático, y reflexiona sobre la urgencia de la acción.



It is part of a deeper sense of where we want to go with each other, where we want to be. I do not think a lot of people grasp the radical change we will have to undertake with each other. {...} We need all the help. We need all the change we can possibly grasp. And so, we have to insulate all of the existing apartments and houses within Rotterdam, within the Netherlands, within the world. {...} So, it is amazing that there is no sense of urgency there. It is like we don't really get that. It is too far away. {...} But we need this tipping point in Awareness. That something needs to be done. [Forma parte de un sentido más profundo de hacia dónde queremos ir unos con otros, dónde queremos estar. No creo que mucha gente comprenda el cambio radical que tendremos que emprender unos con otros. {...} Necesitamos toda la ayuda. Necesitamos todo el cambio que podamos captar. Para ello, tenemos que aislar (térmicamente) todos los apartamentos y casas existentes en Rotterdam, en los Países Bajos, en el mundo. {...} Por lo tanto, es sorprendente que no haya sentido de urgencia. Es como si realmente no lo entendiéramos. Está demasiado lejos. {...} Pero necesitamos este punto de inflexión en la concientización. Que hay que hacer algo. (Guido Zeck, entrevista realizada el 7 de mayo de 2021)

La capacidad del cambio climático para poner en movimiento nuevas dinámicas sociales ofrece una valiosa oportunidad para aumentar la demanda pública de contar con entornos naturales saludables. Para ello, es clave seguir avanzando en el desarrollo de políticas que reconecten con la naturaleza y los beneficios que vienen sujetos a un ambiente diverso, y pongan en cuestión las políticas tradicionales, para dar lugar a prácticas que atiendan las demandas socioambientales postergadas y prioricen el desarrollo sostenible a largo plazo.

## Sección 5: Conclusiones

Al abordar la investigación se establecieron los principales riesgos que afectan a las ciudades en el contexto del cambio climático. Principalmente, el riesgo de fracaso de la infraestructura gris, que ha presentado en ocasiones, un nivel de respuesta insuficiente frente a fenómenos meteorológicos extremos afectando el bienestar de las comunidades que la habitan. Ante la necesidad de contar con infraestructura que sea resiliente y, a su vez, contribuya al desarrollo de metas sociales y ambientales, las SBN han ganado reconocimiento frente a los actores de política como una estrategia alternativa frente a estos retos, y ha servido para estructurar las agendas de adaptación climática de varias ciudades europeas en el último tiempo.

De acuerdo con los objetivos planteados, la investigación ha permitido establecer que las SBN son, ante todo, prácticas que vienen a reemplazar el modo en que las ciudades vienen concibiendo el desarrollo urbano tradicional y, por tanto, se posicionan como un enfoque superador al instalar prioridades socioambientales y fomentar el cambio de comportamiento individual y social. En este sentido, las SBN sugieren enfoques menos conservadores que promuevan innovaciones en el uso del suelo urbano y priorizan el capital natural, permitiendo alinear la planificación de las ciudades existentes con los objetivos ambientales y sociales en una época que exige cambios. Al priorizar la búsqueda de soluciones que contemplen las necesidades de una amplia gama de partes interesadas y sean sostenibles en el largo plazo, las SBN animan a movilizar todos los esfuerzos disponibles, sobre todo las acciones iniciadas desde el sector privado para extender la cobertura en materia de adaptación de las ciudades más allá de las iniciativas lideradas desde los organismos públicos.

La evidencia presentada en el análisis y los hallazgos identificados a partir de la revisión de la literatura y del caso de la ciudad de Rotterdam, permite extraer conclusiones sobre el alcance de las SBN como estrategia de adaptación, y consideraciones prácticas para continuar perfeccionando el diseño, comunicación e implementación de las SBN en el futuro.

Los resultados de esta investigación han demostrado la relevancia de las SBN en materia de adaptación, principalmente por la capacidad de los ecosistemas naturales de mantenerse más o menos constantes, dentro de los límites de la variación natural, frente a perturbaciones y los cambios en el régimen climático. Se destacan, también, por ser instrumentos sensibles capaces de acompañar los cambios sociales y dar respuesta a las presiones urbanas. Su naturaleza adaptable y flexible las convierte en mecanismos aplicables interesantes para la adaptación de la infraestructura en las ciudades, porque permite acomodar el cambio en una era que precisa

soluciones que sean sostenibles en el largo plazo. No obstante, la medida en que puedan hacerlo dependerá tanto del contexto en el que se ubiquen, como de la salud de los ecosistemas naturales dentro del medio urbano. Por lo tanto, para acelerar el proceso de transición hacia la adopción de las SBN en la gestión de los riesgos relacionados con el clima, es prioritario explorar su efectiva implementación y generar capacidades para desarrollar casos de referencia.

Sobre este último punto, la evidencia exhibe que las SBN siguen siendo instrumentos que precisan profundizar en los modos de aplicación. Si bien en la teoría se presentan como soluciones holísticas, y ofrecen enfoques atractivos para resguardar la infraestructura tradicional, en la práctica, sobre todo de países europeos que han avanzado en la implementación de las SBN en proyectos urbanos, el desafío se encuentra en la incertidumbre sobre su conducta y rendimiento, que son motivo de desconfianza. Esto guarda relación con el aspecto multifuncional que caracteriza a las SBN, lo que las convierte en sistemas complejos que a menudo se pasan por alto en la planificación de políticas debido al esfuerzo que significa comprender nuevas soluciones, e integrarlas al entorno construido. Frente a esta cuestión, la infraestructura gris de ingeniería suele ser la solución usualmente aceptada por la esfera política más conservadora, debido a su alto nivel de previsibilidad, lo que posibilita fijar metas y cumplir con los objetivos (políticos, sociales, económicos y ambientales) en los tiempos preestablecidos. Es interesante observar que la infraestructura gris presenta elementos complementarios a las SBN, por lo que la dicotomía de emplear una solución o la otra no resulta eficiente en este contexto, en donde los esfuerzos debieran centrarse en desarrollar sistemas integrados que aborden las causas fundamentales del riesgo y reduzcan la vulnerabilidad de las poblaciones a largo plazo.

Para lograr la acción integrada de la infraestructura gris y las estrategias de gestión de los ecosistemas naturales, la investigación reconoce los nuevos acuerdos de gobernanza que exigen las SBN como el puntapié para reformular patrones establecidos en la escena urbana. En oposición a las formas lineales en las que las soluciones tradicionales se han diseñado, construido y gestionado en el tiempo, las SBN ofrecen enfoques transversales que generan sinergias entre los distintos grupos sociales, en una gama de entornos ambientales y económicos. Un enfoque ampliado significa un sistema de planificación y gobernanza de riesgos distribuido y, por consiguiente, más resiliente, que se traduce en la capacidad de adaptarse en respuesta a circunstancias nuevas, y seguir funcionando incluso cuando las partes individuales no alcanzan completamente sus objetivos.

En función de lo aquí expuesto, los hallazgos sugieren continuar explorando los diversos

modos de incluir las SBN en programas y/o proyectos urbanos para avanzar en la evaluación y monitoreo de la eficiencia de las SBN a la hora de generar beneficios sociales, económicos y ambientales. A partir de la experiencia de la ciudad de Rotterdam en el desarrollo del programa local *Multifunctional Roofs*, se incluyen una serie de recomendaciones dirigidas a los actores de política para la elaboración de programas locales de adaptación de edificios, formuladas a partir de los aciertos y limitaciones detectados en el caso de estudio. Se sintetizan mejores prácticas para alcanzar un mayor nivel de incorporación de las SBN entre los distintos actores sociales, así como estrategias para maximizar los beneficios y evitar, o minimizar, la repetición de errores y la pérdida de oportunidades.

En primera instancia, el gobierno local debe concientizar a la población sobre los riesgos que enfrenta la ciudad, y sobre la responsabilidad y la necesidad de la sociedad de contribuir en las medidas de mitigación y adaptación al cambio climático. Para ello, los distintos sectores de política deben integrar un objetivo y, consecuentemente, un discurso único y unívoco que comunique el valor agregado y las posibilidades de las SBN. Es indispensable contar con líneas de comunicación robustas y permanentes, en donde las SBN puedan ser presentadas y transmitidas con claridad. En este sentido, al reforzar la conciencia colectiva sobre la urgencia del desarrollo sostenible y las oportunidades que la naturaleza ofrece, se estará contribuyendo a los cimientos de una política que le sea afín a los ciudadanos.

En segundo lugar, es imprescindible identificar sendas para coordinar la política de adaptación con la política de planificación y edificación. Del mismo modo, es importante priorizar las áreas en las que la acción política pueda actuar en el progreso hacia la sostenibilidad de la infraestructura e incorporarla como aliada en la adaptación de las ciudades. Sobre este punto, se sugiere a) avanzar en la simplificación de los marcos regulatorios, que hoy pueden presentar vacíos e incongruencias que desalientan la adopción de las SBN; b) contar con información y bases de datos detallados para poder estimar y cuantificar los impactos de la implementación de las SBN en las ciudades y c) ajustar los criterios de rendimiento de las edificaciones, para que incorporen un espectro más amplio de uso de recursos e impactos ambientales, y así abordar de manera integral el concepto de “sostenibilidad” en edificios existentes, en donde se tome en cuenta su relación con el entorno. Hasta ahora, la política de vivienda evalúa a la “sostenibilidad” de los edificios existentes según el rendimiento energético en la fase operacional del ciclo de vida de las construcciones. En un contexto en donde los incentivos para la aplicación de las SBN por fuera de las nuevas construcciones son escasos, se incorpora muy lentamente por parte de los propietarios la mejora de sus viviendas con objetivos

ambientales.

Por último, los programas y/o proyectos deben estar respaldados por casos de negocio que demuestren la rentabilidad de las SBN. A tal efecto, los esfuerzos deben concentrarse en desarrollar estudios empíricos que generen datos de referencia y lecciones aprendidas para la optimización del diseño de las SBN fundados en la experiencia. Reforzar la evidencia sobre los beneficios económicos de las SBN dará lugar a importantes argumentos para futuras inversiones en la implantación de estas prácticas, a la vez que transmite confianza sobre la efectividad de las SBN. Esto último, no solo responde al interés empresarial, sino que generará adhesión en el propietario privado, que es quien realiza las inversiones apalancadas por los estímulos gubernamentales.

Como última reflexión, se sugiere que una política o programa sea determinado y diseñado a nivel específico según las condiciones y contexto local. Cada solución debe estudiarse individualmente y según cada área urbana, distinguiendo los distintos retos ambientales y socioculturales, y la disponibilidad de recursos para afrontarlos. Por tal motivo, el uso de una política determinada en otra ciudad se debe concebir a modo de inspiración. Al combinar estas ideas, se crea una visión general que permite traducir estrategias de otros ejemplos en una estrategia de aplicación específica que pueda aplicarse con la misma efectividad en otros escenarios.

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## **Anexo 1**

### Interview: Type 1 / Municipality of Rotterdam

#### **1 PLANNING AND DESIGN**

- 1.1 Which were the perceived opportunities to be seized when planning the program?
- 1.2 Which were the municipality's motivations to design and execute the program?
- 1.3 Which are the program's objectives?
- 1.4 How does the program cope with the split incentive situation<sup>14</sup>?

#### **2 COMMUNICATION AND DISSEMINATION**

- 2.1 Which strategies are being used to communicate the program? Were some other strategies implemented when the program was initiated?
- 2.2 How does the municipality reach the final user? Are there intermediaries?
- 2.3 Have the program set partnerships or alliances? With whom? Why were those actors selected?

#### **3 EXECUTION**

- 3.1 Which are the program's strengths and weaknesses\*?
- 3.2 What improvement opportunities have been identified?
- 3.3 Do you consider the program would be replicable in other locations/cities?

\*See Table 1

#### **4 IMPACT**

- 4.1 Does the program have a monitoring, reporting and verification system? Which are the main indicators?
- 4.2 What is the social, economic, and environmental impact of the program up to date?

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<sup>14</sup> A split incentive: occur when the upfront costs of green roofs are carried by property owners, while the benefits are spread out across the city.



Interview: Type 2 / Intermediate actors

**1 PLANNING**

- 1.1 What is your company's purpose and motivation?
- 1.2 Who participates in the decision-making process? (private owners, associations, municipality)

**2 COMMUNICATION**

- 2.1 What is your company's relationship with the program Multifunctional Roofs (2019-2022)? Or Green Roofs Program (2008)?
- 2.2 Is there a partnership with the program or others?

**3 EXECUTION**

- 3.1 Which are the main barriers\* when executing a roof retrofit?
- 3.2 Which are the program's strengths and weaknesses from a company's perspective?
- 3.3 In which way did the program impact your company?
- 3.4 How can the program be improved?

\*See Table 1

**4 IMPACT**

- 4.1 Does your company have a monitoring, reporting and verification system? Which are the main indicators?
- 4.2 What is the social, economic, and environmental impact of the roof retrofit up to date?

Interview: Type 3 / Final user

**1 PLANNING**

- 1.1 What was your household/roof situation before the retrofit execution?
- 1.2 Who participated in the decision-making process?
- 1.3 What were the reasons/motivations to decide undertaking a house retrofit?

**2 COMMUNICATION**

- 2.1 How did you find out about the program Multifunctional Roofs (2019-2022)? Or Green Roofs Program (2008)?
- 2.2 What did you find appealing about the program?
- 2.3 How was your relationship (if any) with the people managing the program? Were there intermediaries?

**3 EXECUTION**

- 3.1 Which are the program's strengths and weaknesses\* as a user?
- 3.2 Did the program reach your expectations?
- 3.3 How can the program be improved?

\*See Table 1

**4 IMPACT**

- 4.1 What are the benefits you perceive as a consequence of your house retrofit?
- 4.2 Would you recommend the program to others?

Table 1 – List of Barriers<sup>15</sup>

BARRIERS	IMPORTANCE			
	LOW	MEDIUM	HIGH	NOT A BARRIER
Lack of political will and long-term commitment				
Lack of sense of urgency among policymakers				
Lack of public awareness and support				
Risk aversion and resistance to change				
Silo mentality				
Misalignments between short-term plans and long-term goals				
Lack of supportive policy and legal frameworks				
Lack of design standards and guidelines for maintenance and monitoring				
Lack of skilled knowledge brokers and training programs				
Functionality and performance uncertainties				
Perceived high cost				
Lack of available financial resources				
Lack of financial incentives				
Property ownership complexities				
Space constraints				
OTHERS***:				

\*\*Add new barrier to OTHERS if you believe it is missing in the list.

<sup>15</sup> List of barriers taken from: Ershad Sarabi, S., Han, O., L. Romme, A.G., de Vries, B., Valkenburg, R., y den Ouden, E. (2020) *Uptake and implementation of Nature-Based Solutions: An analysis of barriers using Interpretive Structural Modeling*. Journal of Environmental Managements. <https://doi.org/10.1016/j.jenvman.2020.110749>

## Anexo 2

Entrevista: Tipo 3 – Dolores Giribone – Desiree de Baar

***Entrevistador:***

Dolores Giribone (Arquitecta) - DG

***Entrevistado:***

Desiree de Baar (Dueña de cubierta verde en Rotterdam) - DdB

Día: 23-04-2021

Hora: 9am-10am (UTC +1h)

***Transcripción:***

DG: But well let's get started so we can, you can, go back to your day. Um.. well of course I share with you the questions, but it is just like a conversation. So, I wanted to start with, how is like your household situation? Like where, do you live, or where did you live and how this whole green roof idea came up?

DdB: Yeah, like yeah, I think it's quite the specific situation because this is a..., we live now in a newly built house, and we... it was like a... How do you say it in English? Like a joint project of collaborative development of this house block with the owners itself. So, there was no party between us and the constructor, construction company. For instance. So we organized this as a group. In Dutch, we call that CPO. So it's like a collective of.. How do you say that? Yeah, *particulier*.

DG: If you want to say it in Dutch, then I can ask my boyfriend to translate he is Dutch.

DdB: Okay. Yeah, so it's like a *Collectief Particulier Opdrachtgeverschap*. So, we were like, giving in an assignment as a group of group of people. Yeah. And but so yeah. So, we developed our house ourselves and so that was like the opportunity for us to immediately start thinking how to make use of the roof, and because it was like for me some sort of a wish to have more options for gardening and also to think about environmental things we decided to, or he thought like, hey, we could do a rooftop garden. And there is this example in Rotterdam as well, like

the DakAkker, probably you have heard of that and I know the people who were involved like in the beginning. So, I knew it this was possible to do this; and like to do it in a different way, like not putting pots with vegetables or with plants on the roof, but really like making let's sort of like a layer of soil, as if it was, of course, it's not this thick, but at least as if it was more like a normal garden situation.

Yeah, so yeah, we knew that this was gonna, that we just started to see if it was possible to integrate it into our plan.

DG: Yeah. So, I have a question about the organization. So, you together with the other private owners just gathered and started thinking about this?

DdB: Yeah, that is true. Yeah, there was a plot, like a plot that was not built yet, but it was always meant to be for housing. But it didn't happen like for years. And then there was someone who took the initiative and contacted the municipality of Rotterdam for like, “hey, is it an option that we are gonna develop something here as a private party?”

DG: Yeah.

DdB: And that was accepted. So, it was like a very long process of like I think four years.

DG: Yeah.

DdB: And it is like also, it's not unique in Rotterdam but I think the way that we did was because there was a lot of freedom for all the people because we really did it together, and because this type of organization is growing, but then, it's much more, I don't know, restricted with rules because there is some sort of organization already involved. But for us, it was really from the top, I mean, from the bottom, we organized it ourselves.

DG: Very nice.

DdB: Yeah.

DG: And you knew all these people beforehand? Like...

DdB: No, not some of them because we heard about this through one of the people, so it was really like via, via.

DG: Yeah, yes.

DdB: So, we were also super lucky to be...

DG: Yeah. You were.

DdB: ...able to do this. Yes, yeah.

DG: Is a project... Can it be found online? Is it like a model project?

DdB: It's yeah, we won, because we like... a yearly price for architecture.

DG: Nice.

DdB: And we won this price with our project. So, I think there must be like the report from the jury should be found online.

DG: Okay.

DdB: I let me see if I Google. Then I can send you the link.

DG: Yeah, that would be great or just the name and I can do all the search.

DdB: Yeah.

DG: So great. And you said that you started thinking about green roof. Is it something that just comes up in like between people in Rotterdam, is it like because before like people just develop their household and the roof is something that is there, like not many people decide to use the roof so...

DdB: Yeah, I think it was really because I knew of the DakAkker and of course this is an open

or at least it used to be more open than now, and I don't mean by Corona but also because a lot of people came to the roof and also stepped on the plants, etc., but it was really open so many people could actually see it and that was like super inspirational because otherwise I wouldn't have known. And I wouldn't have thought of it, of doing it like that. I would also, I think we would just have made a roof, or maybe thought of putting solar panels of course, which would also be great because we don't have them now. Because of the garden. But I think that was really important to have this example.

DG: Yeah.

DdB: And also I knew what were the challenges if you would want to do something like that. And I also go to, via the DakAkkers, I got in contact with the company who made their roof. Like who made sure that like the drainage was good and because I thought, if I do this, if we do this, which should be done in a proper way, so it can actually work. Yeah.

DG: Yeah.

DdB: And so also this company we contacted them and said, “okay we're gonna do like a house and would it be possible that for you to participate even in such a small skill projects?” But then they said, “yeah we will”, because they also thought it was nice of having this example like if to do it on a small scale because there are only doing like big projects like for companies.

DG: What's the name of the company?

DdB: Binder.

DG: Ah yeah, I know it, but I don't know it. I just I heard about it.

DdB: You heard of it. Yeah, yeah.

DG: Nice.

DdB: And because also construction wise, I knew that on DakAkker, the building was not meant to have a weight on the roof that much. So, they really had to think about, okay, where

can we do this? And how? and balance the weight. And so, for us, it was a huge, of course, It was really good that we already knew we could. We could when constructing the whole thing we could say, okay, we could take it into Council.

DG: Yeah.

DdB: There was like more steel in our roof than in that of our neighbors. So that we were going to put more weight per square meter on the roof.

DG: So, not all the neighbors decided to go for a green roof.

DdB: No, no.

DG: Okay. Well, that's a shame.

DdB: Yeah. Actually, it is.

DG: Yeah.

DdB: I mean there's a lot of people have solar panels so that's good. I think.

DG: Yes. Yeah.

DdB: Hmm.

DG: But of course, like solar panels. It's good for, as a matter of energy, like renewable energy, and what I believe that a green roof, it solves other problems. Like well for you I believe is like aesthetic problem. No, not problem. But like it gives you like a nice roof, gives you the possibility to just have your plants and do some gardening and of course, you have a new building, so I'm sure that it's very well insulated and everything, but green roof also help with like thermal comfort and those kind of issues.

DdB: Yeah. yeah, I think, I think because if you put it like this now, because I know these things of course, and maybe if we do this a second time, we would have tried to get all neighbors



or more neighbors to do the same.

DG Yeah.

DdB: Yeah.

DG: Yeah.

DdB: But that didn't happen in the process, I'm not sure why, maybe because I don't know because of the timing when we decided to make this roof or I mean, of course, everyone has other plans and not everyone is... Well, yeah, doesn't matter but we didn't really discuss it or make a proposition for the whole block.

DG: Yeah. So basically, well, you had this project from bottom-up, like nothing was there and you decided that, you wanted a green proof. So, you had this model project like as an inspiration, which was this big garden. The DakAkker.

DdB: Yeah, the DakAkker. Yeah.

DG: The DakAkker and contacted the Binder company. So, from there how was the process? So, they gave you back like a quote or how was like from having the idea, contacting the vendor to the actual execution? Was the municipality part of it?

DdB: Yes. Because I knew there was, well not, I knew there was then, there was still like a subsidy for group Green roofs to stimulate people, having a green roof. and there was like, there were some guidelines for that in order to get the subsidy. Then the water that could be buffered. I don't know what the English word is.

DG: Yeah, or stored?

DdB: stored. Yeah.

DG: Yeah.

DdB Yeah, it should be like, I don't recall the exact numbers but let's say 150 liters per square meter, something like that.

DG: Yeah.

DdB: Yeah, if you could show that, that was actually the fact, then you could apply for this and get per square meter, you could get an X amount of Euros back from the municipality. So, I knew that this was possible and then I thought, okay, I had some savings because this was like extra on the project we were not, in the beginning we didn't intend to do that. It was all not part of our mortgage.

DG: Yeah.

DdB: So, it was like an extra So, then because we knew that we could get a bit of money back. And with the savings, we could get like the budget to do it. And with Binder we made like first made sure that all the regulations were right, like and they like it was a bit... We already knew that we wanted to do something like that but we didn't really work out the details. So, there was some, we could put some extra weight on the roof, but we didn't talk about that on forehand with Binder. So, we just had okay this so we had like the calculation from our Constructor like saying okay you could put this amount of weight on it and with this information we went to Binder and then they said "okay then you can make we can do this on your roof" like we could put like a layer of... It was like 10 centimeters, only 10 centimeters if you would spread it out on the whole roof. And so, then I was a bit disappointed like, oh is that it? you know, because if I had known before, maybe we would have made the roof even stronger and because it is like a professional company, they were like for a super strict with all everything concerned, because they, of course, they don't want to get sued later on because the roof was like heavily load or anything because but there, you know, in practice, then there can be much more on the roof, but they have like this very strict calculation, when there's like rain and snow and heavy wind and people on it and that everything is still safe. So it was like very within the restrictions, we could do this. And then I made a design, like okay, I'm not going to put it, you know, I'm gonna put like the roof is 60 square meters. So we're gonna use in total 40 square meters for the soil. But there's also little paths in which contain actually no soil, so you could make thicker layers in some parts. So that's where we leveled out. And I was just thinking, okay, here we can make because I also wanted to do something like trees or like smaller bushes like with fruits and some

is more for herbs so that could like it would not need this thick layer, so this how I could make a bit of balance in the design and then also again I spoke with Binder and I thought how yeah they just designed all the technical aspects like okay, the layers that we needed and also they constructed the a fence for safety, because there was no fence yet on the roof, of course that needed to be there as well. They did that for us. Yeah, s together, we came up with his plan and also they when we just when we already moved in, they came and they did also did the work itself.

DG Okay. Yeah.

DdB: Yeah.

DG: Did you recall if Binder gave you some advice about the best ways to store water. Or if you design in this way, maybe you can have more. I don't know develop more species of plants, like I want to understand in which way Binder influenced your design, like in which way did they advise you?

DdB: Um, I think for the for the designing part did not really because I was just looking in books, you know on gardening like the size of the beds, etc. And I had, of course, the DakAkker in Wouter Bauman. I don't know if you know him or if you spoke to him, but he's like the main farmer and he is like, how do you say that? I forgot the name, but like, it like the bigger organization behind it and so, I also spoke to him and I just looked at, okay, what is possible? what sort of plants you could have? And from Binder, it was more the technical solutions and they had like this standard solution with this more plastic cup-like system to buffer the water in. And like the substrate they use like this specific. It's not real soil, I say soil but it is not, it's made of this volcanic, very small rocks, and mixed with organic material. And this is what I did get advice for. Like, what sort of nutritions should be added? and this is also something they figured out like, there was knowledge that Binder was still developing, and I could make use of that. They also supplied me with some specific nutritions, for instance, for the vegetables, in combination with this specific substrate in Dutch that they put on the roof.

DG: Yeah.

DdB: And also later on they gave me some advice because there was like, the first year was

great with growing and the second year was less.

DG: Yeah.

DdB: So it's also with because it's like the roof and less like if it's raining if there's a lot of rain, there's also some water leaving through the gutter, and it takes a lot of nutrition and of course that's a pity, but there's not much that you can do about it, so you could, you should you need to add more to it, than just a normal garden because the roots cannot go that deep, you know, from the plant. So...

DG: But you are the one in charge of, like, kind of maintaining the roof, right?

DdB: Yes. Yes. Yeah. Yeah.

DG: Like okay, it's not that they come or they have like a follow up.

DdB: No, no, no, dear, their job is done and because of their, they had sympathy for this project and then, yeah, I think they also know it costed me a lot of money and like for private person it's really a lot of money. So that's also I think it's very good that this subsidy was there. Of course. But, and I was with them a few times in a public meeting where they asked me to, you know, to speak about the garden. And I think also in return is that, I mean, they say you can always, you know, just contact if you need some advice or anything, they're not going to charge me for that.

DG Of course.

DdB: So that's really nice but I mean I'm just I'm not doing this. Yeah, by myself. Yeah, they're not involved in maintaining.

DG: No, and that is an important aspect. I think. It's mentioned a lot in literature and in everything that I've been reading about green roofs, there are two main reasons why people don't go for a green roof, one is because they don't know the benefits about it. Like maybe like your neighbors, that it's not even part of their plan. There are no questioning the idea of having a green roof, because yeah, they don't know a lot about it. I can tell from your experience that

you reach out to a lot of people, you asked a lot of questions. And that is amazing. Because in order to be able to make this a movement, a little bit more contagious, people have to know their benefits and I think that it is an important thing to keep working on; and I think...

DdB: Yeah.

DG: ...and the other part that I think it's very important is how private owners, specially, cope with the cost and maintenance of the green roof, which is, I don't know, maybe more expensive than just like a regular, well-insulated roof, right?

DdB: Yeah, yeah. And it takes a lot of time investment so you should be up to that, because if you don't do anything with it, the roof, I mean, if it fails, you know, then also the roof wouldn't do its work. I think, you know, not as a green roof, it would just become a vast plain thing.

DG: Yeah.

DdB: But and for me, of course, it's like more intensive rooftop garden but you could also do more like, less intense. And because if I speak to my neighbors, they really like it. You know, they're curious, they come and see, but they're not all real gardeners so they could never do it themselves.

DG No. So you said that with the 10 centimeters, you have an intensive green roof?

DdB: Well, so I have like 20 to 30 because of, I didn't spread it, you know, I made this design where it could be like 20 centimeters and there be less and also like a part, where there is a bench and where I just keep some pots. There's no soil, so yeah.

DG: Nice, nice.

DdB: I have also like now I have like a very... like the neighbor who had like an apple tree. There was too much in her garden so she took it out and she cut it. I mean she didn't cut it but she, Uh, like a trimmed it down...

DG: Yes, yes.

DdB: ...and she gave it to me. So, that's on the roof now and I think it's gonna work but I have some smaller trees and a fig tree for instance...

DG: Amazing.

DdB: ...that usually works and like bigger fruit bushes that are really going well, next to all of the vegetables. So yeah, actually like the herbs and the fruits, etc., is something that goes really good but also what is like what I didn't think of before that would be such a problem is like the heat. Because it's like sometimes it's like the desert. It feels like the desert on the roof. Because it's it's so warm because you're up higher and it's like sun and...

DG: How high are you?

DdB: Well, it's not that high, it's like 10 meters.

DG: Okay.

DdB: But it's still.. There is some shade because the neighbors have like how their houses partly higher than ours. But still, it gets it gets pretty warm in summer and it if you have like very vulnerable plants, they just they just burn. Can happen on warm days or with high Sun intensity. So maybe, you know, in the future maybe think of doing something like with shadowing. Being able to make shade. Watering was very important. But I do have like water on the roof. So that luckily I thought it before, otherwise it would not succeed.

DG: Yeah.

DdB: And the wind is also very problematic. So, for some plants it works. So now I have this now for three, four years now I sort of like know what works and what works not.

DG: Yeah. And this is not your first summer, of course. When was the house finished?

DdB: In 2016.

DG Okay.

DdB: Yeah.

DG: So, have you been on one of your neighbor's terraces? To see if your terrace is as.. like theirs is as warm as yours? Because I can imagine that with plants yours should be less warm.

DdB: Yeah, well, yeah, it's an interesting I haven't checked and but I can imagine theirs is way more warm. And of course, it's already ? because I have some small part is terrace, with the stone where you can walk and that gets really hot. But of course, if you step on the soil part, it's cool, you know. But it's stays cool, but it's more for the plants who are, of course with their leaves and if the leaves are still a bit vulnerable than the sunlight is like very and that is way more exposed than in the garden downstairs.

DG: Of course. Yeah.

DdB: Yeah.

DG: So. Um. Okay.

DdB: But for instance, some plants and herbs, like Mediterranean, as a climate that are good in those climates that are very good on the roof as well.

DG: Yeah, yeah.

DdB: So it's that's nice.

DG: Yeah, it's important to just... of course, like the type of plants is very important because again, that is an important aspect to research before building your green roof. You don't want to just put your favorite tree and then get it burned by the sun, you know.

DdB: Yeah, exactly.

DG: That will be a shame.

DdB: Yeah and also because of the wind, for instance, and then I thought, okay, the wind let's go because I really like nearby the sea in the dunes, you have like the **down door**. I'm gonna write it down.

DG: Okay.

DdB: In Dutch. But they have like this very small orange berries. And I really like them but they just grow in the wild. But they're on the near the sea. So there's always a lot of wind, so I thought that could work on my rooftop, etc. So, but that's and it worked really good, but it was a bit too good because they tend to spread out on the roof. So like a very strong roots and so I had to take them out and put them in pots, you know.

DG: Yeah.

DdB: Yeah. Things like that. Yeah.

DG: Just because you mentioned the roots, have you had any trouble with the like the slab or the immediate roof under the plants.

DdB: No. Yeah, of course you, you would not be able to see if there was a problem but like the...

DG: No, from inside, like, have you..?

DdB: Oh no, no.

DG: Good.

DdB: No, no. And the roof is also, because also, of course, always on a roof there you put like it to be. How do you say that? Like, yeah, like the black stuff that they put on roofs.

DG: Yes. Yeah.



DdB: And I asked for specific to also that the roots couldn't get through. So it should be [unclear word] because I wasn't able to like see the difference but mine is different than what the neighbors have.

DG: Yeah. Yeah.

DdB: Yeah. And then because of the layers, it should be protected that the roots from the plants cannot get through.

DG: Okay. Okay, yeah.

DdB: yeah, that's important of course because if you get leakage, then, but that's also why I wanted to work with this professional company and not do it myself because if you get leakage yeah then it would be a bit disastrous of course. But this is all going well.

DG: Yeah. So, can we say that you're happy with having, with your green roof?

DdB: Yeah, definitely.

DG: Is it working good so far?

DdB: Yeah. Yeah, definitely.

DG: Nice, nice.

DdB: Especially in the summer, you know, there is like super... There are a lot of insects There's a lot of live. And yeah, I like it very wide variety of plants and flowers. So it's not just like, production of vegetables, you know, usually I have just some species of every, you know. So it's also really for fun, like having a few beetroots, having a few of these few carrots, you know, because it's all only small and I just want to have a very wide variety of stuff.

DG: Yeah, you're mentioning so many things that I'm now, I need to ask you for a photo of your rooftop. I mean, it's basically yeah, like a farm-garden.

DdB: Yeah. Yeah. I so of course. I like to share it. I'm proud of, I'm proud of the roof, so...

DG: Yeah.

DdB: So, I'll be happy to send you some pictures.

DG: Please, please. So, and you said that your neighbors now are kind of curious and maybe considering having like an extensive roof, a green roof without too much work or it's just..?

DdB: Yeah, maybe more just with pots or maybe bigger. With yeah. Already our neighbor have put some but they're really terrible in gardening, so, but they've put some stuff on the roof. Yeah, but in this case also the people have gardens as well. So then there is not that much pressure of having extra.

DG: Of course, of course.

DdB: And if you wouldn't have a garden, I think a lot more people would have considered it.

DG: Yeah. Yeah, yes.

DdB: Yeah.

DG: Um, well let's hope they do in the future and I believe that thankfully Rotterdam has a lot of different programs that kind of help people to together, green roofs or multifunctional roof, that you were not very and aware of it, but basically, it covers like a bigger range of roofs. You can just go for solar panels or more like get together roof, or they are also talking about like kind of building bridges between buildings to have a whole new landscape on a roof level.

DdB: Exactly. Yeah, I think also you probably found Esther Wienes, who made this book?

DG: Yes.

DdB: Yeah. And of course, I think you need more people like this, who is sort of like yeah. They're steering up.

DG: Do you know her?

DdB: Yes. Yeah. Yeah. She also contacted me because, well yeah, just people who are interested get to know and then she also interviewed me for this book that she made.

DG: Amazing. Yeah, I'm having next week a meeting with her so I'm super looking forward. And then you mentioned that DakAkker reference. Like I don't remember...Walter

DdB: Wouter Bauman

DG: Well yeah. Unfortunately, he has he's very busy, so he's very busy, but of course when you start researching and looking for information about this in Rotterdam, that roof comes like as the jewel. You know, like this big farm kind of... Yeah, it's amazing.

DdB: Yeah, and I think, yeah, because also you speak about government Etc. And I know a bit about like, the development of that building where DakAkker is. And because I know the people who sort of like found it, the current organization which is working in there right now because it was like anti squads building. Many years ago.

DG: Mmm.

DdB: It was like these very enthusiastic people who had also like an architecture Bureau, ZUS, maybe you know, them.

DG: Just by reading.

DdB: Yeah, yeah. And so I think it was a really a bottom up development and they won, they won this prize because there was like we had like City love new Teen as well. It's like for initiatives in the city where you can you just propose a project you could get money for this. And that's how this also came to role. But yeah, there were, I mean, there were people who maybe they saw this in New York or they were thinking, yeah, like having other inspirations and think we should do this in Rotterdam, etc. So yeah that's really interesting.

DG: Of course.

DdB: Yeah.

DG: Of course, and I love all this examples that you mentioned where it's super, super important to have bottom up initiatives and also because most of the buildings are not from the municipality, right? Are like private owners or you have many other kind of organizations like the VvE, which is like, I don't know, like housing associations or something like that. So, it's fundamental, I believe just to get together and as a as a private owner or association, just come with that idea. And then...

DdB: Yeah.

DG: ...yeah, go to the municipality or...

DdB: Exactly. And then if things go well then and you don't get bothered with rules that like work against you and it's that's important. Yeah. Yeah.

DG: Yeah, yeah, yeah, okay, so well amazing. So I think that we, I've covered a lot of what I wanted to talk to you about. I don't know if you had a chance to just read about the barriers or if you found one that you want to just share with me and say yeah, there was like huge deal when wanting to develop the green roofs.

[Desiree de Baar reading the table of barriers]

DdB: Perceived high cost, of course, was a thing. And because I feel very lucky, you know, I can talk to people about this but yeah. It's also because of a sort of privileged position that I get that I could do this. And I had to solve(?) the financial resources. And for instance, what we had to do is what made it so because you had to get a large crane in the street in order to get everything on the roof, and only these things cost like thousand Euros. So this is like, whoa. It's like that's really a barrier.

DG: Yeah, and you dealt with that right? It wasn't okay.

DdB: And yes. Yeah.

DG: Yes.

DdB: And well functionality and performance uncertainties. Yeah. So what you there I think like the knowledge of what you can and cannot do on a roof. Yeah. Well, this is something that could still be developed. I think I mean I just went for it and yeah.

DG: You went for it. Yeah. But you believe that even I can tell that you are very do you go for it and you also, if you don't know something you go and just ask about it or research about it. But do you believe that in Rotterdam you have regardless of campaigns or information available there just to that encourage you to do something like this or you have really to...

DdB: Yeah, there are, yeah, they, they are doing stuff, of course, like it with a Resilient City Program. And yeah, I mean, it's always hard to reach an audience. That is not already interested. And so, of course, if you're interested, you start searching anything, you can find a lot. Now, maybe my five years ago, it was, it was already different. There was less.

DG: Yeah.

DdB: So, it changes quickly.

DG: There was less.

DdB: Yes.

DG: Okay. Okay. Um, Well. Amazing, amazing. It took a little bit longer, but I'm very happy and I hope that I didn't take too much of your time.

DdB: No, it's fine.

DG: But it was super super helpful.

DdB: It's also for me. It's yeah, it's nice for me to talk about it as well. Yeah. And send me the

outcomes if you, I don't know, if you finished or something like that.

Entrevista: Tipo 2 – Dolores Giribone – Pamela Logjes

***Entrevistador:***

Dolores Giribone (Arquitecta) - DG

***Entrevistado:***

Pamela Logjes (Lider de Proyecto en Rooftop Revolution) - PM

Dia: 23-04-2021

Hora: 2pm-3pm (UTC +1h)

***Transcripción:***

DG: if you don't find a word, I'm sorry, I don't want to interrupt you, but if you don't find a word, just say it in Dutch and then I translate it.

PL: Yes, yes. Well, I since 2020 I work for Rooftop Revolution, it's in yeah it's kind of an NGO and it's based in Amsterdam. It's now, exists for five years. And our goal is to use the largest surface, unused surface, in cities. Namely the rooftops. And we are not gardeners, we're not the people who make the rules, but we make sure that people know the value of our rooftops, our flat rooftops. So you get more awareness around using roofs multifunctional. Green, blue, red, yellow, like plants, water, storage, solar panels and recreation. Not many people already know about that possibility, so our goal is to create awareness and we are experts in what the possibilities are. So we are creating awareness and besides that we help people from idea until execution. So all the steps we lead the way.

DG: Yeah.

PL: We work together from start in 2016, it was mostly in Amsterdam and mostly house owners. So small roofs or shed. And, and since a few years, we also worked together with municipalities like in Rotterdam and in Nijmegen, in Harlem, in The Hague. And we go into the city and talk with the citizens and ask them what they need to make the first step to a green roof. So that's what we do, that's what groups of Revolution does. And besides that, there is also rooftop Revolution Rotterdam, because Rotterdam wants it and has also got a mission: Rotterdam wants to be green in the city, and Rotterdam wants to create awareness around the

use of our roofs. And Rotterdam, I think, has the most flat rooftops in the Netherlands. So there is a lot of possibilities. There are a lot of possibilities. And but the problem is the roofs are not owned by the municipality of Rotterdam, but they are owned by housing companies, real estate companies, VvE. I don't know if, you know the yeah.

DG: Yeah.

PL: And so it's very difficult if Rotterdam wants something they have to make sure that the roof owners. So the real estate owners And yeah, one that as well. So, and the idea of Rotterdam and Rooftop Revolution was if we create some kind of energy or awareness in the city and we make the citizens enthusiastic, they will start moving. They will start moving and they will start creating green roofs, but of course...

DG: Yeah, can I...

PL: The only, yes.

DG: No, I have a question of...

PL: Yes.

DG: What? What came first right? Like, was it like The Rooftop Revolution (NGO) saw something that was happening in the city. Like the, did you kind of perceive an opportunity thinking, Well, I have I want to treat this, I don't know. Environmental problem of the city or I really want to create new businesses model. And I see the roof as a mean to do that or came the other way. Like, like you, the start point where the roots, like just thinking, okay, so we have all this roofs and, What can we do? or, and how did you actually got to the municipality as a partner? Like the, the municipality contacted you or did you go to them? Like, how that started?

PL: And yeah, the first question about that did we? I didn't I don't think we really saw a business case or something in it. We were just thinking this is an opportunity to go in battle with climate change, this is something we have to do with, of course, we also have to make money and so we are now more and more developing and business models to keep yourself alive because we want to be independent. And we want not we don't want to be and we don't want to depend on



money from the municipality, for example. But it's and not or, or I mean, of course, we want to make money ourselves. But we also want to do projects with municipality so it's way and we can make some money, but for now, it's mostly Mission. Yeah, Mission minded like yeah, we want it, we want to use these roofs and we want to make people enthusiastic. And if people see the chances, they probably want to pay us for the realization and, of course, there is, of course, there is a benefit for using roofs, for example green, because the roof will last longer. So there is some interesting business case in it, but it's not that interesting as solar panels. Solar panels are a much more easy business model to sell, and green or blue roofs are, yeah it's a big investment. And yeah, the house owners not always get something back for it in money. Only in yeah it looks nice and the roof will last longer. It's cooler in the summer, it's isolation in the winter so it difficult to explain those values to people.

DG: Yes, yeah. I know I can imagine and from what I've been, yeah, doing my research and getting a little bit of understanding about the main barriers for people to just decide to go for a green roof. It's basically this cost benefit. Because of course, as you said on the solar panels, like business case, of course you get the energy so it's more... It's easier to just see the money or see the savings, you know. But do you believe that people now are kind of getting more aware of the environmental benefits? Do you think it's important to them? Not quite? What are the main motivations for people to just when they reach out to you and say, well, "I'm thinking about a green roof or...?"

PL: For us, it's feels like a people more and more see the value of it because we are in the middle of it, but I still think it is just a little group. And for example, your second question will yeah. The reason why Rotterdam asked us to help them is because yeah, they don't have the time or maybe opportunity to get that close to the people in the city, it's really strange. But yeah, they are the producer of The City, the director of the city, the municipality, but they cannot get so close to the citizens, or to the people who own the roofs. So I think, they want to have an independent organization like Rooftop Revolution to make that connection and then it for people, it feels more real because when municipality say something they think like yeah, they want us to do that, I don't believe it, but if we say it, maybe it feels more pure. So I think people do see more the benefits of green roofs, but still lot of times the main question is, yeah, who's gonna pay for it? And if the Municipality finds it so important, why don't they arrange it themselves? That's also a question but the real and, yeah, intrinsic. I don't know if the people who are motivated by heart, they really go far to realize the dreams they have and besides that,

here is a lot to win in regard to policy rules, laws, to make it more easy for people to get started. Because if you want to get started with your roof, you will yeah, you come across a lot of difficulties in regard to rules or whatever. On the other hand, they subsidize also, there's money from the municipality to make your roof, green or green blue. And, but it's not that easy as buying, a new kitchen, or something.

DG: No. And are you...? and part of Rooftop Revolution is to kind of make it easier for the owner to just interpret all this policies rules or codes, building codes. Or because I can imagine I would like if you could explain a little bit, How is now in Rotterdam? If you know about the legal frame of the rooftops. I know that it's not like a national kind of policy so that's why it's also very difficult for Rotterdam to just make something mandatory. But how is it now? Someone comes and they want to do and execute a green roof and they come to you, how is the process there from starting to end?

PL: Oh, and the first thing we do is we go to the roof and do research about what the possibilities are, and what we think the possibilities are. So, we have also specialists who know a lot about roofs. So they go to the roof and they check all things, the construction and the height of the, yeah. I don't know how you call it. I don't even know how you call it in Dutch, but never mind. They, they...

DG: Maybe all the technical things?

PL: Yeah, they do. They do the research about what is possible. And what's the best for the building, and what the wishes of the, or the needs of the, the owner are. And then we start looking for the stakeholders or if the one who wants to do something with its roof is not the owner. We have to get in contact with the owner so we do the research, what possible on the roof? We bring the stakeholders together, and then we help the owners and the stakeholders with looking for the best builder for the job and we help them to make an official construction and measurements. Construction *berekening* (construction calculation)

DG: Documents or...?

PL: Document. Yeah, you need a construction document. If you want to build something on your roof and sometimes you need a permit. And in Rotterdam they subsidize a blue green roofs

and green roofs. So you can get a lot of your money back and not the whole amount, but a big part of it and maybe you have experienced it sometimes but doing an apply for subsidized something it's a lot of work. So we also help the roof owner with that, and sometimes it's a lot easier, sometimes it's a small shed in the backyard and people say I want something on it and the next day you can start building your green roof. But if it's big and surface and the construction is not really clear and they have a lot of dreams like a biodiverse garden or a roof where you can do your sport class on, then you have to do much more research. So all the steps, we help the people with it with a roof dream. Now, we have, because the Municipality of Rotterdam really wants to make green meters on the roofs, they hired us to help people. But in the future, hopefully, a lot of people want this and they will, the people themselves, hire us to help them. So that's our goal.

DG: Mhm. What would be every meters?

PL: Sorry.

DG: What are green meters that you said or...?

PL: I mean green roofs, green meters on the roof. So green. And if you, green meter I mean...

DG: Like extensions or like as in a meter or...?

PL: Yeah, like if you have built a green roof if it's finished, you have made green meters.

DG: And okay.

PL: Yeah.

DG: Okay. Thank you. Yes, yes. And in which way do you think that this, I know that the goal or the aim for the municipality is then for maybe NGOs or organizations, like your own, just take over and continue this process, right? But in which ways do you think that the program as it is now the Multifunctional Roof or before it was just Green Roofs it's working properly? You know? Because just to gather like the best practices in order to... Did you see what's working? Because from what I read and even in the municipalities site, they are always kind of suggesting

that the subsidies are like a first step or just to get started, but then they wish to just remove entirely the subsidies but I'm thinking, how do you believe this could be developed without a subsidy. Do you think it's possible?

PL: I don't think it's possible for now. People really need a way to lower the hurdle. The financial hurdle. So to subsidize a part of the construction of green or blue or yellow roofs is really necessary. Now, it's for people a way to make their dream possible and besides for the municipality, it's a way to accomplish their goals in regard to climate adaptation. So if they don't subsidize that, I don't think people will... it's a lot of money, they have to invest, of course, this for sheds. I think. They will manage himself.

DG: Could be done.

PL: Yeah, but the big surfaces from [dutch word] or housing corporations or real estate owners that. Yeah. Maybe they have the money, but they really want to have a little bit help...

DG: Yeah.

PL: ...in, in a form of... now it's not the time to get to stop subsidizing this movement.

DG: Yeah.

PL: I don't think so.

DG: Yeah.

PL: I think they could do something to make it more, easier to get your, to get it arranged. It's like a wood where you get lost in the wood of subsidize, subsidizing things. So, It can be. I think it can be done more easy, I think, but I'm not an expert in that but and there's another big problem and that's policy and it's an example from my own house. I have a little shed in the backyard. It's really small. It's made from wood I think, or stone. Well, doesn't matter. No, it's stone. It's Stone. And I wanted to have a green roof on top of it. And I asked the housing corporation because I rent this house. I asked the housing corporation. Can I make a green roof on it? Well, they didn't really react enthusiastic, and they even said, "No, we don't want that,

it's not possible, and we don't have policy for that". But, on the other hand, the director, the boss, the CEO of that housing corporation, in an interview with her in a newspaper she said, "We want to make all our real estate green and especially the roofs". So, it's that's not matching. I want to make it green. She said we want as well. But it's not allowed. So there is policy...

DG: Yeah. Yeah, that speech is not quite aligned.

PL: Yeah.

DG: So, I read that the housing corporation is the VvE or the VeV is like a big entity and then you have different housing, like, names.

PL: Yes, yes.

DG: Okay.

PL: Yes. The VvE is like an organization, that unites a different house owners in one building.

DG: Okay, because I read that they...

PL: Yeah.

DG: And the housing corporation like yours. It's...?

PL: That's the owner of the real estate.

DG: okay, okay.

PL: Yeah, the real estate owner that has a lot of houses and you can rent them. Yeah.

DG: Because I also read about the VeV010, that is kind of like the sustainable Department. That according to their site, they're trying or giving advice to housing corporations, if anyone wants to be more environmentally friendly. Yeah. Maybe was something that was growing in Rotterdam, but maybe not.

PL: Yeah, there is, there are a lot of initiatives that want to help people be more aware and that want to help people to reach their goals in regard to sustainability. But sometimes they're two problems, money and policy. And these two things are sometimes in the way and then people start to look at the government and they say, well, give us money or get rid of those rules.

DG: Yeah.

PL: Help us get there. So it has to work from both ways. The policymakers have to make steps, also the house owners themselves, we have to invest also, we cannot wait, sit and wait until the policymakers free our way, we have to do something ourselves as well. And there are a lot of organizations that aim to help people, on the road to more sustainable real estate.

DG: Yes, yes. And just to get it out of the way. This table with barriers that I attached to the file. You mentioned...

PL: Okay.

DG: How to make it easier. Like it will be best if this whole process could be easier. So I know that you just mentioned like money and policies. But I don't know if you have it there all the other barriers, but I would also like to know if maybe you consider one of these that I stated there like as another possible barrier that you notice during your time doing this.

PL: Yeah. I mean barrier in regard to not starting to green, not starting to make your roof more sustainable or start doing it.

DG: Yeah, like, for adopting these kinds of measures, you know? I stated like, for example, risk aversion and resistance to change, like, maybe people are happy, and they don't want to change the way they do things.

PL: Yeah. Yeah. I think that, how do you say? In Netherlands, we say: What the farmer doesn't know, he doesn't eat. I don't know if you know that saying.

DG: No, but I can understand a little bit the meaning.

PL: Yeah. So, unknown makes unloved. So that is why we want to, also, want to focus on the value of your rooftop. A lot of people don't know about it, so I think, yeah, resistance to change. But it's more like, not knowing, not knowing what the benefits are.

DG: Yes.

PL: So that's it. And yeah, well you said you mentioned lack of support policy and legal frameworks that is a thing that it is in the way. But they are working on it. I know the policymakers are also working on making this easier, but it's still in the way. And yeah, and high costs absolutely. And for me lack public awareness and support... Well, for me, there's no lack of that, because yeah, it's, it's happening all around me and more and more. But there is another problem. And that the following. People if they start to think about using their roofs they immediately think about solar panels. Roofs, solar panels. No, no question about it. Of course, roofs that are not flat you can also use them for green but it's easier to use the... [dutch word] How do you say...?

DG: The slope, like the...

PL: Yeah, the sloped roofs for solar panels. But there is also something going on, the energy transition. So, we have to invest in clean energy, and solar panels are a way of investing in clean energy. And where can you put solar panels? On roofs. But if you put solar panels on them, you cannot put green on that. Yeah you can combine it, you can do green and solar panels, but a lot of people just choose solar panels.

DG: Yeah.

PL: So, there is no possibility then for making those roof green; but we think please put up solar panels on the very very high buildings or outside the city, but inside the city and on the low roofs, please use them for green because the city needs to be cool and there's a lack of biodiversity. So, you have to make a city greener, and putting solar panel on roofs doesn't make the city cooler and doesn't make city more biodiverse. So that's also some something that's in the way and it's called the "Battle of the rooftops". And like, yeah. "We want to use them for solar panels." "No, we want to use them for green." So well.

DG: Yeah.

PL: And that's something that...

DG: Do you think that has to do with the fact that many roof are not kind of technically suitable for intensive green rooftops? Like if people cannot access to the green roof and they think it's just like sedum or mini herbs, I'm not going to pay for that because I cannot use it. Or what is your stand?

PL: Yeah. Yeah. I think. yeah, I think that I haven't experienced it much, but I think for a lot of people that can be yes, something they experience it like, yeah. On top of my roof, I can never sit there. I can never see it. Why should I invest in green? That's absolutely a thing because it's not valuable directly for yourself. And well if you live just underneath the roof, then you benefit from it, because it's cools in the winter. Sorry, in summer. And it isolates in the winter. But the value life, the mostly life. Yeah. For the surroundings, for the biodiversity, for the few of your neighbors or something. And so, yeah, I think that's it. That's the thing. What benefits me the most? Yeah, then people probably will rather choose solar panels than green. And that's why it's so important that we create awareness around the green function and the water storage for... [not clear]

DG: Mmm.

PL: Yeah, you're right. If you want to have a green, blue, yellow roof, your roof has to be really strong. And yeah, most, yeah, most of the time that combination is no possible or it's too expensive.

DG: Yeah. Well. Amazing. To kind of wrap up and go to the last part of Impact. But I am missing one question that about communication, that I forgot to ask about Rooftop Revolution. How do you reach people? or, are you just waiting for people to go to you for advice?

PL: Both. So, you can...on our website if you want to do something with your roof, you fill out a form and we contact you. And if there are other questions, of course, people can email us always. And yeah we of course have our social media. And we try to get in touch with as much



municipalities as possible. So, everybody knows we are here. And so yeah, it's not that we get a hundred of people in the email, in the inbox every day. Absolutely not. But we hope in the future that that will happen. But if we do a campaign in a city and you immediately... Yeah, for example, in [Dutch City] we made a press announcement that we wanted to make the city center of [Dutch City] more green and together with the municipality and we said, “well, if you want to do something with your roof, get in touch with us”, and within a week we received like 70 people who were interested in greening their roofs. So, and sometimes there is a lot of energy around it, but Yeah, you first have to say, okay, we are here.

DG: I'm here.

PL: Yeah. So I think especially [Dutch City] is a very [unclear word] orientation city, so a lot happens over there, in regard to green or sustainability. And in Rotterdam also, we also did a campaign and a lot of people contacted us. But the difficulty lies in the real estate that is owned by housing corporation. Because of the gaps in the policy there. Yeah. But yeah, we did both ways. We do some campaigning and people come to us if they find us.

DG: Yeah, great. And last, I saw in the site, in the Rooftop Revolution that you have all this very cool maps, where you are kind of mapping the opportunities in every city, and that is basically takes a lot of... I'm sure, you know, you also mentioned that they, you know, the site, they use indicators to tell you all these opportunities in every city. So, I was wondering just to cover the last part of Impact. Which, how do you do the monitoring? Do you, then do a follow-up of the of the roofs that you help to execute? Do you measure the impact or not?

PL: Well. Actually, We are not quite there yet. I think that's a very good idea, but if we if you really want to measure the impact, I think you have to make more scale. And there is a project that is called RESILIO and in that project we do measure the impact. And that it is a very unique project because it's in Amsterdam and it's blue-green roofs on real estate from housing corporation, and it's a project that is subsidized from a European fund. And together with like eight partners, we create 10,000 squares, meters of blue green roof and Amsterdam, and we also want to measure the impact. So, when you have scale, you can measure it.

DG: And how are you measuring it in that project?

PL: There are, in the project there, one of the partners is the [Dutch name], in the food, the University of Amsterdam, and the researchers, they do interviews. But they also do research on biodiversity, the effect on biodiversity, but the measurements also happen because there is well, that's a difficult to explain, but there is decision support system. And that's a system that is yeah, regulated by data microbes. Micro Data and macro data. So, and that system decide if the water on the roof has to stay there or has to leave the roof. So, it's a System that it is...

DG: It's like smart.

PL: Yeah.

DG: Like smart system, grid...

PL: Yeah. Smart group. And of course, that's system also has a lot of interesting data. So, and that is measured by WATER NET. That is a big company in The Netherlands that regulates our water supplies. And the goal is, of course, that we more and more seeded value of water and that we work together with water instead of fighting against it.

DG: Yeah.

PL: So, that's the way the measurements are taking place. But it's a good question. How to measure the impact? And yeah, it's because if you want to build a green roof on a shed. Only, if you have a lot of green roofs in the neighborhood, you can really measure the impact. And well, that we can do more and more, because there are more and more sheds being greened, but big projects of big surfaces from housing corporations or CCE or real estate owners, it takes a lot of time to get from idea to execution. So, there are two little projects of that scale, so we have to wait to have more scale and then we can measure the impact, but it's good to remind us to do more measurements. Yeah.

DG: Of course, because well, this is a personal opinion, it's just if people go to you and said, "I'm thinking about this, what are the benefits?" If you are actually able to have data about it, like an actual fact, maybe it's easier for people to be more...

PL: Willing.

DG: Kind of convince.

PL: Yeah.

DG: Yeah. A...

PL: Yeah, well, of course we have data in, like and if combine solar panels with green, your solar panels will have 6% more benefits, that the solar panels benefit of it. And that's like just six percent and data like your normal black roof can get like 80 degrees in the summer and green roof only 40 and it. So that kind of data we have. And the benefits we can give them for an individual roof. But on a large scale, what it means for a whole neighborhood that sometimes the difficult, but we can also make those measurements, but it's a little bit more, I guess than real database. but we have a lot about the benefits. It's like, yeah, benefits that are not so familiar with everybody, so, it's also always takes a lot of talking to convince people, or also to find out what they want to get out of it. Is it for a view? Is it for cooling? Is it for...? So, you have to really yeah, every roof, every roof owner and will be seduced by other benefits.

DG: Yeah.

PL: Yeah.

DG: So, on that note, my last question is that you are in the middle of municipality and owners so you know both ends and they know what one end wants and what the owners maybe as you said are seduced with and, of course, it's a great program, but there's a lot of room for improvement, right? So, what do you think it would be good to have as a new version of the program, but will be good in order for the program to work better?

PL: Here. You mean the proof of Revolution revolter Dam or the Milky functional program. So, I can hear. Oh wait. I love you there.

[Bad Internet Connection]

PL: I've missed all of it.

DG: Hello. Right. Yeah, yeah we're back on. I lost my phone so but no, I was just saying what do... I believe that there's room for improvement and what would that be for you? just what can we do better to just make people or program with these characteristics better?

PL: Mmm.

DG: Maybe within the organization you're already discuss it and thinking, guys, this is not working. Like, what is...?

PL: Yeah. Well, I think for us as an organization we need to do more sales. We have to do more...say more often "ok we can help you, and we are here to make this work" That's maybe for our own organization.

[Bad Internet Connection]

PL: I think we have to be patient and do more about our lobby with government lobby and we have to go out more. But well, something like Corona and that's was also a little bit in the way of doing real outdoor campaigning and events and yeah.

DG: Okay, okay. Great. Well, that was my last question. So...

PL: Okay.

DG: Thank you so, so much for your time. I'm sorry that we cannot finish this meeting with my camera.

Entrevista: Tipo 2 – Dolores Giribone – Esther Wienese

***Entrevistador:***

Dolores Giribone (Arquitecta) - DG

***Entrevistado:***

Esther Wienese (Fundadora de DakenDiva) - EW

Día: 28-04-2021

Hora: 3pm-4pm (UTC +7h)

***Transcripción:***

DG: Okay. Um, okay. So, let's start out.

EW: Okay.

DG: I want to know about you. I want to know about your company and what do you do? what does what motivations and purposes and... that.

EW: Good. Well, I'll call myself the *Daken Diva*, if you translate this, like the rooftop diva. Well, you have to pick a name.

DG: Yeah.

EW: No, it is because I started, well, I got interested into rooftops when I was being a guide in Rotterdam, I was already writing and doing PR about City developments and how to deal with water and nature and housing and how to make that a good plan for that. And then I, I got... Well, the rooftops came on my path, I was talking to someone who worked at the municipality and he said, where you're doing this amazing program and I think it is good to have a book about that and do you want to write it? And I say, yeah, and that's how it started. I did that not, I did it as a how do you call? [Dutch word] I don't work for the municipality, but I did it on my own. So that's how I got, I heard about this Multifunctional Rooftop Program and I got really inspired. I didn't really know what was coming towards cities, and I also didn't know that there was a solution on the rooftops. So what I did is I interviewed about 20 people from

different perspectives. They told me about why it's important to use the rooftops. And I also had about 30 examples of rooftops that are already multifunctional. And a book is now the relation gifts of the municipality. Also the English versions. So you are in Jakarta now, I think. Yeah. And also well Aboutaleb, our mayor, went to Indonesia for the water week. He brought this book, so in Jakarta, maybe you find the book, what's called? Rotterdam Rooftops. Yes. And the subtitle of the English book is "Taking resilience to a higher level."

DG: Nice. And how...?

EW: This book.

DG: Look at that. Well if I see it here, I would definitely like buy it or at least read it. Um, but how do you just kind of discover the rooftops? because you were doing like tour guides right? And you didn't know much about roofs. But did the municipality just came to you and say, "why don't you take a look at the roofs" or was something that you showed around?

EW: I was at a meeting about the development of the city center and I met someone who was working at a municipality. And also was writing for the same magazine that I write for in Rotterdam and we got together and we talked and how you doing? and how is work? like things like that. And then he said your guide and you know more about City development and you're also on rooftops because when I guide people through the city, I usually go up because then you have the best view so that's all came together. And it was kind of a brainwave, you know, and then I succeeded to bring it further and to get sponsors and to realize the book. Yeah. That's what happens. And during it was kind of a research all the time because every time I talk to someone and he said you should talk to that person or you should go to that rooftop and so it developed, it was, I was for exploring and the result of that was the book. Yeah.

DG: Yeah, yes. Okay. So that was like the starting point, and then, was like an immediate jump to Daken Diva? or how was that?

EW: Sorry you, I didn't really hear you. There was a bleep on the...can you repeat the question?

DG: Of course, I'm going to just turn off the camera. Just I don't know if my internet is very good and maybe that will help. Is that okay?

EW: I hear you fine now. So I would like as long as it's possible. Keep the camera on.

DG: You let me know. You let me know.

EW: Yes.

DG: I was saying, so that was the starting point. How you got to know the rooftops and their opportunities and their potential. So was there like an immediate jump to the Daken Diva kind of company or initiative, or how was that?

EW: No, it kind of developed after I launched the books. It was in November 2017. I was really excited, and I thought now everybody's going to ask me to tell about the rooftops and everybody's going to develop them and kind of nothing happened. It came became Christmas and New Year and nothing happened. So I saw Hmm. This is not this is not enough to publish a book. So, I was thinking how can I bring this further? and then I made the English version with Rooftop Revolution, Rotterdam Rooftop version, and I also launched a Rotterdam rooftop tour because you know, a book it's great, but a few people take the time to read it all and I had... I was a woman on a mission, and I wanted to tell this story so I developed the rooftop tour and it was great. It became more and more popular, we started with once a month and then it was twice a month and then every week and then more times every week. And so people, I took people onto several rooftops and to spread the word. And then I also began to do talks about the rooftops. I did a TEDx talk on the Rotterdam Rooftops and well, it kind of developed. And then I came towards a point that, you know, I was making people aware and inspiring them, and then more and more they came with questions. But, okay, now, I want to make my rooftop green, where do I start? And I didn't know the answers. I didn't know how to help them. So that's when I found Rooftop Revolution and now the two of us work together.

DG: Okay. Yeah, I saw when doing a little bit of research on Rooftop Revolution, it was funny because I already had talked with you and I saw like kind of your logo there. So I thought, Okay, small world.

EW: Yeah, it is.

DG: Um well, at any point did you have any kind of help from the municipality? I mean, the municipality wasn't behind you saying I have a solution or send this people to the municipality to if they want to develop a green roof. No. Wasn't the municipality part of your journey in this first stage?

EW: Well, no. Because my corporation with the municipality started when I wrote the book, they were really supportive for giving me information and money to make it. So that's where our relationship started, and you know the municipality has this difficult position that they can give information and they can help you with subsidy if you want to make a rooftop green, but they cannot... If I go to the municipality and I have a rooftop, they cannot say, you have to go to that person because he can make you a real beautiful rooftop. They can't do that because they have to keep distance towards the markets. So, no, I cannot go to. I cannot help you but I can send you towards the municipality. That's not possible.

DG: Okay.

EW: So, what I did with Rooftop Revolution, we heard that the municipality had this plan to add 20 acres of green towards the city and six to eight acres had to be on the rooftop. So I went to Jan Henk [Director Rooftop Revolution] and I said, can we work together and then we go to the municipality and I said we want to help. Because the big problem of the municipality is that most of the rooftops they don't own them, they are from private persons or housing corporations or companies or VvE. Sorry.

DG: Yeah, I know. Yeah, I know the...

EW: Well, Yeah. So, if they have this big vision about how to use the rooftops, they need the rooftop owners and they didn't have enough... giving a subsidy to make your rooftop green wasn't enough stimulation for those rooftop owners. So, Jan Henk and I went to the program manager of the 20 acres extra green and we decided together to do it, to start a pilot in four areas in the neighbor in the city to find out what do we need to reach out to those rooftop owners and to help them to act. Because if rooftop owners already think about the rooftop as an opportunity, then what the most thing they do is they reach to solar panels, but not for green



and that's a big risk because the city, if you put solar panels on all the flat roof tops, the city gets dirty, ugly, and hot.

DG: Yeah, of course.

EW: So, we want the rooftops to be green. So, that's where we started to work together with the that pilot. municipality, we're in the middle of that pilot now. We started last summer and in four areas and we find out, okay? What do people need? how do we reach them? and how can we help them? And also, is there a business case in that? because the municipality cannot always support us. At one point, there has to be a market. And yeah. So that's what we're, what we're trying to find out now.

DG: Yeah.

EW: Yeah.

DG: So just to have it clear on my mind. So, the municipality basically they launched like the Multifunctional Roofs these last few years and then before, since 2008, they had like the green roof program like as a just to say they had this subsidy to green roofs.

EW: Yes.

DG: They were the ones communicating these initiatives but and people like heard about it from them, but they came to the municipality they didn't have a like an actual solution to execute, just the subsidy, and then people had to find other ways like you or Rooftop Revolution to kind of have further advice and then to build it.

EW: Yeah, I think we came at the right moment, the Green Rooftop program started in 2008, or 9, I think and the municipality they gave an example by making their own rooftops green and, but it was really difficult because he had to tell people, you have to make your rooftop green and catch the rainwater. And people were afraid that they would get water in their houses. And so, it was a real communication action to get them in this position. It took years and then slowly people became they brought... Paul [Program Manager Multifunctional Rooftops] can tell you all about this if you call him Paul van Roosmalen. People said “oh if I make my rooftop

green, can I put a little bench there? So, I can enjoy the view.” And then it developed into a multi-functional roof so program. And yes, the municipality did do PR and did do any everything to give the subsidy, but it's really hard to reach people to reach them at the right moment. The right moment is when they have to renovate their roof. Anyway, that's the right moment. So, when Jan Henk and I came to the municipality, “so we want to help, and we think this is the way” they said “okay let's give it a try”. Yeah. And because they know how difficult it is, they also give us time because we get maybe over a year to figure this out. Yeah.

DG: Yeah. Yeah.

EW: And it takes time. Yeah.

DG: Yeah. Okay. Can you tell me a little bit about how was that experience? From starting to reach out to people and understanding what are their needs. What do people want out of their roofs? Now you mentioned like solar panels, but are there, is there like a group growing that is interested and having green roofs? The people understand the benefits that comes with green roofs or how is the field to start upscaling this?

EW: Yeah. Well, there are people who themselves discover that it's nice to have a rooftop terrace. And that's not the same as a green roof, but it's a start. If they put some plans there we are already happy. Solar panels is the first thing people think about because it's so easy and it's so fast that it gives you money back. Like a green roof is a long-term investment and solar panels you really, you get your money instantly, especially on sunny days. You see it. So, that's really a big competition. So, you know, when you're working in this rooftop business, you say it's a small world, it is a small world. And when we are all together we talk the same language and then you step out of it, like we do now in this in this pilot, and you notice that lots of people have never thought about what they can do with their rooftops and the people that come to you, it's really the start, the frontrunners that are coming and they are already interested and also they think the first thing they think about a solar panels. So, to get them in this position of green rooftops is already a challenge. Yes.

DG: Yeah.

EW: But it's getting more and more. And what also what really helped because I was I wrote

that book and I think two and a half years later we had this heat wave in Holland. So, for about a month it was really hot and was really dry and that was a kind of a tipping point where the newspapers also wrote about “hey we can do things on the rooftops”, and I thought “I don't have to do it alone anymore”. It felt like that. More and more people adapted and also more Architects like MVRDV, maybe it's nice to talk to them too, I can give you a contact. MVRDV is very famous. Now all over the world but also in Rotterdam they made the Depot Boijmans Van Beuningen, you know is a museum.

DG: No, I know the studio.

EW: Okay. Boijmans Van Beuningen is a museum, and they have lots of artwork. They had in the cellars and because the water level that made it danger. So they made this huge pot with the rooftop on it with more than 70 trees. I can send you a picture and this "Winy" Maas is the director. He's really making an effort for green roofs. So, it's important that Architects also from the beginning, make designs with green rooftops, and solar panels and the combination of all.

DG: Of course. But then I think, talking a little bit about Architects and Constructors. A few of the people that I talked to, they mentioned policies and codes and no being able to make this kind of practice mandatory, you know, and that it's super difficult to get like through all these regulations that are now in in the municipality. So, do you think it's, do you share that vision?

EW: Actually, I shared a vision if I am still, not able to tell people what subsidy they can get, for instance, for a green roof or a green blue roof. A green blue roof is a roof that catches rainwater, because it's too difficult. So people sometimes they get discouraged because they don't know where to start and the municipality is working on it, but 's difficult even for me. And I am really motivated. But it's getting more and more simple, but not only because of the municipality, but because like a party like INTERPOLIS, they have this green roof so program, you should Google them, and they make it really easy. If you want a green roof press here. You get this subsidy and yeah.

DG: Where is that?

EW: But there's it's changing every day. In INTERPOLIS.

DG: Okay.

EW: I will send you an email later with some links, okay?

DG: Okay. Thank you.

[Bad Internet Connection]

DG: Well. I'm losing you.

EW: But if you want to know about how... more the research, the knowing. How many people have a roof green roof or how do we reach them? Paul can tell you more about that, because they monitor it. Maybe Jan Henk also can do that.

[Bad Internet Connection]

DG: Okay.

EW: I told you about regulation and this MVRDV, told you about these architects.

DG: Yeah.

EW: We worked on a rooftop catalogue. Do you call it that way?

DG: Yeah.

EW: MVRDV they made about 150 nice sketches of what you can do on your rooftop, it's really amazing. It's gonna be launched during the Rotterdam Rooftop days. That's also always the first weekend in June. And Paul also knows about it because he gave the [Dutch word] Yeah. Well he asked MVRDV to make this catalogue. And he also said, well, 99% of what you designed is probably difficult or not possible now because of the regulations. So, if you are ambitious, more ambitious than only making a little green roof, then it's really hard. So we have a long way to go, to tell people, "Look how much is possible, look how beautiful the city can be". If we use

those rooftops for all those different functions and if you have them inspired, then it has to be possible too. So that's really... Steps we have to make together.

DG: Of course. And okay, so we have, of course, the regulations that is a big barrier to overcome and imagine that you can do... that you get all the framework in the right place, then the only way that the municipality is helping you is with subsidies right now, right? Or...?

EW: No, no. The municipality is doing more. They really do their best. I don't, they pay us to do these pilots for instance, so we can... that's how they support us. They make beautiful films videos about the possibilities for rooftops, they have a good website. They work really with the corporations to have the long-term developments and get the roofs in them. They check all the new buildings, the high rise in Rotterdam. They ask the high-rise, the rooftops, to have two extra functions, so they do a lot of things to make people more aware and help it. But it's really difficult because of regulations. Yeah, Paul can explain you all about that.

DG: Okay. Beautiful.

EW: And you know what the big challenges is? We have several levels of buildings. The new buildings that's kind of the easiest part, you know, in Holland, you know, have nature inclusive building. That's what we're talking about. Nature inclusive building. That's the new way to develop new buildings, but most of the buildings are already there. And that's really... if you have to renew your rooftop, that you can only do that when you make it green or give it more functions that would be really helpful. But that's not the regulation at the point.

DG: Those are, actually, the buildings that I'm interested in, like the green roofs as a retrofit, as a way of making those buildings that are already there better in terms of... it could be insulation or purifying the air or helping with the heat as you said. So, I'm super interested in, not the new ones, because I know that even though maybe it's also difficult to put a roof there, most of the buildings are already built. So I'm super interested in having this green roof practice as a way of retrofitting all those flat roofs that Rotterdam has. Right?

EW: Yes. Yeah. Well that the biggest owner of the roofs, the existing rooftops in Rotterdam, is the housing corporations. And the municipality is talking with the housing corporations to have a long-term development program or... [Dutch words] but it means that in the long term they

know “this is the work we have to do on the building, and when we have to renew the rooftop, we make it green or we give it more functions”. So that is what the municipality is talking to with the CEOs of the housing corporations. And what we do from the pilots is to reach out to the people who live in those houses and say, if you ask the housing corporation, “we want green roofs”, then we kind of grab them from above and from the bottom.

DG: From the bottom. Yes. Yeah, that is the way to go.

EW: Yeah.

DG: Um, so okay, so we mentioned a few barriers. Do you have the file I sent you?

[Bad Internet Connection]

EW: I don't hear you. I didn't hear your question. Can you repeat it?

DG: Yeah, sure. Because I sent you a file apart from the questions. There was a table there, with barriers.

EW: Yes. Yes.

DG: And I just wanted to see if I was missing any barrier that you think is something that comes up like a lot during your experience. I can share my screen or maybe you have it there.

EW: Well. The only thing I would add is lack of ambition.

DG: Okay.

EW: You hear me? Yeah.

DG: Yes. Yeah.

EW: Lack of ambition. And that's also because people are not aware of the possibilities or think about a little green rooftop or solar panels, but these hundred and fifty possibilities MVRDV

designed, they don't know. So, we have to stretch them, we have to show them how much more is possible. And so, the one thing is they don't know, they don't have the imagination. They were not inspired enough yet to do more and the other thing is this lack of financial incentives. That's really, that's really a thing. I work a lot now with VvE, and it's really easy if they have the money and if they have the will, but if they don't have both of them then you can do nothing.

DG: And do you do believe that it will be possible at some point to just get rid of the subsidies? or because I read about that in, in the municipality's site that their wish is in the future to get rid of the subsidies, when this kind of movement has taken off.

EW: Well. I think it will take a while.

DG: Yeah.

EW: Because I noticed this in the pilot that when we can tell them, you know, if you have to do a roof which the municipality pays, that really makes a big difference. Yeah, it really makes a big difference. If they have to do it on their own, well, they really have to be motivated and they have to see the benefits themselves. If they notice that you know, it's more interesting if it's a green roof where they can also sit or maybe they can also make vegetables or I don't know, use it, then they are more inspired than when it's only a green roof above their head. And also if they have a view on a roof, they are all so interested because they, they notice that their view will be better and that it will be less hot in summer. The people I thought they realized that so it's a big difference. If it's a roof above their head that they don't see or a roof that they have a view on.

DG: Yes. Yeah, and well I noticed that you together with a Rooftop Revolution, you have all these cool maps. I don't know if you were part of those in order to map the possibilities of green roofs in these four places in the city that you mentioned.

EW: Yeah, Yes, we made them.

DG: So, I think that way...

EW: Yes, we made them together. Yes, we made them together. Those maps you mean; this is before and this is after?

DG: Yeah, I saw. Well, I cannot look a lot into it because it's just one photo, but it reads “These are all the possibilities of green roofs in these four neighborhoods in Rotterdam”. I think it's in the Rooftop Revolution site.

EW: Okay, because we have this Rooftop Revolution Rotterdam for the pilot and we made these artist impressions. Like we took a picture of the rooftops and we said, okay this is how it looks now and then we made an artist impression. This is how it can be in the future. And that really helps. It's nice to show that.

DG: I'm gonna check that out. No, I haven't seen those. But where I was going with this is...

EW: Okay.

DG: ... after you managed to just to build one extra green roof and added to the to the city meters, as Pamela told me, do you keep like a monitoring or do you do like a follow-up in order to see how the area was improved after it or in order to, with those results, communicate to new people that are interested or...

EW: Okay, well, I don't keep... personally, I don't. Maybe Rooftop Revolution will do that in the future. I'm not sure but the municipality maybe is so I will check in there. Yeah.

DG: Okay, because I was just thinking, of course, if the city manages to have a lot of green roofs, eventually that will impact in the water runoff, on the heat levels, you know, for the best for the better.

EW: Yes.

DG: So, I was thinking if these independent companies are keeping track of monitoring or doing a follow-up of all these new green roofs...



EW: Yeah, well, I really think it will be good to do but I also have noticed that these things like having less rainwater in the sewers or making the city cooler. It's important for the municipality, but it's really a big distance from a house owner to this big climate changing challenges. You know. They don't really "Oh I can make money by using solar panels, or my house will be worth more if I have a rooftop terrace. Or I can enjoy my rooftop more when I have rooftop terrace, or my view is going to be better when I have green roof." So, it's really close to home where, you know, all those big challenges for cities, like it's getting too hot or it's getting too wet, or it's getting too dry, or it's getting too dirty. It's away from people's motivation. You understand? So, the smaller we make it, the more close we bring it to their home, the more motivated they are. And for the municipality I think is interesting to monitor and to have the figures because they have an obligation towards the climate contract in Paris. They have to reduce Co2, they have to reduce the heat in the cities and so they have to know.

DG: Yeah, yeah. Well, that was one of my...

EW: Understand? Okay.

DG: ... big questions, where I thought, how do you make people... how to engage people to be part of this bigger problem for the city that is climate adaptation? but the municipality needs them and they both have different motivations and reasons to do it. So that was just like this big gap. That we have to...

EW: I think that's why the rooftops are so interesting. Everybody has a house or wants a house, and everybody wants a roof above his head. And that makes it so beautiful because that's where you can reach out to them. You want this roof above your head, and you can make an even better roof than you have now. I hope, I still hope that really will help to reach them, because it makes it so small and so concrete the things you can do. If everybody does that on his rooftop, we get a better city.

DG: Of course. of course. One of my last questions would be: What do you think? well, I think now by now, I know why the municipality is doing right, you talked a lot about all the work that they are putting into kind of expanding this program and making people more aware, but I'm sure that there is also room for improvement, and what is that for you? How can this program become like a little bit better? You have any ideas on that?

EW: Mmm. Well, I would love to have a huge campaign. I really think there should be a huge campaign to make people aware that when they have to, that once in a while you have to renew your rooftop, and that these are the chances for those rooftops. And that the municipality is supporting you in any way they can by giving subsidy, by looking at the rules and making it easy for you. That's the improvements. Yeah.

DG: Yeah. Okay, wonderful.

EW: Because you really have to grab them. You know, when they know in a year's time, or in two years' time, we have to renew our rooftop, it really takes time to get people in the position. Oh, we can do more than a new layer of bitumen you have to take time, especially with a VeE. It takes time to get all those people together. So, you have to grab them maybe two years before it's really necessary. And a campaign maybe in ongoing campaign can really help that will be great. And I also said you, we have to show them the beautiful examples. I really, I want to make a TV show in too much. One is I want to go International and show the most amazing rooftops in the world to inspire. And I also want to make it really small. We have this programs in in Holland where you can have a renovation of your house, [Dutch TV Show name] and then people come to your house and with an interior architect and they make it beautiful. And I believe in a program like that. It's called "in love with your house" and you can call it "in love with your rooftop". So, you show people how they can do it, maybe how they can do it themselves and inspire them. It's really necessary. I'm really looking forward that in my neighborhood between now and few months we are going to really make the first green rooftop. And when we can show the pictures and we can show people, we can tell the story about the making of them, it gets easier. People think oh, oh, they did it. It wasn't that expensive. They did it, didn't this way. They did it themselves, for instance, or they had help and they had the subsidy. Oh, we can do that. So, we have to make a lot of examples.

DG: Yeah. Examples are good, of course. But have you have you seen it like a change from when you started like making the book and now have you seen like more energy, positive, positive energy towards...?

EW: Yes, I have seen I think there are more and more people. Yeah, more and more people with influence they have adopted those rooftops like [dutch influencer] For instance. He is this

sustainable influencer and you have now this nature inclusive building. He was really big in that. So, in The Hague, they're now talking about, okay? If we make new buildings, we have to make them green. That is really important. So, the green is also in The Hague where the politicians are is really they're really talking about it. On the other hand, sometimes I go to another municipality and talk there and then I noticed that they're really in making the first little steps, they have no idea where to start. So, Rotterdam is really, really already a front runner, but also there lots of people don't know. We have a lot of mission work to do yet.

DG: Yeah.

EW: Yeah, I also looked at your barriers and well, the importance I had two medium and every all the others were high. There's so much to do.

DG: Yeah.

EW: Yeah.

DG: Yeah.

EW: I don't know what Silo Mentality is.

DG: Silo mentality is just in the government or the municipality, like every department is focused on their own way of doing things. So, and you don't know who's responsible of this. So, everyone is saying it's, you and everyone just stays in their own little house and do not communicate. It's a mess.

EW: Yeah, that's a really good one to talk with Paul about because this rooftop program in Rotterdam is adopted now by five different programs in the city. So, it has to do with energy, sustainable energy, with building, with green and they all work together. And they all meet on the rooftops. So in Rotterdam they work together on that. That's really good question for Paul.

DG: I will ask him, yeah, because he is... I know that he will be. He knows like they the inner the insights. The really specific things about the program. But I'm very curious about also how...

EW: He developed the program.

DG: No. It's just... I'm curious about how... I mean, the program specific questions but also how people like you or roof owners receive that program, right? If like, I don't know. Because he can have all these ideas and explanations. But then when it gets to your hands and you still think no, this is too difficult, you know.

EW: In my book, Jan Rotmans, really famous, and he says, 90% of people have never thought about using their rooftops. And I think that's still through still true. There is a really a small part that's now aware and has the money to do something with it. But, but lots of people, you know, we also have areas here where people are trying to survive, they are really not thinking about the rooftops. So. stopping the subsidy. No, I don't see it. No, I think the municipality really has to support it for another. Maybe five years, at least.

DG: Okay.

EW: Yeah.

DG: Yeah.

EW: Yeah, but I do, I do really believe that the rooftops can be a solution of a lot of challenges that come towards cities and that makes it really grateful subject. Yeah.

DG: Yeah, yeah, me too. So, I hope that more people kind of adopt this practice. And yeah, in a few years I'm excited to see how Rotterdam is doing. But, well, baby steps, right?

EW: Baby steps into this, all to do with money. I heard in Dubai. They kind of decided that now, the city is the Oasis, so every movement of this green there, it's normal, but they have lots of money.

DG: Yeah, of course.

EW: They yeah. And everything is new so it really...

DG: There's a deal breaker.

EW: yeah.

Entrevista: Tipo 1 – Dolores Giribone – Paul van Roosmalen

***Entrevistador:***

Dolores Giribone (Arquitecta) - DG

***Entrevistado:***

Paul van Roosmalen (Program Manager, Multifunctional Roofs) - PvR

Día: 04-05-2021

Hora: 10pm-11pm (UTC +7h)

***Transcripción:***

DG: I just one question.

PvR: Yeah.

DG: Would you mind if I record this so I can listen to you, okay?

PvR: Not at all, perfect.

DG: Yeah.

PvR: We're recording.

DG: Yeah.

PvR: Good. So Rotterdam started with green roofs in 2008. And that was a start for Rotterdam. And actually, also for Amsterdam and Groningin the three first cities in the Netherlands, that started acting on green roofs. And there were a lot of German cities before and in America, Canada. That was a lot of happening already. But that's the starting point for Rotterdam and it was green roofs because we were thinking about two things, we thought Rotterdam is this Delta City. So water retention was a main aspect. Like how can we take the water away from the sewage system? How can we keep that rainwater these downpours? How can we keep them away from the systems that are, in the end always, too small. So, can you catch it where it falls?

basically. So, on the rooftop, you catch it there, and then Greening because we already saw, then that we need green extra green in the city. So that was a starting point green and water. Green as in nature plants and it evolved over the years to what we're doing now, which is multifunctional roofs. And, and there's a few issues with that. One is that it became more normal. Like we could add aspects, that's the positive story. That not. So, positive story, is that there were so conflicts. So we had green roofs and then an alderman came that was interested in solar panels. And he suggested that we take away the green roof and replace it with solar panels. And that that showed us like, okay, so that's not really helping because we still have this need to do greening and water storage. And of course, we also have to produce sustainable energy, but but it's not or-or it's and-and. That's when we started thinking about an integral program where we start to combine these functions. That's very generally, the line that will walk for the last 10 or through 13 or so years. And and maybe that's what the point where we are now. We see that a lot of things are happening. People start understanding the value of green and water in the city, climate issues are not debatable anymore. We know it. We're taking it seriously, everybody understands, and everybody knows that we should all act. I mean, I think in the Netherlands, at least that is the mindset of the people is like that, it wasn't like that 10 years ago. I didn't start at that time. My colleague did Evelyn and she she was one of the first civil servants, who came to the people that said, let's install a green roof on your house. And people were like, are you mad? It will leak. It will attract mosquitoes. I can't see it. So why would I put something beautiful on the place where I cannot see it? It will cost me extra money. I will not get any money from in in return. So there were a lot of issues to be solved. People didn't see the quality. And, and that's surely changed. And and I think now using rooftops is a very normal thing to do. Everybody understands it, everybody sees it. Although they're still not so visible. I mean, when you stand on this, on the ground, on the street, You don't see the rooftop, you see the building? You see the street? You see a lot, but you don't see the Rooftop.

DG: Yeah.

PvR: So that makes it hard and at the same time, we're now... So we're expanding in teams more going to happen and we're all so deepening in the teams that we already have. So we didn't abandon green and blue, but we're looking at more A higher quality green and blue. So when it comes to higher quality for water, it's more water. Very simple. So all the green roofs could store maybe 15 liters of water or 20 liters. The newer systems, we'll talk about 70 liters, 100 liters, 150 liters, huge increase in water, storage capacity, And it's it's more than dynamic but

we can go into that if you want. The other side, the Greening is about biodiversity. So we started off with these the traditional Sedum roofs and we find that they're very... they don't really add a lot of biodiversity. A lot of those plants are not native plants. They're morally, more Mediterranean plants. So we're trying to improve the quality of the plants that are going to the rooftops.

DG: Yeah.

PvR: So you see an improved Improvement there.

DG: Yeah, so okay, you started with this “Let's add more green, we need to treat water management”, of course, Delta City, lot of rain, and and the green roof makes sense. And but other activities or other desires from people started kind of competing with these green roofs because well, basically solar panels, which everyone agree with the other people that I interview. Specially because it's actual money that people see back, you know.

PvR: Yeah.

DG: So how are you? How are you kind of, yeah, competing with that? because I know that you're asking more out of the green roofs and the the blue roofs, but if the people have a simpler solution with solar panels, what are you doing? In order to convince them to do otherwise.

PvR: So, maybe three things. The first thing is to, to combine things. So if you have a solar panel, try to put a green roof under it and they will both benefit, the solar panel will have more energy produced. Sorry. And the green roof will have sun a shadow. So it will have more diversity in plants and animals that can grow there. So and and the water under the green roof will, of course, make the green move grow. And if you would also isolate (insulate) the roof that was already there before you install, all this stuff, then you also lower the amount of energy that is used in the building. So they have four things that you win, on one space like one side, one one roof. So combine, please, and and it will works. I mean, you can make money on the solar panels. Use that money to invest in your green and blue functions. So combining is one. The second is that we are still at the phase that there's a lot of roof space. Like it's millions of square meters. There's still quite some space available, although although we see that there's an urgency and and we cannot... We cannot just mono functionally roll out everything, like let's



do solar roofs here and then the green roofs there, and and we won't have enough space. If we want to make an old ambitions come true. So there is, there is a struggle for space somewhere in the future; but at this moment we also said to people just what whatever makes you happy. I mean doing something is better than doing nothing if you really want solar panels. Well then do the solar panels. I mean it's better to have solar panels than nothing. If you want to do a green roof, do the green roof. We have green roofs on buildings that are not in need of water storage, where there's a lot of green around. Technically is not necessary, but if people like it, why would you stop it? So we go where the energy flows in the city.

DG: Yeah.

PvR: And the third. So that's the third, the second thing. And the third thing that we do is that we we figured out very early already that you basically need three things to make people enthusiastic. The first is that they need a place where they can see it. An example, they need to be able to see smell hear, like experience something. The second is that they that we need ambassadors' people who are not from municipality who tell this is a good idea. You're an architect. You you might know Winy Maas from MVRDV. It helps when he says it. I mean, it really helps.

DG: Yeah.

PvR: I mean I can say it 100,000 times but if he can just drop it on national TV, and all the designs in the world will listen to him, not to me. So that those kind of people are ambassadors are really important. And the third thing that you need is, you will always have to pass by a calculator in any project. At some point, somebody will say, okay, but how much will it cost? How much will we benefit? And, and do we want to make this investment? And for green and blue it's very hard to calculate that because those, they are valuable but not profitable. And what we desire, what we are designed and are still like improving is a system how you can calculate what's the value of green? What's the value of one tree in Euros? So how much euros is a tree worth?

DG: Yeah.

PvR: And how much euros is a cubic meter of water worth and for who? And can you also...?

If somebody says it's important for them, like, for example, water boards, in the Netherlands, for them, water source is important. So we can ask them the question, okay. How much do you want to pay for one cubic meter of water that doesn't go to the sewage system? And then you get a figure. I mean it's somewhere probably around, 400 euros per square per cubic meter. Okay, that's interesting because then you can start calculating on the benefit for them. So, in this way, that's the third way I think, is to technically you call it a social cost benefit analysis. That we can start calculating the social benefits of these kind of interventions. Because we have to go to somebody who plays the calculator.

DG: Yeah.

PvR: That's the way we try to deal with it.

DG: Okay, well, it's nice. Of course, you being from the program, you are the first one that actually is telling me a little bit about how you're actually putting like a figure, like a like a value, Euro value, to to all these benefits because at least because at least what I heard from researching is that everyone else science and ecologists, they say Okay nature is great, but I think that for normal people, just to put it like that, that value has to have a price or like a price that, you know, so it's good that you're...

PvR: It's, it's interesting Dolores because normal people, like really normal people, like you and me, we don't need a price tag for nature. We buy plants and we spend money on stuff without thinking, what it's worth or how much it the revenues will be. I mean, most of the things we do in life, we don't calculate that; but in a commercial or in a business environment we do that, maybe that's not so normal people. And and in that situation that's what projects happen. So somebody who is also green roof on the on their house because I love it, they like to see flowers, they often don't calculate the money.

DG: Yeah.

PvR: I mean, for them is the same as a kitchen or a car or close. I mean, you buy them because you like it, but you never calculate how much it's worth.

DG: Of course.

PvR: We never do that.

DG: But yeah, but I I wouldn't say that they're a normal people. Those are like passion is about nature. I talk up with one lady which is super passionate. She has a beautiful rooftop garden and and that takes me to the next topic. She spent a lot of money even though, even though she got the subsidies that then I would like you to tell me a little bit about it. I was thinking, of course you you hear like on TV, the super famous architect telling you, the rooftops are great, please do it. And then when you actually want to do it, I think that you get two major problems which are money, it is expensive and regulations, codes. That are, that make everything super, super difficult. Can you tell me a little bit about how are you dealing with that?

PvR: So, when it comes to money, this social cost benefit analysis, really helps. And, and it's very intriguing that people... you're wearing clothes, everybody's wearing clothes. You might have had a car in the past or you might have a stuff like a watch. A watch is a very good example. Nobody ever calculates a return on investment of a watch. I mean, it's basically non-existing, right? I mean you don't get something in return by knowing the time I still people buy them and very expensive ones and and a kitchen is also a good example. How many times can you take order takeaway food, before you end up at the same sum that people spend on their kitchen?

DG: Yeah.

PvR: Nobody ever makes a calculation. I think you would be surprised, how many years you can take take-away food day in day out for the amount of money we spend on the kitchen and then people see some kind of quality and one way or another in business worlds, we forgot about the quality part and we forgot about the value of nature of the planet and all those things. It's very awkward. That money is the only thing that counts.

DG: Okay.

PvR: And and so it play I would prefer to have a system, an economic system where we value those things. I mean, I think we're all working towards that, but it's not there yet. I mean, we still have to grow our economies and and only then things will be fine. And well, you know,

the story I think. And we should have a different setting for that but in the meantime, as we don't have it yet, we have to speak at language and that's what the social cost benefit analysis does; we try to speak the language of the people who talk in return on investment and I always tease them a bit like, okay, but what's the return on investment of your car? I mean the day that you buy it has half the worth of what you paid for it. I mean this is stupidest investment. You could do still you buy it. Why do you buy it? And the only answer is Quality. It has value because people have pride in it or they have an ego or whatever it is. It's fine. And we never put that value on nature and on a good living environment. And I think that's what we should do in the end.

DG: Of course.

PvR: So that's what we try to stimulate with people, so that's the financial part. Regulation later. But the second thing that's very important is construction. How much load bearing capacity is there in the existing building? How much can you add? Which is very often, very limited. So that's a very technical issue and you can just do as much as you can with the low bearing capacity. And there's some awkward things happening there as well, but but maybe that goes too far, but that's Technical. And also think of, when you make it more, integral like, people on the rooftop, you have to think about Escape Route, you have to think about Access and Etc. and then it becomes quite a complicated. So that's a technical complexity. You could say that. I never knew that we have in the harbor of Rotterdam, there are circles of the amount of noise that companies can make...

DG: Hmm.

PvR: ...and if they reach houses or not, and they don't reach them on street level, but on the roof of level, the sound comes in easier because there's nothing blocking it.

DG: Okay, okay.

PvR: So then you're breaking the regulations of the sounds barriers that are there never thought of that. So those things also happen. So, when you start using a roof that didn't have a function, we run into all kinds of issues that we never thought of because it was never planned like that.

DG: Hmm.

PvR: So that's, that's the regulation part and it's sometimes very complicated and mostly because the roofs never had a function. So, in our building codes in our city planning policies, we never thought of the roof as a space where you could do stuff, whatever that stuff would be and because of that, there's, there's no regulation, so the computer always says, no, like now that's not possible because well we never thought of it. So, we spend a lot of energy in finding the spit like the, What is possible within the rules? So, it's very easy to take a rule and say, how is the rules? That is not possible; but if you look closely, there are a lot of possibilities very often that you can work around those rules or find a solution to the to the problems that that occur. But it that again...

DG: Yeah. No. And who's helping people with all, with looking to to see the opportunity because maybe neighbors get together, "I want a green roof", but if they have to look for the opportunity in the regulation... Is the municipality helping with that? Do they have to just look advice in like a third party?

PvR: All of the above. So it depends a lot on who's the stakeholder, right? If it's just a person having a how a house it's completely different when it's a housing corporation, which is a professional organization that knows all the rules and regulations. Or when it is a developer, who has a very strict goal in mind, which is very often making money or when it is, I don't know an architect or it may it makes a difference. So we try to cater all the different groups and try to give them what they need. So we want to give people a perspective from the from within the municipality like how can they act, what do they need to act? And for the developer, the financial issue will be much more important probably than for the private owner that thinks it's fun but wants to know if it's within regulation. So we try to cater all those groups in a different way and it starts with giving them information, like, where can they find what they need. So we were building, mostly web nowadays, like web-based portals. Where there is information for them, on how to deal with it. And and I don't know anything about your qualities in the Dutch language. And, but most of that, of course, is in Dutch, unfortunately, Maybe.

DG: Yeah.

PvR: But one of the websites is multifunctional edakenhave. Do we have a chat here? I've never, I don't use this very often.

DG: Again, we do, we do.

PvR: Break the right.

DG: I've been there. I've been everywhere. Like, I checked all of them, even the Dutch ones, the ones that gives advice or you can check guidelines, every one, I translated everything.

PvR: But this one, this website, we build it a few years ago together with the city of Amsterdam. Can you see it or not?

DG: Yeah, I'm go.

PvR: I've put it in.

DG: Let me Yeah, I've been here. Yeah, I completely know it.

PvR: So what we did here is, this is just the private person and they want to be inspired first. So we really thought of the in marketing, they call it the voice of the customer. So what is the voice that the customer goes through? So first, I want to be inspired. I think that's a good idea. This architect or a more a nice example, then they start to dig into it and then slowly they come to this part of finance and regulations, and permits, and this, and that. So this website caters them in all those steps and where can I buy it? Now, what should I think about when it comes to maintenance and all those things? What options do you have? What? What? Color coding and the functions. So, step by step, we take them through the process. And that's a totally different process than the process of a housing corporation So that's what we're trying to do. And and mostly with would maybe you could say, private citizens. We have these kind of tools websites and we have a online... How do I translate it to English? like a place where they can ask the questions. It's basically like a contact page where they can put a question and we will help them further with that and it can be anything. Like, where can I buy solar panel, or how many different plants are on a green before anything and we have a team of colleagues that answer those questions. Help those people further. And the other hand, you have the

professionals and though they are most often they know what to do. And they know the bigger outline. But they have processed questions like how can I get a permit? Who's the building inspector? What's allowed, what's not? Those kinds of things and those people we help by connecting them to the inspectors that do the controls like, that give the permits. And that's, that's a public role of the municipality, right? You have public roles and private roles. So, what I'm doing is basically a private role. I'm just advising and helping people and we have some subsidy money, but the public role is the municipality in its function as the organization that gives you a permit. And that's in the end, a different world. I mean, I can advise anybody everything, but when it comes to giving a permit, we cannot just fool around, we have to stick to the rules very strictly. So I can ask my colleagues who do that part of the trick to help people out and see what's happen with what's possible within the set of rules. So that's how we help professionals. I think that's the two big groups. Maybe the third group is people like you. It's both students and international cities and delegations and everybody who's from outside the city interested in what we're doing. So, before we would have made a tour through the city, walked the roofs. And nowadays we do this kind of things and we also started the video series like a professional series of interviews with professionals. That helps to get an idea when you're from wherever you are from why people have Rotterdam do these crazy things. Why did this people in the hospital do what they did?

DG: But is that the one that interviewed you?

PvR: Yeah.

DG: And DakAkker and like six videos.

PvR: Yeah. Yeah. And Winy is there and a lady from the hospital and some others, and we're building this, so they're more coming.

DG: Well, that was one of the most interesting pieces of information that I got like and all these months.

PvR: Thank you.

DG: Um yeah, yeah. Because I read a lot of papers and everything, but I got so many point of

views and it was super clear. Yeah, it wasn't that easy to find maybe because I don't know if it wasn't Dutch or I don't know how I got there.

PvR: No. We have we have not really started broadcasting it on our social media. And once we start doing that it will come up in the in Google search and whatever. But but this is this is relatively new. We started a few months ago and Leon, the guy in the... what is it? Purple or so suit that there's all the interviews, he's the director of the Rooftop Festival.

DG: Okay.

PvR: So he offered to do this and what if your questions is how that we work with other stakeholders in the city?

DG: Yeah, if you have Partners, yeah.

PvR: So this is one of the organizations that we work with. So he has a NGO that that organizes a festival and they're into using the rooftops in a festival setting as a part of it, it's basically an architectural Festival in the end and I try to activate people to start using that. So it really works well with what we want to do is a municipality. So when he came, we had the idea of making a video series and we said, okay, but why don't you, What why don't we do it together? So, you do the interviews and you make it in your own style and and we broadcast them in our own media and you can use them as well. So it's a lot of co-creation like we work together with organizations in the city and this is a festival but sometimes it's building owners or Architects or a neighborhood initiative or whatever it is like we work with them all. Esther rooftop Revolution, the Renee, you must have seen her somewhere around. She was also one of the videos.

DG: Okay.

PvR: The lady that was going to live on a rooftop.

DG: Okay.

PvR: So she's so she really wants she already did but she wants to start living on a rooftop. In



a tiny house.

DG: Yeah. Yeah.

PvR: One of the videos about her. So, they're all doing their own stuff, their own thing and we try to work with them as a municipality. So we're always on this edge of working inside a municipality, which is regulations with the policy, connecting it to other policy fields and and the subsidy, for example, and otherwise we have this co-creation with organizations in the city. And other thing is a very interesting approach because a lot of times as a municipality we're really inward looking with all the stuff I have 15,000 colleagues, right? I mean there's so much that we can discuss with each other within the municipality. I could spend my whole day there and we said as a team, okay, of course we have to do that but we also gonna look outside and work with Leon and all the others because they're in the city and they make this stronger and better and they also have the part in it.

DG: Yeah.

PvR: Well, that's so that's I think the way we try to work. So to say.

DG: Okay. And for the future, I know or at least the municipality side says or maybe a few articles that you're trying to hit a 1 million square meter like goal, something like that of roof or multifunctional roof is that still a goal?

PvR: I don't like goals. I think they're stupid.

DG: Okay.

PvR: I mean, so you reached a goal and then you're done?

DG: Okay, no, but just as a future reference you would like to...? Let me rephrase it. You want to reach more people

PvR: Now I understand you Dolores. It's okay but just two stories, two stories. One is. Okay, so we have this, we have four weeks of total drought, four weeks of total 40 degrees celsius,

which is a lot in the Netherlands. The city is completely, people die from the heat, like 20-30,000 people have died from the heat. Everything is completely gone. All our solar energy is used for the air conditioning. It's a big disaster. and then, a huge range storm comes like 200,000 millimeters, under 50 millimeters of rain, in 24 hours, and the whole city floods, and everything is super dry. So the water cannot get away and all the buildings, go underwater, electricity goes out. We have a major disaster. Our mayor is interviewed by the TV and they said. What did you do to prevent this Disaster? And he said, well our goal was a million square meters and we've reached it. So that, of course, will not be the answer. You will never do enough, right? So goals, are in that sense. Stupid. And the second thing, do you know why 1 million square meters?

DG: Umm

PvR: We were working...

DG: Is it the center of Rotterdam?

PvR: That's basically the amount of rooftops in the center of Rotterdam, more or less. And we're working with Americans with a resilience team. 100 resilient cities. And now the resilience City's Network. And that's American led and they were like "okay but we need a goal." I said like, yeah they only interested in one million on. Because it had to be big, big. American. So we only did one million because they liked one million. And it doesn't matter. Because by the time we're there, It's just gonna be what it is. We try to do as much as possible but so the goal. Yeah, the goals goal, one million, perfect, 20, 30, I think. Okay. It's nine years from now, I don't know. I mean, whatever. But in the end I think a real goal should be that all roofs get a function.

DG: Yeah.

PvR: And especially newly built roofs. And as much as possible, existing roofs, I mean some won't be possible. Fine. But as much as possible, you should start using roofs. And I think those kinds of words, ER words, more, this not the best one, but better, higher, further. That kind of words are much more useful to use when you talk about goals, then the strict amount that we use. It's very project thinking. Okay, if I'm there, then I'm done. It's from here to there and then

it's finished. This is never finished and...

DG: No.

PvR: So we're trying to make as much as we can. And we're seeing now like if you look at the last data from 2020, there were 430,000 square meters. 430,000 square meters of green roofs. And 200, something thousand solar panels, which is times 1.65. I think that's over 300,000 square, meters of solar panels. it's close to 750,000 square meters of roofs that are being used, that we know of. There's a lot that we don't know. So this 1 million, we'll get there but that's not really interesting.

DG: Of course, I'm not super, it's not that I care about the 1 million, I just wanted to start saying that to ask about, imagine what I was trying to say is, you are now in 300,000, put it like that and you have to reach more people. And I know that you just said, newly new buildings, I can imagine they are easier because you can plan a few things in advance. But you have a lot of exists and buildings, existing rooftops and you...

PvR: Most.

DG: And you want to reach them, you want to, like, get to 1 million, two million, or yeah, as much as needed. So, how can we improve? Or what can we do better? Having done this since 2008. Like you need to reach more people, where are the opportunities?

PvR: So in two parts, the first is the new buildings and it works really well there because developers and designers, see the value of green spaces near houses in a city. So and in Rotterdam we have a few, not so many rules, but we have a few rules when it comes to high rise and we don't allow standalone towers, you always have to connect your tower to the to the city around it. And most of the time it means that you have a low rise, that connects to the height of the buildings around it seven or eight stories high and then the high rise. Going wherever high, I don't care. What happens on this low rise? It becomes a garden because all those apartments in the tower they want to have a space outside so they make a communal garden on the lower area and they pay it from the value that they get from the high rise apartments for the beautiful view. So this business case starts working in new building in new towers. Look at all the designs that are being presented nowadays 90 percent I'm sure has a

multifunctional rooftop on the lower roof with green with water, but also for people, I mean those three are very very often combined. So that I'm not even sure if we need regulation for that. We need to stimulate them. To keep it doing but that's happening. If you're going to design something next time, you will think about the roof space. And once designers start thinking about it, they will come up with a good solution. If it's a facade, or a floor, or roof doesn't really matter something good will happen. So that's one part. The second part is, which is you're right, the existing builders are much more difficult. And our, what we're doing in the program, you've read this program plan, I'm sure we identified seven roles and we think we... Stole is a nasty word, but we borrowed these roles, from Paris. Paris inspired us. They were doing this as well. We inspired Milano by the way, they took them from us again.

DG: Yeah.

PvR: So cities exchange, these roles and they're interesting, because the verbs in them. They're very soft. It's about informing people and inspiring people and those kinds of things, facilitating. And I think we also always will need to do all these things at the same time because people are in a different phase. So, some people are really enthusiastic and just need a little push, maybe some money or just the right way to go. Well, other people, they totally don't understand, and you really have to start building the mindset with them. And that is a constant process. And, and we found out that it's not always the same process. It's not that you start with step A and then step B and C, and it doesn't work like that. So, something sometimes starts as an experiment and then it... You need to change the rules and regulations for that because it doesn't fit and that leads to informing people and it might end up to become a project or a total different way. And in this flexible approach of what is needed at the moment and which role we take, that's I think what we're trying to do and which is relatively new or unique, because we're as a municipality very often, we have this very strict idea of what our role should be. Like this inspector of the permits, he always have this list of questions at a stand when everything is okay. And then these kind of co-creation environments, it's not always the same. It's like maybe it's like with relationships between people, I mean, it differs all the time and you have to look at the moment and see what is needed at that time. So what we see at this moment, for example Dolores is that there's more and more debate or demands, better, for a vision on which roof should be used for what. So, a lot of people ask us, okay, but I have this room here. What should I do with it? What do you want most municipality? We cannot answer that yet. Okay, everyone we want every...

DG: Okay.

PvR: So there's some clarity needed at this moment.

DG: Can I... I read this in an article and well, what you just said is, like, completely the opposite so.... But no, no, no...

PvR: Maybe. Okay, cool.

DG: Because I wanted to get there and you just said, it differs per area which solution works best, you know. So it's just a phrase, it is not that you said the opposite, is just I wanted to ask you if you were kind of taking a different approach per area knowing that this area maybe needs more this more that if you get, like, if you're monitoring, those kind of needs or not as municipality,

PvR: So that's what we're building now. So we know that we have different climate issues in different areas. So the harbor for example is huge in Rotterdam, it's outer dike area. So if it floods, the water will just run off into the river. It's not the biggest problem.

DG: Yes.

PvR: Behind the dikes. If it floods, the water that goes nowhere, because, maybe somebody told you, but what's the highest part of Rotterdam? The highest terrain?

DG: I think there's not is none. I read it's six meters below water level like.

PvR: Yeah. Yeah.

DG: Yeah, you know, if you have a zero.

PvR: So, the zero and makes sense, the zero is next to the river. Because the river flows to the sea, right? So it must be a little bit above the sea and then behind the dikes, it goes down to minus 6. So the water problem is the worst in the lowest areas which is far away from the river.

If you're in a Rotterdam and the dikes break run to the river, it's the highest place.

DG: Yeah.

PvR: It feels totally weird but that's how this, how it works.

DG: I will tell people.

PvR: Every area has a different demand. When it comes to energy, the same, some areas, we will start heating with rest leftovers from the industrial processes, but others will have to heat all electrical. In all the electrical you would probably want to focus on solar energy on rooftops, while another area as you, you might want to emphasize more the greening or the water storage or the usufruct or whatever. So we have this this idea in our minds but it's very complicated to combine all those demands that the city has all the issues and put them in one map or one system. And then say, okay, so now here, this is the most important and there, that's the most important. So that's what we're building now. To make a vision that say, well, we can make this differentiation that we can say, okay in the harbor, my idea just rules of thumb that's focus on solar panels energy production because in a harbor you need energy while greening, maybe the harbor is not the most logical place to start working on biodiversity. And when it is, when it comes to these pre-war districts, there are very stony and very densely built, greening. Green space for people and probably also water storage; while other areas that have like suburban areas that have much more space around the buildings, maybe water storage is not the biggest issue on the rooftop. You can solve that somewhere else. So we have some ideas but we still have to make it into a complete vision that encompasses the whole city.

DG: Yeah.

PvR: And it will, and it will have to make a fight with a lot of people because they all think that they're item is the most important, right? So, if I ask the energy guys, they will say energy everywhere. I've asked the water, guys, they'll say water everywhere. So we have to start dividing and combining and that's really the next task when it comes to policymaking.

DG: Well, I have two last questions. One, are you measuring the impact that you are kind of creating or generating from the program in any way?

PvR: Yes, and no.

DG: Impact. Okay.

PvR: It's very hard. So, some things we can measure, right? So, amount of square meters of green and amount of solar panels, and that you can translate to liters and cubic meters of water. You can calculate how many kilowatt hours of energy. So those kind of things we can measure and we do and we see a steady incline in and all the things that we need and want to do. But also very soft benefits. Like if somebody has a better view or feels more happy because he saw a bird in the morning on a green roof. It's very hard to measure those kind of things, the quality of life stuff. There' are not very easy ways to measure that. And if you can measure it, it's very hard to find the cause and effect. I mean we have all kinds of measures like on the happiness of people on how they value their surroundings and stuff like that, but it's almost impossible to say and that's because we did this because or because that happened so always a lot of different factors. So if you have a good idea for that, please let me know. But I'm still struggling how to make to show the value stuff and I think, Much much, what we can see is sometimes, kind of trend, we do see that people accept these kind of things more, a lot better than they did 10 years ago. Acceptance of people of green roofs now, very high or 10 years ago. Nobody wanted them. Some five years ago, there was a political discussion, if whether or not somebody could keep a pig on the rooftop, because the pig was supposed to get vertigo, And then we knew okay this is interesting. I mean I don't care if and how you solve that but that we start discussing under which conditions do the pig, can be on the rooftop. Then we are one step further.

DG: Okay.

PvR: The DakAkker you might have heard of them, they have chicken on the roof. They have a problem now because one of them was a rooster waking up people at five in the morning.

DG: Yeah.

PvR: So we start to have these kind of discussions, so it's not if we should do it, but under which conditions and it's very hard to pinpoint that but you can see a trend.

DG: Yeah.

PvR: And I think, so the awareness of people is growing and that helps, what we do helps, what the festival does helps. But what helps best is small disasters. Awareness is highest, when there was a lot of rain or a period of drought or those kinds of things. The danger of a dike breaking. Then everybody's like, and then people started realizing that they should do more about it.

DG: Yeah. Do you think that they believe that from like a person standpoint they can help like in a to a bigger problem like a city problem? Do you think that they believe?

PvR: Yeah, more. Yeah, more and more more and more because that's also that's also communication and marketing, but also when it comes to the whole energy transition, anybody can do something like, that's what they say. And in Dutch it works even better. *Iedereen doet wat*. And watt of course is also like the measure for electricity, but you can do something. I mean just put in one bulb that is uses less energy and you help a bit. And you see that, that really catches on, also with the nature based solutions. And I don't have an English word, but the word *Geveltuin* does it. If you ever heard of it.

DG: I know 20 words in Dutch.

PvR: Okay, that's not enough.

DG: If you tell me that one. I can add it to my list.

PvR: And I wouldn't want you to learn this one then, but...

DG: Okay.

PvR: *Geveltuin* is like a facade garden. Very small. So what we allowed in The Netherlands is that people take out one or two stones from the pavement. Put them on the side and make a small garden against their façade of their building, their wall of their house.

DG: Okay.



PvR: They're allowed to do that, we support it. We even take away the tiles if you want. And this is very small. It's like two meters, three meters, whatever. last year, there was a Challenge between Amsterdam and Rotterdam who could make most of them. And we made almost 1,000 in in the summer.

DG: Nice.

PvR: This year we did a national championship with I think 30 or 40 cities all teamed up in pairs. So, What is it for you? Montevideo, the big rival? I don't know like...

DG: But that is another country. It's like, is that you with Brussels?

PvR: Yeah that could work but, it's also well River and Boca or...

DG: Yeah. But, how do you know so much?

PvR: It's yeah. Well.

DG: Other story, for another time.

PvR: Sorry.

DG: Like, why do you know so much about like South America?

PvR: Oh, I like it and I have been there and it's very intriguing. But anyway, that's not the point.

DG: Yeah, next time.

PvR: There's always this first city, second city, the Rivalry. And it really works if you ask people on that. So what we do more and more, it's like we want people to make these facades, these small facades gardens. But we use the fight that we know from sports between the big cities, and also smaller cities have their rival city next to it, and it really works because people start building these things like crazy because it's like being a fan of a sports team. I do this for my city because then we can win. I mean, there's nobody was winning, except for everybody.

DG: Yeah.

PvR: And so, those small things, they really work and we were better and better in this nudging. I think it's nudging in the end what we are doing. We try to move people's percent effective to do the good thing because I want to do it because I like it, because of the game because of the fight because of the competition. I mean, because those kinds of things, and of course you need a lot of small initiatives to make a big win, but in the end, it I think it does help if not for the things that I really do, then it already will help in their mindset and they will probably bind different stuff next time or not spy stuff for it. It might have an effect on another things as well.

DG: Yeah, and lastly, I want to know if you think that this kind of practices or what you were doing with multifunctional roofs can be can be replicable because you told me that every time you receive like a new request or whatever it's so unique like the building is so unique, the, what they need is so unique. So I don't know if you believe If seeing what Paris is doing, seeing, what? In Germany they're doing that, I think that they're very also good at green roofs. Do you believe that there's like similarities it's something that we can do somewhere else?

PvR: Yeah. well, very simple and every city has rooftops.

DG: Hmm.

PvR: Right. It's one of the very few things that each and every city in the world shares streets, buildings and dust rooftops. So you can do something with your roof. But what we also learned is that you shouldn't copy. You should Translate. And it's very, I've been in India with an exchange of knowledge and we were helping them with their issues, which of course are different, with our knowledge and we really have to translate it. You cannot just say, okay, this is our design now, copy it here and then it's fine. It doesn't work like that. Cultures different, the the issues are different. And what the stuff to work with is different. They have different buildings with different building techniques. Everything is different in the end. So yeah, you can use it in other places, I think everywhere, but you really have to look and watch the issue at hand. And how can we do it? And what we try to do is to share as much as information as we can with other cities in the Netherlands, but also abroad. So that also municipalities at least learn from our example and see what we did well, and we also made some major mistakes. And

to see what they can do better next time. So, yeah. And a very interesting one in that sense. On the 4th of June. there is a, it's a Friday, it's the the knowledge day of the Rotterdam rooftop Festival, And you can you can participate. It will be online. It will be broadcasted online. And one of the things that we're going to present, there is a book that we made with, with Winy Maas and his team on, What can you do with rooftops? So, in the inspiring part we ask them those crazy designers. Okay what can you do? and they came up with I think 130 for options on what you can do with a rooftop. Really the next thing like crazy ideas. Very, very much fun to make that. But they also said, okay but sustainability is just the basis for all of them. So we do isolation on the of the existing roof It has to have water storage and/ or green and solar and then you can continue there, you can do crazy stuff. And I think that those kinds of documents, it will be a lot of like images that show like a typology of a h ighttower or of a I don't know all kinds of typical buildings that we have, but you also have school buildings, two or three stories, long flat roof. I mean they're pretty much the same all over the world and that typology can be used in various ways. So that's what they're making. Now for us, it's almost finished and the thing that that kind of information will really help to get Inspiration. Also in other places in the world that they people can start doing it in their place. Okay, what would work for me? What would I like to do?

DG: Yeah, and it's very good that you have them.

PvR: Because I think that's in.

DG: have them. Yeah that's it but I was just going to say it's very good that you have them as a as an architectural studio. I think that they come from Rotterdam or from the Netherlands. Because they are so creative. And if you like a little bit of design, you can you always bumped into MVRDV and they're great, they're just completely great and that was it. So it was amazing. You gave me so, so much new information and I really, really appreciate again you taking the time without even knowing who I was. Yeah, thank you again.

PvR: My pleasure. I hope it helps you further and not backwards but if you have any other questions later on, just send me an email or something like I think email would work and I'll look into it and please subscribe for this. I'll have a look if I can. Because we had this chat right?

Entrevista: Tipo 3 – Dolores Giribone – Guido Zeck

***Entrevistador:***

Dolores Giribone (Arquitecta) - DG

***Entrevistado:***

Guido Zeck (Dueño de cubierta verde en Rotterdam) - GZ

Día: 07-05-2021

Hora: 5pm-5:40pm (UTC +8h)

**Transcripción:**

*GZ:* This sustainability agenda I think which is good specially in the Inner City. However, it's there's not much as far as I know, that's not that much progress. Despite the fact that there's a lot of that, a lot of green fat roofs here, that's an excellent possibility to create roofs. But it's. It's not. It doesn't start that much yet. It's, it's slow in the undertaking. But, fire away at Dolores, it's yeah.

*DG:* Okay. Okay, let's start by you. If you want to tell me a little bit. What what's your case? Um, how, what do you have? I don't know if you have green roofs or if you have solar panels or you have... I read that you had a green roof, but I do want to tell me a little bit about your situation.

*GZ:* Yeah. We live in a larger apartment building. It's about 40 now, 50, six apartments and shops underneath. And for this whole block, we started out to, okay, transform that into a green roof full of for all of the apartments. And a few of the apartments at the top apartments do have roof terraces now as well. My apartment has had as well. So...

*DG:* Okay, and it's something that came we with the apartment or the building, it's something that...?

*GZ:* No, no. We've been... with started this initiative and also in collaboration and close collaboration with you municipality we made that possible, it's financially there's been... [Loud

noise] There is a lot of noise on the background with you.

*DG:* I'm so sorry. That's why I just turn off my microphone. I'm so sorry.

*GZ:* Yeah, this is more relaxing, without your microphone indeed. You can hear me clearly just not if you can.

*DG:* Yeah.

*GZ:* You can hear me clearly?

*DG:* Perfect.

*GZ:* Yeah. Okay cool. Okay.

*DG:* Perfect.

*GZ:* Okay starting to wonder. Now, it's been within a close collaboration with the municipality and with an Institute, I'm not sure the English phrase for that, but [dutch organization] And that means as much that it's this, it's the oldest organization, actually, and the Netherlands because it keeps us safe from the outside water. But there's also these more and more, these big moments in rain, they, they will grow in frequency and they will grow in intensity. And that means that there's a bigger task for the pipes underneath the city to get all this water year [unclear]. So yes there is a financial contribution from [dutch organization] in adding, in making these green roofs possible. And it's better to invest this in green roofs than in pipes underneath the soil, which you don't see, which are only a technical solution. And I don't beautify the city. They're not in a plus for biodiversity Etc. So that for the, the whole of this apartment block, with the benefit of this [dutch organization], help and with the collaboration with municipality, we've made this green roof, all of these apartments possible, and a few of these apartments are now, as well. Do have an apartment. I do have a roof terrace on top of that, so there's more it's a broader liveliness on the roof altogether and not only for the apartment block in general. Which adds to also a better isolation, Etc. But also for the higher buildings around us who have a nicer view on our roof. And is now breeding season. So, there are some birds on the roof which are breeding now on the roof itself and in a greener roof, it's a more pleasant. I think it seems to be

a more pleasant place to lay your eggs and and breathe. I think.

*DG:* Yeah, and so so, you're talking about a whole block. And, how was it to? I mean, I know that I know that you're, I know an architect. So a lot of things that you just mentioned are kind of because you're aware or maybe you, you have kind of this climate change conscious or or knowing that sewage system needs just a little bit of help from from their citizens. But how was it to to put everyone like in the same page? And why do decide to go for green roofs? Because I'm sure that not everyone thinks that that is like the immediate solution for them or the or the best way. Right? There are many many voices in one block.

*GZ:* Yeah. Yeah that was a bit. That was a bit of a hassle that wasn't there wasn't easy at all. Now because there are... Firstly, as you point out quite correctly, not everybody is aware that we have to change things in order to survive. That's the first. The second it says in a larger block there's and as always, a more conservative force to to deal with and so it was, we cut it a little pieces so people could get a grasp and get could get more acquainted with with the whole idea of having a green roof. So, yeah, just trying by small steps to diffuse fear and and taking them along, you know, along the path into this decision making. And in the end I them, most, all of them are quite or either they don't care or they're quite happy about it. It's it's nobody is against it anymore. So that's, that's a plus, I think.

*DG:* Yeah. And and who like assumed that role of of kind of guiding and informing and and yeah constantly kind of trying for for all the neighbors to engage in this project, who did that? Were there many partners, stakeholders?

*GZ:* A few. My girlfriend, the most important one because she really did all the willing and dealing with the, with the municipality, with the contractor and we had like, we were, I think the investors so, "*A Greener city is a better City*" and part of the contracts are this information evening where the guy with a tie and [unclear] and it's who did the more, we did the money talk and addressed, especially the more conservative force within the this bunch of people. So, we have and then there was the actual planning. And I mean, it's, it's not like we going to be build the whole block, but we, we had like three, basically three flavors of addressing different kind of people, the, the pragmatic, the idealistic and the conservative. That's it's basically at least three information, things, you could, you could label them like that.

*DG:* Yeah. And why was your girlfriend so so helpful? What does she do? Or why was she so involved?

*GZ:* She's urban planner and a project architect. So that's I think that explains.

*DG:* Yeah, of course. Me too. So that's what. That's why I'm passionate about about this subject as well. And okay, so you finally, accomplish the green groups on the block, but can you tell me then how was a little bit the process when you got everyone on board. I know that you mentioned a little bit of help. I imagine you got a subsidy or from the Municipality. Is that right?

*GZ:* Yeah, it's it's not it's not a lot, but it's it's just made a difference between, redoing the roof with EPDM like a solution or making it green and that just made it made it even. So, at the end, you could choose as to the similar solutions. But this one, it's a place for biodiversity, for the sewage, for sustainability, for a longer roof. It will last better. And this one was ugly, it's it creates city stress, the urban heat impact, and contributes with the heat effect. So at the end it's like it's all here plus here, it's all mines.

*DG:* Yeah. And so you mentioned that you have to change the roof. So it was you got this issue. I mean, I'm not this issue. You got this whole green roof idea when it was time to renovate, the roof, right? Was just okay...

*GZ:* Yeah, yeah, yeah.

*DG:* ...I, I think that also kind of plays an important part of this, the biggest. Do you think this could have been possible if it wasn't time to change the roof? It was just because of the green.

*GZ:* No, no. Yeah, you need the sense of urgency and that can be leakage. That can be the fact that we are living in older environment because these are building blocks A large part of the inner city of Rotterdam dates from the 1950s and further, but only until 1980 something like that due to the oil crisis and a few other environmental effects which became more widely known, isolation became an issue. But from the 1950s and even further back of course, since World War Two and 1980 isolation on flat roofs is hardly ever done. So, in the winter, it's it used to be freezing cold here and in the summer, during due to more tropical days we having now, it's, it's like, it becomes very hot under these roofs if there's nothing done. So you need a

sense of urgency to make this change, to swap your to do to, to undertake a step in general. And and in this case, that is and making your roof green. And luckily we had that sense of urgency, the state was deplorable and so, we added, we suggested basically a two things, having a serious layer of insulation, and on top of that at the green roof. And that the insulation it's been paid by the top apartments because they will benefit from that. And I think nobody ever regret that it's, it's a big plus and the green roof. We contributed with two [unclear] for all of the whole of the block. Because of the fact that the water resilient layer will have a longer lifespan. So, and that contributes to everybody.

*DG:* Are you in the Upper Floor? Are you immediately under the...?

*GZ:* Yeah.

*DG:* Have you felt the difference like...?

*GZ:* Oh, definitely.

*DG:* Yeah.

*GZ:* It's yeah, definitely. It's the green roof doesn't help in insulation, but they do contribute to less urban heat effect. And if you'd like to we, I could show you.

*DG:* I don't know where you are, if it's very difficult, but of course.

*GZ:* It is not difficult at all. [Lost internet connection] Okay, hear me now?

*DG:* Yes, yes.

*GZ:* Yeah. I think something went wrong. It's I lost the wifi signal, never mind. Then that comes later.

*DG:* It's okay. It is the is the rooftop connected to your house. Or is it something for everyone?

*GZ:* No, it's no, it's just this house, just a staircase. [unclear]



*DG:* Yeah. No, I what's going to ask if it's a, if it's a terrace or it's a roof of that you can use or it's just like like sedum or...?

*GZ:* No. it's a no, it's that would have been too dangerous because the the construction the way all these building blocks, they are made in [dutch word] this rebuilding phase of the after World War Two. It's too much architectural history. It's a professional habit.

*DG:* I love it. You you? Yeah.

*GZ:* Okay.

*DG:* I'm learning a lot and I love it. It's my thing.

*GZ:* True. Now, it was the the sports to make it as cheap as possible because the building ingredients like concrete and brick and everything, it was scarce. So and and one of the things they come up with was to start of this modular building principles, which now ended up in that we are living nowadays, more or less more, all of us in the same houses here in Holland. But so it's kind of a downside as well, but it's for that moment, it's the the roof is a kind of low weight, very effective building material. It is good enough for a roof and a snow of certain thickness but you can't use it as a Terrace, the roof will collapse. So there's this alternative structure on top of that which the load bearing walls are being used. And so, there's basically a second floor over it and that is what you can use a roof Terrace.

*DG:* Yeah. And um well you mentioned like technicalities and or that doesn't allow you to just to do this kind of terraces like where you can actually live it, right? You cannot access. Were there another kind of issues when you decide to do the the rooftop, like, maybe regulations or yeah, codes?. I don't know, once you decided to actually execute it.

*GZ:* Sorry that bits of pieces, which you just faded away. Could you repeat the the question?

*DG:* Uh yes, of course. Well let me tell you, for example, something that other people from interviews, told me it's very difficult to do something on the roof, because roofs have never been taken into consideration in the code because before you, we didn't use them. So feel about

that in terms of regulation, have you had any any issues when you went to the municipality? I want to do this or how easy or not easy, was it?

*GZ:* Yeah. The beauty commission. I'm not sure if that's the English term for that but it's it's part of the The. City Center. And the block we're living in is a part of a [dutch word] And that means as much as that it's and strict review of having any alterations. At the same time, you want to have a more livable city in which you'll want to add layers in time. So, to say that the city evolves it's instead of large only having large uniform, building blocks. You'd like to also have to you like to also to add this individual, these small-scale alterations, which tells you that yes, it is vibrant and it's and it's moving, it's changing. It's and I think that is also that this is part of the argumentation, which we presented to the municipality. In a sense that the the role of the building block and the structure it will, it will maintain there's there's no there won't be any alterations in that but the feeling of the different aspects within the structure that is going to be a surplus. That's going to be an addition, which eventually in the end it only reinforces this structure. Not only in, not only aesthetically but also in use, because there's going to be an addition in the kind of apartments typology, you're going to add to the urban fabric. So, eventually they approve, and they were positive about adding these roof Terraces on top of the structure but indeed, within [unclear] and envelope. So there's and this is something we developed together in the sense of what, what can be done, what can be added on the roof? We've taken that down within a building brief for people who want to have a roof Terrace. And within that brief, there is a part of construction, a part of the water, how to deal with water so there's no leakage going to be involve; about a percentage of green, which you must be taken into your roof Terrace. And the way you go along with the measurements, the amount of distance you need to place the area where you have, where you can build your roof Terrace, and the distance you need to be from the front and from the back. And the way you put your, the railings to the edge of your apartment of your roof Terrace.

*DG:* I don't know if you would mind this but, could I then take a look at that brief?

*GZ:* Yeah, [unclear] I can send you. Yeah.

*DG:* Okay, thank you and well now that you mentioned that that you do put together that brief, I don't know if you talk with people and also peers and you're well very, very involved with this architecture, construction, and urban planning. But can you tell me a little bit how about how

you see people reacting towards these kinds of solutions or do you think that they are kind of getting a little bit more curious about these kinds of solutions if they have to retrofit their home? Are they giving any thought to, I don't know, climate adaptation?

*GZ:* Yeah. Yeah, once in a while, people want to visit the roof, not only people from our block who also want to put on a roof Terrace with also houses in the neighborhood. And I think, I'm not sure and I don't know how many, but there is an increase in roof Terraces here. In this neighborhood. Yeah. Yeah. And it's not only this, of course, I mean there are many, they're more people doing that. What is funny is that people, the real estate brokers from houses in the neighborhood who look upon this, who can look upon this roof, they do take pictures of the green roof. So it's it's added value and that is exactly what we said to the municipality.

*DG:* Yeah, it's funny because I'm sure that it's going to add value to their real estate by looking at yours, you know?

*GZ:* Yeah.

*DG:* And they have nothing to do with it.

*GZ:* Well, it's... I understand but it's towards the municipality, that's a way of also saying that this contributes to the liveability within your inner city and so embrace this. Yeah.

*DG:* Of course I know. Yeah, people appreciate just looking to like a roof that it's not. Yeah, black.

*GZ:* Yeah. Yeah.

*DG:* Yeah. And okay so, this has been super great and I don't want to take too much of your time so I'm going to ask one more question. And you said at the beginning that, you know that people are doing this or yeah, kind of embracing this green roof, but it's very, yes, slowly moving forward. And so what would you say is the things that are being done correctly within the municipality or Rotterdam that make people want to do this and what could be improved that you believe, no this is not working. So that kind of like discourage people to adopt this.

*GZ:* Um, yeah, it's I don't have any tips. Yes, I am an architect, not a policy maker, but a few things which are really important I think and that is that if you want to, it's part of a lighter picture. It's not just a beautifying your roofs, not just creating green roofs. It's part of a of a deeper sense of where we want to go with each other, where we want to be. I don't think a lot of people grasp the the radical change we will have to undertake with each other. If Rotterdam still wants to exist within like 60 years, the war is, The Second World War, it's been it's been in a farther pass away than the problems which will arrive, which will arrive here in the city 60, 70 years from now. We need all the help. We need all the change we can possibly grasp. And so we have to insulate all of the existing apartments and houses within Rotterdam, within the Netherlands, within the world. If you look at Rotterdam, then it is Rotterdam. It's about like three, three and a half, 50,000 apartments houses or something. It's a huge task and as... That's very little movement on that front. So, it's amazing that there's no sense of urgency there. It's like we don't, you know, really get that. It's too far away. So, this is my worry and I don't really know how to [unclear], because people have written beautiful books about it and and made movies and everything, right? This is happening, you know, it's it's we are maybe not in the middle of it, but it's it's definitely at the start of it. I don't know. This is, it's just amazing, basically. But yeah, well, but I don't really know how... We need this tipping point, not as much as in, because I think we've passed that on another, we mentioned the change in how we deal with stuff. But we need this tipping point in Awareness, that something needs to be done. Like George Floyd was a tipping point. We need George Floyd climate wise.

*DG:* It. Yeah, I was going to just after you said, oh yes, it's awareness basically what you're trying to say. It's beyond policy making, it's just before doing like, like a nice policy or project or program, people need to understand the urgency, right? Of this I believe.

*GZ:* Yeah. Yeah.

*DG:* And one of the people that I interviewed that it's part of the municipality, he told me something quite sad but true that was people are actually understanding that something needs to be done. For example, when they get this fear of being like getting covered by the water like when a flood is coming, you know, when they're told that, they actually want to act like a yeah on it.

*GZ:* Yeah. Yeah.

*DG:* So, it's that I believe it's kind of the same as something that you both you're trying to tell me and yeah. So well, basically that was it. But in and what I'm trying to do with this is understanding what I believe is a program that is kind of trying to move in that direction, but it's still very difficult to execute and in many forms. So, the idea of my thesis is basically saying or trying to understand what we can do better in order to reach more people with this kind of solutions. Which now I think it's still a little bit difficult for the normal neighbor that just wants to do it and gets stuck with so many barriers along the way.

*GZ:* Yeah. Yeah.

*DG:* But yeah.

*GZ:* Yeah, I understand. Yeah. That is why I like to contribute as well. Because it's good to do this.