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BY COSTANTINOS CARTALIS, UIA EXPERT

Keeping the city resilient under climate extremes

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Cities face climate extremes - defined as the occurrence of a value of a weather or climate variable above (or below) a threshold value – with devastating impacts on the safety and the lives of citizens, the city infrastructures, the private properties, the urban environment, and the local economy. At the same time, climate projections for the next decades indicate that climate extremes will be of higher frequency, duration, and strength.

What are climate extremes and why is it relevant?

RESILIO rooftop in Amsterdam

Cities face climate extremes - defined as the occurrence of a value of a weather or climate variable above (or below) a threshold value – with devastating impacts on the safety and the lives of citizens, the city infrastructures, the private properties, the urban environment, and the local economy[1]. At the same time, climate projections for the next decades indicate that climate extremes will be of higher frequency, duration, and strength. The type of climate extremes differs depending on geographical location and local/regional climate. They may be heatwaves, droughts, heavy rain/storms, floods, strong winds, and sea-level rise; they may be also an accumulation of climate events that are, individually, not extreme themselves though their compound effect is. Greater Manchester has seen surface water flooding incidents increase by 10 times since the 1950s, while in Seville, projections forecast a 4,5° increase in average temperatures, and a reduction of 20% of rain, leading to an increase in the number of days where the city temperature is above 55°.

In such circumstances, keeping cities resilient under climate extremes is a major political and policy priority for well-being and growth. City resilience under climate extremes is to assess, plan and act to prepare for and respond to all hazards – sudden and slow-onset - related to climate extremes. A resilient city can maintain a continuity of services and functions throughout any shock or stress while protecting and enhancing people's lives[2]. The UIA projects of RESILIO, GBG_AS2C, IGNITION, OASIS, GUARDIAN and CARTUJA QANAT were invited to reflect on how their projects contribute to the long-term adaptation of their cities.

How do the six UIA climate change adaptation projects contribute toward building city resilience to climate extremes?

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[1] IPCC, 2021

[2] Urban Data Platforms Plus, European Commission

Learnings from the projects and the policy lab

Prepare the city to overcome barriers to resilience – challenging assumptions and current practices

Barriers to resilience were found to be overall common among the projects of the 6 cities, although of different weight depending on the city. To their majority, they referred to a lack of understanding of what city resilience under climate extremes means in practice, as well as to a partial knowledge of the practices and tools leading to resilience under climate extremes.

IGNITION developed a Living Lab to act as an experimentation environment, but also as a demonstration and dissemination of innovative new products and services linked to Nature-Based Solutions (green walls, street trees, urban green space, green roofs, sustainable drainage systems). Partners organised multiple activities and tours, inviting various partners such as the highway authority, property developers, mall owners and elected representatives. These tours aimed to challenge their assumptions and convince them that multiple, cost-effective climate adaptation solutions exist.

In RESILIO, two Innovation Labs were developed. These were roofs for experimenting with the innovative smart Blue-Green roof systems, as well as demonstration centers serving as community spaces for educational and interactive events. RESILIO also linked the installation of the Blue-Green roofs with the social housing program, thus demonstrating the capacity of a climate resilience measure to support social cohesion. It pushed the action of the municipality beyond traditional publicly owned spaces. Some of the UIA adaptation projects have been opportunities to open spaces to new usages and to approach spaces differently beyond traditional occupancy. Some of the RESILIO rooftops are now open to the local communities, enabling them to access spaces previously closed. The OASIS schools offer their playgrounds to the local community beyond school hours as neighbourhood parks. This required extensive collaboration between Paris' city departments to unlock issues arounds responsibilities, safety, maintenance.

OASIS also aligned to the Paris Climate Adaptation Plan to give space to a new model for urban planning, prioritizing green and sustainable development with a strong social dimension. Furthermore, it worked on innovation procurement processes to integrate eco-innovative products into city planning, for doing so, a reshuffle of the city's technical processes was promoted. These changes to the procurement guidelines can open the way to more green procurements in the longer term in the municipality.

Exploit green sectors in city resilience plans

Green sectors have shown their potential to support city resilience plans to climate extremes in all six projects. Yet, a clear conclusion is that the type of the green sector(s) used in a city resilience plan depends on the urban and climatic characteristics of each city, as well as on the climate extremes already faced or expected to be encountered in the future.

GUARDIAN worked on forest fires in the wildland of 'La Vallesa', in a Natural Park between the cities of Riba-Roja and Paterna. Five tanks (reservoirs) were developed that collect (recycled) water from the regeneration station and direct it – through a network of 6,500 meters of pipes - to forty fixed water towers covering an area of 35 hectares. A wireless sensors network was installed as a precautionary measure; it monitored the risk of forest fires in real-time. New sustainable forest management actions are also carried out to improve the resilience of the Vallesa forest.

CARTUJA QANAT scope is to reduce air temperature in external public spaces and thus improve the city's resilience to climate extremes associated with excess heat. In particular, the project promotes a hybrid air cooling/heating system for conditioning an underground gallery (souk), exploits photovoltaic systems for energy production, and foresees increased urban greenery and shading. In particular, an over-the-ground-underground water cycle was developed by combining the centuries-old Arabic technique of the qanat and solar energy for the elevation of water to the ground and its subsequent evaporation (acting as a cooling mechanism).

GBG_A2CC and OASIS promoted Climate friendly urban planning by converting school yards – removing concrete, using greenery and eco-innovative materials, developing shaded areas, etc. – to "cool islands" and thus improving the cities' resilience to heat waves. An assessment of the implementation of the GBG_A2CC project in eleven schools has shown that 1,000 square meters of concrete were replaced with vegetation, 74 trees have been planted, 2,213 square meters of shaded areas were developed 26 new water supply points added.

In order to adapt the schoolyards, OASIS had to train its inhouse engineers on co-design methodologies and on the use of innovative green-blue materials, highlighting the urgent need to invest in green professional training

The OASIS project prompted the city of Paris to adapt its work processes between different services within the municipality, and to train their inhouse workforce (engineers, architects, planners) on co-design methodologies

and on the implementation of innovative green products and services, highlighting the urgent need to invest in green professional training.

Promote new governance for building long-term resilience to climate extremes

New governance mechanisms and participatory, bottom-up approaches could foster deliberative processes in policymaking. IGNITION supported the setting up of a new charity to raise funding from different sources to deliver projects on the ground. The financing schemes and business cases were developed to provide a potential blueprint for multiple partners to come together in the future to co-fund projects. Multiplying funding sources will enable the municipality to widen its adaptation intervention capacity with the help of new actors.

In the GUARDIAN project, the two cities of Riba-roja and Paterna joined forces to tackle the forest fires of La Vallesa. Coordinated and complementary actions are necessary, involving not only the respective municipalities' services, but also the water authority, a local SME specialised in fire defence systems and two research institutes. Their cooperation was essential to develop an integrated strategy for fire risk mitigation.

Collective intelligence could support policymakers in re-designing the way they work to make better decisions and prevent policy mistakes. GBG_A2CC was fine-tuned with thematically similar ones (e.g. the "Open Schoolyards" program) already under implementation by the City of Barcelona. At the completion of the GBG_A2CC project, its upscaling proved to be a straightforward process as the project was integrated into a running city program on open schooling (the "Let's transform the school yards" program"). As a result, the solution was transferred to twenty more schools, also converted to cool islands.

Plan with and for the society for city resilience to climate extremes

A critical precondition for keeping a city resilient to climate extremes is to engage citizens in co-design and public space management while developing and implementing a climate resilience plan. This is of particular importance taken the social implications of climate extremes and the strong need for coordinated action at the local scale. Spending time outside, in public spaces is a cornerstone of the Sevillian lifestyles. Therefore, the city wanted to propose the CARTUJA QANAT project that would enable to maintain local habits, with a strong cultural dimension, during in the hot summer months.

The GBG_A2CC and OASIS projects involved the educational society (teachers, pupils, parents) and citizens at large in the co-design of the interventions at the school and neighbourhood scales, as well as in local management actions.

A sense of local ownership was developed in all projects above, strongly facilitating the successful completion of the projects as well as their continuation thereafter. An additional accomplishment of the projects was the exposure of young students (the new generation) to a new way of thinking to improve the resilience of the places they live to the impacts of climate change. For instance, OASIS was also linked to the Climate Academy as developed by the City of Paris; the Academy aims to strengthen the power of young generations to act and provide them with tools to fight against climate emergency.

In the RESILIO project, several scenarios to make stakeholders and beneficiaries pay for the societal benefits of Blue-Green roofs were discussed, with the outcome being to apply a proportional split between the owner, the City of Amsterdam and the public water management organisation.

Preventing interface fires in Riba-Roja and Patterna

Lessons learnt

- Cities should consider **climate resilience as an issue of urgency** as the integration of innovative practices and tools in city operations and functions needs considerable time taken the orientation of city administrations to traditional solutions and the absence of multi-parameter decision-making processes.

- An **overarching Climate Plan at the city scale** is a major precondition for designing and implementing in a coordinated manner the actions needed for resilience under climate extremes. In the absence of such a Plan, actions may fail to deliver their full potential, whereas the inter-link of running projects may not be the case.

- **Local administrative practices need to be adjusted** to comply with the demanding requirements of a climate adaptation plan. At the same time, climate plans should consider the local environmental, climatic, urban, social, and economic characteristics and needs. They also need to take note of the exposure, sensitivity, and adaptive capacity of the city as well as its vulnerability to climate extremes.

- A **new governance model** is required to secure the city's resilience under climate extremes. Such a model should take note of the indispensable need for close and continuous communication among the city administration, the stakeholders, the public, and the business sector.

- **Green sectors can support city resilience under climate extremes**. Opportunities in this direction are in such sectors as nature-based solutions, eco-innovative products, green and blue infrastructure, energy retrofitting of the buildings stock, smart energy systems, green firebreaks, and greywater for forests' irrigation.

- **Skilling and re-skilling programs need to be implemented by cities** in order to raise the competence of their personnel on climate resilience and secure long-term organizational and planning horizon irrespectively of political changes.

- Climate-friendly urban planning can support a city's resilience to climate extremes, as interventions in the public spaces can ameliorate the impact of climate extremes.

- Keeping cities resilient under climate extremes **challenges traditional practices and business-as-usual solutions**. To this end, there is a strong potential for innovation at the city scale, with close attention to the solutions reflecting local characteristics, at the neighbourhood scale to the extent possible.

- Innovative actions need to be **demonstrated** to both the public and private sectors to gain attention and approval. The concept of Living and Innovation Labs has proved highly successful in this direction as they support the interplay among various actors, integrate higher education institutions, facilitate knowledge transfer and provide space for entrepreneurship, for instance in the form of start-ups.

- Strong potential for public-private partnerships is recognized for keeping a city resilient under climate extremes, especially in the building, greenery and energy sectors. Relevant initiatives for frameworks in support of the development of such partnerships should be prioritized.

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