

TeMA

Journal of
Land Use, Mobility and Environment

print ISSN 1970-9889 e-ISSN 1970-9870
FedOA press - University of Naples Federico II

DOAJ

anvur
Rivista scientifica
di classe A - 08/F1

Scopus WEB OF SCIENCE



NEW CHALLENGES FOR XXI CENTURY CITIES

Multilevel scientific approach to impacts of global warming on urban areas,
energy transition, optimisation of land use and emergency scenario

Vol.18 n.2
August 2025

TeMA Journal was established with the primary objective of fostering and strengthening the integration between urban transformation studies and those focused on mobility governance, in all their aspects, with a view to environmental sustainability. The three issues of the 2025 volume of TeMA Journal propose articles that deal with the effects of Global warming, reduction of energy consumption, immigration flows, optimization of land use, analysis and evaluation of civil protection plans in areas especially vulnerable to natural disasters and multilevel governance approach to adaptation.

TeMA is the Journal of Land Use, Mobility and Environment and offers papers with a unified approach to planning, mobility and environmental sustainability. With ANVUR resolution of April 2020, TeMA journal and the articles published from 2016 are included in the A category of scientific journals. The articles are included in main scientific database as Scopus (from 2023), Web of Science (from 2015) and the Directory of Open Access Journals (DOAJ). It is included in Sparc Europe Seal of Open Access Journals, and the Directory of Open Access Journals.

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2 (2025)

Published by

Laboratory of Land Use, Mobility and Environment
DICEA - Department of Civil, Building and Environmental Engineering
University of Naples Federico II, Italy

TeMA is realized by CAB - Center for Libraries at University of Naples Federico II using Open Journal System

Editor-in-Chief: Rocco Papa
print ISSN 1970-9889 | online ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n°6 of 29/01/2008

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The cover image was created using an AI tool, taking into account the thematic content of the articles included in this issue.

TeMA - Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include: engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science and complex systems.

With ANVUR resolution of April 2020, TeMA Journal and the articles published from 2016 are included in A category of scientific journals. The articles published on TeMA are included in main international scientific database as Scopus (from 2023), Web of Science (from 2015) and the *Directory of Open Access Journals* (DOAJ). TeMA Journal has also received the *Sparc Europe Seal* for Open Access Journals released by *Scholarly Publishing and Academic Resources Coalition* (SPARC Europe). TeMA is published under a Creative Commons Attribution 4.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

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TeMA 2 (2025) 307-314

print ISSN 1970-9889, e-ISSN 1970-9870

DOI: 10.6093/1970-9870/12348

Received 07th June 2025, Available online 31st August 2025

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<http://www.serena.unina.it/index.php/tema>

REVIEW NOTES - Urban practices

Competitive climate adaptation.

European startups driving climate change adaptation in cities

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Abstract

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. This section of the Journal, Review Notes, is the expression of continuously updating emerging topics concerning relationships between urban planning, mobility and environment, through a collection of short scientific papers written by young researchers. The Review Notes are made of five parts. Each section examines a specific aspect of the broader information storage within the main interests of TeMA Journal. In particular, the Urban Practices section aims at presenting recent advancements on relevant topics that underline the challenges that the cities have to face.

This note provides an overview of the role that innovative bottom-up initiatives can play in fostering climate adaptation while promoting urban competitiveness, and the strategic support that these entities can provide in managing urban and territorial transformations. The nature of these entities and the role they can play in the governance of urban transformation is outlined, and a brief review of European cases is carried out. Finally, the results are discussed, highlighting the potential that these social constructions have in urban climate adaptation and urban competitiveness, but also the challenges they face. Three significant case studies of start-ups promoting climate adaptation in urban areas are presented, showing the relevance of the topic and its potential role in the urban adaptation discussion.

Keywords

Climate change; Adaptation; Urban practices; Competitiveness; Climate startups

How to cite an item in APA format

Competitive climate adaptation. European startups driving climate change adaptation in cities. *TeMA - Journal of Land Use, Mobility and Environment*, 18(2), 307-314. <https://doi.org/10.6093/1970-9870/12348>

1. Europe: warming fast, innovating faster

Since the 1980s, Europe has been warming twice as fast as the global average, making it the fastest-warming continent on Earth (Copernicus & WMO, 2025). According to the European Environment Agency's 2024 European Climate Risk Assessment Report, Europe is experiencing more frequent, intense and costly climate-related events, ranging from extreme heatwaves and droughts to floods and wildfires. These events, combined with environmental and social risk drivers, compromise food and water security, energy security, financial stability, and health of the population (EEA, 2024a). Weather- and climate-related extremes caused economic losses of assets estimated at EUR 738 billion during 1980 - 2023 in the European Union, with over EUR 162 billion (22%) between 2021 and 2023 (EEA, 2024b). Moreover, in the record-hot summer of 2022, between 60,000 and 70,000 premature deaths in Europe were attributed to heat (EEA, 2024a). Climate-related extreme events will become more frequent and severe around the world as global temperatures rise (IPCC, 2021), threatening the livability, functioning, and sustainability of urban systems across Europe.

Despite growing awareness and increasing policy commitments, the adaptation gap in Europe remains significant. In 2021 the European Commission adopted its new EU strategy on adaptation to climate change, setting out how the European Union can adapt to unavoidable impacts of climate change and become climate resilient by 2050 (European Commission, 2021a). Nevertheless, the aforementioned European Climate Risk Assessment Report warns that current adaptation measures are insufficient to cope with projected risks in key sectors such as health, infrastructure, and agriculture (EEA, 2024a). At the global level, this imbalance is mirrored by the latest Adaptation Gap Report by UNEP (2023), which highlights how – despite the rising climate change impacts – climate adaptation is slowing instead of accelerating, leaving communities, ecosystems and cities increasingly exposed.

Rapid warming trends and a growing frequency of climate extremes call for urgent investments and innovations to strengthen resilience across urban territories. Europe has embraced the undeniable centrality of urban contexts as both key targets and change engines, placing them at the center of their climate strategies such as the EU Mission on Adaptation to Climate Change and the European Urban initiative (European Commission, 2025b; Climate Adapt, 2021; European Commission, 2021b). The European Union aims to make climate adaptation smarter, swifter and more systemic, and to lead a significant uptake at the international level (European Commission, 2021a). To achieve this goal, aware of the great economic requirements needed, EU's strategies deeply link climate action to innovation, promoting the creation of digital tools supporting the transition, as well as boosting entrepreneurial opportunities.

EU member states are therefore united in the pursuit of inclusive economic growth, driven by a vision of building the conditions for businesses to thrive while the environment is protected and everyone has an equal chance of success. To do so, the European Commission placed sustainable competitiveness as its first pillar of prosperity, placing the conditions for business to be productive while environmentally friendly (European Commission, 2024). Mario Draghi's report "The future of European competitiveness" findings have informed the Commission's work on a new plan for Europe's sustainable prosperity and competitiveness: the EU Competitiveness Compass, a strategic roadmap to drive the Commission's work towards an environmentally friendly and just economic growth (European Commission, 2025a). Thanks to this innovation-driven approach, deeply rooted in the principles of sustainable development, the European Union is supplying the tools to drive a sustainable transformation that will make European cities more competitive and more resilient.

2. The EU's roadmap to competitiveness: innovative climate tech startups

While Europe is among the regions most exposed to the accelerating impacts of climate change, it is also positioning itself as a global leader in climate innovation. As the continent is experiencing the tangible consequences of a rapidly changing climate, with rising risks to health, infrastructure, and urban livability, the European Union holds a vast potential to lead the transition toward adaptive and regenerative urban futures.

This potential is rooted not only in public policies and research capacities, but also in Europe's growing network of startups capable of delivering concrete, scalable, and tech-enabled responses to adaptation challenges.

In recent years, the European Union has placed innovation at the heart of its strategic agenda, recognizing its critical role in addressing global challenges and reinforcing the Union's geopolitical and economic competitiveness. The *New European Innovation Agenda*, launched in 2022, represents the EU's most ambitious framework to date for fostering innovation across its member states (European Commission, 2022a). The Agenda outlines five flagship actions, including the scaling-up of deep tech innovation, improving access to finance, creating innovation ecosystems across the EU, attracting and retaining talent, and aligning policy tools to support innovation in strategic sectors. It explicitly aims to position Europe at the forefront of the new wave of technological advancements while ensuring that innovation translates into real societal and environmental impact. Complementing this overarching framework are targeted initiatives such as *Horizon Europe*, the EU's main research and innovation funding programme, and *InvestEU*, which channels investments into sustainable infrastructure, research, and digitization (European Commission, 2021c; European Union, 2021).

Within this broader innovation policy landscape, the *Startup Europe* initiative and the *EU Startup Nations Standard of Excellence* stand out for their dedicated support to the startup ecosystem. The *Startup Europe Strategy* promotes cross-border networking, mentorship, and funding opportunities for early-stage ventures, particularly in emerging technology sectors (European Commission, 2025c). It also aims to reduce fragmentation in the European startup landscape by harmonizing regulatory and fiscal frameworks. The EU Startup Nations Standard, endorsed by 26 member states, encourages governments to adopt best practices in startup policymaking, including streamlined visa regimes, digital-by-default services, and simplified procedures (Startup Nations Standard, 2021). These initiatives underscore the EU's acknowledgment of startups as engines of economic dynamism and climate-aligned innovation.

A cornerstone of the EU's innovation ecosystem is the *European Institute of Innovation and Technology (EIT)*, which operates through a network of Knowledge and Innovation Communities (KICs). Among them, *EIT Climate-KIC* is Europe's leading climate innovation initiative, supporting startups that address climate mitigation, adaptation, and systemic urban transitions. Through accelerator programmes, seed funding, and collaborative networks, Climate-KIC empowers early-stage ventures to scale high-impact solutions (EIT Climate-KIC, 2025a). Thanks to this dense network of initiatives, startups are emerging as key agents of change in the transition toward resilient and net-zero urban futures. Their agility, openness to experimentation, and capacity to scale solutions position them as potential partners for local governments. By connecting top-down policy ambitions with grassroots innovation, startups play a strategic role in accelerating systemic transformations and ensuring the environmental, economic, and social sustainability of European cities.

3. Europe's climate tech ecosystem, a review

In recent years, the European Union has increasingly recognized climate tech startups as key enablers of its twin transition – green and digital – and as essential actors in advancing urban adaptation, sustainability, and resilience (JRC, 2022). A central pillar of this strategy is the creation of an enabling ecosystem for innovation, where startups can thrive through access to funding, networks, knowledge, and supportive regulation. Among the most prominent initiatives is EIT Climate-KIC, the EU's largest public-private innovation partnership focused on climate. Established under the European Institute of Innovation and Technology (EIT), Climate-KIC acts as a knowledge and innovation community (KIC) that brings together over 150 partners from business, academia, cities, and the public sector to accelerate systemic climate innovation across Europe (Climate-KIC, 2025b).

EIT Climate-KIC provides support through education, startup incubation and acceleration programs, systems innovation labs, and large-scale experimentation. Through initiatives like the ClimateLaunchpad, ClimAccelerator, and the Deep Demonstrations program, it has helped launch and scale hundreds of startups across Europe, with a focus on solutions for climate adaptation, mitigation, and just transition. In particular,

the ClimAccelerator network supported more than 1,000 startups across 65 countries between 2015 and 2025, including many working on adaptation-related themes such as water management, agriculture, disaster risk reduction, and nature-based solutions (ClimAccelerator, 2025).

As a result of this ecosystemic support, Europe has witnessed a strong growth in the number and maturity of climate tech startups. According to Dealroom (2023), Europe is now home to over 3,800 climate tech startups, with a combined enterprise value of more than €100 billion. Key hubs include UK, Germany, France, and the Nordic countries, but Southern and Eastern Europe are also witnessing rapid development, especially in sectors related to energy, mobility, circular economy, and urban resilience. In 2023 alone, European climate tech startups raised around €13 billion in venture capital, marking a steady increase despite the global downturn in startup investments (Lockwood, 2023).

These trends confirm that, although Europe is facing some of the most severe and accelerating climate impacts globally, it is also at the forefront of providing innovative and effective responses. Climate tech startups, supported by a robust European policy framework, are emerging as both a strategic resource and a driver of climate-resilient urban transformation across the continent. In this review, three exemplary cases of newborn, innovation-driven, European climate startups founded through the EIT Climate-KIC ClimAccelerator program are reported.

1.1 Sense4Green. Transform Data into Information



Sense4Green is an innovative startup that harnesses the power of sensing technologies and real-time data analytics to improve the performance and sustainability of urban water infrastructure systems. Founded on a mission to bridge ICT innovation with environmental responsibility, the company develops intelligent, cost-effective solutions designed to monitor, detect, and respond to anomalous events – such as leaks or pressure transients – in water networks, thereby reducing water losses, energy consumption, and operational costs.

The startup's flagship product, SmartWater, enables continuous, automatic monitoring of water systems and delivers several key benefits: enhanced infrastructure efficiency and control, faster response to faults, mitigation of damage, reduced non-revenue water, and improved customer engagement. By integrating Internet of Things (IoT) technologies with advanced analytics, SmartWater supports water utilities in transitioning toward more resilient, energy-efficient, and sustainable operations.

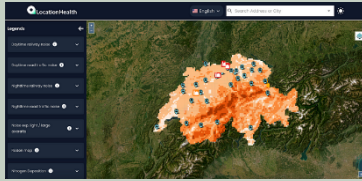
Sense4Green emerged from the research and interdisciplinary experience of founder Daniela Tulone, whose work at MIT and Bell Labs laid the foundation for the company's vision. Inspired by personal experiences of water scarcity and deteriorating infrastructure in her hometown, Tulone sought to apply cutting-edge technologies to one of the most pressing urban challenges: sustainable water management.

Since its inception, Sense4Green has been recognized by several prominent European innovation platforms, including the Climate-KIC Accelerator, TIM WCAP Accelerator, and PA Idea Challenge, and has participated in major innovation expos such as EXPO 2015 and SMAU Bologna. These milestones reflect the startup's relevance at the intersection of climate innovation, smart cities, and digital transformation.

Sense4Green's broader mission extends beyond technology. It aims to raise awareness among utilities, policymakers, and citizens about the urgency of sustainable water use. By combining technical excellence with social impact, the company positions itself as a key player in fostering resilient and intelligent urban water systems across Europe and beyond.

Startup page: <https://sense4green.myfreesites.net/>

1.2 LocationHealth. Countering climate risks with effective products & solutions



LocationHealth is a Swiss climate adaptation and resilience startup headquartered in Herrliberg, Switzerland, offering an advanced platform that bridges climate analytics with tailored mitigation solutions for built assets (e.g. real estate, infrastructure). As part of the EU ClimAccelerator programme, the company leverages data-driven insights to help stakeholders assess, manage, and mitigate climate-related risks.

At the core of LocationHealth's offering is its climate risk analytics engine, which delivers asset-specific projections and real-time predictions – extending as far out as the year 2100 – on key hazards such as flooding, heatwaves, wildfires, and other physical and transition risks. Equipped with intuitive mapping tools, the platform enables users to visualize climate impacts and vulnerability across their properties, helping identify areas of highest priority.

Complementing analytics, LocationHealth integrates a marketplace of climate adaptation products and services – ranging from flood barriers, cool roofing systems, heat-resistant landscaping, to runoff management infrastructure. Users can quickly find mitigation solutions tailored to geography, asset type, or specific risk profile. Central to its design is the fusion of climate data with procurement functionality: users not only assess risk, but can also act via the platform to source optimal resilience solutions.

Beyond analytics and marketplace, the platform includes collaboration tools – facilitating risk communication, document and task management, and ESG-aligned reporting workflows. This end-to-end digital environment supports coordinated climate risk strategies among asset owners, insurers, planners, and service providers.

As a startup targeting real estate developers, investors, insurers, and financial institutions, LocationHealth positions itself as a comprehensive climate-risk management solution – emphasizing high-resolution data accuracy, transparency, and modularity to support ESG-aligned decision-making and investments.

In summary, LocationHealth brings together predictive risk assessment, marketplace access to mitigation products, and collaboration tools into one platform, empowering stakeholders to proactively adapt infrastructure and built environments in line with changing climate realities.

Startup page: <https://locationhealth.solutions/>

1.3 PlattenBaum. We co-create prototypes for climate transition



PlattenBaum is a Berlin-based urban-agriculture and climate-adaptation startup specializing in modular and mobile infrastructure systems that transform underutilized urban spaces into productive and socially engaging landscapes. Founded in 2020 by architects Kerem Halbrecht and Maayan Strauss, the company merges built-environment expertise with social design to deliver scalable, off-grid solutions for sustainable urban food production and community cohesion.

Its core innovation is the Mini-Biosphere, a self-sufficient greenhouse roughly the size of a parking space. This compact unit collects rainwater, harvests solar energy, composts organic material, and enables year-round cultivation – all without foundations or external infrastructure. Mini-Biospheres can be rapidly deployed on paved public areas such as streets, courtyards, or brownfields, providing localized access to fresh produce while reinforcing urban biodiversity and resilience.

In addition to product development, PlattenBaum offers co-creation workshops and strategic urban regeneration services, engaging stakeholders to design community-driven, climate-adaptive urban interventions. Their hands-on workshops – ranging from one-day activations to weekend design-build intensives – are tailored to foster social capital and accelerate climate-media transition efforts at neighborhood scale.

PlattenBaum has received support from EIT Food's startup programmes and was featured at innovation platforms such as EIT accelerator events and municipal pilot projects, including early collaborations with housing associations in Berlin panel housing ("Plattenbau") estates. The founders' multidisciplinary experience, blending architecture, urban planning, design, and participatory practice, underpins the company's dual mission: to enable sustainable urban agriculture and strengthen social cohesion through accessible, decentralised infrastructure.

By bridging high-impact food production, environmental sustainability, and community building, PlattenBaum offers a novel model for urban food systems that is equitable, resilient, and scalable across standardized mass-housing contexts. Its long-term ambition is to evolve into a turnkey general contractor, providing integrated infrastructures and project management for regenerative food ecosystems in cities across Europe.

Startup page: <https://www.plattenbaum.de/>

4. Considerations from case studies

The examination of Sense4Green, LocationHealth and PlattenBaum illustrates the emerging role of climate tech startups as effective enablers of urban adaptation to climate change. Despite operating in different sectors – water infrastructure, climate risk intelligence and urban agriculture – each of these startups exemplifies how innovation, when grounded in local needs and supported by advanced technology, can deliver tangible solutions to complex and evolving urban challenges. Sense4Green addresses the pressing issue of water scarcity and aging infrastructure by deploying real-time monitoring systems that detect anomalies such as leaks and transients, enabling water utilities to reduce losses, optimize maintenance, and improve operational efficiency – key elements of climate-resilient infrastructure. GIScience methods and techniques are fundamental to build innovative cognitive frameworks for spatial analysis (Caprari & Malavolta, 2023). LocationHealth provides high-resolution climate risk assessments combined with an integrated marketplace for resilience solutions, allowing cities and asset managers to both anticipate and act on physical climate threats through data-driven decision-making. To ensure greater synergy between the processes of urban regeneration and containment of climatic risks it is necessary to base planning choices on a quantitative and spatial analysis of local climatic vulnerability (Palermo et al., 2024). PlattenBaum, meanwhile, reimagines urban space through mobile, self-sufficient greenhouses that foster local food production, social cohesion, and ecological regeneration in dense, vulnerable neighborhoods. These urban transformation initiatives involving citizens have been gaining recognition within the scientific literature (De Noia et al., 2024).

What unites these initiatives is their ability to mobilize hybrid, innovative financing pathways – blending public support, private investment, and entrepreneurial drive – to implement scalable and locally adapted solutions. Their responsiveness, modularity, and capacity for rapid prototyping allow them to complement public administrations by filling critical gaps in capacity, technical know-how, and community engagement. As cities face mounting climate risks with constrained budgets and urgent timelines, startups like these offer not only disruptive technologies but also new governance approaches rooted in agility, co-creation, and impact. In this context, the European Union's commitment to fostering a dynamic innovation ecosystem – through initiatives such as the *New European Innovation Agenda*, *Startup Europe*, and *EIT Climate-KIC* – provides a compelling roadmap for how climate resilience and entrepreneurship can be mutually reinforcing. By creating fertile

ground for the emergence of high-impact startups, the EU sets a practical example of how innovation ecosystems can accelerate the urban transition toward a more resilient and climate-proof future.

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