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THE NEED FOR (WHICH) ADAPTATION TO CLIMATE CHANGE IN CITIES?

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With hundreds of cities declaring climate emergencies, there is little evidence about successful climate adaptation and its upscaling. In parallel to the case for adaptation, there is also a distinct need to mitigate climate change, reducing greenhouse gas emissions.

Exploring synergies and trade-offs between adaptation and mitigation, a third concept – resilience (and resilience thinking) – is a perspective that can scrutinise adaptation and tie it to mitigation.

Which adaptation, to what, and how do we measure the success or fallacy of adaptations to climate change in cities?

Adapting to what? The growing awareness of "compound risks"

While it seems we are becoming accustomed to news alerts in the manner of "this summer was the hottest of the last decade", the first images of Spanish or Italian mountains with no snow throughout the winter but blizzards in June should make us wake up to the fact that scientists' evidence about the Mediterranean being the fastest-warming region in the world is something we should be deeply concerned about. Far from being just something unusual about the weather, global warming is impacting our lives in many ways. To begin with, it is worth clarifying that climate change is not one risk, but a "risk multiplier", affecting our built environment, our life routines, our economies and our dependencies on local and distant resources.

Apart from all the scientific literature, data and evidence, which may be too specialised for the broader public, there is a global awakening on the part of governments regarding regulations requiring official "disclosures of climate risks" from organisations, businesses and investors (see the recent UK or US Securities and Exchange Commission rules). This should grab our attention, because it finally means that climate change and its risks are not just one topic of concern, but a new normal to actively address in the course of our business, contracts or lives.

The European Environment Agency (EEA) just released the first ever "European Climate Risk Assessment" report (EEA, 2024). What is interesting here is to see how indeed every single climate risk analysed across the five clusters (on food, ecosystems, health, infrastructure, and economy and finance) has a dedicated section on "risk cascades", highlighting how every risk is linked to a chain of other stresses and vulnerabilities (on which our life support system relies). The emergence and recognition of what are called "compound effects" (linkages between different climatic and non-climatic drivers of change that culminate with a high climate impact) was already mentioned in 2014 (in Chapter 19 "Emergent Risks and Key Vulnerabilities" of the Intergovernmental Panel on Climate Change (IPCC) report). When wildfires hit Portugal, Spain and Greece last year, those were compound effects of a heatwave, long-term vegetation stress and human negligence in managing forests and agriculture, resulting in hundreds of thousands of hectares burnt and dramatic socio-economic losses. A compound risk is also when, in our case near Barcelona, we have an economy living off coastal summer tourism, dependent on villas with private swimming pools near densely occupied beaches that are poorly connected to highways in a region suffering from drought and water shortage, as well as stressed vegetation. These vulnerable socio-economic patterns of development are the perfect ingredients

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for a compound effect both in the short and long term when a heatwave or a fire strikes.

While IPCC scientists focused their attention more on how multiple climate hazards interact when they addressed compound risks, other scientists focus on the interaction and cascade effects between climate hazards and many other ecological, economic and sociocultural risks and vulnerabilities (Simpson *et al.*, 2021). Such complexity calls for urgent improvements in climate risk assessments internationally (Arribas *et al.*, 2022) because "existing constraints in current climate risk assessments make them inappropriate to effectively assess the true exposure of society and businesses" (Arribas *et al.*, 2022: 4326), especially when laws start to require businesses and organisations to provide disclosures (thus assessment and evaluation) of climate risks. What we are learning from this state of play is that our exposure to them goes beyond rain, drought or temperature impacts. The EEA (2024) states that climate impacts compromise the ability of EU policies to meet their objectives, since most of the policy areas are directly or indirectly exposed to climate risks, while existing climate policies are insufficient to manage most of them.

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Are cities making enough progress on adaptation?

Understanding and reporting progress in terms of adaptation has always been a challenge. There are many sources providing the state of the art on cities' performance in adapting to climate change, from assessing the quality of climate plans to climate governance mainstreaming within urban policies, and indicators measuring the results of implementation.

Starting from what is perhaps the easier way of assessing progress, scientists have developed different qualitative evaluation frameworks for climate plans. In Europe, for example, there is a group of 40+ leading scholars collaborating through the EURO LCP (Local Climate Planning) initiative. They gathered most of the European cities' climate plans (885) across 28 countries and are delivering consistent quality assessments of them. The last comprehensive review of the 885 plans highlighted a north-south "divide" regarding the quality of the plans, which were addressing mitigation only (66%), adaptation only (26%) or both mitigation and adaptation (17%) (Reckien *et al.*, 2018). At that time, six years ago now, apart from seeing mitigation as the main domain of climate action as against adaptation or integrated approaches, there was also a clear pattern correlating large cities with quality planning (or at least the presence of a climate plan). A total of 80% of the cities of more than 500,000 inhabitants had a strategy, while only one third of smaller cities (between 50,000 and 100,000 inhabitants) had a climate plan.

According to the most recent study using the ADAQA (ADAptation plan Quality Assessment) framework, the evolution of the quality of urban climate adaptation plans over time is not so encouraging (Reckien *et al.*, 2023). While half of the 327 plans analysed (assessing the progress of adaptation in those cities from 2005 to 2020) improved in overall terms, i) participation and monitoring aspects of plans are generally very weak; ii) consistency in connecting vulnerabilities and adaptation goals was also weak in most of them; and iii) the attention given to the most vulnerable groups decreased when looking at the implementation promised by the plans. This latter aspect is perhaps the worst one if we look at it from an ethical and political perspective since "climate plans focus more on impacts and risks of vulnerable sectors and industries than on the needs of vulnerable groups of citizens" (Reckien *et al.*, 2023:8).

Such a discouraging (European) climate planning overview recently received a boost from the European institutions through the establishment of enabling policies to accelerate local level action: the EU Adaptation Strategy, introduced in 2021. The strategy prepared the ground for making Europe the first climate neutral continent, with the European Climate Law writing the climate neutrality target for 2050 into a binding legal obligation for all member states. However, what do we know about the actual implementation of this strategy? Apart from academic literature, EEA Report 14/2023 entitled "Urban adaptation in Europe: what works? Implementing climate action in European cities" sheds some light on the dubious climate action performance. This 230-page report explores the governance, financial, technological, physical, nature-based and knowledge and behavioural solutions, presenting good practices across Europe, but also putting forward hypotheses on how to enhance climate action, since all the chapters candidly reveal the limitations of the solutions and the challenges of upscaling. While identifying sustainable political commitment, integrated and adaptive governance, peer learning and citizen engagement, effective use of knowledge and data, and sustained funding as enabling conditions for climate action, the report states in its conclusion: "we still miss the tools to be able to say whether real progress is being made or not and if the wide range of individual actions being taken by cities are really making an impact at the continental scale. Progress is being made, but it is clearly not yet enough" (EEA 14/2023: 198).

The technicalities of the challenges of tracking adaptation and its performances are complex, as there is an ongoing debate whether outcome rather than output indicators should monitor adaptation and the International Platform on Adaptation Metrics (IPAM) has been recently launched in this regard. However, there is a more pertinent reflection on the reasons why climate action is so difficult to implement in an efficient way. It goes hand in hand with the concept of our "risk society" (as Ulrich Beck and Anthony Giddens named it back in the 1980s). In the light of the above-mentioned compound and cascade risks, knowing that we live in a society constantly exposed and vulnerable to multiscale risks, "what or who should adapt to what?". In other words, and to be more precise, we all know that it is better to adapt and fix the origin of the risk cascade than to address and adapt to its consequences, but sometimes adapting to the consequences is a better short-term political goal than launching into the political suicide of changing the deep root causes of problems. I will delve deeper into these adaptation fallacies threatening the effectiveness of climate action in the next sections.

Sometimes, adapting to the consequences of the risk cascade is a better short-term political goal than launching into the political suicide of changing the deep root causes of the problems.

Adaptation, mitigation and "maladaptation": why do we so easily mismanage the two sides of the same coin?

If from one side we addressed straight adaptation and its challenges, there is an easier way to address climate change, which was indeed how climate action began some 30 years ago: through the concept of sustainability and climate change mitigation (greenhouse gas emissions reduction). As noted in the review of European climate plans (Reckien *et al.*, 2018), most of the plans tackled mitigation. While assessing the goal of reaching $100bn of climate finance per year in developing countries, the OECD revealed in 2022 that only $83bn had been raised, of which adaptation finance – increasing year after year, from $16.9bn in 2018 to $20.3bn in 2019 and $28.6bn in 2020 – still pales in comparison to the $48.6bn for mitigation. But why are we comparing and contrasting mitigation and adaptation if both are part of climate action? These concepts, and respective agendas, were launched as separate goals within the same mission of fighting climate change, and although the IPCC has been calling for integration since 2008, most climate action still operates in silos.

The work in silos, also reflected by the European Union (EU) through the creation of Mission Net Zero Cities (a platform for climate change mitigation) as against another platform for Mission Adaptation, reveals the hidden problems of policy coherence in climate policy: climate action trade-offs. It all started when in 1999 Richard Klein first defined the concept of "maladaptation", highlighting that some specific adaptive action may increase, rather than only decrease, the exposure or vulnerability to other risks. Many academics embraced this concept, and there is now a literature studying adaptation failures, outlining how there could be i) infrastructural maladaptation (i.e. hard infrastructures preventing flooding which induce a series of negative environmental consequences for local ecosystems, decreasing ecosystem services to local communities while provoking a false sense of safety, allowing people to stay and grow in the long term in places where flooding risks rise and the community is exposed to increasing infrastructure failure risks); ii) institutional maladaptation (i.e. farmers becoming dependent on climate insurance covering their harvest and gradually losing their skills to adapt crops); and iii) behavioural maladaptation (i.e. when individuals dig a borehole for their own benefit, accessing fresh water during droughts and enhancing their resilience while exposing others to increasing water scarcity if many individual adaptations follow the same example, while also contributing to lowering groundwater levels and therefore inducing salt water intrusion and environmental crisis) (Schipper, 2020).

Other clear examples of climate action trade-offs are the paradoxes of mitigation inducing greater exposure to climate threats. Biofuels policies in Brazil – a prominent climate change mitigation strategy for replacing fossil fuels – lead to extensive deforestation for sugar cane plantations, particularly in ecologically sensitive areas such as the Amazon rainforest. Deforestation is not only releasing carbon stored in trees but reduces a variety of ecosystem services including climate regulation, rainfall pattern and flooding regulation, causing loss of biodiversity and increasing extreme weather events (Nepstad *et al.*, 2014). Solar power plants built in arid environments for producing renewable energy need water for cleaning mirrors and thus contribute to water scarcity (Chelleri *et al.*, 2014), as hydropower development is well known for its environmental costs too. On the other side of the coin, adaptation action implying trade-offs with mitigating action is also recurrent. Cooling systems for coping with heatwaves are

increasing carbon emissions through energy use, or water desalination plants coping with droughts at the cost of carbon emissions for the building of these infrastructures, and from the energy required to produce fresh water, as well as sea walls and coastal defence systems using carbon-intensive materials and construction techniques.

Because of these trade-offs, an analytical framework for assessing the level of integration or conflict between climate change adaptation and mitigation in climate plans was recently developed (Grafakos *et al.*, 2019). This framework was applied in the qualitative evaluation of 147 European integrated adaptation and mitigation plans, and the results were clearly showing that most of the plans scored a moderate level of integration, showing some qualitative consideration of the synergies between adaptation and mitigation, while lacking a systematic consideration of potential integration opportunities (Grafakos *et al.*, 2020). As shown through these scientific papers gathering the evidence for maladaptation and trade-offs between adaptation and mitigation, the calls for an integrated approach between the two goals are crystal clear and have been well defined since the Paris Agreement of 2015 (Article 7 highlights the importance of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, while recognising the synergies between adaptation and mitigation); the IPCC Special Report on Global Warming of 1.5°C of 2018 (highlighting the importance of "synergies between mitigation and adaptation strategies to achieve sustainable development and reduce climate risks…[with] integrated approaches [that] can provide multiple benefits, including enhanced resilience, reduced emissions, and improved health and well-being"); the UNFCCC Adaptation Committee technical paper of 2019 on adaptation co-benefits and mitigation co-benefits; the European Green Deal of 2019 and the Sendai Framework for Disaster Risk Reduction (2015-2030).

The answer to the question posed in this section's title ("why do we mismanage the two sides of the same coin?") could be as simple as: "because we think and work in silos". The next section elaborates on this by proposing resilience thinking as the not-so-easy fix for adaptation and mitigation misalignment.

Urban resilience thinking as the golden coin?

There is a great deal of confusion when somebody mentions "climate resilience". You never know whether they are talking about adaptation or about "climate action" in generic terms, including mitigation. This confusion is due to the metaphorical meaning of resilience, synonymous with "adaptive capacities". Most of the time, resilience is referred to as adaptation, thus climate adaptation. Yet it is also very true and logical that in order to adapt to climate change, and to be able not just to survive but adapt to it in the long term, we need not just to cope with impacts but also adapt our lives and economies. So we need to fight its drivers (carbon emissions). Climate resilience could, then, be seen as both adaptation in the short term and mitigation as a way of adapting in the long run. In other words, if adaptation is one side of the coin and mitigation is the other, resilience is the coin.

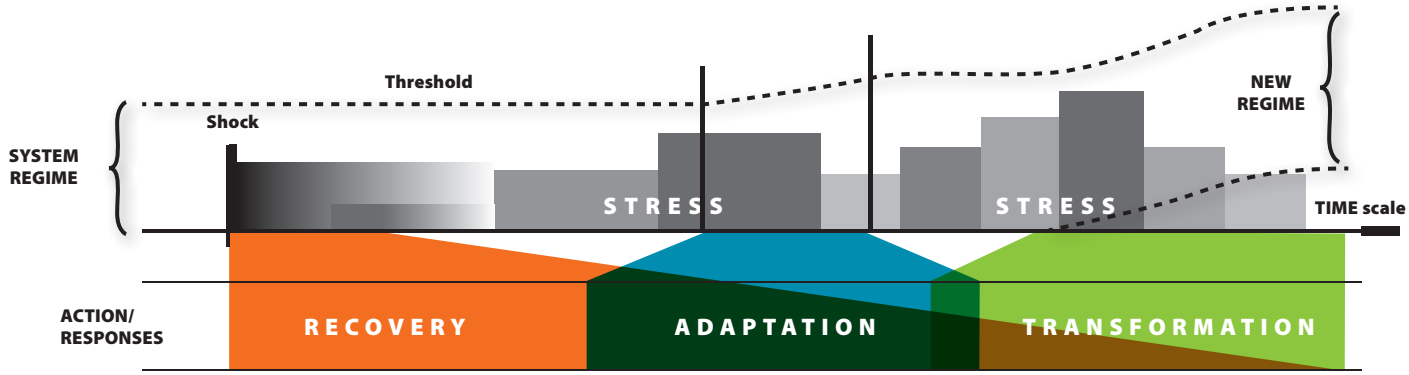
This integrated and integrating view of resilience could be a promise of a better alignment of adaptation and mitigation, or a buzzword promoting fuzziness. The key feature of resilience, and resilience thinking, as a guiding principle towards integration is its comprehensiveness of approaches, among which we should look for consistency. To be more precise, resilience thinking as a comprehensive metaphor for adaptive capacities represents at least three families of operational approaches to action (as shown in Figure 1): i) recovery and robustness, ii) adaptive measures and iii) transformative measures.

Climate resilience could be seen as both adaptation in the short term and mitigation as a way of adapting in the long run. That is, if adaptation is one side of the coin and mitigation is the other, resilience is the coin.

The first approach of recovery and robustness is the one most related to short-term, shock or disaster responses. It is about building a robust system, one that can cope with disruptive events, withstand them, quickly reorganise and adapt to disruptions within its infrastructures, services or routines, while guaranteeing business continuity. It applies after the disaster, but also before as a preventive measure. This approach is widely used in disaster resilience and the aim is to maintain the status quo of routines and services.

In the case of adaptive measures, the second approach, the aim is to protect the system and guarantee a "safe operational space" for as long as possible. Some examples are the dikes or mobile flood barriers in the Netherlands or Venice, where flooding risk is purposely monitored and these adaptation infrastructures intervene by closing the gates to water when floods threaten the harbour or city. It applies to all climate action that looks to adapt to the external drivers

Figure 1. Resilience approaches in relation to time scale



Source: Adapted from Chelleri *et al.*, 2015.

of change by protecting assets or routines without changing them. The benefits and performance of this approach are limited in time when long-term stresses are increasingly threatening the system to a point where these adaptations no longer work, leaving no other option but the third approach.

It is time for transformation. This third, long-term approach calls for infrastructure, business and societal transformation, the modification of buildings, structures and routines so that the threat is no longer a risk but an element (heatwaves, floodwater etc.) with which to coexist. Clear examples are the floating houses in the Netherlands, representing transformations which no longer need the adaptive measures protecting the old-fashioned vulnerable houses from flooding. This approach, of course, takes the long view, requiring profound changes and thus time to happen, but simultaneously guaranteeing long-term resilience.

If from one side the concept of resilience refers to and incorporates all these resistance/adaptive/transformative approaches, any resilience implementation could potentially imply trade-offs among them, because working on an infrastructure's robustness will impede the same infrastructure's transformation, whereas working on transformation will of course imply forsaking current infrastructure resilience. These resilience trade-offs (Chelleri *et al.*, 2015) are natural and part of what is conceived as the "politics" of urban resilience (Vale, 2014). What is the difference, then, between climate change adaptation and mitigation trade-offs and these resilience trade-offs? Why might resilience be the new mantra aligning adaptation and mitigation?

If adaptation or mitigation can be enhanced at the expense of the other concept, resilience, representing all three approaches, could not be enhanced without thinking of its possible trade-offs. The potential internal inconsistencies among robustness, adaptation and transformation should guarantee the implementation of resilience, harmonising and integrating its own approaches. Indeed, it is inconsistent with the long-term resilience (and therefore survival) of a city to only act on robustness. Sooner or later, without adaptation and transformation, the city will collapse under incremental stress. At the same time, working on long-term transformations alone would neither work nor provide resilience to the system either; without responsive mechanisms for shocks and short-term potential disruptions it would fail and collapse before seeing the transformation take place. Therefore, increasing city resilience should consist of enhancing response capabilities (to resist shocks in the short term), while building adaptations which would allow the city enough time to complete longer-term transformations, requiring prototyping, upscaling, people's behaviour and business model changes. Hence, in order to become resilient you cannot choose between adaptation and mitigation.

The potential internal inconsistencies among robustness, adaptation and transformation should guarantee the implementation of resilience harmonising and integrating its own approaches.

From theory to practice: current challenges facing adaptation and resilience

Ten years ago, Charles Redman, founding director of Arizona State University's School of Sustainability, described how politicians always preferred short-term adaptation over sustainability or transformation, because it helps to maintain preestablished orders without changing power relations (Redman, 2014).

Many other critical scholars shared this view, highlighting how policy arenas always favoured short-term thinking and results, resulting in reactive adaptation approaches. Only recently, after a decade of critiques, has there been a trend towards defining "successful adaptations", leaving maladaptation behind (see Castán Broto *et al.*, 2024, for a very recently published special issue on how to build new concepts of adaptation in cities).

While new concepts and definitions of positive, or successful, adaptations are shaped, the challenge of resilience to be recognised as "the golden coin" spanning adaptation and mitigation remains a political battle for "legitimacy". Indeed, after so much work done by the Rockefeller 100 Resilient Cities programme (now the global Resilient Cities Network) to establish City Resilience Officers, convincing institutions internally that resilience is not just climate change adaptation but a new way to integrate urban policies, it seems resilience still has a long road ahead of it. The walls of city departments' silos remain reluctant to incorporate such a cross-cutting approach to reorganising city governance.

As in many other cities, if one looks at resilience in Barcelona, for example, there is so much to describe beyond adaptation or mitigation per se. Thanks to the regional law establishing local centres for the promotion of cooperatives, many initiatives for cohousing, urban farming, for energy transition through energy communities, cooperatives offering local organic food that break long market chains, or neighbours self-managing rainwater to face drought started to pop up, demonstrating the citizens' capacity for co-managing resources. At the same time, Barcelona displays modern urban design in its public spaces through green blocks, which even while challenged because of induced gentrification, better regulate local microclimates and water runoff, reducing traffic pollution while offering a safe place for people to enjoy the city. And under these spaces there are infrastructures that are risk proofed thanks to the control room of Barcelona City Council, recognised by the United Nations Office for Disaster Risk Reduction (UNDRR) in 2013 as a role model for critical infrastructure resilience.

All these different examples contribute to reducing climate risks through different responses, sometimes in a manner that is not coordinated yet (even if potentially they are highly synergistic). The challenge for resilience in driving adaptation and mitigation is a political one, as well as a matter of capacities and capability. Enhancing resilience and managing its different approaches from different urban spheres requires capacity building for our communities, industry and markets, and, last but not least, our political leaders and practitioners. Indeed, it is easy to choose a risk and propose a short-term-gain solution. It is more challenging to tackle the compound risk and act through capacity building, coordinating responses in both the short and long term, drawing in different actors in the urban sphere to work synergistically on the drivers of risks, in a coordinated fashion. This is what resilience implies.