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Urban Resilience

In the face of deleterious shocks
and mutations, should cities bounce
back rather than resist?

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Resilience, a new imperative?

We find it mentioned in mechanics, biology, psychology, ecology, economics, as well as urban planning and architecture: the concept of resilience is everywhere. At times it can seem trite – or even downright suspicious. Now that it is used in so many different fields, has the term lost its meaning? Or has resilience emerged as a new imperative?

Fig. 1:
New Orleans after
Hurricane Katrina

The vitality of thought in this area is something to celebrate, as shown by the conference on "Resilient Cities and Territories" organized at Cerisy in September 2017 by *La Fabrique de la Cité*, the *Institut Veolia*, and Sabine Chardonnet Darmaillacq. However, we should not overlook the need to interrogate this notion and its premises, because there is no guarantee that everyone is talking about the same thing when they talk about resilience.

The popularity of this concept has no doubt benefited from recent events, as we have seen the impacts of various shocks – attacks, earthquakes, hurricanes, floods, fires, and even economic crises – and the corresponding stories of renewal following these shocks. We can all remember the images of Houston under water, of New Orleans devastated by Katrina, of Paris staying strong in the face of terror and rediscovering its motto "*Fluctuat nec mergitur*" ("She is tossed by the waves but does not sink"), or even of Kigali, which in the 24 years after it became ground zero for one of the 20th century's bloodiest genocides, has reemerged as a green city with the concerns and well-being of its residents as its top priority. Academic work on the concept of urban resilience[1] and research on the concept's operability[2] have also seen an uptick.

That is why *La Fabrique de la Cité* has chosen to offer a series of four insights on urban resilience, each with a respective focus on:

1   the concept of resilience

2   reducing urban vulnerability

3   network resilience, urban resilience in the face of demographic shifts

4   urban demography and resilience

Resisting and adapting to a shock

Let's start with the basics. **We have a relatively broad general definition that describes resilience as the capacity of objects, individuals, or systems to resist and adapt to a shock they experience and return to their initial state.**

From that definition we can sketch out the following rough diagram. **After the time of shock (t0),** comes the time of **crisis and crisis management (t1),** which is characterized by rapid action and the need to protect against the most urgent dangers, notably by getting vulnerable people or things to safety. **The next phase (t2) is characterized by a longer timespan combining action and reflection,** focusing notably on the reasons behind the shock, how the crisis was managed, and potential actions. Those actions may aim to improve the crisis response to limit the impact, or to change the way the system operates with the goal of targeting the contingency directly and limiting its probability of recurrence. This is the time of adaptation – which can take several forms that vary on a sliding scale between total conservation of the system (protection strategies) to total adaptation (rethinking the system). **The final phase (t3) corresponds to a return to equilibrium, which involves implementing appropriate measures and the long-term management of the consequences of the crisis and shock, though without the urgency of the previous phases. The notion of equilibrium does not necessarily imply that the system has returned to its pre-shock state,** simply that it has regained sufficient stability to resume operating at a normal rate. It should be noted that the affected system is rarely the only one concerned by the crisis: shock waves vary in size and may impact one or more interconnected systems.

Fig. 2:
Diagram: The timeline of resilience
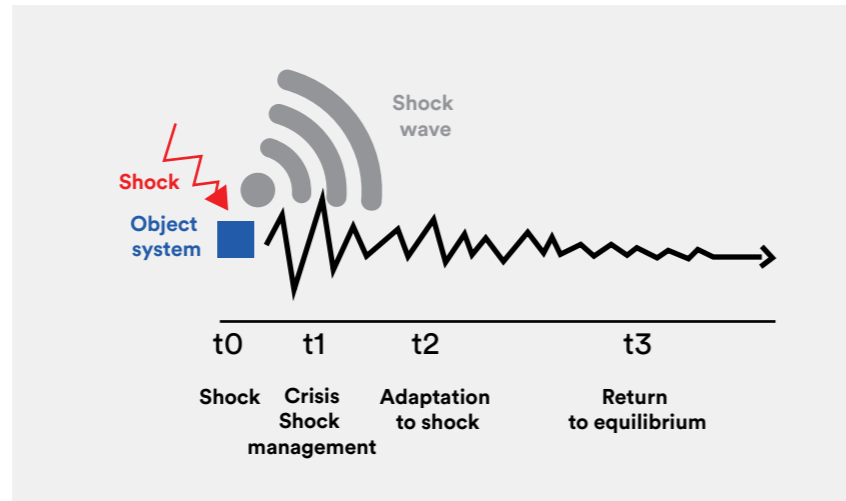
The final phase (t3) corresponds to a return to equilibrium, which involves implementing appropriate measures and the long-term management of the consequences of the crisis and shock, though without the urgency of the previous phases. The notion of equilibrium does not necessarily imply that the system has returned to its pre-shock state, simply that it has regained sufficient stability to resume operating at a normal rate. It should be noted that the affected system is rarely the only one concerned by the crisis: shock waves vary in size and may impact one or more interconnected systems.

Using this diagram, we can easily see that **resilience, which comes from *resilere* – meaning to jump or to rebound – is opposed to resistance, which comes from *stare* – to stand.** In a way, that brings us back to the classic fable of the oak and the reed. Resilience (the reed) is dynamic, while resistance (the oak) is static; **the former accepts loss and change resulting from the adaptation, while the latter relies on its capacity to protect against the shock and to absorb its impact – even at the risk of breaking** if the force of the shock is too great.

Resilience takes an alternative approach to risk: we abandon the hope of zero risk and simply accept moments of crisis; we try to lessen the shock and shockwaves by ensuring that the affected system is stable enough not only to avoid a total collapse, but also to execute the necessary transformation. **Resilience introduces the idea of coordinated long-term action, taken both before and after the crisis.**

It's an appealing concept – so appealing that many neglect to interrogate its underlying premises: **what is a shock? Who defines a shock? Who determines if an event is a shock – or is not?** What is the state of equilibrium and who determines whether or not it was impacted? Who designates what is resilient and what isn't? At what point is something considered resilient? During the crisis? In the immediate aftermath of the crisis? Or can resilience only be determined after a long period of hindsight that places the shock in perspective?

1   **Resilience is often associated with the idea of improvement. By this logic, the shock and crisis would provide an occasion to rebuild a better system…** Here we find the idea of shock therapy, which is supposed to galvanize and unify energies, as well as creative destruction. Surviving is not enough, the goal is to become even better. That means a set of norms and powers underlie resilience. As observed by Samuel Rufat, HDR Senior Lecturer at *Université de Cergy-Pontoise* and junior member of the *Institut universitaire de France*, isn't resilience just one step away from casting social Darwinism as a desirable state of affairs?

2   **Resilience is often understood as a process for ensuring consistency among the actions of various parties.** However, resilience is premised on accepting shock and loss – meaning that it is premised on a choice. So before ensuring that each party's actions are consistent, it is necessary that these parties agree on a shared definition of vulnerabilities as well as an acceptable level of risk and loss for society. That means resilience is less a technical project, and more of a political one.

Insights from psychology: beware of gold stars and playbooks

Resilience is a central concept in psychology, which is where the concept of urban resilience finds its roots. In psychology, resilience focuses on the ability of individuals and communities to overcome the various challenges they must face in order to continue building their lives. Several definitions of the term have been proposed over the years and now coexist today – leading to a divergent range of proposed actions and support, as pointed out by psychiatrist Serge Tisseron. Resilience was defined in the 1960s as the "*capacity to build a good life for oneself in spite of an unfavorable environment*" (Tisseron). At that time, less attention was paid to the factors that hinder individuals (unfavorable environment, for example) than to factors that protect them. Resilience was thus seen as a quality that is intrinsic to individuals. In the 1980s, resilience was defined as a process: anyone can become resilient as long as they get help from someone who is already resilient – a resilience mentor. That shift brought resilience out of the purely individual sphere (you either have it or you don't) and into the collective sphere (a support system). In the 2000s, resilience came to be seen as a force that everyone possesses, but in variable quantities, and which therefore must be developed, notably by overcoming the obstacles that stand in the way. Today, resilience is starting to take on a collective dimension that shifts from "me" to "us," a move that encompasses the whole of society, extending well beyond interpersonal relationships with resilience mentors. In that way, it has become inseparable from risk culture.

Fig. 3:
Photo of US Airways Flight 1549 after its emergency water landing on the Hudson River in New York

These different definitions highlight the two principal pitfalls concealed by the concept of resilience, namely the pitfalls of gold stars and playbooks. If we consider resilience as a quality that is intrinsic to the person, then the effect is to divide humanity into those who possess this quality and those who do not, handing out gold stars and demerits accordingly. If we consider that everyone can acquire resilience with a little help, then we end up creating "playbooks" and "recipes for resilience" that a person need simply follow in order to become resilient. That is why Serge Tisseron champions the idea that **these different notions of resilience are in fact three complementary facets that define a resilient system.** By proposing three orthographic variations of the same term (resilience, as a set of personal qualities; resiliance, as a collective process that favors resiliencies; and Resilience, as an inner strength), he describes reciprocal action feedback loops which form a resilient system through a triple formula: "*Resilience favors resilience through resiliance,*" "*resiliance favors resilience through Resilience,*" and "*resilience favors resiliance through Resilience.*" Stepping outside the arena of psychology, the formula proves just as pertinent and effective when applied to cities and territories.

This detour by way of psychology is, in fact, a useful route towards thinking about resilience for cities and territories. The reason for this is **that it highlights the importance of the human factor – both in terms of managing crises after they happen and anticipating their occurrence.** The example of Chesley Sullenberger, cited by Eric Rigaud at Cerisy, offers a telling example: in 2009, US Airways Flight 1549 struck a flock of Canada geese just minutes after takeoff from LaGuardia Airport, while flying over the Bronx. Just 13 seconds after losing power from both engines, Captain Chesley Sullenberger took control of the plane. After a flight time of 5 minutes and 8 seconds, US Airways 1549 crash-landed on the Hudson River, where teams were able to rescue all passengers and crew. Although birds pose a well-known risk to air travel that is already managed by air traffic systems, that risk can still present surprises that overwhelm our standard procedures. In the case of Flight 1549, the operation's success depended neither on following procedure nor on any specific pilot training for emergency water landings. It relied in part on seamless communication between the pilot, copilot, and air traffic controller, as well as the individual decision-making power of Captain Sullenberger who, when faced with an unforeseen situation, quickly analyzed the available resources (plane, engines, time, etc.) and the necessary actions to execute (emergency landing on the ground or on water, saving passengers, etc.)… all while acting *contrary* to standard procedure – for which he was later answerable.

What this example shows is that **resilience comes into play especially in unforeseen and/or highly uncertain situations that exceed the capacity of routines, experience, or protection systems developed on the basis of this experience.** That's why it is essential, on one hand, to design technical systems that do not overlook the human factor, but instead rely on it as an efficient relay in case of system failure; and on the other hand, to empower individuals to protect themselves and others (empowerment). In order to do this, it is necessary to prepare residents for crises by informing them of existing risks and training them to adopt pertinent behaviors to avoid risks and take adequate measures if a crisis occurs.

It is in that sense that we must develop and share a risk culture (Tisseron). Both technical systems and human factors, collective systems and individual decisions, must go hand-in-hand and achieve a form of synergy in order to promote resilience.

Cities at the epicenter of risks

The history of cities stands as a testament both to their impressive capacity to resist shocks and crises, as well as their capacity to adapt and be reborn. **All throughout their history, cities have always had to confront and cope with slow and deleterious transformations, as well as sudden and brutal shocks.** Géraldine Djament, Senior Lecturer at the University of Strasbourg, delivered a perfect illustration of this fact in her thesis on Rome, which she calls an eternal city: Rome now stands as the archetype of the "sustainable city" – as much for its capacity to overcome a vast array of upheavals all throughout its history, whether brutal or deleterious, as for its capacity to foster a discourse that emphasizes the city's continued existence in the face of any hardship. **Sudden and brutal shocks, often reaching a spectacular scale, leave a strong impression on people's mindsets and mobilize massive responses** (fires, floods, attacks, hurricanes, etc.) – just look at the international commemorations paying tribute to the cities and victims affected by terrorist attacks.

On the other hand, slow and deleterious transformations (economic crisis, social exclusion, climate change, etc.), which extend over a long period and undermine the system from the inside, with no easily identifiable or sudden catastrophe requiring an emergency response, **can long go unnoticed and make it harder to mobilize a response** – socio-spatial inequalities aggravated by a context of metropolitanization do not make the news beyond the occasional flare-ups that generate eye-catching headlines but little long-term or substantive action. Two different time frames play into this situation: a sense of urgency on one hand, and latency on the other. However, they both point to the need to carry out long-term and substantive action – without which the system will not regain its equilibrium and become resilient. **That is where we find the most important and most interesting challenge posed by resilience, in this capacity for long-term alertness and mobilization – which goes beyond urgency and against latency.**

This challenge reaches its full extent in cities. **Not only are cities the subject of risk, they can also serve to aggravate that risk. That's why they play such a central role in conversations about resilience and risk management in today's world.** Fueled by a continuous process of urbanization, cities contain ever growing populations, economic hubs, and political centers, meaning ever more pressing challenges… Moreover, globalization exacerbates shock waves by connecting cities into networks and fueling their interdependence. Furthermore, cities can amplify and even create risks: their planning and organization, the ways in which they operate, and the activities they contain can all aggravate climate change. **Finally, as a corollary to these aforementioned reasons, cities are now more than ever the primary agents in charge of risk management and contingency planning, since they offer a pertinent and efficient scale of action and governance.**

Cities now face shocks and deleterious upheavals that vary in nature, timespan, and scale. **Resilience abandons the hope of zero risk and the goal of maintaining a territorial or social system in an identical state: instead it aims to develop the capacity to bounce back, organize, and adapt. The city must be conceived as a system that is at once complex, flexible, and agile. How can cities achieve this target state of dynamic equilibrium?** What skills, resources, and tools do we have at our disposal to reflect on resilience, depending on the discipline approaching it, the society reflecting on it, or the context, timespan, and scale in which it is applied?

There is no doubt about the relevance and pertinence of the notion of urban resilience – nor about the need to interrogate the concept and understand its operability.

Delaying or avoiding the collapse?

Testing different strategies for reducing vulnerability

Is resilience a new imperative?
It may seem that way at first glance: everyone talks about it, though not everyone means the same thing, to the point that resilience can seem like just another empty marketing concept with no real substance behind it. While that is certainly the case from time to time, it shouldn't preclude all interest in the concept.

Fig. 5 :
Snow must go on: protests against climate change on Berlin's Schloßplatz in 2010

On the contrary, that fact makes it even more crucial to hammer out a clear definition of the term. Above all, it requires us to investigate the concept's operability by analyzing case studies of areas that have implemented resilience strategies. Because resilience is less about the successful or precise application of a concept, and more about a capacity to steer actions and unify a wide range of stakeholders. This action aims primarily to make our societies less vulnerable to contingencies and reduce the extent of shocks. What strategies been enacted? How effective have they proved?

Becoming resilient, or doing better with what we (still) have

Several major changes have disrupted the way we understand urban risks:

1 **Climate change, above all.**
Due to its planetary scale, massive extent, irreversible nature and capacity to provoke virtually unmanageable chain reactions, the implications of climate change go far beyond a rise in the number of natural disasters. Climate change has radically altered our "constellation of risks" (Quenault[3]) and represents one of the greatest challenges humanity will face over the next decades.

2 **Next, the emergence of new, wide-scale systemic risks.**
These include risks of various nature (social, economic, ecological, etc.), tied to the widespread interconnection accompanying globalization.

3 **And finally, a growing awareness of the finite nature or rising costs of accessing certain essential resources, like water, food or metal deposits.** The World Bank, in a report published in May 2016, pointed out how shrinking water resources poses a massive risk to economic growth (with losses potentially reaching 6% of GDP in some regions) – and to global political stability as it is expected to fuel vast waves of migrants. Another study[4]

just published in Nature Sustainability by M. Flörke, C. Schneider and R.I. McDonald shows that over one hundred metropolitan areas may experience severe water shortages by 2050. Los Angeles, Jaipur, Dar es Salaam, Dalian and Karachi face the most immediate risk.

The extent of these changes forces us to reflect not only on how to reduce contingencies (difficult to manage because of their planet-wide scale), but also on how to make our societies less vulnerable in the face of this new generation of risks. A city's vulnerability is defined as its relative capacity to preserve its essential functions in the aftermath of a shock or crisis. There are two ways to reduce vulnerability: limit cities' exposure to shocks or adapt cities following a disturbance. **In this case the major challenge becomes durability: how can we make the resources at our disposal last longer, even in the face of shock?** CHow can we reduce the impact of a shock on the urban system? At the Cerisy conference on "Resilient Cities and Territories," numerous presentations stressed the idea that reducing vulnerability first means "*recuperating resources*" (Alexis Delaunay, engineer at the General Council on the Environment and Sustainable Development (*CGEDD*)) and reducing dependencies. Circular economy, synecoculture, modular building and other solutions have emerged to respond to this question: how can we do better with what we (still) have? Though this new way of producing the city and managing resources can help delay the collapse, will it be enough to avoid it? Many have cast their doubts and called into question the fundamental growth paradigm that our urban societies are currently based on, even in their "sustainable" forms. And they have done so in order to lobby instead for a truly systemic approach to resilience and reducing vulnerabilities.

Shrinking resources, a two-part challenge for resilient cities and territories

In today's world, it is hard to ignore the rising scarcity of resources, the growing cost of accessing resources, and the rapid loss of biodiversity. A study by Inge de Graaf (Utrecht University), presented during the American Geophysical Union Fall Meeting in December 2016, showed that **about 1.8 million people in 2050 may live in regions experiencing absolute or partial water scarcity** – first among which are India, Australia, Argentina, California, and southern Europe. Why? Demographic growth and an uptick in personal, agricultural, and industrial consumption rates have placed stress on all types of natural resources, not just water. Over the course of the 20th century (1900/2009), global extraction of raw materials (biomass, industrial and construction minerals, metal ores, fossil fuels) has climbed from 7 to 70 billion metric tons; between now and 2020,

Fig. 6:
An example of the effects of increased scarcity of resources: the multiplication of drought episodes in California

that figure is expected to reach 80 billion metric tons[6], which doubles the quantity extracted 40 years earlier and marks a clear acceleration in the rate of extraction.

Since the 1980s, our world ecological footprint has in fact exceeded the Earth's capacity to produce the amount of natural resources we consume and to absorb the waste we produce.

Moreover, the much talked about "Earth overshoot day," calculated by the Global Footprint Network, arrives earlier every year: in 2017, we used as many resources as the planet can produce in one year in just 7 months, meaning that we started living on credit on August 2. From a geological standpoint, some resources are obviously still a long way off from total scarcity. However, the cost of operating these resources will increase due to the difficulty of accessing certain deposits. McKinsey notably suggests that operating a new oil well will cost twice as much in 20 years as it does today[7].

This is alarming news. It poses a two-part challenge for resilient cities: on one hand, natural resources are essential to our survival on Earth, and their depletion represents a damaging shock that is likely to set off a chain reaction (from the environmental impact of resource overconsumption – greenhouse gas emissions, pollution, overproduction of waste, aggravation of climate change – to the social impact – mass migrations). This dire situation will require us to take appropriate adaptive measures in response. **On the other hand, this unparalleled depletion of the world's reserves will make territories more vulnerable to other shocks by leaving them dependent on importing natural resource.**

Fig. 7:
The "Earth overshoot day" grows ever more precocious
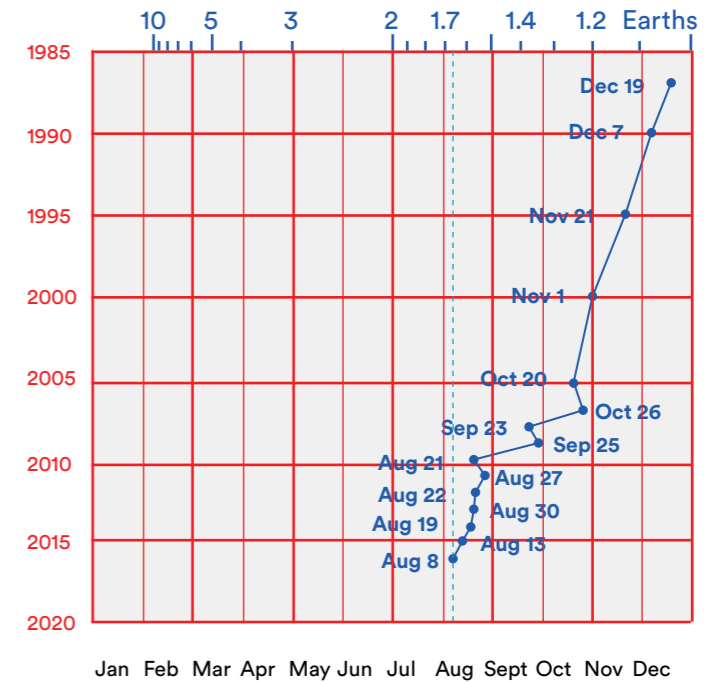
The circular economy: turning resources into assets for new growth opportunities?

How can we cope with the challenges posed by the energy transition? How can we reconcile economic development, personal well-being and natural resource management? 75% of wastes are not reused, only 2% of wastewater is recycled, fewer than 20% of energies are produced by renewable sources, 20% of water in France is lost through leaks (Laurent Auguste, Veolia). These figures point to a new avenue for solving the equation of "producing more with less": the circular economy.

The circular economy is a new economic development model that breaks with the linear economy model: extract, manufacture, consume, discard. It emphasizes sustainable ways of using natural resources while simultaneously creating new wealth – thereby renewing the economic paradigm based on growth. By focusing on the local scale and cooperation between local players, the circular economy rethinks modes of production, distribution and consumption. It opts for short cycles that optimize material and energy supply chains, while also promoting moderation, extended life cycles, shared usage (vs. property) and recycling, in order to limit waste and raw material consumption as much as possible. In this new economic model, **wastes and refuse become new growth-generating assets and sources of sustainable new jobs**

So what is the connection between the circular economy and resilience? **First, the circular economy would help to reduce our ecological footprint and act directly on contingency in two ways (combatting resource scarcity and associated negative externalities – such as climate change); it would also make territories more robust by reducing their dependency on outside supplies and strengthening their social cohesion.** In fact. One of the arguments put forward in favor of the circular economy as a vector of resilience is that it fosters new ties between local stakeholders – whose cooperation is crucial to crisis management – and between local stakeholders and their home territory, which stakeholders must understand in fine detail if they are to manage and adapt its organization as best they can.

that can't be outsourced, enabling Laurent Auguste, innovation and marketing director at Veolia, to declare at Cerisy:

> 66 the circular economy is an element in the renaissance of territories."

In a study published in 2015, McKinsey notably estimated that the circular economy could enable European countries, by 2030, to generate 1.8 billion euros in savings, while boosting annual productivity by 3% and GDP by 7% based on growth scenarios for the current economic model[8].
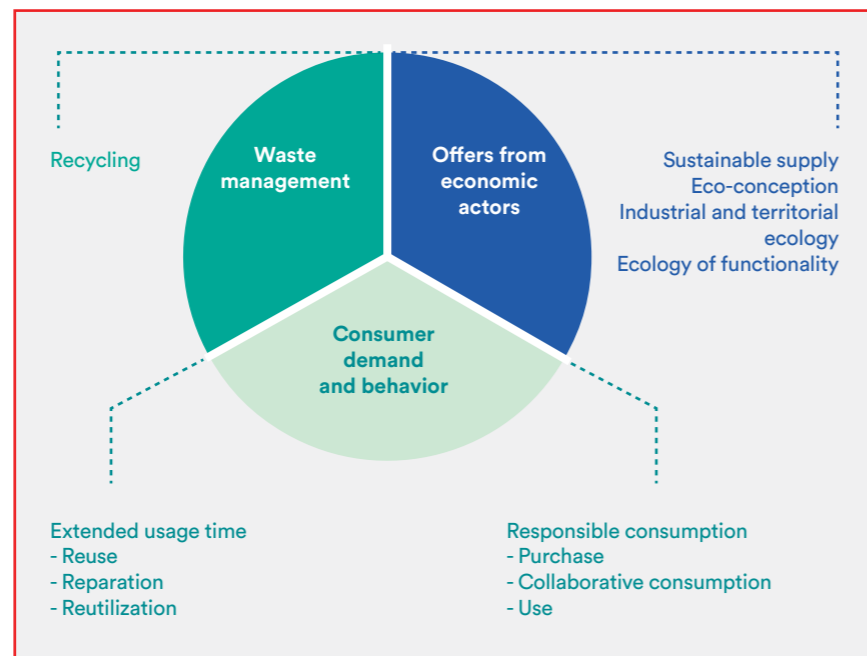
Circular economy:

- 3 fields of action
- 7 actions

Recycling

Waste management

Offers from economic actors

Sustainable supply
Eco-conception
Industrial and territorial ecology
Ecology of functionality

Consumer demand and behavior

Extended usage time
- Reuse
- Reparation
- Reutilization

Responsible consumption
- Purchase
- Collaborative consumption
- Use

Fig. 9:
The three fields of action and seven pillars of the circular economy according to *ADEME*

Agriculture, cause and victim of global warming… but also a hope for more resilient cities?

In one sense, due to its production and consumption methods, agriculture can frequently appear like an underachiever in terms of its relationship to climate change and the circular economy. Indeed, today's agricultural production methods contribute to climate change and amplify its risks: globally, these methods account for some 25% of greenhouse gas emissions; the adoption of industrial production methods is a major factor that has fueled deforestation, soil erosion and a sharp decline in the moisture-holding capacity of soils; the shift to monoculture and the massive use of agricultural inputs have brought along the main negative externalities of soil pollution and loss of biodiversity. McKinsey's study shows that 31% of the available food supply goes to waste at some point in the supply chain.

In a different sense, agriculture can also seem like a victim of climate change. The main risk factors weighing on the industry include the quality and availability of fresh water, rising sea levels and saltwater intrusion in coastal regions, a potential spike in climate risks like flooding, drought and rising global temperatures – as well as indirect effects including higher food prices, land scarcity and increasing energy and fertilizer prices.

In this context, how can we determine the best resilience strategy for securing the world's food supply – considering that we will have to feed over 9 billion people by 2050, which will mean doubling global food production?

Whatever resilience strategy we adopt, we will need to enact it over a two-step process.

1 **Immediate adaptation:**

the goal here is to develop technologies and growing methods that are suited to future climate conditions, apt to resist various deteriorations and able to generate higher yields without exhausting resources or lands.

2 **Subsequent adaptation:**

the aim of this stage is to act directly on agricultural production methods in order to reduce greenhouse gas emissions and improve their environmental impact and use of resources, while also acting on demand by limiting overconsumption and food waste and adapting diets to include more products with lower emissions.

In addition to its role as both a cause and victim of climate change, does agriculture also have a role to play in solving climate challenges? The "land sector" could generate 20–60% of potential greenhouse gas reductions between now and 2030 by functioning as a carbon pump, producing renewable energies and materials – and making cities less vulnerable by offering a viable alternative to food import dependence. As it stands, cities rarely operate their own agricultural production. The functional relationship between cities and the domestic agricultural countryside has also deteriorated, giving way to a system of global agricultural production, which has significantly increased the average distance between where food is produced and where it is consumed – now around 2,000 km.

Masatoshi Funabashi, researcher at the Sony Computer Science Laboratories, demonstrated at Cerisy that another form of agricultural production is not only possible, it can also help to make cities much more resilient: **synecoculture. By utilizing reduced spaces to ensure intensive and varied food production, this novel form of market gardening is adapted to the urban model.** Its principle is based on "*mixed polyculture with augmented biodiversity*" (Funabashi), which greatly limits the use of agricultural inputs and amplifies biodiversity to guarantee better agricultural production. Polyculture, as

opposed to monoculture, is less vulnerable to climate fluctuations, since its diversity not only promotes the adaptation and survival of a wider number of plant species, but also feeds off climate change: greater climate variation leads to more diverse agricultural production. It also makes it possible to diversify nutrition and meet new dietary goals, while creating a new local and sustainable socioeconomic ecosystem, which boosts cooperation between urban and rural areas, as well as producers and consumers, by favoring peer-to-peer systems. For example, in the Sahel Region, synecoculture was used to **transform 500 m² of bushland into arable fields producing 150 different species per year and boosting *per capita* GDP in Burkina Faso.** With this system, cities with more options at their disposal would become more resilient, thanks to a stronger capacity to adapt.

Fig. 11:
Construction sites produce over 40 million tons of waste per year, for 28 million tons of domestic waste

Adaptable, flexible, modular: new paradigms in resilient architecture and urban planning

How can we do more with what we have? This question applies in a direct way within urban planning and architecture.

Resilience is a challenge that operates on several levels:

1 First, in reducing the ecological footprint of the construction industry.

Buildings and construction currently account for nearly a quarter of greenhouse gas emissions in France. Both in France and across Europe, construction is the most energy-hungry sector, even beating out industry, notably due to its high electricity needs. In addition, construction sites produce up to 40 million metric tons of wastes every year, adding to the 28 million metric tons of household waste. Despite its heavy environmental burden in this respect, construction still has ample room for improvement, notably by integrating eco-

design principles. These concepts aim to reduce a building's environmental impact by taking into account its full life cycle, social consequences and associated costs at every phase in its design and maintenance. In this way, the strategy can reconcile the sustainability and economic viability of eco-designed projects. This approach offers real benefits built on a systematic approach to sustainable development. As shown by Jérôme Stubler, Chairman of VINCI Construction, during *La Fabrique de la Cité*'s international seminar in Lyon in July 2017, **eco-designed projects reduce the stress placed by the construction sector on all type of natural resources (energy, water, raw materials, biodiversity, etc.) by optimizing their use and protection, while also improving health.** For example, the Horizon window developed by VINCI Construction and SunPartner Technologies transforms a simple window into a mini electric power plant, which helps to combat urban heat islands, improve occupant health and comfort by optimizing heat and light regulation, and promote optimized building use. On a similar note, the ParisTech-VINCI Chair on "Eco-design of building complexes and infrastructure" developed its tool, Biodi(V)strict®, to analyze biodiversity before operation and forecast its state after operation, in an effort to reduce the project's environmental impact and favor the successful integration of construction projects into areas that support biodiversity.

Fig. 12:
Tangram Project

Fig. 13:
Project for the FCB browfield site, Lille

2 Next, in promoting adaptability in construction.

The second lever for action pertains to adaptability in the construction industry. This priority aligns with the first lever in that it helps to limit building obsolescence, while also focusing on a building's long-term uses and functionalities. Resilience accepts the fact that cities will face brutal or deleterious shocks that will force it to adapt on a permanent basis. Natural disasters are one obvious example. But this also includes more common practices, such as adapting buildings to rapid urban growth or decline, as well as obsolescence in terms of how the building is used.

Flexible practices and modular planning represent interesting new avenues, as demonstrated at Cerisy by François Decoster, architect and co-founder of *Agence AUC*. **Both strategies take a long-term view of the building as a structure that can adapt to changing needs and practices, whether structural or circumstantial.**

Tangram, winner of the *Réinventer Paris* (Reinvent Paris) call for projects, is composed of seven different modules:

1   *Solid,* flexible platforms for offices or homes

2   *Soho,* activity venues in addition to housing

3   *Appartement,* a social housing program

4   *Capable,* a complex of loft homes with high ceilings, and a productivity platform

5   *Coopératif,* cooperative housing and offices

6   *Vertical Factory,* a productivity platform

7   *Pavillon Productif,* a ground-level productivity platform[9]

These buildings are modular in that each module can be updated over time to match occupant needs. In addition, the project is modular in that its final design is determined through a participatory urban workshop.

As a result, these buildings become more resilient in that they are better able to bend under the pressure of various "shocks" and subsequently regain their shape.

Let's turn our attention now to silent, more deleterious types of shocks: those caused by invisible urban boundaries erected by divisive and fractious urban planning or architecture, which fragment society in a way that degrades social cohesion – and, as a result, urban resilience more generally. This response comes from a renewed focus on the memory of place and a detailed understanding of how it operates in social and spatial contexts, with the aim of rebuilding ties and coherence between buildings and public spaces through meaningful action. At Cerisy, François Decoster notably presented the rehabilitation and transformation of the FCB industrial area in

Fives, one of Lille's most dilapidated areas. The project took a clear approach based on continuity, despite the site's status as an enclave in the neighborhood, with its high walls that block the view and cut off through streets, as well as its radical embodiment of the dramatic decline of heavy industry and textiles in the Lille metropolitan area. It accepts the neighborhood's industrial past and showcases it without nostalgia: renovations conserve the most visually appealing halls and buildings and reveal all their potential; the organization imagines a new life for the site which maintains a continuity with its industrial past. No high-tech commercial space here, but instead a site devoted to training a new generation of hospitality and restaurant professionals with a food court, urban agriculture and a new location for the Meert bakery production unit. The end result is a site that is open, traversable and brightened up by a garden tended by residents.

Temporary and reversible forms of urban planning also present many advantages: first by favoring a subtle integration of temporality into urban planning, enabling the dialogue and experimentation needed to lift invisible barriers, reveal the potential of sites and reestablish a new form of confidence between different players; next by allowing users to play a central role in projects by making experimentation and citizen participation an essential step in defining and carrying out urban development projects.

One of the more emblematic examples of this approach comes from the *Grands Voisins* project in Paris. By opening the former Saint-Vincent-de-Paul hospital for temporary occupation by associations, solidarity enterprises, start-ups and a housing structure for poor and disadvantaged citizens managed by *Association Aurore*, the project revealed the site's potential, rebuilt local ties within the neighborhood by creating a new local hub and, finally, helped outline the future of the program.

The softer they fall – but will they fall? A new paradigm for a long-term approach to resiliency

Not everyone has faith in these optimistic scenarios. Many have spoken out to show how **proposed solutions for reducing the vulnerability of territories, due to their attachment to a growth hypothesis, simply continue the paradigm of resource depletion.**

Fréderic Lemarchand, co-director of the Risk Pole MRSH CNRS Division at the University of Caen, posed the following radical question at Cerisy:

❝ Can we indefinitely substitute reproducible capital for the natural capital inevitably destroyed by our economic activities? Doesn't resilience allow us only to delay the collapse, but not to avoid it?"

Christian Arnsperger and Domnique Bourg, researchers at the University of Lausanne, deliver similar nuance concerning the hopes placed in the circular economy as it is conceived today[10]. They notably demonstrate

❝ [that] a circular economy would be one in which the growth rate for the consumption of a given material remains below 1% per year, because beyond this level, even if we recycle 80% of the material, almost nothing would change […] If we want our economy to align with the capacities of the Earth system, we must not only stabilize, but also significantly reduce the flows entering into this economic system [and] the scale of all our activities[11]."

On one hand, this position notably shows the promise of actions taken with a fundamental awareness of our ability to reduce vulnerabilities by altering production methods so that they preserve the equilibrium of our resources; on the other hand, it also points out the inadequacy of current actions and the need to continue our efforts across two main priorities:

1 **Promoting true systemic action:** even if each individual sector develops its own separate strategy for reducing vulnerability, that will not be enough to make the economy, society or the city as a whole less vulnerable and more resilient. At Cerisy, Daniel Florentin, post-doctoral researcher at LATTS, cited the example of waste incinerators in Germany, which certainly align with the principles of the circular economy by producing heat and electricity from waste. However, the systems have become so widespread that it is now necessary to import waste from all over Europe just to keep them running…

2 **Succeeding in adapting not only our production methods, but also our consumption methods to avoid the dreaded "rebound effect,"** which occurs when environmental gains achieved by adopting a new technology are canceled out by overuse. For example, drivers of fuel efficient cars take advantage of the situation by driving farther with the same quantity of gas – instead of simply reducing the amount of gas they use.

All this means that we need a more profound paradigm shift if we are to implement a long-term resilience strategy. And it is certainly no easy task to continue turning cities into places that offer more (more well-being, activities, movement, interactions, projects, etc.) with… less.

Networked infrastructure: the Cinderella of resilience?

Is networked infrastructure the Cinderella of resilience, to borrow an expression from Stephen Graham and Simon Marvin, who see them as the forgotten background of urban studies[12]?

It may seem like an absurd question, considering the critical and vital role played by these different types of networks (transport, electricity, water, gas, ICT, hydrocarbons, sanitation, etc.) in ensuring the proper functioning of cities and efficient crisis management. For example, everyone knows that we need strong roads to allow emergency vehicles to reach those in need or help people evacuate during natural disasters. We are also well aware that electric grids power every other network in place to serve populations. **For this reason, one might logically assume that networks would play a crucial role in any resilience strategy that endeavors to make a system robust enough to absorb shocks and continue operating even in a weakened state.**

But think again. **The connection between networks and resilience is not always so clear,** primarily because it runs up against three main setbacks: **actual vulnerability**, which tends to increase over time; **an array of existing networks** that must be renovated if they are to become more resilient (as opposed to new infrastructure, which can be built according to more resilient principles); **finally, the fact that these networks were designed and built to expand and accommodate growing volumes, which does not always align with the needs of today's world. This situation has set the stage for a new kind of crisis, one that is invisible, deleterious and spans longer periods of time.**

Robust but vulnerable?

When Hurricane Irma recently devastated the islands of Saint-Martin and Saint-Barthelemy, it also underscored the importance of reestablishing an efficient telecommunications network in the immediate wake of a disaster. The French association HAND (Hackers Against Natural Disasters), founded by Gaël Musquet, former chairman of OpenStreetMap France, took the initiative to send the IT materials needed to restore communication on the islands, enabling locals to share information about their situation on the ground and help emergency services

coordinate their operations. France's internal security code also reflects this need to ensure service continuity for major infrastructure. Decree no. 2007-1400 of 28 September 2007 requires network operators to "*maintain priority resources in a satisfactory state*". This obligation contains preventive measures that limit the vulnerability of networks to risk, measures that serve to ensure a minimum level of service and restore normal operation in the event of a crisis, as well as complementary measures defining corrective actions to remedy deficiencies observed during the crisis. **This legislation ensures that networks benefit from tight security and maintain their reputation as particularly robust in the face of stress.**

Despite this, several natural disasters have recently laid bare the vulnerability of these networks to risk and the subsequent impact on cities and businesses. This is especially evident in some of the more spectacular and dramatic natural disasters of late, whose massive scale has placed severe stress on all security and safety systems, such as the 2004 Indian Ocean tsunami. Many communities still have not managed to fully restore their infrastructure after this event.

3

Fig. 16:
Traffic jam on the Pont
Alexandre III during a
snowstorm in December 2009

Fig. 14:
A blackout left Manhattan in
the dark after Hurricane Sandy
passed through in 2012

On top of it all, a downed power line sparked a forest fire that reduced 1,000 hectares of woods to ash. All told, the storm caused 5 billion euros in damages, including 3 billion euros from the forest fire and 1.7 billion euros of insured losses among residents.

A similar situation occurred with Hurricane Sandy in October 2012. The storm left 8.5 million people without electricity, including many in the chic neighborhoods of Lower Manhattan, and caused 65 billion dollars in damage. Sandy brought many to the cruel realization that, since **September 11, 2001, most efforts to secure infrastructure have focused primarily on human-caused risks rather than climate risks; in addition, that the United States has typically prioritized crisis management over investing in prevention.** Examples of this include the total absence of federal regulations on building codes, and the fact that urban development policy – one of the main factors in a region's vulnerability – is left up to the individual states. In the case of Sandy, there was no plan in place to stormproof the area before the hurricane. But while the upstream side of things did little to boost the region's resilience, the downstream phase – or crisis management – picked up the slack through the widely applauded efficiency of emergency and recovery efforts. These actions showed that the country had learned and implemented several lessons from the poor response to Hurricane Katrina. Information concerning the energy resources available and the recovery efforts in place was made widely available, while more than 60,000 electric grid specialists from all across the country came in to help restore power.

Fig. 15:
Cyclone Klaus caused
massive damages when
it hit Southwest France
in 2009, as seen here in
Fonbeauzard

In January 2009, Cyclone Klaus became one of the most destructive storms to hit mainland France, offering another particularly interesting case study for urban resilience. Klaus made landfall in southwest France with sustained winds over 170 km/h. Memories of Cyclones Lothar and Martin were still fresh in many minds. Though they hit in December 1999, few had forgotten the sheer destructive force of these storms, and the notable failure of the national alert system, which made their toll even worse. France worked hard to improve its warning system in the intervening time: when Klaus came along in 2009, more than a dozen departments were placed on red alert, for the first time since the system was created in 2000, allowing emergency services to gear

up for action in advance. And yet, even with such an efficient system in place, 1.7 million people still lost electricity, some for a period of six days; several towns were left with no fixed and mobile telephone network; and rail traffic was disrupted across 3,000 kilometers of track. To make matters even worse, the electricity outage caused water pumps to shut off, leaving 140,000 people and two hospitals without clean water for several days, while also shuttering several gas stations, making it difficult or impossible to power the backup generators needed to palliate grid outages.

Cyclone Klaus delivered three lessons:

1 **It showed the cascading impact of network failure.**

2 **That when it comes to networks, the notions of vulnerability and resilience apply to both the physical infrastructure and the associated service: when infrastructure fails, so does the service it helps to provide. For that reason, the concept of an acceptable failure rate should play a key role in any talk of resilience.**

3 **Finally, it showed how difficult it can be to coordinate all the different parties involved in managing a crisis impacting networks, as they each have their own mindset[13].**

In the case of Cyclone Klaus, the mindset of officials and prefects ran counter to the mindset of network operators, with the former hoping to restore service in priority areas first and the latter shooting for quantitative targets (restoring network service for the largest number of consumers).

Recent events have brought the vulnerability of networked infrastructure to light, but this vulnerability is only expected to increase:

1 **With climate change, first of all, due to the growing number of extreme climate events (hurricanes, storms, floods, fires, drought, etc.), as well as less catastrophic weather conditions that can still place heavy stress on networked infrastructure and service continuity (heat waves, snow accumulations, freezing rain, etc.).** Snowfalls in the Île-de-France region in January 2018 delivered ample proof of this fact: snowfall paralyzed the Paris bus system, caused massive traffic jams and left motorists stranded overnight on snowy highways. The winter storm revealed the vulnerability of the road network, which was designed to operate under "normal" conditions. Compounding matters, public perception made this vulnerability appear even greater, since the public has a low acceptability threshold for this type of phenomenon. Since the public does not view this type of incident as a "shock", the fact that it can disrupt a service typically provided by the local infrastructure seems unimaginable…

2 **With the growing dependency of cities and companies on electricity and ICT,** which, on one hand, makes networked infrastructure even more crucial to the proper operation of the urban system, even during times of intense stress, and, on the other hand, further reduces the acceptable rate of failure for these networks.

3 **With shrinking budgets and investments in preventive measures and post-crisis rebuilding efforts,** which becomes a way of favoring the unknown costs of likely events over the known costs of precise investments.

Strengthening infrastructure and improving recovery capacity: the winning hand for network resilience?

In this context, how can we make networked infrastructure more resilient? We can point to two major strategies that respond to the following two questions: how can we make networks more robust in the face of a specific risk? And, if networks are still impacted by a disaster in spite of these efforts, how can we promote the most rapid recovery and return to normalcy?

The first strategy, which aims to strengthen infrastructure, consists in taking preventive measures. This may seem like a relatively obvious step: to limit the effects of risk, you have to protect yourself. Yet this ostensibly simple assertion raises several important questions:

1 What risks should we protect against?

Our knowledge of risks remains incomplete and geographically uneven. The aim of this question is to increase our knowledge, from mapping and modeling risks to collecting feedback from previous crises. This knowledge will serve as the basis for adapting networks to make them even more resilient, rather than simply maintaining their current state. It is also necessary to forecast currently unknown risks that will impact cities in the future.

2 At what cost?

The effort to adapt existing infrastructure – and maintain it in proper operating condition – to protect against probable but potentially unknown risks faces a major hurdle: it requires massive investments that may not be the top priority for officials or companies. There are two reasons for this: first of all, despite the clear increase in risk (climate change, cyberattack, etc.), as long as people are not directly impacted by these risks, they hold out hope that they will see little to no consequences from them. Furthermore, the costs of network failure remain poorly understood in many sectors[14]; when these costs are known, they typically only include the costs faced by operators, and not costs incurred by other parties (consumers, residents, other operators, municipalities, etc.), nor the environmental costs, which are not borne by operators in any direct way. In other words, the cost of inaction is unknown, while the cost of action is known. These cost considerations play a direct role in decisions pertaining to the scale of preventive actions.

3 What type of risk management?

In this regard, we can distinguish three types of risk: "local" risks (high frequency, low intensity, low impact); "intermediate" risks (moderate frequency and intensity, causing disruption that requires coordinated action across the network); and "major" risks (very low frequency, very high impact with cascading effects requiring resources from the operator and the municipality)). Does the entire network need greater resilience, or only a specific portion of it? What associated risks (operational, financial, social, image, etc.) are deemed acceptable based on the selected level of risk management? Is there any consensus on the acceptable level of associated risks?

4 What parties play a role in protection?

Several recent incidents have shown how the failure of a single network can set off a chain reaction across other networks and urban systems. This leads to a double challenge: understanding the connections between different networks and their position in relation to one another; as well as the coordinated management of efforts between different network operators and between operators and municipalities, which is the only viable avenue for responding to the systemic nature of these crises.
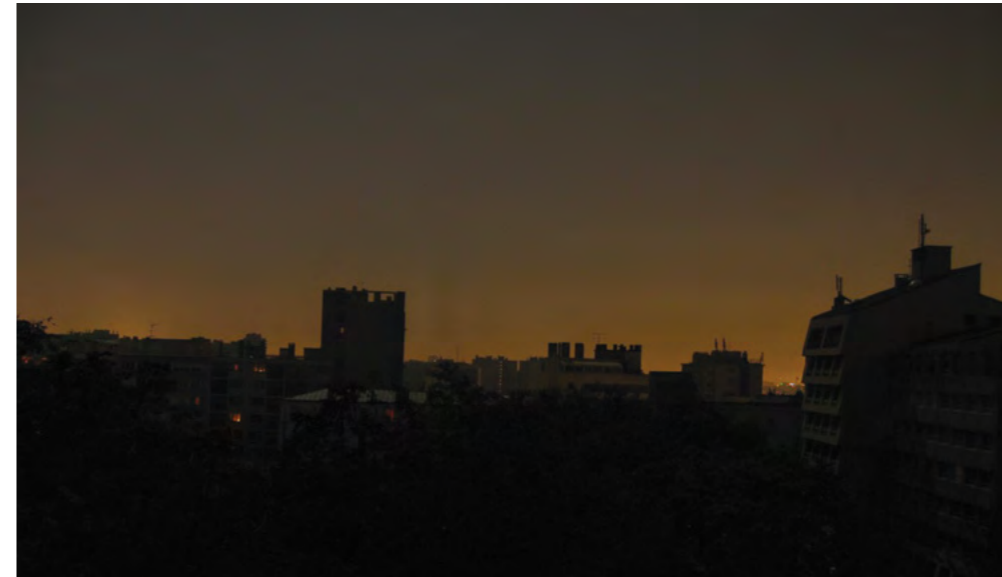
A clear demonstration of the need to manage crises collectively came with the electric outages on November 4, 2006. On that day, power was cut along a portion of the German grid to allow a cruise ship to pass safely across the Ems powerline, which subsequently overloaded the German network in the region. In a matter of seconds, an automated safety system kicked in and triggered selective power cuts designed to keep the entire network from overloading and causing a total blackout across the continent. Ten million European households lost power for one hour. Morocco also experienced a blackout, and had to turn to its North African neighbors for aid, which led to selective power cuts across the Tunisian network. **In this case, it was the interconnection and solidarity of European networks that laid the groundwork for their resilience – just as this same Europe-wide interconnection also propagated the effects of the crisis.**

The second strategy for enhancing network resilience aims to restore them to an operational state as rapidly as possible following a crisis.

Given their strategic nature, major networks should be covered by a specific process to enact in case of disruption, with a clear order of priority: getting people to safety, securing access and accessibility (notably to allow for the passage of emergency vehicles), restoring networks to maximize service continuity (even in a weakened mode) and providing replacements to meet the most urgent needs (generators, bottled water, blankets, etc.).

How does the resilience paradigm change this scenario? Resilience shifts the priority towards recovery by focusing on the long term. That leads to two major consequences:

1 Emergency management and the return to equilibrium become just another step in the process – a major step, to be sure – but the ultimate goal is to transform the entire system so it becomes less vulnerable.

2 Emergency management is also transformed into a process designed by all parties involved in these efforts.

Fig. 18:
Resilience of the
inhabitants vs. resilience
of the territory? Residents
back in their homes
rebuilt following floods
caused by Katrina.

1 Crisis as opportunity? When urgency becomes a risk...

What resilience highlights is the tension, if not the antagonistic character, that can arise between the two different timeframes involved in managing crises that impact major networks: the urgency of restoring service on one hand, the gradual return to equilibrium on the other. Might this tension spring from the ambiguity surrounding the notion of "return to equilibrium": what type of equilibrium do we mean? Do we mean the equilibrium that existed before the crisis, or something else? In other words, **resilience begs us to investigate the connection between a system's operation and the associated risk, instead of simply determining which technical improvements may reduce risk or exposure to risk. Herein lies the crux of this approach: it shifts the focus from networks to the region, from sectors to the system as a whole. Because the real challenge is to answer one question: how can we improve the resilience of the entire region?**

Not only is responding to this challenge a complex matter, it can also become a source of conflict. Complex because it means relaying information between a variety of operators and **a central entity that can consolidate these lessons and feedback**[15] for two main purposes: to grasp the complex web of interdependency and the resulting domino effects, and to develop coordinated action. **Conflictual because the measures taken to respond to emergencies may not align with the goals of long-term resilience,** as shown by Hurricanes Katrina and Sandy. Isabelle Maret and Thomas Cadoul's study of New Orleans[16] shed light on the fundamental attachment to the land that connects residents to their city, neighborhood and home – even when it is destroyed – thus explaining their desire to resettle in the same spot even after

a disaster. Attachment to place is stronger than the memory of risk.

This resilience shown by residents, though it is the driving force behind a city's rebirth, paradoxically becomes a factor that increases long-term vulnerability when the resettling process is not accompanied by an adequate policy of risk protection. For example, after Katrina, 83% of homes on the Atlantic seaboard were not adapted to protect against the major risk of flood they face. After Sandy, the state of New Jersey allocated 10,000 dollars to all residents who decided to rebuild in the same spot after their homes were destroyed by the hurricane – without any subsequent measures taken to reinforce building codes or protect against risk... Damages caused by hurricanes that continue to hit the West Coast of the United States demonstrate that **a region's resilience strategy must include long-term efforts focusing not only on the effects of the crisis, but also on its causes, even as they relate to residents.**

That's why the authors of the report "*Résilience des réseaux dans le champ du MEDDE à l'égard des risques*" ("*Resilience of networks under the scope of MEDDE with respect to risks*") recommend the following: "*Governance needs to account for the factor of time, by seizing the will to act coming from the sense of urgency and combatting the process of forgetting that comes with the passage of time, while it must also outline medium-term and long-term repairs[17]*".

2 Information and training. Towards a collective approach to risk management...

Any regional resilience strategy must involve local residents. However, the example of New Orleans shows that doing this means providing training in risk and promoting an understanding of the long-term challenges. This process should aim to do at least two things: to make a weakened state of operation more acceptable to the public, and to involve residents in an effective way.

Managing the urgent aspect of a crisis depends on how much disfunction is acceptable to the public: the more the public understands the challenges at hand, by receiving information about the actions put in place, the more disfunction it will be willing to accept, thereby relieving some of the pressure to take hasty actions that may have adverse effects in the long run. Recall the famous Somme flood rumor in Abbeville and the headlines it produced: "*The Somme River powers a rumor mill in Abbeville[18]*", "*Rumors flood Abbeville and spark local ire[19]*". In 2001, following a rainy winter that saturated the water table, the Somme and its tributaries

gradually rose and flooded 2,800 homes, causing 1,100 people to evacuate at the height of the crisis. Though a state of emergency was declared on March 23, 2001, rumors quickly spread that waters from the Seine were diverted into the Somme to keep Paris from flooding, at a time when the Olympic Committee was scheduled to visit the city for its bid to host the 2008 Games. Despite implementing a relatively strong "technical" management of the crisis, including an efficient rehousing policy and increased monitoring to ensure proper application of flood prevention plans, the Somme flooding was poorly received by residents, who felt that they had been forgotten. At a time when instantaneous communication has reduced fact-checking and helped to propagate disinformation, we can easily understand the challenge and importance of good communication.

Good communication must begin as soon as possible, by providing risk training before a crisis occurs: among residents first, by explaining the phenomena that can increase risk and teaching the best responses to crises; next, among network operators and public authorities, so they can understand how consumers view these situations. Resilient management of the crisis and fallout will rely on the region's ability to tie residents into the process, by empowering them to relay efforts, develop local solidarity networks and contribute to restoring the system's equilibrium.

The blind spot of networks, or growing agrowth

-46.6% in Gdansk, -40.4% in Budapest, -15.6% in Berlin, -16.6% in Paris, -13.3% in Nantes, -4.1% in Madrid... Between 1991 and 2001, a majority of European cities saw their water consumption drop, reaching particularly exceptional rates in cities of the former Soviet bloc.

Between 1991 and 2001, a majority of European cities saw their water consumption drop, reaching particularly exceptional rates in cities of the former Soviet bloc. In his contribution to the Cerisy colloquium, Daniel Florentin[20] highlighted **another type of shock faced by networks: agrowth, referring to the absence of growth, or even degrowth.** This is a much less spectacular type of shock than the brutal disasters mentioned above. Playing out on a slow and deleterious scale, this problem can long go overlooked, as shown in Sevilla: it was not until other economic and social crises occurred that the impact of a constant decline in water consumption (-40% since the 1990s despite steady population growth) was at last revealed in 2013 and became a matter of public debate.

Does this not leave us before a paradox? The previous article in our series showed that limiting the use of resources was a major factor in improving resilience. So why would it become a shock when applied to networks?

The reason is that, while decreasing consumption promotes the resilience of the entire system by preserving hard to renew resources, when applied to a technical network that was built and scaled to meet a specific level of consumption, it becomes a vector of infrastructure vulnerability for two main reasons.

1 Networks are scaled to operate at optimum capacity. Both too much and not enough can cause problems in operating and altering the network. For water networks in particular, underuse can pose a sanitary problem above all, as underlined by Daniel Florentin, evoking the bacteria crisis of summer 2008 in Magdeburg in eastern Germany: the combination of low consumption, water stagnating in pipes for fourteen consecutive days and high summer temperatures led to an outbreak of bacteria in water pipes that exceeded recommended levels.

2 The economic equilibrium of networks relies on a balance between high management costs and investments on one hand, and the income generated by resource consumption on the other. Declining consumption can upset the economic balance, as underlined by Daniel Florentin, "*through a gradual seesaw effect: costs go up and income goes down.[21]*"

The challenge is at once operational (what new model for managing networks?), economic (how to increase returns?) and regional (is the classic model, based on a vast national network encompassing different regions and offering the same service at the same price, still relevant? What alternative model?).

“ In fact, after witnessing this phenomenon of declining consumption, we realized we had to stop building and manage what was already there to keep everything from collapsing"

(interview conducted by Daniel Florentin with an engineer from *Trinkwasser Magdeburg* (TWM), the intraregional water operator for the Magdeburg region, January 2013[22])

What options are available for responding to this phenomenon? Daniel Florentin, based on the analysis of declining water networks in the *Länder* of eastern Germany, has outlined several:

1   Pivoting to a multi-utility model for major network operators.

2   Raising the price per m³ in order to recoup the lost volumes and increasing network management costs.

On one hand, this solution poses the crucial issue of acceptability among the local population and the impoverishment of a portion of residents who cannot afford these rising costs; on the other, it is not enough on its own to solve the long-term problem because it does not attack the root of the problem, only some of its consequences (lost income).

3   Rescaling networks to adapt to lower consumption levels. Here we run into the problem posed by the extremely high costs of adapting existing infrastructure.

Not only are grant options limited for these operations, but as in the case of the water and purification networks in Germany, they are governed by the "full cost recovery" principle, which places the full cost burden on the end user. Keeping water cheap to ensure greater social and regional solidarity thus limits investment capacities, which, even when the goal is simply to maintain the network's status quo and keep maintenance to a minimum, can create new infrastructure vulnerabilities in the long run. Solidarity vs investment? Degrowth challenges the fundamental economic model of large networks.

4   Dividing and separating networks, which creates two parallel networks: a "first-class" network that is efficient, high-quality and expensive, and another standard option that would inherit the traditional network, remaining more affordable but offering a lower service quality due to limited use.

That is what Simon Marvin and Stephen Graham identify in their book *Splintering Urbanism*[23], which analyzes network design in new urban areas. This trend poses a major threat to the idea of large networks as a public utility, an essential tool for organizing a region, a vector of national solidarity and a guarantor of the public interest. Instead, it prefers to adapt networks to the competing interests of various stakeholders in order to boost efficiency and transform networks into tools for differentiation (social and regional), with the associated risk of splintering (social and regional) and creating areas where infrastructure vulnerabilities compound existing social challenges.

5   Creating new economies of scale by developing a geographic and pricing strategy that can increase revenue and maintain a sense of regional solidarity.

This is the model adopted in Magdeburg, which led Daniel Florentin to see the city as, "*a sort of laboratory for managing the degrowth of networks*[24]". This strategy relies first of all on expanding the regional coverage of the water operator, *Städtische Werke Magdeburg* (SWM), which merged the networks and took over the networks of neighboring regions; next it relies on the intraregional water operator (TWM) to set up a shared governance system that favors negotiation and consensus, while enacting a solidarity price (*Solidarpreis*) on the regional level. The result is that Magdeburg, a region facing fewer consequences from the economic and social crisis and degrowth, pays for other more vulnerable areas in the region, but gains a more robust network by reducing the sanitary risks tied to underuse of the water network.

This last example is particularly interesting in that it sheds new light on the role played by network operators. SWM and TWM, though they are only city service companies and not elected bodies or administrations, have developed a regional vision that offers an alternative to competition and favors regional resilience by seeking to reduce a range of infrastructure and social vulnerabilities.

As noted by Daniel Florentin:

“ Infrastructure and network questions were long seen as the exclusive domain of technicians and the 'hard' sciences, as though they were socially or politically neutral topics. However, behind the primarily technical observations like declining water consumption, we find a great many social questions, tied to the challenges of adapting to a society based on more moderate use of several resources. Behind the questions of outsized infrastructure, we find political choices whose implications can generate major regional transformations[25]."

Waiting for prince charming? The challenge of maintenance

We have now come full circle: are large networks the Cinderella of resilience? Beyond the catchy phrasing, this question reveals a crucial point: just as Cinderella, the daughter of a king, is a pillar of her Kingdom, large networks represent strategic infrastructure that is essential to keeping the urban system in good working order; just as Cinderella, when deprived of support and attention, loses her rank and capacity to act, large networks risk defaulting in their role as the pillars of resilience if they are not held in proper esteem and correctly maintained. All the examples agree: maintenance is a crucial issue for networks. First, because a network in good condition helps fix the consequences of a disaster much faster. Next, because not only does a network in poor condition and in need of maintenance make a region more vulnerable by limiting its recovery capacity, but worse yet it creates more risk. Recall the blackout of August 14, 2003, when nearly 50 million people lost power in Ontario, Ohio, Michigan,

Pennsylvania, New York, Connecticut, and New Jersey. The reason: a lack of maintenance allowed overgrown trees to take down several power lines. Finally, because a new framework for action is emerging, as shown by the water networks in eastern Germany: a new framework based on maintaining existing networks instead of expanding them.

This does not make our task any easier. Because what action can we take when faced with a double bind? On one hand, public authorities invested heavily in building these networks and therefore need to increase their returns. On the other hand, how can we introduce maintenance into our project methodologies, when construction has always been the standard? Resilience opens several interesting avenues for taking action by helping to change the standards: as demonstrated by Daniel Florentin, it makes it possible to shift from a maintenance-repair model to a maintenance-transformation model. And if the path towards this new standard had a name, might it be… innovation?

Ebb and flow

4

> "There is a tide in the affairs of men.
> Which, taken at the flood, leads on to fortune;
> Omitted, all the voyage of their life
> Is bound in shallows and in miseries.
> On such a full sea are we now afloat,
> And we must take the current when it serves,
> Or lose our ventures."

William Shakespeare
Julius Caesar
(Act IV, Scene 3)

The previous developments showed that **in every approach to resilience, residents emerge as a key factor:** first, because population density tends to swell a region's vulnerability and increase risk (each risk has the potential to impact more people and assets); next, because residents play an important role in the decisions and directions taken in the context of emergency management and the return to normalcy, depending on their threshold for acceptable disfunction; finally, because residents represent a critical resource in rolling out a regional resilience approach by taking an active part in restoring equilibrium (strategy of "empowerment" and developing a collective risk culture). In the multivariable equation that is the relationship between residents, region and resilience, it remains to be studied **if and how population size may represent a swift and brutal or slow and deleterious shock to cities. How should we characterize a demographic shock?**

Fig. 19:
Cleaning a drainage canal
in one of Jakarta's slums

Does population size present an obstacle to resilience?

When it comes to size and population, is there a critical threshold below or above which a city can no longer be resilient? This question is usually asked about megacities with populations above 10 million or small to midsize cities caught within an overarching trend of urbanization.

From megacities...

For the former, **the question focuses primarily on the environmental pressures exerted by such large populations and the resulting potential for destabilization.** For example, Jakarta sinks a full meter into the ground every 10 years under the weight of its high-rises atop a vanishing water table, which it has overdrawn to provide clean drinking due to its heavily polluted surface water[26]. As a result, 40% of the city now sits below sea level. This situation has increased the city's vulnerability at the same time as it faces heavy risks from torrential rains: since drainage canals can no longer absorb the high waters, as much as 1.5 meters of water can rapidly flood the city's streets, as in January 2013 (20 people died and 30,000 lost their homes), February 2017 and February 2018 (4 dead, 6,500 evacuated).

Next, the question focuses **on one hand, on cities' capacity to develop a resilience strategy that matches the complexity and interdependence of their challenges, and the interconnection of their networks and infrastructure on the other.** Analyzing the case of Los Angeles, Chiara Daraio, Domniki Asimaki and Steven Low from Caltech see this as the most important challenge facing all megacities[27]: here the challenge focuses less on compiling enough data to optimize infrastructure and networks in accordance with each risk, and more on **coordinating the various strategies enacted by each party** (including residents) so that the entire system can become resilient. **The main concern is to gain a full understanding of how megacities function and the systems of interdependence they create, as well as to create a task force able to establish shared priorities among all parties.**
This function is currently headed in Los Angeles by Marissa Aho, Chief Resilience Officer in charge of the Resilience Assessment Overlay which champions a systematic approach to resilience by design.

… to smaller cities

❝ Requiem for subprefectures[29]?":

the question posed by Xavier Molénat offers a distillation of all the issues facing small and midsize cities in developed countries. **Can they survive within the global movement of urbanization and globalism?** These cities are often highly impacted by deindustrialization, the concentration of of service industry and white-collar jobs in the largest urban areas, as well as the shuttering of certain public facilities and administrations like hospitals and courts, which typically bring many jobs to regions. **Small and midsize cities –** both in developed countries and to an even greater extent in developing countries – **present an acute vulnerability due, on one hand, to their poorer than average population** (for example, in France, the poverty level rises to 17.8% in midsize cities, above the national average of 14.5%[29]), **and, on the other, to limited resources** (technical, financial, availability of data and qualified labor) for implementing a resilience strategy and coping with various shocks. Focusing on the example of Detroit in the United States, which lost thousands of industrial jobs in the wake of the 2008 subprime crisis, Jörn Birkmann affirms that:

❝ size affects how cities respond to economic shocks [...]. Lacking industrial diversity, they are less able than larger cities to attract new employment opportunities by taking advantage of new and growing economic sectors through national policies or international trade agreements. And they lack investment capital to retrofit older manufacturing systems[30]".

Certain counterexamples, such as the cities of Cognac, Châtellerault or Albi, call into question any determinism linked to size: these midsize cities, which recognized the economic transformations underway from an early stage and in turn harnessed their local skills systems, therefore succeeded in carrying out an economic diversification strategy which enabled them to become innovation hubs in their own right. Small and midsize cities, notes Jörn Birkmann[31], **hold a relative advantage in their size with respect to metro areas and megacities: they are easier to monitor, have fewer stakeholders which helps various parties coordinate actions, and resilience strategies can produce tangible results much faster and thereby ensure local acceptance with greater ease.**

The case of small and midsize cities is especially interesting because it underscores the fact that **a city's size and population do not determine any specific outcome.** The key consideration contains two parts: the relationship fostered between a region, its residents and their environment, as well as the capacity to analyze the changes taking place, anticipate their consequences and marshal local stakeholders and resources. For these reasons, though the idea may seem appealing, **it is impossible to determine a critical threshold below or above which a city can no longer be resilient,** as demonstrated very clearly by Géraldine Djament-Tran[33]. However, that does not mean the number of residents has no influence on a city's resilience capacity. As shown by the small and midsize cities in developing countries, which will see the highest growth rates – +32% between 2015 and 2030, compared with +26% for metro areas and megacities[34] – **it is less the stock and more the flow of population that constitutes a significant vulnerability factor.**

Ebbing tides: the specter of decline

Population size often serves as a barometer of good health for regions: sustained growth ensures the area's appeal and promises further growth and development. On the flipside, population loss incites worry by signaling economic decline, regional obsolescence and diminished appeal. The city in decline is a source of anxiety because it breaks with the paradigm that equates industrialized cities with constant expansion. Didn't we move from 7% of people living in cities in 1700 to over 50% today? Doesn't the UN estimate that more than 70% of people will live in cities by 2050?

In this urban century, cities in decline stand apart as an anomaly. Even worse, in an era that champions Richard Florida's argument that the cities which attract and concentrate skills and the creative class will innovate and therefore become the key engines of the economy, **cities in decline seem doomed to continue their same downward trend.** Within a context of competition in which a city's image and positioning count for the most, we can understand **why it seems so difficult even to recognize the phenomenon of degrowth, much less to place it on the**

political agenda (Nicolas Cauchi-Duval, Vincent Béal and Max Rousseau even mention the "*silencing of urban degrowth*" by French politicians[35]), **due to the concern that naming it would only serve to compound the problem.**

And yet, **taking a long view of history first shows us that the phenomenon of degrowth cannot truly be called an anomaly in the development of cities. Cities are mortal[36].** Sylvie Fol and Emmanuèle Cunningham-Sabot recall that urban degrowth has even been theorized on several occasions, citing several widely known examples such as the Chicago School, which conceived of cities as subject to a "*life cycle ending in decline*", or Lewis Mumford, who describes the evolution of cities in the following terms: "*the city, beginning as* Eopolis *becomes* Polis *and expands into* Metropolis, *initiates its decline by becoming* Parasitopolis, *then* Pathopolis, *potentially* Tyrannopolis *and finally* Necropolis, *'city of the dead', the 'final resting place' of every civilization*". Avoiding the fatalism expressed in Mumford's implicit criticism of urban expansion since the Second World War, Cheshire and Hay's studies of 229 cities in Western Europe pointed to a trend of decline in urban areas impacted by suburbanization, without ruling out the possibility of a return to growth.

Fig. 20:
Los Angeles megacity, aerial view

Finally, image and positioning are far from being the only issues in play. **Cities in degrowth present many distinct vulnerability factors which not only make it dangerous to ignore the degrowth phenomenon, but also require equally distinct measures to account for these vulnerabilities.** Population loss is accompanied by shrinking economic activity, reduced public finances limiting a municipality's capacity for investment and action, impoverishment of the local population through a rise in unemployment and aging and, finally, an increase in social problems. Degrowth phenomena also lead to a rise in social vulnerability. Moreover, degrowth does not mean that cities get smaller. As residents flee, certain buildings or neighborhoods become deserted, creating what was referred to in Leipzig as a "*perforated city*[41] ". **This regional discontinuity poses a major challenge** to municipalities working to maintain a standard level of service with diminished budgets and no option to leverage economies of scale. We have already seen this in the case of Magdeburg's water networks, which suffered in terms of safety and maintenance after a decline in water use. The same situation holds for other energy networks, public transit service, mail delivery and keeping schools or neighborhood facilities in operation.

Degrowth is far from being the only phenomenon in this field. It was first theorized under the name of "*shrinking cities*" or "*schrumpfende Städte*", describing trends of decline in America's Rust Belt cities, as well as numerous German cities (notably in the country's new federal states and Ruhr Valley) following the deindustrialization of the 1970s and 1980s and the demographic shift of the 1990s: to mention just a few examples in the United States, Baltimore and Philadelphia lost over 20% of their populations between 1970 and 2000, Detroit and Pittsburgh over 30%, and St. Louis 44%[38], while in Germany, Magdeburg lost 17% of its population between 1990 and 2015, Chemnitz 23% and Leipzig 4%[39]. **The phenomenon now affects over a quarter of cities with over 100,000 residents and is not limited to developed countries alone.** Some megacities in developing countries are also experiencing this phenomenon: Puebla, Havana, Montevideo and Seoul[40].

> *Ausbluten oder gesund schrumpfen ?"*
>
> "Bleed out or shrink in good health?"

This question, asked by Marc Bose and Peter Wirth about the small city of Johanngeorgenstadt in Saxony[42], applies to every city facing degrowth.

Responses vary because not everyone interprets the phenomenon of degrowth in the same way, which means they also have different understandings of resilience. However, we can distinguish three main trends:

1   The stability strategy:

Degrowth is seen as a temporary crisis for cities to remedy. This resilience strategy consists in adapting to the new paradigms (notably economic and social) in order to combat degrowth, succeed in restoring the city's appeal and return to growth. That is the aim of the "*Coeur de ville*" action plan announced by the French government on 27 March 2018 to benefit 222 cities: "*the 'Coeur de Ville' action plan has two aims: to improve living conditions for residents of midsize inner cities and to reinforce their role as regional development engines. When a midsize city functions well, the entire surrounding region, including rural areas, perceives the benefits. […] The program aims to facilitate and support the work of local communities, incentivize housing, retail and urbanism players to reinvest in inner cities, encourage the continuation or establishment of activities in the inner city and improve living conditions in midsize cities.*[43]" The ambition does not stop at revitalizing inner cities. It also aims to regenerate growth engines for the surrounding region, just as metro areas do on a larger scale.

2   The improvement strategy:

Degrowth is seen as a temporary crisis that can be turned to profit. This resilience strategy sees degrowth as an opportunity to recreate a new model for a more sustainable city, though the long-term expectation is a return to growth. Russell Weaver, Sharmistha Bagchi-Sen, Jason Knight and Amy E. Frazier provide a clear demonstration of this principle by analyzing two examples. In the first case, Hartford, Connecticut lost 30% of its population between 1950 and 2010, notably due to a strong movement of flight to the suburbs. In 2008, the city moved to reverse this phenomenon by revitalizing its downtown area according to "smart growth" principles: the new Constitution Plaza East project offered mixed-use buildings (residential, office, retail), while limiting car access to offer a sustainable alternative to suburbanization and to restore demand for downtown real estate. Along with the authors, we can question the example of eco-villages, such as those built in Cleveland, whose "smart growth" strategy can end up worsening the consequences of degrowth: by offering new eco-friendly neighborhoods that are easily accessible by public transit, they hope to promote a more sustainable living model. But can a city truly be called sustainable if it offers no solution for existing vacancies, but instead expands into the surrounding farmland and continues a process of suburbanization to build a green utopia, one that is built less for the area's existing residents and more to draw in newcomers of higher socioeconomic status in a bid to regenerate value through gentrification?

3   The support strategy:

Degrowth is seen as a structural crisis to which cities must adapt. This resilience strategy consists not in combating degrowth, but instead in supporting it and capitalizing on the opportunities it offers to enhance quality of life for the local population. Three examples are particularly notable in this regard: Saint-Étienne, which initiated an active policy of de-densification in the late 1990s with the twin aims of improving the quality of the living environment and creating new open spaces (Franche-Amitié pilot site); Dessau in Germany, which published a guideline for its open plan corridor to prepare for long-term degrowth and lay the groundwork for a concept of the city as archipelago; or Detroit, where local players transformed an island into an urban farm to alleviate the food crisis and recreate a local agricultural economy. Each of these three cases attempts to propose an alternative to the model of constant growth with the aims of improving quality of life and increasing resilience. However, for all the enthusiasm surrounding the new possibilities created by degrowth – "*Toll – endlich Platz!*"[46] – exclaims Thomas Straubhaar – this potential often runs up against several major setbacks in practice, such as rethinking soil management[47] to escape the logic of competition and, above all, financial difficulties[48].

Taken together, these strategies merit one last remark: **the phenomenon of degrowth emerges out of a set of relationships, interdependencies and domination within an increasingly complex urban system.** In many midsize cities, for example, degrowth is inseparable from suburbanization. This dynamic compels residents to live farther and farther from downtown, to use amenities built in the suburbs, and to identify over time with the nearest urban dynamic rather than the inner city, which is left at a disadvantage due to specific effects of size and specialization at work in urbanization[49]. Over time, these inner cities gradually lose all their activity. For this reason, some researchers[50] prefer to talk about "peripheralization" rather than degrowth. **Taking this altered perspective on degrowth may help to further refine resilience strategies by adopting a relational point of view, in order to capitalize on the evolutions of the urban system and better harness local potential.**

Managing surges

Within the horizon of expectations of today's cities, urban growth stands as a desirable condition due to the association of demographic growth with economic development. However, urban growth is also a factor of vulnerability: in 2015, for the first time, the Global Risks Report published by the Davos World Economic Forum considered the risks of "*rapid and unplanned urbanization*", notably in developing countries. ***"Urbanization creates opportunities but also exacerbates risks, and the speed at which it is happening challenges our capacity to plan and adapt.[51]"*** **One of the main challenges posed by urbanization involves its pace:** is growth rapid or slow? Is it sudden and intermittent or continuous? Each scenario allows us to distinguish between different demographic shocks and underline the risks associated with each one. We have chosen three scenarios, which each raise vastly different issues: the heavy urbanization of developing cities; European cities accommodating refugees; and the impact of mass tourism on touristic cities.

**1 Rapid and constant:
the trend of heavy urbanization
in developing cities**

As the world's urban population grows by an average of 1.84% per year, that rate climbs to 6.2% and 5.1% respectively in Abuja and Port Harcourt in Nigeria, 6.2% in Ouagadougou in Burkina Faso, and 7.8% in Mbouda in Cameroon[52]. **This strong urban growth,** observed primarily in small and midsize cities in Sub-Saharan Africa and Southeast Asia, **exerts major stress on natural resources, on agricultural lands** – which are eroded by urban expansion – **on the job and housing markets** (40% of urban growth comes in the form of slums on the city's periphery[53]), **on all types of infrastructure (either saturated or nonexistent) and finally on communities (with a particular challenge posed by social integration).** Faced with these stressors, each of these cities presents **distinct vulnerability factors:** on one hand, there is the demographic challenge posed by **a young population** lacking qualifications and

perspective on its country and forming a fertile ground for different types of enrollment – 60% of Africans under 35, youths between 15 and 24 represent 20% of the population, 40% of the workforce and 60% of the unemployed (for an average rate of 44%); on the other hand, **the inability of cities to control and plan for urban expansion, which occurs largely without governance and according to informal logics,** and often takes place on

lands exposed to elevated natural disaster or climate risks (flooding, earthquake, etc.); furthermore, **intense use of agricultural lands aggravates food import dependence** for a growing population; finally, time is running out to elaborate, test and approve an effective strategy for sustainability – with high social and environmental costs at stake in the short term.

In this case, these cities run the following primary risks: **social instability,** which can lead to widening social inequalities and the development of socio-spatial segregation; next, **health risks** tied to a rapid propagation of epidemics, as demonstrated by the recent Ebola crisis, as well as greater exposure to pollutants; finally, **natural disaster and climate risks,** whose consequences are intensified by the number of people exposed to these risks and by the difficulty of organizing emergency services due to deficient infrastructure. And yet, these growing cities continue to harbor **a strong potential for their residents,** notably through improved access to services and infrastructure, as well as a better chance to climb the social ladder.

Therein lie the stakes of resilience in this context of rapid growth: succeeding in unifying all stakeholders through a long-term strategy of adaptation, just as the sense of urgency encourages small corrective measures. Some cities manage to achieve this feat. The example of Addis Ababa[54] proves it: while 80% of the population still lives in slums, the government is investing in a massive real estate program coupled with the construction of a light rail transport system. In this way, it is leading a successful fight against slums and urban sprawl.

**2 Sudden and in waves: European
cities accommodating refugees
since fall 2015**

In 2014, 563,000 people requested asylum in a European Union country. In the second half of 2015, that number climbed to 1.2 million. **Cities have had to cope with a considerable and sudden surge of people flooding into their region, which can be qualified as a demographic shock.** In Hamburg, for example, 400 asylum seekers arrived each day during summer 2015. How should cities accommodate these new arrivals? National and local responses have varied dramatically across Europe. *La Fabrique de la Cité*, in its report published in January 2018 on "European Cities and Refugees: A Laboratory for Affordable Housing[55]", compared the approaches taken in Sweden and Germany, the two countries that have respectively taken in the most asylum seekers per capita in the European Union and the largest total number of asylum seekers (890,000 in 2015) in the European Union, thus constituting **two laboratories for studying the challenges posed by the massive arrival of new residents within a context of real estate scarcity and a shortage of affordable housing.**

Germany has based its response on the following resolutions: **first, a clear policy decision in favor of receiving asylum seekers.** "*Wir schaffen das[56]*", declared Angela Merkel on 31 August 2015. **Second, its conviction that refugees are not simply waiting to return to their home country, but that policy should assume a long-term if not definitive stay in Germany. As a result, the challenge ultimately chosen by Germany in responding to this demographic shock is how to integrate refugees into German society. Third, a policy of distributing the flow of refugees across all cities in the country,** instead of taking a *laissez-faire* policy. Dating back to 1947 and already tested in the country, this system known as the *Königsteiner Schlüssel* consists in applying a distribution key that accounts for demographic and fiscal criteria when distributing asylum seekers to federal states. In turn, these federal states devise discretionary quota systems for cities within their borders. Finally, **a thinking that soon moved from temporary to permanent housing** for asylum seekers having obtained refugee status. This housing policy is segmented into three timeframes, accommodation types and housing types: first is emergency housing. Germany set a target of "no one left out". To achieve this goal, it has adopted three strategies: first, reusing public buildings (gymnasiums, administrative buildings, etc.) or vacant private facilities (shopping malls, offices); second, booking hotel rooms; and finally, building cheap and easily assembled emergency housing units (Berlin's *Tempohomes*). The primary challenges of this phase include identifying available buildings and land, as well as managing health, safety and security risks, while the comfort

and integration of asylum seekers figure as secondary concerns. Emergency housing is used as a six-month waiting period before moving to **long-term temporary housing** of higher quality, marking the start of the second phase in the housing process. Temporary housing, where asylum-seekers stay until they obtain refugee status, aims to promote social integration. Though this housing offers only limited comfort and privacy (these are shared homes), in exchange it provides higher construction quality, a careful design of exterior space, a connection to the city through proximity to public transport and social infrastructure and, finally, German language training with classes available to everyone and the option to attend the German school system. The challenges of this phase include locating available land and coordinating efforts with the local population to increase the acceptability of this social diversity. **The last phase in the housing process is the transition to the regular housing market.** Unfortunately, this phase has proven to be less streamlined than its planners originally hoped, with some asylum seekers stuck in emergency housing due to a lack of space in temporary housing, just as other refugees have remained unable to integrate the regular housing market – due to a lack of available housing, financial resources or landlords willing to rent to them.

Fig. 28:
Temporary long-term housing with its central playground, Notkestrasse, Hamburg, 2017

The German approach is especially enlightening because it is distinguished by its resilience, though the country did not necessarily theorize its approach in this way. In what ways can we describe it as resilient?

1   Neutralizing the shock:
the strategy of distributing asylum seekers across the region in an organized way made it possible "*to introduce certainty into uncertainty*" (Cécile Maisonneuve) or control into the uncontrollable, and thereby to reduce vulnerability across the entire country. By transforming an undetermined flow into a stock (one that is still growing), the distribution system enabled German cities to improve how they organized their accommodation measures, scaled their facilities and planned for the arrival of asylum seekers, even just one or two days in advance. Policies also became more efficient over time.

2   Despite the sense of urgency, favoring long-term actions:
the goal of housing asylum seekers is underpinned by a more long-term goal than sheltering those in need, namely the integration of these new residents. So that temporary housing could function as a springboard for integration, its location, architectural layout, and social integration methods were designed to answer the following question: where and with whom should refugees live so they can (in terms of resources and capacity) access the job market, professional training or social structures they need? Should refugees be integrated with other population types (Dantebad project in Munich developed by architect Florian Nagler and offering 50 homes for refugees and 50 homes for students or the homeless)? Should officials accept or even organize the concentrated settlements of refugees that Doug Saunders, author of *Arrival City*[57], sees as an instrumental part of the integration process, due to the mutual assistance networks they enable? Or should authorities limit refugees to avoid stigmatization and rejection? None of these questions has a clear answer today, but they all demonstrate the dynamic thinking on the topic of integration.

3   Mobilizing all of society and turning the demographic shock into a societal challenge that concerns everyone:
accommodating refugees did not arise solely through the efforts carried out by administrations. Civil society, through associations, established NGOs, and self-organized groups, played a strong role in organizing aid for asylum seekers, though the current challenge is to maintain this mobilization over the long-term, beyond the emergency phase. The private sector also contributed, sometimes with greater difficulty, to building homes by supplying materials at competitive rates. Some cities like Hamburg coordinated with residents in innovative ways to leverage their knowledge of the neighborhood and inform them of all the legal and regularoty constraints impeding the construction of new homes ("Finding Places" project in Hamburg).

4   Boosting agility to cope with urgency:
the process of receiving asylum seekers quickly ran into strict constraints imposed by federal building codes, as well as environmental codes, which made it impossible to secure adequate land supply or build homes quickly and at sustainable costs. Faced with this challenge, the federal government agreed to promulgate a law to accelerate asylum procedures and suspend the application of certain provisions of its federal building code for a specific period and for the exclusive purpose of hosting refugees, as well as its law promoting renewable energies in the heating industry and its decree on energy efficiency[58].

Fig 29:
"Finding Places" (CityScope) urban visualization tool used to coordinate with Hamburg residents

Fig. 30:
Long-term social housing complex first reserved for use by refugees, Paul-Schwenk Strasse, Berlin

5   Developing systemic thinking:
the problems encountered by efforts to accommodate and house asylum seekers, notably the extremely slow integration of refugees into the regular housing market, sparked a global reflection on the mechanisms that led to these problems, beyond the temporary refugee crisis. The latter crisis revealed the existing affordable housing crisis already underway in Germany and helped trigger public and private action beyond the context of hosting refugees. Sophie Wolfrum, professor of urbanism at the Technical University of Munich, thus remarks: "*This was a problem and everybody knew it, but now it is at the top of the city's policy agenda.*[59]" In this sense, the "*Making Heimat*" project led by the *Deutsches Architekturmuseum* in Frankfurt is particularly revealing: first conceived as a catalog of best practices for housing refugees in Germany, it sparked and organized a lively public debate between municipal representatives, architects, associations and construction companies regarding ways to successfully produce affordable housing and lower construction costs for everyone. Furthermore, all of these stakeholders seized on long-term temporary housing as a testing ground for new construction solutions, new housing models and reflection into modular housing to respond to changing lifestyles. In this way, the construction type chosen for long-term temporary housing evolved from high-quality but temporary containers (cf. the Notkestrasse group in Hamburg) to building long-term housing reserved for refugees but later intended to become social housing.

6   Capitalizing on the experience?
Will this approach improve Germany's ability to prepare for future demographic shocks by capitalizing on the experience it has gained? This question takes on additional importance when we know that this type of crisis is likely to recur and even become more common in the future (political instability, climate refugees, natural catastrophes within the country, etc.). Certainly, this is a positive response, but it does require some nuance. Positive first of all because many German cities had no specific accommodation strategy for asylum seekers prior to 2015, as underlined by Karin Lorenz-Hennig, Director of the Housing and Real Estate Management Unit of the federal institute for research on building, urban affairs and spatial development (*BBSR*). They now have a strategy and, with this in place, have set up a network of partners that can be mobilized in case of future crises. In addition, some cities have decided to keep their emergency housing, as well as their emergency supplies to anticipate future waves of migrants and accept the cost of caretaking and storage (Hamburg). Finally, these cities, which developed highly local strategies due to the urgency of the crisis, have now turned to discussion forums such as those organized by the *Deutsches Architekturmuseum* as a venue for dialogue concerning the policies put in place. However, no network of cities has formed at the federal level, and feedback sharing has progressed on a case-by-case basis to achieve an increasingly broad perspective that may eventually produce a guideline for action, without serving as a strict manual. Moreover, the feedback loops that can help evaluate projects (with stakeholders involved in design, construction and management, as well as refugees) and reflect on the still avenues of improvement remain limited – and may become even more limited as some of the administrations that were reorganized or created to respond to the crisis were shut down after the emergency phase. The goal for Germany is to leverage all its experience and stick to its resolutions and ambitions over the long term. Perhaps it is time to refer to this approach as a "resilience strategy"? Because naming confers reality onto actions, it unifies stakeholders around a common project and, finally, it engages people.

3 Seasonal and regular:
the flow of tourists

The flow of tourists may seem like a minor issue compared to the vast human and social challenges posed by rapid urbanization and accommodating refugees. And yet, the flow of tourists involves substantial numbers: in 2017, according to the World Tourism Organization, 1.3 billion tourists traveled worldwide, a figure that is set to grow at a steady rate of 3% over 10 years to reach 1.8 billion travelers in 2030. Paris hosts 29 million tourists a year, Venice 20 million, while London and the Forbidden City of Beijing each receive 15 million visitors annually.

Fig. 31:
Tourists in Phnom Bakheng,
Angkor, Cambodia

**This surge of tourists is a contributing factor
to three main types of vulnerability:**

1   **Environmental vulnerability:**

The massive number of visitors increases the stress on tourist sites and speeds up their deterioration: soil erosion, strained ecosystems (Galapagos Islands), excessive humidity in interior spaces (Lascaux caves, Valley of the Kings), pollution (Mt. Everest, known as "the world's highest garbage dump"), etc. All facilities built to welcome tourists magnify the pressure on a rare resource – water – due to the water-intensive hospitality industry and the maintenance of artificial agricultural or forest lands (Angkor).

2   **Economic vulnerability:**

Tourism represents a tremendous economic force worldwide and constitutes a strong lever of local economic development by allowing regions to capitalize on a value that can never be outsourced: 10% of world GDP, 1 job in 10 worldwide, 2 million direct and indirect jobs in France, with 300,000 additional jobs expected between 2016 and 2020, $206 billion in tourism revenue earned in the United States in 2016, 60 billion in Spain, 50 billion in Thailand, and 34 billion in France[61]. However, beyond a certain threshold, an overreliance on tourism can lead to a state of dependence on this industry, weakening the regional economy. Widely known examples of this phenomenon include beach and ski resorts. The case of Venice offers another interesting example: the success of the city's tourism industry has exhausted many of its other economic sectors. At the same time, today's excessive consumption rates risk diminishing the quality of services offered to tourists in the long run, jeopardizing Venice's status as a top tourist destination and thus putting the city's primary economic resource at peril[62].

3   **Social vulnerability:**

In Spain in 2017, the massive backlash against tourism amplified to such a point that Prime Minister Mariano Rajoy felt obligated to issue an official statement: *"what we cannot do is kick those people who come to spend their money here, generating revenue and jobs for many in Spain. That seems crazy to me[63]"*. The backlash is a symptom of the tensions stirred up by the massive wave of tourists, which can intensify the competition for assets, services and amenities in cities, without evenly distributing the costs: locals struggle to access Barcelona's overcrowded beaches, spikes in emergency room visits stretch resources thin at hospitals not built to cope with seasonal influxes, housing shortages, etc. Berlin's former Secretary for Housing and Construction, Engelbert Lütke Daldrup, estimated in 2016 that the city's rental market had lost 10,000 homes since the creation of Airbnb, considerably reducing the German capital's efforts to build new housing (12,000 in 2016)[64].

Fig. 32:
Barcelona has seen a massive
backlash against tourism

Tourism presents a two-sided characteristic in that it increases the vulnerability of regions just as it promotes their resilience: the often vital nature of this economic sector means that stakeholders in tourism must integrate sustainability objectives into their strategies. Problems such as deteriorating heritage sites, declining service quality and anti-tourist protests that contradict a culture of hospitality present direct threats to the industry, as it faces increasingly fierce competition since tourism products are hard to differentiate. Protecting tourism sites, promoting sustainable tourism and placing regulations on industry practices and certain new players in the sector (Airbnb at the top of the list) have thus emerged as some of the major trends in global tourism: but does this simply mean that resilience is now becoming a new form of regional marketing?

Population gains and losses each represent a clear source of disruption for cities. Not because there is an ideal threshold above or below which cities can no longer be resilient, but because demographic changes upset the fragile balance struck between a society and its region. The ensuing urban vulnerability concerns the increased hardship of accessing resources, the emergence of new socioeconomic fractures and the quality of life offered by the city.

Defining the conditions that will enable a region to absorb the ebb and flow of population requires a direct reflection on its ability to constitute a society over the long-term. The primary challenge here is to guarantee the resilience of communities, which means ensuring an enduring connection between residents and their region, as well as between all residents involved in any social project.

Notes

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