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Position paper

**»The resilient city«**

Based on the results of the conference under the same title held by the  
Counsellors' Office of the municipal government of Shanghai and the Friedrich-  
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# I. (Climate-)resilient urban development – concept, governance, climate adaptation

## Conceptual bases of resilience and the capabilities of a resilient system

- The concept of technical resilience is focused mainly on the maintenance of system functions in the event of external shocks or disruptions (Juan-Garcia et al., 2017).
- The IPCC defines resilience more broadly as »the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a potentially hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions« (IPCC, 2012). In other words, resilience is identified as an explicit requirement.

Extrapolating from the IPCC definition of resilience the following capabilities and characteristics of resilient systems are at stake (cf. Libbe et al., 2018):

- The ability to observe the system's environment and predict possible threats/dangers → to behave proactively and be prepared.
- Properties of the system, such as robustness, flexibility and elasticity → to absorb and accommodate.
- In the event of external disruption, the system is in a position to resume its functions within a reasonable time and to recover.
- Finally, the ability to learn from external disruption and to adapt the system's structures and properties in order to improve it and to be better prepared to cope with similar dangers in the future.

The following key message can be derived from this:

- Resilience is all about learning and adaptation, and generally about the transformation of systems. A system's governance is a crucial dimension of its resilience (Schramm and Matzinger, 2020).

## Resilience in urban development – dimensions of the »city« as a system

In order to understand and be able to develop resilience in the urban context it makes sense to differentiate between the various dimensions of the »city« as a system:

- the built city (buildings, streets, technical infrastructure and so on);
- material and energy flows, land use, urban environment;
- political institutions and governance;
- socio-economic conditions and dynamics;
- cultural values and norms (informal institutions).

## Four topics for discussion (theses) for the debate about (climate-)resilient urban development

### 1. (Climate-)resilient urban development as a systemic approach

- Cities can be understood as complex social-ecological systems, whose dimensions/elements (see above) affect and depend on one another.

- A city's (climate-)resilience depends not only on the resilience of individual dimensions in themselves, but on the interaction of dimensions of the urban system.
- Integrated approaches are needed (not only technical solutions!) that regularly push the boundaries of thinking in administrative units and in academic/technical disciplines (or »silos«).
- Networked water and green infrastructures can increase climate resilience (Matzinger and Gunkel, 2020).
- A specific example of implementation of systematically networked blue-green-grey infrastructures is the day care centre »Bewegungsreich« in Berlin-Pankow (Reichmann et al. 2020). Here the different dimensions, as well as various groups of actors, different spatial scales, temporal perspectives and different planning aims (natural water balance, water conservation, environmental education) are planned and implemented in an integrated way.

## 2. Governance of cities to boost climate resilience

- Extrapolating from the systematic approach and the assumption that pursuing a vision of the future will require uncertainty and ignorance to be addressed, it makes sense to actively involve the relevant governance actors (to be determined on a case-by-case basis): besides the city administration and urban policymakers, these include citizens, organised civil society and private companies, such as housing associations, industry, and utility and waste disposal companies.
- Involving a variety of actors in governance can reduce the complexity of the challenge and at the same time address actors' uncertainties (Kerber et al., 2018).
- Within the framework of proper governance, processes (operations) should be oriented towards integration and a systematic approach. Experience from Germany shows that aspects of climate adaptation (such as the planning of networked water and green infrastructure) should be addressed in the planning process as early as possible. In their early phases planning processes (and the actors involved in them) are still comparatively open to innovation and transformation, for example because the costs of adapting urban development proposals are still relatively low (Trapp and Winker, 2020).
- Which actors should be involved in the process, when, and for what purpose?
- The Berlin Rainwater Agency (Berliner Regenwasseragentur)<sup>1</sup> is a specific instance of implementation for the improvement of cross-sectoral cooperation and coordination of actors, as well as knowledge management as part and parcel of governance for climate resilience.

## 3. Evidence and data management – basis and limits

- Smart city applications provide a wealth of data, which can be used for climate-resilient urban development and its governance. Data and intelligent data management are important in both the planning process<sup>2</sup> and in case of disaster (for example, for the purpose of communications).
- Data – which can be visualised, for example, in the form of thematic maps – enable evidence-based decision-making (for example, in Germany municipalities use heavy rain hazard maps [*Starkregengefahrenkarten*], micro-/meso-climatic modelling of the urban climate and heat-health action plans [*Hitzeaktionsplänen*], which can also be integrated with socio-economic

<sup>1</sup> On this see: [www.regenwasseragentur.berlin](http://www.regenwasseragentur.berlin).

<sup>2</sup> Cf. <https://de.ramboll.com/greenscenario>.

population data). In many towns and cities in Germany, heavy rain hazard maps and heat plans based on digital tools and data processing are used for climate adaptation.<sup>3</sup>

- It is important to keep in mind that decisions (whether in planning or in emergencies) must always be taken by human stakeholders or political decision-makers. Artificial intelligence and data cannot substitute for democratic/political decision-making legitimised by the state.

#### 4. Limits of resilient urban development

- The resilience of a city in relation to climatic or other kinds of external disruption cannot be increased to an absolute maximum. From a certain point in development, for example, the costs of further measures are likely to be very high, to the extent that they are disproportionate to their usefulness. Or building measures to increase resilience (for example, the most robust possible buildings/technical infrastructure or retention areas in case of floods) reach their limits in terms of resources or extent.
- Resilient urban development is always based on how a society evaluates risk overall and residual risks.
- Disruptions/disasters are likely to occur in the future for which – or the extent of which – cities or society are not or could not be prepared.

## II. Resilience and mobility

### Conceptual capabilities of a resilient mobility system

- Mobility is key to our cities' functionality. It links all central functions and actors. Mobility is essential when it comes to making provision for citizens and the economy.
- The concept of resilience is focused on maintaining mobility in the event of disruption.
- The notion of resilience refers – in relation to transport – to »the ability of a transport system to be able to cope with external disruptions and after an initial failure to be able to restore its original capability« (FIS 2021).
- Regardless of particular definitions a resilient mobility system has the following characteristics:
  - diversity, redundancy, robustness (damage control and precautions);
  - resourcefulness, promptness (crisis response and recovery);
  - adaptability, ability to learn (ability to develop).

### Resilience in the face of possible disruptive events – today and in the future

- Disruptive events have the potential to impair the functioning of transport systems, either as a whole or in part, to a greater or lesser extent. Local disruptive events can have cross-regional or even international effects on the transport of people and goods flows. A prominent example is the container ship »Ever Given«, which got wedged in the Suez Canal for a few days in summer 2021, having a significant negative impact on international trade.
- The consequences of disruptive events in the transport system might include: vehicle breakdowns in public transport; (permanently) destroyed infrastructure, such as bridges, rail platforms or tracks; as a result of business problems affecting public transport operators or mobility services; geopolitical interruption of supplies of raw materials, such as crude oil, with resulting price increases; shifts in demand, avoidance and displacement effects.

<sup>3</sup> On this see, among others: <https://www.steb-koeln.de/hochwasser-und-ueberflutungsschutz/akutes-hochwasser/ueberflutungsgefahrenkarten/ueberflutungsgefahrenkarten.jsp#HGFK4> and [https://www.stadt-koeln.de/mediaasset/content/pdf57/planungshinweis\\_hitze\\_clm\\_endfassung.pdf](https://www.stadt-koeln.de/mediaasset/content/pdf57/planungshinweis_hitze_clm_endfassung.pdf).

- Basically, it must be assumed that the variety and dynamics of these disruptive factors are increasing: climate-related severe weather events, as well as technical or human errors in ever more complex processes and system architectures, manipulation and hacker attacks.

## Theses for addressing resilient mobility systems: resilience as a task for community planning and control

### 1. Evidence-based decision-making on the basis of an ongoing analysis of the threat situation and vulnerabilities

#### Crises will become normal

- They are – in a resilient city – not an exception, but a constant companion in a world characterised by disruptive and continuous change.
- This is a challenge for mobility policy because it concerns the enhancement of functional resilience, alongside the already existing major challenge of the socio-ecological transformation of the fossil-fuel based transport system.
- Analysis of the threat situation and vulnerabilities must be a constant effort.

#### Crises must be recognised at an early stage

- To that end a kind of early warning system needs to be established.
- One example of early detection is hazard maps for heavy rain and heat (cf. Section 1). Consequences for transport systems can be drawn from risk evaluation based on hazard maps.

#### Systems' vulnerabilities are decisively affected by relevant actors

- Cities and towns are key actors in acute crisis management and also for resilience strategies. For municipal and community actors, resilience is often no more than a buzzword. In future, however, it will be essential to integrate resilience as a strategy in urban models, such as sustainability models.

### 2. A systemic approach to strategies and measures to increase the resilience of the transport system

#### Transport planning strategies for the sake of traffic prevention and modal transfer should be developed, along with measures for their implementation

- Transport systems with redundancies; the creation of transport-efficient settlement structures (such as Hamburg's HafenCity) and the shift to non-motorised means of transport must be possible at any time. There must be a balanced relationship between individual and public transport.

#### Decentralisation, mixed use and local mobility

- play an important role in urban citizens' self-sufficiency;
- redundancies and robustness are also central here: intermodality and multimodality and diversity in the transport system all enhance mobility.

#### Digital infrastructure, intermodality and networking of modes of transport

- The expansion of digital infrastructure, intermodality and the networking of modes of transport in both passenger and goods transport will in future play an increasingly important role (among other things with the help of apps and the expansion of mobility stations). Intermodal systems enable switching between routes and public transport lines, between modes of transport as well as allow for temporal priority for certain means of transport (traffic management).

- Key to this are legally binding and practical framework conditions that provide municipalities with reliable structures and the necessary leeway in order to be able, for example, to integrate new mobility services in the local public transport system.
- Example: Hamburg's HafenCity: RealLab Digital Mobility.<sup>4</sup>

### 3. The 15-minute city enhances resilience

- A lot of mobility with less traffic is achieved by means of mixed use, decentralised structures.
- Mixed use structures can help to maintain mobility even in the case of disruptive events, as envisaged by the so-called »15-minute city« or the »compact city«. In principle, a similar idea underlies the two concepts: routes should be short, all main facilities should be reachable in a short time, from shopping to services, doctors, ideally even work. In this way objectives can be achieved, even in the case of disruptive events, and local provision is ensured.
- Society's resilience against functional disruptions in the transport system must be enhanced.
- Examples from Berlin: Berlin Friedrichstraße,<sup>5</sup> pop-up bike lanes,<sup>6</sup> reclamation of parking spaces.<sup>7</sup>

### 4. Adequate expenditure on investment and operating costs boosts resilience

- Resilience requires a budget and in order to enhance resilience expenditure on investment and operating costs must be increased, both for capital investments (infrastructure construction or refurbishment and recommissioning of disused railway tracks and bridges), as well as for running costs. The funding of public transport is key to this.
- Funding for responding to disruptive events and enhancing resilience must be consistently included in municipal budgets and budget planning.
- Municipalities need support. This task must be performed side by side with the federal state, as well as with economic actors, such as local companies.

## III. Closing remarks on the discussion within the framework of the conference

- A lot was said about »governance« and »participation« as key conditions of and approaches to enhancing the (climate-)resilience of urban spaces. It remains open, however, especially in intercultural German–Chinese exchanges, what precisely the two parties understand by these terms. For example, in the German debate in the context of participation various levels or intensities of information and consultation about codetermination and participation, and even collaboration are distinguished. Thus, participation is far more than the gathering and processing of (individual) data (Big Data), and feeding it into municipal decision-making.
- Resilience has a lot to do with (public) communication, both in actual disaster situations, and in the preparation for and follow-up of events, learning and adaptation. It remains to be seen how actors can be made more aware also of less obvious consequences of climate change

<sup>4</sup> On this see <https://www.hamburg.de/bvm/projekte-its/14745370/ankerprojekte/> und <https://reallab-hamburg.de/>.

<sup>5</sup> Cf. [https://www.ivp.tu-berlin.de/fileadmin/fg93/Lehre/Ergebnisse\\_Lehre/Brosch%C3%BCre\\_Neue\\_Mitte.pdf](https://www.ivp.tu-berlin.de/fileadmin/fg93/Lehre/Ergebnisse_Lehre/Brosch%C3%BCre_Neue_Mitte.pdf).

<sup>6</sup> See among other things <https://nationaler-radverkehrsplan.de/en/forschung/schwerpunktthemen/berlin-pop-bike-lanes>.

<sup>7</sup> On this cf.: <https://www.tagesspiegel.de/berlin/jeder-vierte-parkplatz-in-mitte-verschwindet-in-berlins-zentrum-gibt-es-wichtigeres-als-pkw-abstellplaetze/27744150.html>.

(such as heat-related deaths, which tend to occur silently and unnoticed) and how it may be possible to maintain a readiness to act and to change over a longer time period in the aftermath of an incident. How can we get out of the habit of »learning by disaster«?

- In the discussion, resilience was often linked to the notion of adaptation. In particular in relation to the consequences of climate change it would make sense to talk of »transformation« in order to reflect how climate-resilient urban development is potentially linked to fundamentally new physical and institutional structures. The term »transformation« – in contrast to adaptation – also conceptually captures disruptive processes and highlights the need for innovation. Living labs and experimental planning and projects (such as popup bike lanes) can bring about important learning effects for municipal administrations.
- There is no blueprint for climate-resilient urban development. Structural/technical, planning-related, institutional, socioeconomically adequate and financially viable solutions can be developed in detail only in the context of specific local conditions. That does not exclude learning from other municipalities, but it does underline that simple transfer is not possible. Cultural peculiarities of cities, their people and municipal administrations should be taken into consideration.
- Pop-up bike lanes are one example of new governance. Civil society actors in Berlin and Germany as a whole have put the topic of transport policy on the public agenda. As a disruptive event the pandemic was used as a window of opportunity and bike lanes were rapidly approved and implemented. This way of working on the part of municipal administrations can be taken as representing a paradigm change.
- The discussion in Germany on a transport transition, the decarbonisation of the transport sector and the electrification of drive systems, as well as the mobility transition can be regarded as a slow shift away from the car-friendly city.
- Discussions on transport planning in accordance with urban needs have been held and promoted in many cities by civil society actors, among other things through petition campaigns for cycling-related referendums (*Radentscheide*). In municipalities (municipal politics and administration) this may lead to a rethink, but this can often be extremely protracted. Experiments and traffic trials are one much discussed way of taking action across departmental boundaries. This makes it possible to try out a new kind of cooperation in administrations and to communicate better with the public concerning changes. Furthermore, there are also possibilities for rectification and improvement.
- One key challenge is to adjust and streamline administrative processes, and to use participation as a resource with a view to gaining acceptance. Public debates are key and need time, but they also bring about sustained acceptance.
- It should be noted that policymakers and administration in municipalities enable »municipal resilience management« and they should explore their own options. The conceptual, planning-related and organisational approach to functional integrity is key to the creation of resilient structures.

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