RESILIENCE OF A SMART CITY

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Introduction: resilience and resilient city

Resilience of cities is crucial part of the Safe City concept. Preceded by studies on Safe City and Smart City concepts, currently ongoing research at the University science park of the University of Žilina now continues by defining and strengthening the resilience of cities. Research investigates resilience and its connection with systems of Safe City concept, possibilities of resilience measurement and identifies stakeholders in three stages of resilience.

OECD characterizes the resilient city as a city "that have the ability to absorb, recover and prepare for future shocks (economic, environmental, social & institutional). Resilient cities promote sustainable development, well-being, and inclusive growth." (OECD 2019). Resilience is described as "the ability of households, communities and nations to absorb and recover from shocks, whilst positively adapting and transforming their structures and means for living in the face of long-term stresses, change and uncertainty." (OECD 2020)

Janssen defines resilience as "the measure of a system´s, or part of a system´s, capacity to absorb and recover from the occurrence of a hazardous event" (Janssen et al. 2006).

Klein describes also the difference between reactive and proactive resilience as follows: „reactive resilience approaches the future by strengthening the status quo and making the present system resistant to change, whereas one that develops proactive resilience accepts the inevitability of change and tries to create a system, that is capable of adapting to new conditions and imperatives." (Klein, Nichols and Thomalla 2003).

In our opinion, combined approach to resilience design can result in city systems, prepared to adapt to external changes in a way, that causes minimal changes in system operation and functionality. It should be among today's challenges to utilise the ability of modern technologies to ensure systems functionality through different, mutually independent channels. This way, mainly the virtual parts of critical infrastructure could be backed up, so that failure of some channels would not mean the failure of the whole system. To create a resilient net of interconnections, individual resilience systems of the city, which correspond to the systems of a safe city, should all be connected and based on compatible platform.

This approach is supported by Comfort´s conceptualization of resilience as "the capacity to adapt existing resources and skills to new situations and operating conditions" (Comfort et al. 1999). Resources and skills of the city had changed significantly since her conceptualization, and their ability to adapt is now higher than ever. Possibilities of centralisation and decentralisation of data storages and operational centres at a moment's notice may play a big role in achieving resilience within future cities.

Based on studied definitions, we build our understanding of resilience around these keywords: **absorption - adaptation - continual functionality – recovery.**

Resilient city is a city, able to absorb crisis phenomena of various kinds without restricting the functionality of city systems, or in the case of need able to adapt existing city resources, skills and infrastructure to minimalize the time, needed for restoration of said functionality and for recovery of compromised systems of Safe City concept.
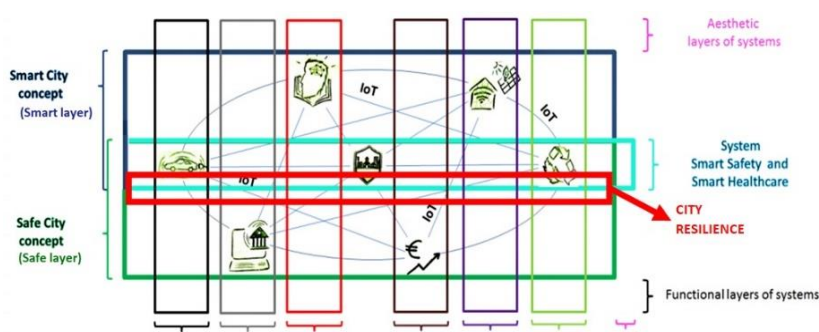
Resilience within Safe City Concept

Figure 1: The position of resilience within city systematization

Measuring of resilience

- Direct
  - after crisis phenomena, only measuring resilience against phenomena, that occured in the past, in the conditions, as they were during the event.
- Indirect
  - measuring, whether cities are likely to be resilient in the future.
- The level of resilience does not represent how serious loses can crisis phenomena cause, but how many systems and functions of the city can crisis phenomena disable and for how long.

Figure 2: 4 drivers of resilience, according to OECD

Stakeholders
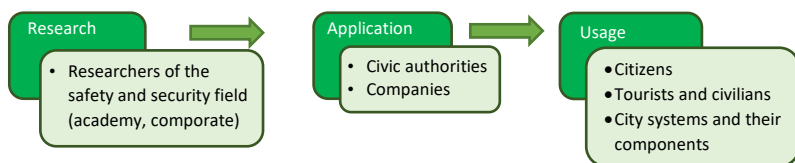
Research challenges

- To align existing methods of measuring of resilience with our current city systematization and create measuring method, compatible with our understanding of the city.
- To identify relevant resilience indicators for cities, based on circumstances within Slovak republic.
- To identify tools of resilience within all systems of a Safe City concept.
- To create methodological procedure of building and strengthening resilience of cities.

Conclusions

Modern technologies bring new possibilities for enhancing resilience in cities. Our goal for next research is to align the understanding of resilience with current understanding of the city, so that we can create measurement tool and strategies for city development, where Smart and Safe Cities will be built along with resilience of every system in mind.

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