

Supporting the Transformation Process to Smart Sustainable Cities in Switzerland: Implementation Guidelines and Promising Practices

Vicente Carabias-Hütter, Jörg Musiolik, Evelyn Lobsiger-Kägi, Pascal Vögeli, Anna Kohler, Onur Yildirim

(Prof. Vicente Carabias-Hütter, ZHAW Platform Smart Cities & Regions, Switzerland, cahu@zhaw.ch)

(Dr. Jörg Musiolik, ZHAW Institute of Sustainable Development, Switzerland, musi@zhaw.ch)

(Evelyn Lobsiger-Kägi, ZHAW Zurich Univ. of Applied Sciences, Inst. of Sustainable Development, Switzerland, kaev@zhaw.ch)

(Pascal Vögeli, ZHAW Zurich University of Applied Sciences, Institute of Sustainable Development, Switzerland, voei@zhaw.ch)

(Anna Kohler, ZHAW Zurich University of Applied Sciences, Institute of Sustainable Development, Switzerland, koln@zhaw.ch)

(Onur Yildirim, ZHAW Zurich University of Applied Sciences, Institute of Sustainable Development, Switzerland, yild@zhaw.ch)

1 ABSTRACT

Challenges such as the digitalisation of administration, the change of cities through urbanisation, climate change and the restructuring of infrastructure systems in the energy and mobility sector require a rethinking of the existing urban development approaches. The Smart City concept enables cities to tackle these challenges in the sense of a holistic development approach across departments, networked with partners and supported by digital technologies. In Switzerland's view, the Smart City concept goes far beyond internal administrative e-government and digitisation strategies. The overriding goal is to develop efficient and resource-saving solutions while at the same time increasing the quality of life and the attractiveness of the location. The overall aim is to create an innovative urban environment that involves the inhabitants and the economy and opens up new design possibilities.

Keywords: digitisation, sustainability, smart city, e-government, holistic approach

2 CONCEPT OF SMART SUSTAINABLE CITIES

2.1 Transformation process based on an integrative approach and the use of ICT

Science and practice agree that Smart City is a concept that provides solutions for the future challenges of cities (cf. Moser et al., 2014). The aim is to create a progressive, networked city that is characterised by a high quality of life for its inhabitants and an efficient use of the required resources (Zwahlen et al., 2016). The path to this goal is to be achieved through a transformation process based on an integrative approach, i.e. focusing on intelligent networking of all relevant actors (e.g. in public-private partnerships with the city's commitment) as well as (urban) fields of action and (new) technologies. This integrative approach should be reflected above all in the smart city activities of the cities. Information and communication technologies (ICT) play a key role here: many practical projects already use ICT, and from a scientific point of view ICT is seen as a necessary framework for smart cities to network fields of action, technologies and stakeholders (cf. e.g. Peris-Ortiz et al., 2017).

2.2 Growing interest in Switzerland for promising smart city use cases and transitions

In comparison to the European pioneers of smart cities, such as Vienna, which already positioned itself as a smart city in 2010, developed a smart city framework strategy based on a broad stakeholder process, set up a monitoring process and established entire smart neighbourhoods in partnership with companies, cities in Switzerland are still at the beginning of their development towards a smart city. This can be attributed to the fact that large cities are more attractive for investors. Cities in Switzerland are expanding their networks and exchanging information with each other, for example in the Smart City Hub Switzerland with companies close to the federal government, in order to serve them as test environments before the nationwide rollout of promising implementations. This networking is intended to make up for the difference in scaling between megacities. Scaling should only be considered for successful projects. Pilot projects allow administrations and companies to identify new fields of application (use cases) and develop marketable services based on them. The general interest in Smart City projects is currently growing significantly in Switzerland, but for most municipalities it is still unclear which use cases can generate local added value and immediate benefits. The first pilot projects will be realised by upgrading the existing infrastructure, such as enhanced broadband connectivity, area-wide fibre-optic network, LoRaWAN, sensor technologies and Internet of Things (IoT), smart grids, smart meters, diffusion of e-mobility and smart lighting systems. Future-oriented transformation processes involving relevant actors are increasingly emerging in Switzerland in order to become Smart Sustainable Cities & Communities. Scenario developments can help in the transformation of cities by

initiating processes and opening up new perspectives in the transition to a Smart Sustainable City. In addition, the holistic, integrative nature of scenarios can provide a basis for guiding principles, strategies and action plans (Eschenauer et al., 2017) including the upscale of promising Smart City use cases.

2.3 Holistic and participative understandings for sustainable transformation processes

Cities that are committed to sustainable urban development take equal account of technical, social, ecological and economic aspects in their actions. This starting position can form a good basis for cities to begin the transformation process towards a Smart Sustainable City and to shape it successfully in the long term (cf. Peris-Ortiz et al., 2017). Today's Smart City pilot projects focus on the integration of different technologies and areas, the introduction of information and communication technologies and questions of integration and participation of the population (e.g. European Union, 2014).

3 FROM PILOT PROJECTS TO SMART CITY INITIATIVES AND IMPLEMENTATION

3.1 Smart City strategies and pilot projects

Many cities are currently on the way to becoming a Smart City. The most advanced cities have developed smart city strategies that build on and complement their long-standing experiences of sustainable urban development (cf. Bisello et al., 2017). In some cities there are already pilot projects in the form of living labs or urban districts in which smart city approaches are to be developed and tested for a city-wide rollout. Other cities have first experiences in the implementation of individual, topic-specific Smart City pilot projects.

3.2 Promising pilot projects and initiatives to advance smart sustainable cities

One possible solution for reducing energy consumption of street lighting is smart LED lights that only light up when someone is using the street. In addition, the street light could communicate with other lights and traffic sensors via an IoT network, produce electricity itself with a PV system or supply vehicles with electricity as an electric car charging station. New business models and participatory approaches are needed not only to meet the needs of the residents, but also to integrate them into the development process of solutions through co-creation. Further examples are "Share your Bicar", a PV electric vehicle sharing system geared to urban areas, or "Social Power Plus", which aims to raise awareness of energy system transformation among the population through gamification, energy-saving tips and feedback on their own energy consumption. The ZHAW's "Virtual Smart City Hero" project includes a virtual reality game that enables the inhabitants of a city to experiment with an emerging technology while at the same time recognising the potential of a Smart City (cf. West et al., 2019).

In Switzerland and elsewhere, cities moved from pure energy related governance activities such as the European Energy Award for local authorities towards an implementation of broader Smart City initiatives. These activities might accelerate the transition process of cities, since a joint governance and management of energy, mobility and housing issues is applied with the help of ICT. However, the number of successfully realized Smart City projects is still low. There seems to be a large gap between policy visions and implementation. Especially since one third of medium-sized and large cities are expected to define their Smart City roadmaps within the next few years, research governance of Smart City implementation is of key importance.

4 SUPPORTING SMALL AND MEDIUM-SIDZED CITIES

For the majority of small and medium-sized towns and municipalities in Switzerland, the introduction of the smart city theme is challenging. While pioneering cities have already gained initial experience in the implementation of smart cities in recent years, smaller and medium-sized cities need adequate support to get started. In order to meet this need, guidelines have been drawn up on behalf of the Swiss Federal Office of Energy (SFOE) in collaboration with a stakeholder support group. The guidelines present various steps, instruments, variants and practical examples for the implementation of smart cities (cf. figure 1), from which interested cities can choose according to their needs. These guidelines therefore not only summarise the relevant literature and experiences from pioneering cities, but also enable cities and municipalities to develop their own understanding and appropriate measures to implement their Smart Cities. In this respect, they support cities in the development, selection and implementation of project ideas. Once the cities have gone through this phase, many cities want to approach the implementation of Smart City by means of an

overarching strategy and a corresponding organisational unit. For this institutionalisation phase, the guidelines present all relevant steps as illustrated in figure 1 (SFOE, 2019).



Figure 1: Steps towards Smart Sustainable Cities as illustrated by the Guidelines for Smart City Initiatives (SFOE, 2019)

The ZHAW supports cities and municipalities on their way to Smart Sustainable City and the associated solutions. This can be achieved through the intelligent networking of infrastructures with modern technologies, social innovation and the integration of relevant actors as well as transformation management, process support or support in strategy development. With the specially created ZHAW Smart Cities & Regions platform, the ZHAW bundles competencies and experience across its institutes in order to use them to identify future business areas and innovations, apply promising use cases, implement co-creation platforms, and to work within the Smart City Alliance on the integral or partial handling of future-oriented smart city developments in such a way that quality of life and resource efficiency are increased.

5 CONCLUSIONS

The results of the Smart City research so far (e.g. Furrer et al., 2018) show that there is a need for research first concerning the implementation of pilot projects as well as the coordination and management of an innovation community. In these new urban systems, technologies, infrastructures, organisational structures, regulation and the behaviour of people will interact systemically. Their co-evolution has not yet been sufficiently researched. Maturity models and corresponding tasks for transition management are of particular interest. Therefore, the design, management, implementation and monitoring of successful Smart City projects should be investigated in further research projects in order to provide recommendations for the management of holistic Smart City programmes. The development towards a Smart City is a long-term and complex transformation process to which many technological, institutional and organisational changes contribute. This requires coordinated actions of all relevant actors such as companies, politics and administration, investors, households and research institutions. Ultimately, the aim is to establish and further develop a comprehensive innovation system in which actors enter into new cooperations and build networks.

6 REFERENCES

- Bisello A. et al. (2017). *Smart and Sustainable Planning for Cities and Regions*. Berlin: Springer Internat. Publ.
- Eschenauer, U.; Braunreiter, L.; Kuehn, T.; Yildirim, O.; Lobsiger-Kägi, E.; Spiess, H.; Carabias-Hütter, V.; Müller, A. W. (2017). *Smart Cities in Theorie und Praxis: Szenarien, Strategien und Umsetzungsbeispiele*. Energy Governance Working Paper 12. Winterthur: ZHAW.
- European Union. (2014). *Mapping Smart Cities in the EU*. Brussels: European Commission.
- Furrer, B.; J. Musiolik; O. Yildirim (2018). *Kurzbericht Projekt "Smart City Innovation Office Winterthur"*. ZHAW.
- Moser C.; T. Wendel; V. Carabias-Hütter (2014). "Scientific and Pratical Understanding of Smart Cities". in REAL CORP 2014 Proceedings.
- Peris-Ortiz M. et al. (2017). *Sustainable Smart Cities, Innovation, Technology, and Knowledge Management*. Springer Internat. Publ.
- SFOE (2019). *Guidelines for the implementation of Smart City initiatives in Switzerland*. Bern: Swiss Federal Office of Energy. Smart City Schweiz. <http://www.smartcity-schweiz.ch/de/interessengemeinschaft/> [30.12.2019].
- West, M. et al. (2019). "Enhancing citizen participation through serious games in virtual reality". in REAL CORP 2019 Proceedings.
- Zwahlen, M.; Yildirim, O.; Eschenauer, U.; Carabias-Hütter, V. (2016). *Konzepte für die Zukunft: Eine Delphi-Umfrage zu Smart Cities liefert konkrete Ansätze*. VSE Bulletin, 12/2016,16-19.