Federal Institute for Research on Building, Urban Affairs and Spatial Development
within the Federal Office for Building and Regional Planning

BBSR-Online-Publikation 36/2025

Increasing European municipal cooperation in digital urban development

by

Dr Charlotte Räuchle
Dr Bettina Distel

Increasing European municipal cooperation in digital urban development

The project was carried out by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) on behalf of the Federal Ministry for Housing, Urban Development and Construction (BMWSB) with funds for dialogue and networking in the field of smart cities.

IMPRINT

Published by
Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)
within the Federal Office for Building and Regional Planning (BBR)
Deichmanns Aue 31–37
53179 Bonn

Project management
Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)
Division RS 5 "Digital Cities, Risk Prevention and Transportation"
Dr Charlotte Räuchle
charlotte.raeuchle@bbr.bund.de

Dr Bettina Distel
bettina.distel@bbr.bund.de

Authors
Dr Charlotte Räuchle
Dr Bettina Distel

in collaboration with
Enoh Tabak and Sandra Schett,
Gesellschaft für internationale Zusammenarbeit (GIZ) GmbH

Edited by
Marius Matheja

State
June 2025

Typesetting and layout
Katrin Heimersheim
Bettina Mehr

Picture credits
Cover image: imaginima via Getty Images
City of Hamm: p. 7; Harald Nachtmann via Getty Images: p. 9; George Pachantouris via Getty Images: p. 9; Lars Dünnebacke, City of Arnsberg: p. 15; Raluca Krisbai, City of Alba Iulia: p. 15; City Administration Pirna: p. 17; City of Bolesławiec: p. 17; @ Didier Marti via Getty Images: p. 24; xbrchx via Getty Images: p. 24; Murat Taner via Getty Images: p. 24; Municipality of Vari-Voula-Vouliagmeni; City of Geestland: p. 26; City of Krefeld: p. 32; Sergio Formoso via Getty Images: p. 32

Citation
Räuchle, C.; Distel, B., 2025: Increasing European municipal cooperation in digital urban development. Publisher: Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) BBSR-Online-Publikation 36/2025, Bonn.
https://doi.org/10.58007/f2ya-fa40

DOI 10.58007/f2ya-fa40
ISSN 1868-0097

Bonn 2025

Contents

1 Introduction 5

City Partnership Hamm – Arezzo 7

City Partnership Munich – Utrecht 9

2 Empowering Smart Cities – Approaches to European networking 11

2.1 Brief overview of the project 11

2.2 Events and networks for European municipalities 13

City Partnership Arnsberg – Alba Iulia 15

City Partnership Pirna – Bolesławiec 17

3 The urban digital transformation and the European Union 19

3.1 Regulation 19

3.2 Funding 21

3.3 Initiatives, platforms, instruments 21

City Partnership Basel – Freiburg – Mulhouse 24

City Partnership Geestland – Vari-Voula-Vouliagmeni 26

4 European cooperation in the digital, urban transformation – Findings 28

4.1 Social and institutional innovations 28

4.2 Digital twins 29

4.3 Implementation LoRaWAN 29

4.4 Open data, data sharing and data spaces 30

City Partnership Krefeld – Sofia 32

5 Citizen-centric Smart Cities: Advancing Participatory Problem Solving 34

5.1 Thoughts and experiences from a #connectedinEurope-tandem 34

5.2 Examples for Participatory Smart Cities 35

5.3 Smart Cities as Collaborative Cities: What do we know from research? 36

5.4 Aspects of participation and innovation to derive from the #connectedinEurope-project 37

5.5 Conclusion 40

6 Summary and outlook 41

Bibliography 43

1 Introduction

Over the past ten years, the European Union (EU) has set up a wide range of network initiatives, funding lines and funding programmes to support the digital transformation. The goal is to foster the development of European municipalities into Smart Cities. The focus here is on the municipalities' contribution to achieving the EU's climate protection and energy efficiency targets. According to the European Commission (COM), digital approaches to urban development play an important role here (see COM 2024a).

Examples of current European funding approaches to strengthen the digital transformation of European municipalities include the "European Innovation Partnership for Smart Cities and Communities" (EIP Smart Cities and Communities, abbr.: EIP), the "Horizon Europe" research funding programme, the successor to the "Horizon 2020" programme, and the EU Structural and Investment Funds (cf. COM 2025a). The EIPs mobilise and bring together various groups of actors (cf. COM 2025g). "Horizon Europe", on the other hand, funds scientific projects and cooperation as well as innovation that predominantly address the political goals of green and digital transformations and more closely integrate society in research and innovation processes (cf. COM 2025h). Amongst other things, the aim of the Structural Funds was to strengthen the European economy and generate new jobs. With a view to the European digital single market, regulatory approaches of the EU such as the "Digital Services Act" (DSA), the "Digital Markets Act" (DMA) and the "Data Governance Act" (DGA) have a direct or indirect impact on urban development and municipalities.

Enabling cities and regions to initiate European Smart City projects and participate in international competitions has long been a political goal. German municipalities are also increasingly taking part in various European partnerships and initiatives that promote the exchange and networking of municipalities as Smart Cities at European level. In addition to the municipalities, individual EU member states and institutions as well as pan-European city networks (e.g. "Eurocities") take part in various programmes. Examples of existing European municipal networks and initiatives that encourage dialogue on digital and sustainability topics include "living-in.eu", the already mentioned EIPs and the "Intelligent Cities Challenge" (ICC).

Municipalities in Germany are already demonstrating that networking at European level is possible in various fields and can create real added value at the local level. Experience is particularly available from major German cities. Results from projects dedicated to topics other than digital urban transformation also show the gains that transnational and European cooperation and networking can achieve for municipalities (cf. BMI 2019). In addition to the transfer of knowledge on proven and innovative practices in digital urban development, the network offers stable partnerships, collegial consultation and opportunities for subject-focused exchange on replicable projects. It can also form the basis for joint applications to EU funding programmes (cf. ibid.). Beyond that, European networking offers the opportunity of providing information on German approaches to Smart City solutions.

But to date, at least at national level, there has been a lack of structured bundling and support for the participation of German municipalities in European networks and digital transformation projects. Small and medium-sized municipalities in particular hardly participate – although there is a definite need to develop their digital skills and strategies. This comparatively low level of integration of German municipalities into European structures may entail various disadvantages: Less exchange with European partners can have a negative impact on access to EU funding and innovation-driving pilot projects. This may also lead to a loss of innovation potential in the fulfilment of important tasks of municipal public service. Information deficits may also arise with regard to future regulatory framework conditions that also concern Smart City projects. Apart from participating in partnerships and initiatives for digital urban transformation, it is becoming evident that German municipalities need support in actively participating in corresponding European funding projects.

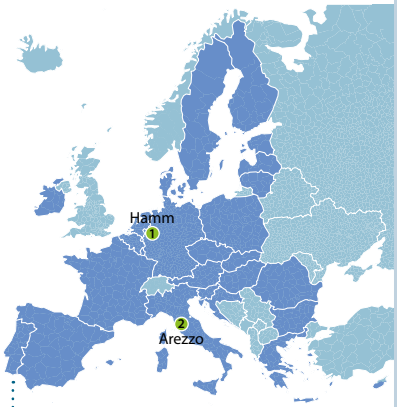
The project "Empowering Smart Cities – Approaches to European networking (#connectedinEurope)" of the Federal Ministry for Housing, Urban Development and Building (BMWSB) was carried out by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in course of the project International Smart Communities Network. The Federal Institute for Research on Buildung, Urban Affairs and Spatial Development (BBSR) supervised the project. It aimed to systematically analyse and support the participation of German municipalities in European networks, projects and initiatives. On the one hand, the project developed overviews of funding programmes and initiatives of the EU funding period 2021 to 2027 on digital urban transformation, regulations including standards and norms (cf. Kahlenborn/Janßen/Weidner-Jashi 2023) and existing (institutional and informal) intermunicipal networks in the EU (cf. Libbe/Lange 2023). On the other hand, knowledge transfer and networking were furthered by means of various events and workshops for municipalities and the support of six European municipal bilateral partnerships and one trilateral partnership was achieved. They cooperated on various Smart City projects and exchanged ideas on digital topics.

This report presents central findings and experiences gained from the project. The content-related findings are explained on the basis of background information on the project and its methodological approach (Chapter 2) as well as on the digital urban transformation at European level (Chapter 3): What conclusions can the project draw regarding how European municipalities can work together to shape the necessary urban digital transformation? And how can they be supported in doing so (Chapter 4)? Against this background, in a guest article, Chapter 5 examines the participation of citizens as a central connecting element of European Smart Cities. The report concludes with a summary of how European municipal cooperation can be strengthened in the digital urban transformation and an outlook (Chapter 6). Across the report, there are profiles of the seven municipal partnerships that have been working together for several years on the topic of "digital urban transformation" in the context of the project. These profiles basically describe the results of the exchange.

City Partnership Hamm – Arezzo

Challenges in Urban Development

Hamm and Arezzo are facing similar challenges: Both cities have to deal with the effects of structural change, digitalisation and sustainable urban development. While Hamm is driving forward the transition from an industrial city to a smart city, Arezzo is looking for new economic perspectives to cushion the consequences of the decline in the gold processing industry. Common to both cities is their development of innovative strategies to achieve climate neutrality, optimise digital administrative processes and actively involve citizens in this transition.



1 **Hamm, Germany**
Population: 180,761
→ Smart City Strategy 2022/2024

2 **Arezzo, Italien**
Population: 96,535
→ Mobility and sustainability plan 2019

Digital Projects and Solutions

A central component of the cooperation is the digitalisation of the city administration. Both cities are focusing on modern technologies to improve the efficiency of administrative processes. In Arezzo, digital identity systems, open-source software and cloud services are intended to make it easier and faster for citizens to deal with administrative matters. The "Digital Days" in Hamm serve Arezzo as a good example of citizen participation.

Major progress is also being made in the area of sustainable urban development. Arezzo is pursuing the goal of becoming climate-neutral by 2050 and is increasingly focusing on the use of intelligent sensors for climate monitoring, for example. Hamm, on the other hand, is contributing its experience in the development of sustainable mobility solutions, such as the implementation and use of intelligent traffic lights. The mutual exchange promotes new ideas and innovative approaches for environmentally friendly urban planning.

Another common theme is integration into European smart city activities. Arezzo's activity in this regard provides an example from which Hamm can learn. Both cities are actively looking for EU funding and networks to support their respective digital activities. In particular, EU initiatives for the development of municipal data spaces are being intensively pursued.

Project members Hamm-Arezzo

Source: City of Hamm

Results of the Cooperation

Hamm and Arezzo have focused on the following key topics: the use of clean hydrogen technology, the use of sensors for climate monitoring, the digitalisation of city administration and European data spaces. Regular working meetings, both digital and on-site, have deepened the exchange and provided a valuable impetus for the further development of the projects. Various experts took part in the presentation of digital instruments and explored possible collaborations.

> ***The exchange with Arezzo will be continued in a needs-based and practice-orientated manner. Hamm's smart city website is now also available in Italian to facilitate communication. We want to stay in contact and continue the exchange of knowledge.***
> *(Hamm representative)*

That the collaboration was particularly successful was due to clearly defined key topics and a high level of commitment on both sides. Fixed contact partners ensured personal continuity, while face-to-face meetings created a trusting basis for dialogue. These were supplemented by virtual meetings to further develop specific topics.

The principal successes of the cooperation can be summarised in three points:

- **Digital administrative innovations:** The introduction of new digital tools has been driven forward and the transfer of citizen participation formats has been launched. As a result, Arezzo will partially adopt the "Digital Day" format from Hamm.
- **European cooperation:** The close coordination has proved that medium-sized cities can develop innovative solutions together. Joint scouting of EU calls and integration into existing networks are important in order to benefit from European funding opportunities.
- **European data spaces:** As part of the project, the cities intensively analysed European data spaces. The exchange benefited from the European networks into which Arezzo is integrated (Eurocities, living-in.eu initiative). Even if the respective municipal data ecosystems are not yet sufficiently mature for them to apply for a corresponding EU call, the cities will continue to pursue the topic.

Despite these positive developments, the high workload in both municipalities posed a challenge. It became clear that funding additional staff hours could be a possible solution to make the intermunicipal exchange even more efficient.

Insights for Other Municipalities

The city partnership between Hamm and Arezzo is an impressive example of how European cities can learn from each other and jointly develop innovative solutions. Successful intermunicipal cooperation is based on a clear focus on content, continuous knowledge exchange and the targeted involvement of relevant stakeholders. The following lessons can be learnt from the cooperation:

- **Clear objectives:** Focusing on core topics from the very beginning of a cooperation promotes the efficiency and motivation of all those involved.
- **Public participation as a success factor:** Digital and sustainable transformations can only meet with broad acceptance if the civil society is actively involved.
- **Utilise networks:** Access to international platforms such as "Eurocities" and to European funding programmes facilitates the transfer of knowledge and the financing of innovative projects.
- **Low-threshold knowledge transfer:** Intermunicipal exchange enables the low-threshold transfer of knowledge and experience, even on complex topics such as the EU funding landscape.

City Partnership Munich – Utrecht

Challenges in Urban Development

Just as many other European cities, Utrecht and Munich are under considerable pressure to provide affordable housing as they are both economic and mobility centres with trans-regional importance. Thus, both cities have not only implemented urban development plans that focus on good housing and living but also consider aspects of sustainability and digitalisation.

1 **Munich, Germany**
Population: 1,510,387
→ Digital Strategy 2024

2 **Utrecht, Netherlands**
Population: 376,735
→ Spatial Development Strategy 2040

Digital Projects and Solutions

Both Munich and Utrecht provide digital tools for citizens to participate in the implementation of their urban development plans. As many other Dutch cities, Utrecht uses an interactive web viewer with 3D views of the city. This tool enables digital city planning, but also visualises plans and thus can be used for communicative and participatory purposes. Further development of this 3D visualisation will eventually lead to the realisation of digital urban twins, a project on which Dutch cities are working intensively at the municipal level.

Munich provides a digital map basis for its urban development plan, which also contains a report and an investment plan, so that all strategies and measures can be presented clearly and organised by topic in an up-to-date format. In addition, Munich is a forerunner in developing a digital twin and has already defined use cases in the area of integrated urban development, sustainable mobility planning, and public relations. The urban digital twin is being implemented in cooperation with the cities of Leipzig and Hamburg as part of the "Connected Urban Twins (CUT)" project, which is funded by the BMWSB as part of their Model Project Smart Cities programme.

Source: Harald Nachtmann via Getty Images

Source: George Pachantouris via Getty Images

Results of the Cooperation

Utrecht and Munich were in touch with each other even before the project started, but existing contacts were deepened and became more professional in the course of the project. Both cities were interested in exchanging knowledge and experience about acquiring (EU) funding. However, the partnership mainly focused on the use of digital urban twins for urban development goals and the transfer of knowledge and experiences in this area.

> ***Experiences from the Utrecht-Munich partnership impressively show the importance of exchanging technical solutions. It is a good example of how cross-border cooperation can increase efficiency***
> *(Bettina Distel, Project management)*

The considerable momentum generated by the topic "digital urban twins" proved to be the driver in this exchange partnership. This was reflected in the fact that other cities, such as Amsterdam, participated in various meetings at their own expense and out of interest in the topic. Furthermore, the following aspects were shown to be critical for the success of the exchange:

- **Transfer of technology:** A key part of the cooperation was the successful integration of Munich data into the Dutch 3D model. To achieve this, the team cloned the Dutch model and imported data from Munich which then could be visualised. This was the first practical interoperability test between the systems of the two cities.
- **Thematic focus:** Right from the outset, the Munich-Utrecht exchange focused on the topic of digital urban twins. In addition, they were able to build on extensive experience and expertise with the use of digital twins for urban development.
- **Cross-project exchange:** In addition to the meetings planned for the project, the participants were regularly invited to other, thematically appropriate events in the other partner city. Together with the informal exchanges between meetings, these events contributed to the considerable momentum of this collaboration.

Due to the team members' involvement in other large-scale projects and funding acquisition activities, restricted time capacities became one major challenge in this cooperation. It was the face-to-face meetings that brought the necessary movement, a group feeling and a high level of commitment to the collaboration. Despite the digital possibilities, personal contact on site was highly valued.

Insights for Other Municipalities

The topic "digital urban twins" bears a lot of potential for transfer and replication at the local level. Legal regulations must be observed when handling data in the respective countries. Yet, the successful integration of Munich data into the Utrecht twin not only shows that cross-border transfer of knowledge is possible, but also that specific technological solutions can be transferred and that the pursuit of this type of cooperation is worthwhile.

- **Use of existing networks:** Including further actors in existing cooperation can foster the exchange of knowledge and experiences and can result in the creation of new, cross-border special-interest networks.
- **Sharing resources:** There is great potential and a degree of willingness among cities to share digital resources, such as cloud infrastructure or programming code. Municipalities in Germany and the Netherlands are pioneering in this regard.

2 Empowering Smart Cities – Approaches to European networking

2.1 Brief overview of the project

The "European Green Deal" and the "Digital Europe" programme play a central role in the implementation of European regulations and the conception of funding instruments. The aims include developing European municipalities into smart cities. This requires an exchange between institutional actors and municipalities on the question of how the digital transformation can contribute to reaching the goals of sustainable, integrated urban development for the common good. Access to European networks and initiatives has so far been difficult for medium-sized and smaller municipalities in particular, partly because they have fewer resources. Therefore, they need support.

Such initiatives already exist at the state level, for instance in Hesse (Hessian Ministry for Digitalisation and Innovation 2025). The project has also set itself the goal of enabling German municipalities to network at European level. For this purpose, they should be provided with practical tools and knowledge by means of peer learning programmes and specialist workshops to enable them to independently develop and consolidate corresponding activities. Furthermore, it was envisaged that various European city partnerships would work together locally on Smart City projects.

The project posed the following main questions:

- What funding programmes/initiatives exist in the current EU funding period? What is the status of European discussions/regulations/strategies in the subject areas of "Smart City development", "digitalisation", "digital internal market" and "urban development"? What networking approaches are there?

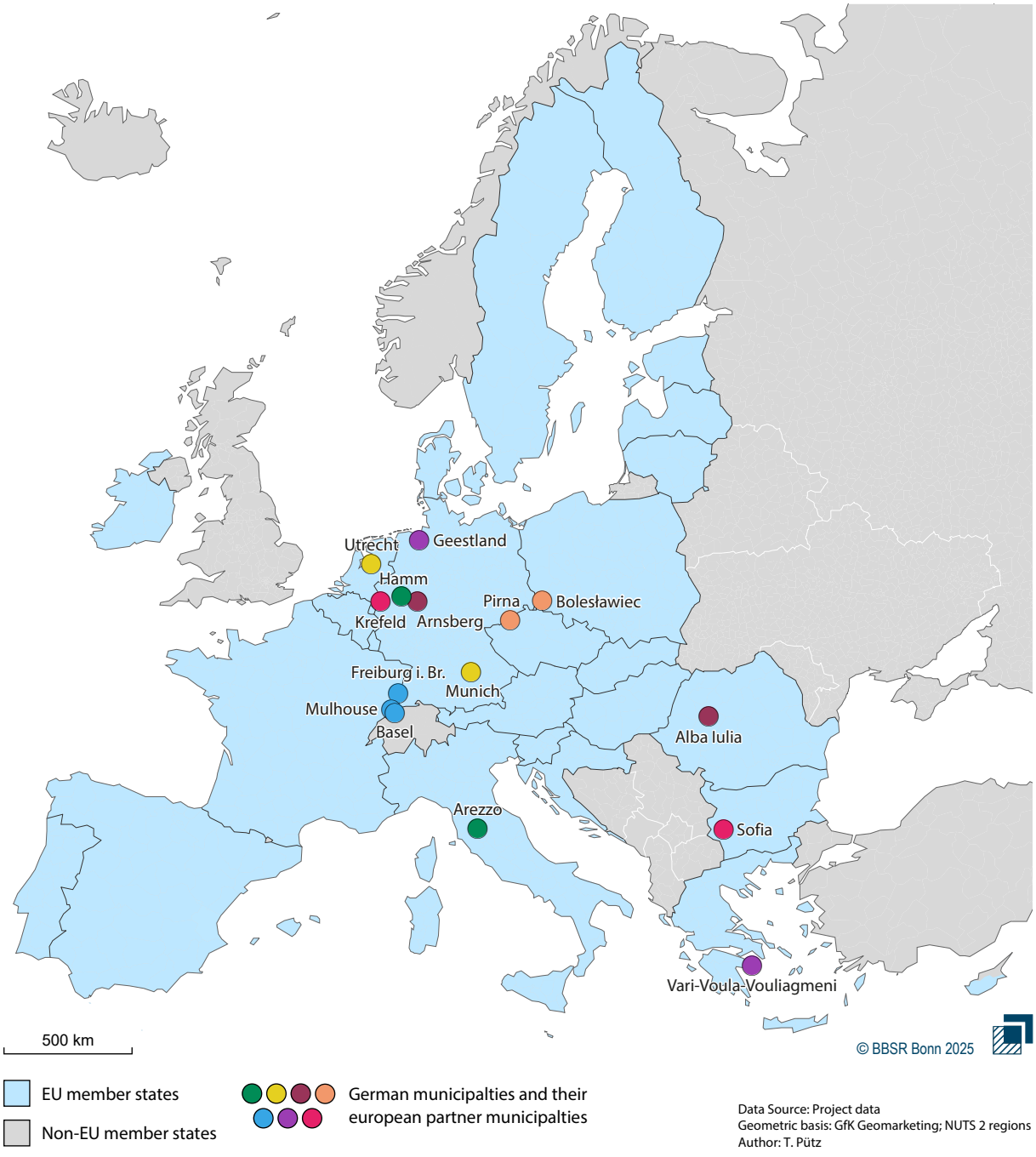
- How can German municipalities gain European partner municipalities and participate in initiatives and funding opportunities at EU level? How can German municipalities be supported in being more involved at EU level? What knowledge do German municipalities require for this and how can this be imparted?

In order to answer these questions, in addition to desktop research, the project planned to interview the participants of the organised events about the success and added value of the respective measure and to jointly evaluate the exchange activities (see the partnership profiles and Chapter 2.2 for the organised events). Amongst the topics of this evaluation were the methodological approach, networking between the participants and the impetus set for the municipalities for sustainable urban development/smart cities. The bases of this publication are the results of the accompanying surveys, the networking activities and the work with the municipal partnerships.

A total of 15 municipalities were directly involved in the project, twelve of them in bilateral partnerships and three in a trilateral partnership. They were chosen from more than 20 applications. The decisive factor in each case was that a smart city strategy was present or a certain degree of "smart city maturity" was discernible in combination with the "urban development" topic area and/or the municipality had already implemented first projects in the topic area. Cities from all over Europe were chosen for these peer learning partnerships (see. Figure 1) and "matched" with each other. Examples of the reasons for this were a city partnership that already existed prior to the project (Arnsberg – Alba Iulia), similar urban development policy challenges and the same Smart City topics (Munich – Utrecht) or the wish to learn about areas in which the respective partner municipality had proven expertise (Hamm - Arezzo). The following pairs were formed:

- Hamm (Germany) – Arezzo (Italy)
- Munich (Germany) – Utrecht (Netherlands)
- Arnsberg (Germany) – Alba Iulia (Romania)
- Pirna (Germany) – Bolesławiec (Poland)
- Basel (Switzerland) – Freiburg (Germany) – Mulhouse (France)
- Geestland (Germany) – Vari-Voula-Vouliagmeni (Greece)
- Krefeld (Germany) – Sofia (Bulgaria)

Figure1
Location of the participating municipalities



2.2 Events and networks for European municipalities

Shaping the digital urban transformation effectively regarding sustainable urban development for the common good poses many local challenges in individual municipalities or regions. The (new) knowledge and resources required to implement Smart City projects are not necessarily available at local level. An exchange with other municipalities may help here. As part of the project, in addition to the bilateral and trilateral peer learning cooperation projects, overarching events were also offered to facilitate the exchange of experience and knowledge as well as the setting up of networks beyond the individual partnerships. Table 1 lists the events organised and the various formats that have proved to be successful.

Some of the overarching events were aimed at **all interested municipalities**, including those that were not directly involved in the project. The **conferences and workshops** focused on imparting specialist knowledge, for example in the areas of "funding opportunities" and "best practices", as well as networking across municipal and national borders. In order to provide sufficient space for informal dialogue, some of these events took place over two days.

The much shorter **webinars**, in which selected aspects of digital urban development were presented and discussed with experts, were also aimed at all interested municipalities. The main topics were European funding programmes, data strategies and digital sovereignty.

The programme focused on **networking meetings for the partner municipalities**. Here, too, the municipalities should be given room for dialogue. In addition to the practical experiences with and progress made in the city partnerships, the participants were able to gain insights into the general Smart City developments of all partner cities and countries. Utrecht and Krefeld, for example, provided information on existing challenges and solutions in the provision and handling of (sensitive) data.

The on-site meetings for all municipalities facilitated informal communication, which was an important factor for successful cooperation overall. The partnerships were able to further develop existing ideas and discuss them in the group as a whole, resulting in opportunities for cooperation beyond the existing partnerships. The final meeting for the partner municipalities took place in September 2024 in the lead-up to the fourth OECD Roundtable "Smart Cities and Inclusive Growth" in Paris. The combination with this roundtable enabled the participating municipalities not only to exchange ideas with municipalities worldwide, but also to contribute their own successes and projects to the international discussion.

The connecting experience across all events and formats was the realisation that municipalities around the world are facing similar challenges, which they are specifically trying to address with the help of digital solutions. The discussions were assessed as informative and beneficial and ranged from the exchange of knowledge to specific solutions.

> ***"The programme has shown that smart cities all over the world are facing similar challenges while dealing with the topic of digitalisation. It was very interesting to learn about new innovative approaches to these challenges. In the future, we will try to be even more collaborative and connected."***
> *(Geestland representative)*

> ***"The peer learning meetings and on-site visits were designed to be practical and offered direct insights into the projects in both cities. […] Presentations were held at the various locations to exchange knowledge and experience. The face-to-face events in particular enabled in-depth discussions, which were valuable for comprehensively understanding the structures and challenges of the other city and learning from each other"***
> *(Hamm representative)*

> ***"[…] it is once again clear that every city struggles with the same issues and that exchanging knowledge is key to understand how different cities cope with that issues. And learn from others who are maybe a bit further in solving them."***
> *(EU city representative)*

The insights gained through the intensive dialogue between the participating municipalities at the various events and projects can serve as orientation for other municipalities for their own projects. Before these are presented in Chapter 4 and the guest article, the following Chapter 3 introduces the European framework conditions that municipalities have to deal with in the digital urban transformation. This is based on three consultation papers prepared during the course of the project.

Table 1
Overview of the events organised in the project

Title	Contents
European kick-off conference 10 February 2022, digital	The kick-off conference "#connectedinEurope: Funding, Networking and Best Practices for Smart Cities" marked the official launch of project. During the event, the 278 participants learnt about European networking opportunities in the field of "Smart Cities" and took part in three parallel sessions on the topics of "Current EU Digital Strategies and Regulations", "Stronger Together: The Case of European Networks" and "EU Funding and Programmes".
Networking workshop Leipzig 21/22 September 2023, hybrid, Leipzig	This meeting marked the beginning of formal exchange, knowledge transfer and networking between European and German municipalities. The event provided almost 50 European city representatives from Belgium, Germany, Finland, Greece, Iceland, Italy, Portugal, the Czech Republic and Ukraine a platform to exchange views on the topics of "Digitalisation and sustainable urban development" and "Smart City governance".
Webinar on selected EU funding opportunities for cities and municipalities ("Digital Europe", "EDIH", "NetZeroCities") 06 December 2022, digital	The aim of the webinar was to present the EU funding programme "Digital Europe" and the corresponding funding opportunities for municipalities. The possibility of regional support from the "European Digital Innovation Hubs" was also highlighted. The event concluded with a presentation of the EU mission platform "NetZeroCities" and its programmes for municipalities.
Webinar "City follows data – How municipalities develop their strategy in the age of data" 17 December 2022, digital	The webinar offered participants insights into the topic of "Data strategies and data sovereignty" and highlighted their significance for urban development in the digital age. Sixty-four participants registered for the event, including representatives from German and international municipalities, research institutions, politics and associations as well as interested parties from companies.
Project meeting 23/24 October 2023, on site, Berlin	During the first project meeting, the municipalities involved in the project had the opportunity to get to know each other and, for the first time, to exchange ideas on Smart City topics beyond their bilateral/trilateral peer learning partnerships. The focus of the meeting was on concretising ideas for the implementation of joint projects.
Workshop: Sharing Experiences and EU Funding Opportunities 14 May 2024, digital	The exchange between the participating municipalities was strengthened in a digital network meeting. The participants had the opportunity to inform each other about the current status of their partnership work and also gained comprehensive insights into EU funding opportunities.
Workshop: Datasets in Smart Cities 30 July 2024, digital	The last joint online workshop was dedicated to the topic of "Datasets" and "Cyber security". In addition to a report on a recent cybersecurity incident, the focus was on the municipalities' mutual exchange of information on their databases. The participants exchanged views on possible uses for different datasets.
Project closing meeting 16 September 2024, on site, Paris	At the joint on-site meeting of all participating municipalities in Paris, the experiences of the municipalities with the project were once again prioritised. All peer learning partnerships reported on the progress of their cooperation and drafted plans for further collaboration in breakout sessions. Some municipalities also presented current Smart City projects, including their digital twins. The meeting took place in the run-up to the 4th OECD Roundtable "Smart Cities and Inclusive Growth", which offered participants the opportunity to contribute their experiences to the global discussion on Smart Cities and regions.
Workshop: Debrief on the World Urban Forum and the Smart City World Expo Congress, new relationships and project ideas 10 December 2024, digital	The project concluded with the final online event, in which the municipalities once again exchanged views on the possibilities for permanently continuing their projects and the relationships that were established. In addition, the workshop offered summaries and a discussion on current leading events on urban digital development.

Source: BBSR

City Partnership Arnsberg – Alba Iulia

Challenges in Urban Development

Sustainability is central to current urban development policy for both Arnsberg and Alba Iulia. Early on, both municipalities developed initial strategies for enhanced sustainability and are currently testing how digital technologies can support the achievement of sustainability goals in various projects. For Alba Iulia, the massive out-migration of young people is another problem to which the city is increasingly testing digital solutions, for example in the areas of economic development and mobility.

1 **Arnsberg, Germany**
Populatio: 74,206
→ Smart-City-Strategy 2022

2 **Alba Iulia, Romania**
Population: 64,227

Digital Projects and Solutions

Alba Iulia's goal is to reduce emissions by 40% by 2030. To achieve this, the city converted public street lighting to smart lighting and traffic lights to LED technology. The city has also developed its own mobility concept and aims to improve the overall life quality for its citizens. Many projects in Alba Iulia are financed through EU funding, which the city successfully acquires with its own team.

Arnsberg, too, realises many of its projects by means of public funding stemming from the "Model Projects Smart Cities" programme of the BMWSB, where it is a member of the city network "5 CITIES FOR SOUTH WESTPHALIA". One of the smart city measures already implemented is the "freiRAUM" innovation lab, a physical space that provides room for digital learning, participation, communication and experiences to all those interested in these topics. In addition, the city uses satellite-based technology to monitor its large forestry holdings.

Both cities are interested in the topics of citizen participation and e-governance and still see potential for further development in these areas in their municipalities. Additionally, they are also characterised by the fact that they are already active in a number of national and international city networks.

Source: Lars Dünnebacke, City of Arnsberg

Project Members during the on-site meeting in Arnsberg

Source: Raluca Krisbai, City of Alba Iulia

Presentation of the certificate for the continuation of the town twinning

Results of the Cooperation

Arnsberg and Alba Iulia have been twinned since 1974, a partnership that has been cultivated with varying degrees of intensity in its 50-year existence, but which has provided a good basis for a trusting cooperation. Amongst other aspects, the partners exchanged ideas on how to incorporate smart city topics into the 50th anniversary festivities which took place in autumn 2024. Further topics included knowledge transfer on modern and sustainable lighting technology and – for Arnsberg – on project funding.

> ***Within the programme, this partnership [between Alba Iulia and Arnsberg] was revived and taken to another level of collaboration, involving the two cities in very detailed discussions related to smart city development, sustainable development, smart buildings, digital twinning and so on.***
> *(Alba Iulia representative)*

The cooperation was very successful and created new impulses for the city partnership that garnered attention mainly during the 50th anniversary celebrations. In a workshop with representatives from both cities, attendees discussed how open data activities in both cities can be more closely linked. To this end, they identified topics that can easily be integrated into existing structures and would be of interest to citizens in both cities. The workshop closed with developing a roadmap with specific steps towards realising this idea. In doing so, the municipalities laid a foundation for further cooperation in the area of sustainability and smart cities that moves beyond the scope of the project. Also, they strengthened digitalisation as an additional dimension of the existing city partnership.

The following aspects were central to the successful partnership:

- **Established relationship:** The existing city partnership was a solid basis for the exchange, because structures had already been established and both city administrations supported the project. In addition, parts of the project teams already knew each other from other cooperation, which made possible trust-based working right from the start.
- **Open and experimental attitude:** The teams exchanged ideas on various topics and reacted with agility to changing conditions. This was necessary, for example, after mayoral elections in Alba Iulia and after a Arnsberg had been hit by a severe cyber-attack.

Insights for Other Municipalities

Alba Iulia and Arnsberg showcased the importance of city partnerships beyond their social and cultural value. The cooperation of such partnerships in areas of digital, sustainability and urban development policies can benefit from political support and established structures. Moreover, the partnership showed how learning from each other can be particularly fruitful when the partners have different prerequisites but share common interests, as was the case in the area of project funding.

Overall, the partnership demonstrates that the following actions are particularly fruitful:

- **Combine a city partnership with digitalisation:** There is particular potential in digitalisation for the renewal of city twinnings.
- **Secure political support:** Political support is particularly important for a project in order to implement measures and decisions in a timely and straight-forward manner.

City Partnership Pirna – Bolesławiec

Challenges in Urban Development

Pirna is the administrative centre of the surrounding district. Its location on the river Elbe and close proximity to the Saxon Switzerland national park make Pirna a popular tourist destination and tourism an important economic factor. Culture and tourism are also very important for Bolesławiec, a town in the Polish province of Lower Silesia and famous for its ceramics production. The cities have been twinned since 1980.

1 **Pirna, Deutschland**
Population: 39,303
→ Smart City Strategy 2021

2 **Bolesławiec, Poland**
Population: 36,864

Digital Projects and Solutions

Both municipalities have been actively focusing on smart city approaches for some time. While Pirna adopted a corresponding strategy with "Pirna gets smart(er)" in 2021, Bolesławiec won the national "Most Smart City" award in the same year. Both cities are working on the digitalisation of their administration and municipal services. While Pirna is introducing an online reporting system to report defects, Bolesławiec is further developing its existing spatial information system and digitalising its infrastructure (e.g. water, waste management, SMS warning system) under the heading of "smart services".

Pirna is also focusing on smart city measures to realise its ambitious environmental and energy efficiency goals – the city was awarded a gold certificate in the 2021 European Energy Award scheme. Other key digital topics are tourism and city marketing (e.g. city guide app), mobility (car sharing) and citizen participation. However, Bolesławiec is also tackling the digitalisation of culture, tourism and city marketing (e.g. development of a "museum of the 21st century") as well as the environment and mobility (e.g. sensor-based air quality monitoring, water management, bike sharing, smart lighting).

Source: City Administration Pirna

Canalett app to explore historic Pirna

Source: City of Bolesławiec

Project members during their on-site visit in Bolesławiec

Results of the Cooperation

Pirna and Bolesławiec are not only linked by their decades-long town twinning and the desire to cooperate on new topics such as digitalisation, but also by their interest in developing and financing new digital projects. On-site meetings with excursions were supplemented by digital meetings. Interpreting during the exchange meetings was essential due to existing language barriers.

> ***Participating in the #connectedinEurope project was a good opportunity to strengthen the partnership with Bolesławiec at the professional level.***
> *(Pirna representative)*

Specifically, the municipalities exchanged views on various smart city topics, for example:

- **Intelligent services/defect detector:** Pirna presented its defect detector app from the field of "Citizen services and digitalisation". Concepts, implementation options and experiences were discussed in detail.
- **Mobility/car and bike sharing:** Pirna has its own car sharing system, although there is little interest in such providers in small towns. Bolesławiec draws on its experience with a bike sharing system.
- **Culture, tourism and city marketing/VR app:** Pirna has developed an app for a historical city tour that works with virtual reality. When you look at an existing building through the app, its historical elements are displayed on the screen.

Despite these positive experiences, the exchange partnership had to deal with various hurdles, including linguistic ones. Funding for translation services or a link with other (language) exchange programmes could be a possible solution to make the intermunicipal exchange even more efficient. Due to a reduction in personnel resources, the cities unanimously decided to end the exchange around halfway through the project.

Insights for other municipalities

The cooperation between Pirna and Bolesławiec also highlights the challenges that arise when transferring and replicating specific smart city projects across borders. Restrictions are more likely to result from the local level – and not from EU level: if, for example, local public transport has different organisational and responsibility structures. Against this background, intermunicipal exchanges should focus more on the framework conditions of digital solutions and not just their technical implementation.

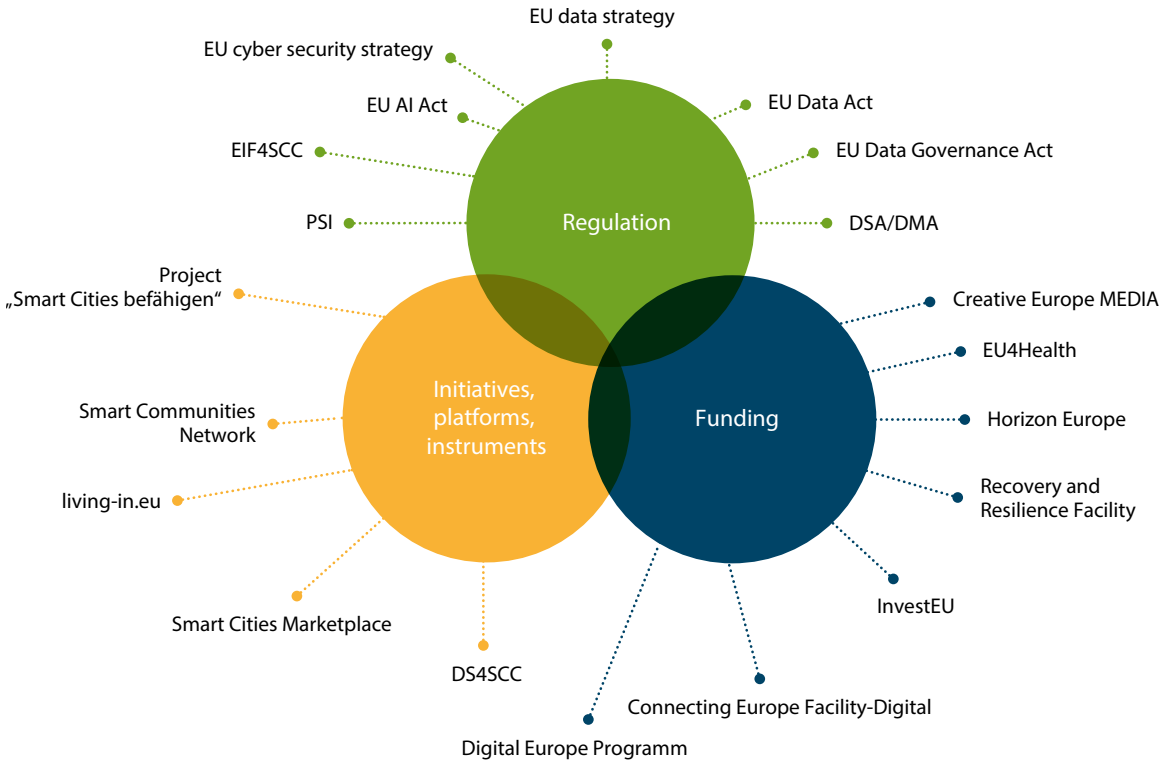
The following lessons can also be learnt from the cooperation:

- **Consider possible language barriers:** Employees of European municipalities do not necessarily speak English fluently, which can be an obstacle to international cooperation. Where necessary and possible, multilingual communication mechanisms should be set up and translation and interpreting services should be considered.
- **Utilise internal knowledge transfer:** Knowledge is not only exchanged with the partner municipality. Rather, exchange meetings can also strengthen internal knowledge transfer and networking within the respective administrations if colleagues from different departments take part. This potential must be utilised.

3 The urban digital transformation and the European Union

The field of urban digital transformation is characterised by different framework conditions in the context of the European Union. These in turn characterise municipal action. Three dimensions are of particular relevance in the context of the project: (1) regulation, (2) promotion and (3) initiatives, platforms and instruments (see Figure 2).

Figure 2
Framework of the urban digital transformation at EU level



Source: BBSR

3.1 Regulation

Four topics currently play a central role in European digital and urban development policy and are therefore also becoming the focus of regulatory efforts: “Handling data”, “Digital services and markets”, “Key technologies” and “Security and resilience”. Among other things, as part of the renewed European industrial strategy “Updating the 2020 new industrial strategy: Building a stronger single market for Europe's recovery” from 2021, competitiveness, the internal digital market, climate neutrality, the strategic autonomy of the EU, artificial intelligence and digital skills are also at the centre of interest (see Kahlenborn/Janßen/Weidner-Jashi 2023). All efforts are characterised by an emphasis on European values and fundamental rights. The EU Commission is thus preparing a “specifically European path” of digital transformation, which should contribute to the long-term significance of the EU member states and their digital economy in global competition. The currently relevant regulations and strategies therefore focus in particular on the handling of and access to large amounts of data from public and private companies (cf. ibid.).

1. When it comes to **handling data**, the "European Data Strategy" adopted in December 2020, formulates an overarching framework for data access and use. It is intended to help improve the storage, processing and value creation of data in order to increase the efficiency of the European economic area and the EU's share of the global data economy (cf. COM 2020).

   The "Open Data and the Re-use of Public Information (PSI)" directive from 2019 forms the legal basis for the re-use of data from public administrations and wherever possible and useful, also obligates the member states to make their data and documents available electronically in open and interoperable formats (see EU 2019).

   The data strategy is supported by two legal frameworks: The central instrument for implementing the strategy is the Data Governance Act (DGA) of 2022, which regulates the simple use of data and the secure exchange of data in the European internal market, especially for public administrations (see COM 2024b). In addition to the DGA, the EU Commission adopted the so-called "Data Act" in 2023, which came into force in January 2024. In contrast to the DGA, this regulation focuses primarily on consumers and companies and is intended to facilitate their access to and use of data. However, access to corporate data is also to be simplified for public authorities, particularly in crisis situations and emergencies.

   Finally, the development of interoperability standards for the re-use of data is also regulated (see COM 2025d). In this context, the Commission presented a "European Interoperability Framework for Smart Cities and Communities" (EIF4SCC) in 2021, which defines an approach for the development of smart services. In addition to relevant definitions and design principles, it also includes specific recommendations for action and practical examples to support municipalities on the path to digital transformation (see COM 2023).

2. The Digital Markets Act (DMA) of 2022 is central to the area of **"digital markets and services"**, as it is intended to ensure the functioning of the European internal market. This regulation is therefore particularly important for the digital economy, as it introduces standardised rules for platform providers that have a gatekeeping function. This means that they form independent, closed ecosystems with their programmes and can potentially contribute to the monopolisation of digital markets (see COM 2025b).

   The Digital Services Act (DSA) also dates from 2022 and is oriented towards the digital economy. While the DMA is intended to balance market inequalities, the DSA deals with the liability of providers for third-party content and thus prioritises the safety and protection of consumers. The regulation ensures greater transparency and accountability obligations on the internet, especially on online platforms (see COM 2025i).

3. **Key technologies** include artificial intelligence (AI), which has been regulated by the AI Act in Europe since 2024. This regulation differentiates between various risk classes for AI-based systems and regulates their development and use in the EU. In addition to the ban on high-risk systems, the regulation also introduces transparency obligations and guidelines on compliance with applicable law and ethical standards (see COM 2025c). This gives companies legal certainty in the development and use of AI-based systems. However, public administrations and research institutions are also directly affected by the AI Regulation.

4. In the area of **"Security and Resilience"**, the European Commission presented its cybersecurity strategy in 2020. It is intended to form the basis for the EU's digital sovereignty and an EU-guided development of international norms and standards. The strategy basically pursues three objectives: Firstly, it aims to strengthen Europe's resilience to critical infrastructure failures and promote the EU's technological independence and leadership. Secondly, the strategy provides for the development of operational capacities for prevention, deterrence and response at EU level. Finally, cooperation with international partners is intended to promote a global open cyberspace and strengthen cyber diplomacy (COM 2024d).

Overall, the EU is thus providing an overarching strategic framework to enable digital transformation. This should firstly focus more strongly on European values and fundamental rights, secondly strengthen the digital sovereignty of the EU and its member states, thirdly increase the share of European companies in the global digital economy and fourthly counteract monopolisation and further negative developments in the so-called platform economy (cf. Kahlenborn/Janßen/Weidner-Jashi 2023). The EU is also addressing other challenges in the field of digital transformation, such as the digital gap between urban and rural areas and between social groups, as well as the highly heterogeneous technical infrastructure within the EU. In addition, the European initiatives create incentives for both companies and public administrations to invest in digitalisation and secure the digital infrastructure more effectively against external attacks (ibid.).

For municipalities, the main question in this context is how the EU framework can be implemented at local level. On the one hand, specific instructions and recommendations for action as well as practical examples are provided to facilitate practical implementation. This is the case with the EIF4SCC, for example. In addition, easier access to sectoral data can promote innovation and reduce administration costs in the long term. On the other hand, smaller municipalities in particular face challenges when the provision and use of large data volumes in interoperable formats require considerable technical and human resources, for example in the context of the DGA (cf. ibid.). Finally, the AI Regulation also requires the development of new competences not only in the handling and evaluation of data, but also in the risk assessment of (AI-based) information systems.

3.2 Funding

In past decades, the EU has created a range of different funding opportunities to implement the vision of Smart Cities and regions across Europe. In most cases, the individual funding programmes are embedded in larger strategic programmes with a digital or Smart City focus, in particular the "Digital Decade" and "Climate Neutral and Smart Cities" programmes. In addition to financial support for projects, municipalities can gain access to Europe-wide networks, learn together with and from other municipalities and increase the visibility of local best practices. In the funding programmes, importance is often attached to the inclusion of different stakeholders and the access of various disciplines. The thematic orientation of individual funding programmes is therefore not only sectoral with a view to individual fields of action such as "mobility", but also across specific subject areas.

In the areas of digitalisation and digital urban development, municipalities can currently apply for seven main EU funding lines: "Digital Europe Programme", "Connecting Europe Facility - CEF Digital", "Horizon Europe", "InvestEU", "Creative Europe MEDIA", "EU4Health" and "Recovery and Resilience Facility" (COM 2024c). The "Digital Europe" programme addresses the use of artificial intelligence, but also the development of users' digital skills, and aims to achieve the "twin transition" in the long term – i.e. the achievement of climate targets and the digital transformation (see COM 2025e). Specifically, it is about the closer integration of research and the application of the results. Other programmes support the implementation of innovative and ambitious concepts in model municipalities. As part of "Horizon Europe", for example, five missions are currently being funded that address the pressing "Grand Challenges" of society, including the "100 Climate-Neutral and Smart Cities" mission. The participating cities across Europe are developing specific (digital) solutions to the challenges they face due to the impacts of climate change and which contribute to achieving climate neutrality in cities and municipalities (see COM 2025f).

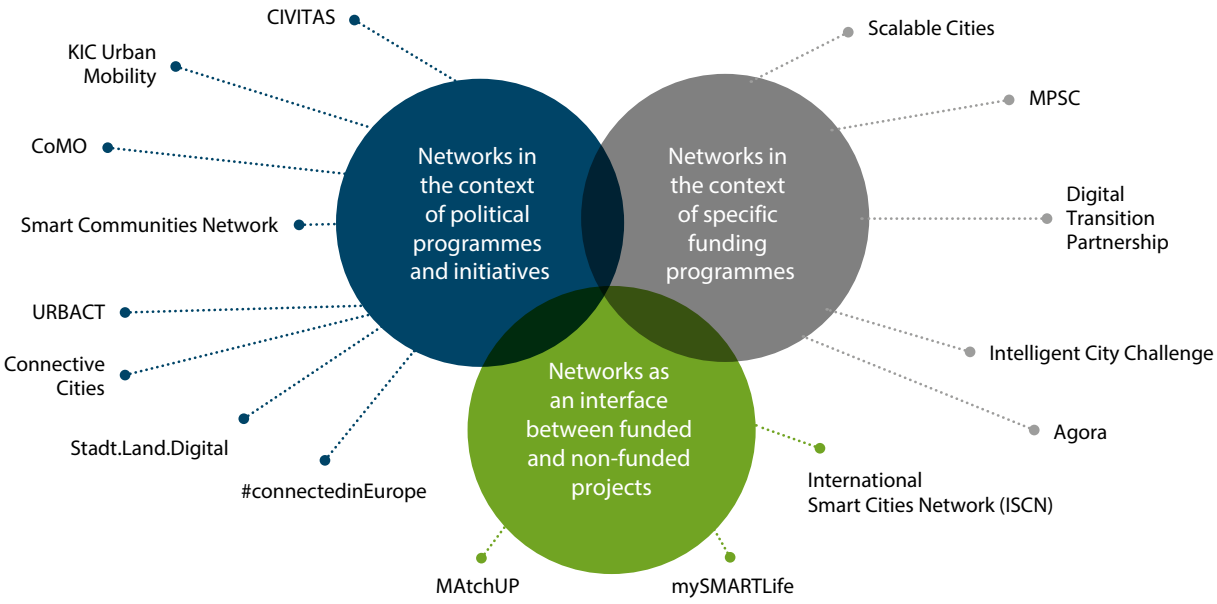
3.3 Initiatives, platforms, instruments

As a result of the twin transition i.e., the transformation towards a more sustainable and digital society, many municipalities are facing immense and often similar challenges in the development of digital solutions. Therefore, particularly in the past few years, they have been increasingly searching for opportunities to

exchange knowledge and experience across regional and national borders. The topics range from experience in the technical development of digital solutions and the development of suitable business and operator models to issues relating to the impact and evaluation of Smart City measures. In combination with increased political interest in urban and regional development issues, this has resulted in the emergence of a large number of different networks in the field of Smart Cities and digital transformation. In addition to pure exchange, they are incubators for new, shared projects and sometimes develop into resilient alliances beyond individual events (cf. Libbe/Lange 2023).

The networks differ in terms of organisation, structure and funding and can be divided into top-down and bottom-up networks (see ibid. for a detailed presentation of the individual networks, their objectives and key actors). **Top-down networks** are usually characterised by the fact that they are initiated at a higher level, for example by federal ministries or the COM. They implement political programmes, are developed as part of specific funding programmes to network the actors involved or serve as an interface between funded and non-funded projects (see Figure 3). What unites the networks is that they are generally time-limited due to their link to political programmes or funding programmes. One example is the "Smart Communities Network", which – initiated by the COM – is a Europe-wide community that supports municipalities in the early phases of the digital transformation by sharing knowledge and experience.

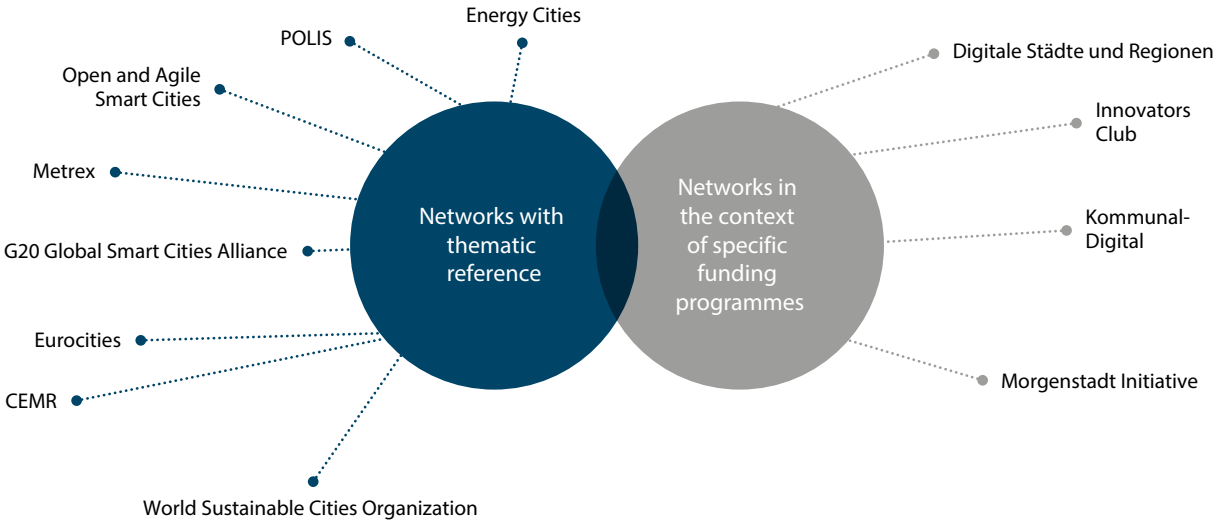
Figure 3
Overview of top-down networks



Source: BBSR based on Libbe/Lange 2023

Bottom-up networks emerge from already established, informal relationships. The pursuit of shared interests and goals is formalised in networks. This association of stakeholders makes it easier to represent interests and bundle resources in order to develop joint solutions. Bottom-up networks also arise in the context of funding programmes through the informal, voluntary exchange between individual funded projects (cf. Libbe/Lange 2023). This can result in alliances related to a specific topic, for example mobility, energy or climate adaptation, or in the context of an individual organisation (see Figure 4). In both cases, however, the focus is on the networking of different actors and technical exchange. An example of a bottom-up network is "living-in.eu", which was founded in 2021 by several other European networks and organisations and strengthens cooperation between municipalities at European level in the field of digitalisation.

Figure 4
Overview of bottom-up networks



Source: BBSR based on Libbe/Lange 2023

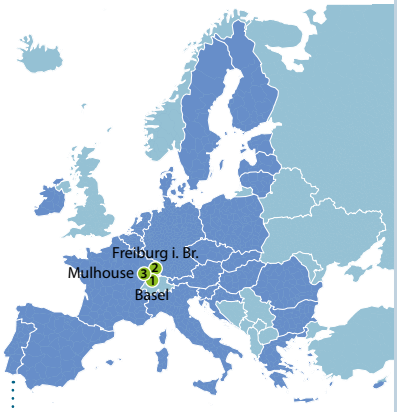
The content of the networks usually depends on the initiators and ranges from the exchange of experience in specific fields of action, for example "health" or "mobility", to the joint development of (Smart City) strategies. The activities realised in the networks are similarly diverse: In addition to regular and ad hoc meetings, joint workshops and conferences, further training measures are also offered, often in the form of peer-to-peer learning sessions and webinars (cf. Libbe/Lange 2023).

The project fits into this very dense network landscape as a top-down initiated project. It has set itself the goal of enabling German municipalities to network more intensively in the Smart City context at European level. To this end, the project focused in particular on peer learning sessions and specialist workshops to support municipal networking activities. The findings are presented in the following chapter.

City Partnership Basel – Freiburg – Mulhouse

Challenges in Urban Development

The cities of Basel, Freiburg and Mulhouse are located in the prosperous border triangle of the European Union. The close social, economic and political ties are particularly important for the region, which are reflected in commuter traffic and the cross-border movement of goods. Tourism plays an important role for all three municipalities, they are all confronted by the need to adapt to climate change and each is affected by a shortage of housing.



1 **Basel, Switzerland**
Population: 207,515
→ Smart City Strategy 2018

2 **Freiburg i. Br., Germany**
Population: 232,811
→ Smart City Strategy 2019

3 **Mulhouse, France**
Population: 108,038
→ Smart City Approach

Digital Projects and Solutions

All three municipalities have been focusing on smart city solutions in urban and regional development for some time and have adopted corresponding strategies. The handling, storage and utilisation of data is approached strategically. This also relates to the creation of data ecosystems.

As part of its current data strategy, Basel is working on a comprehensive data catalogue and improved preparation of open data, Freiburg is integrating its data sources and flows into its 'Daten:Raum:Freiburg', a platform of platforms, and Mulhouse is strengthening digital inclusion in the city through targeted surveys, programmes and opportunities for digital participation.

There has also been great progress in the area of sustainable urban planning. Freiburg, for example, has developed its own digital flat exchange. Basel recently set up a framework with its Smart City Lab as an interim application on the Wolf website, from which over 40 projects and start-ups have emerged. And Mulhouse has designated several focus areas that are being analysed for their climate impact and are being adapted accordingly. The municipality is also working on a digital twin for a transformed factory site.

Source: @ Didier Marti via Getty Images

Source: xbrchx via Getty Images

Source: Murat Taner via Getty Images

Results of the Cooperation

Basel, Freiburg and Mulhouse have always fostered cross-border cooperation in the field of urban and regional development to achieve political and strategic goals in areas such as mobility, the environment and the economy. Cooperation in the border triangle has now also been extended to the fields of smart cities and digitalisation.

> ***Basel-Freiburg-Mulhouse look back on a long history of cooperation in the tri-border area. It is this foundation that carries a pioneering project such as the cross-border data space - this was noticeable throughout the entire cooperation in #connectedinEurope.***
> *(Enoh Tabak, Project management)*

In several on-site workshops and additional online meetings, the participants learnt about the smart city activities of the individual cities. They developed a common understanding of the infrastructure of a cross-border data space and exchanged ideas on prioritised fields of action and use cases for cross-border data sharing. They also jointly outlined the structure for a longer-term project for a shared data space, the "Triregio Data Space". At the same time, the Swiss Federal Chancellery also began to support the project for individual areas of activity. The greatest successes of the cooperation can be summarised in three points:

- **Concept for a trinational data space:** As a result of the collaboration, a concept was developed for the establishment of a trinational data space. The aim is to create a jointly orchestrated infrastructure for the trusted exchange of data between the three cities of Basel, Freiburg and Mulhouse.
- **Consideration of the governance contexts:** The decentralised and heterogeneous governance landscape - specifically: three countries, different legal bases and requirements, officially appointed data protection officers in each country/canton - complicates the implementation of a common data space. The system concept developed in the project addresses these challenges, allocates areas of responsibility more precisely and brings together the different contexts.
- **Funding application:** The cooperation will now be transformed into a multi-year implementation project, for which funding applications have been prepared and will be submitted (e.g. Interreg).

The collaboration was particularly successful due to jointly defined key topics, a pioneering spirit and a high level of commitment and intrinsic motivation among all project participants. The external support for the development of a project application was financed by the municipalities themselves.

Insights for Other Municipalities

The cooperation between the three cities impressively demonstrates how European cities in border regions can extend their already established cooperation to smart city topics and jointly develop innovative solutions for specific use cases. The following lessons can be learnt from the cooperation:

- **Enable open-ended discussions:** An open-ended dialogue between project participants on possible smart city projects and use cases can be particularly fruitful and enables the development of tailor-made projects.
- **Iterations and varying scopes of the actors involved:** In the conception phase, iterations of discussion points and alternating constellations of actors (large and small groups, different sectors and departments) are helpful in identifying synergies and gaining an overview.
- **Neutral moderation synchronises complex constellations:** Even in a trusting constellation such as Basel, Freiburg and Mulhouse, neutral moderation can be helpful in reducing transaction costs, performing translation work and synchronising perspectives.

City Partnership Geestland – Vari-Voula-Vouliagmeni

Challenges in Urban Development

Geestland and Vari-Voula-Vouliagmeni face similar challenges: Both municipalities were created through the merger of several municipalities. They are large in terms of area but with relatively few inhabitants. In Geestland, the urban-rural divide means that the town has to deal with a shrinking retail sector, ensure healthcare provision and promote the strengthening of the community. Vari-Voula-Vouliagmeni has set itself the goal of becoming one of the most innovative, environmentally friendly cities in Europe as part of the "Intelligent Cities Challenge". Geestland also wants to position itself in the areas of sustainable mobility and the environment and is also focusing on participation.

1 **Geestland, Germany**
Population: 31,713
→ Smart City Strategy 2022

2 **Vari-Voula-Vouliagmeni, Greece**
Population: 52,546

Digital Projects and Solutions

Both municipalities are tackling their challenges with a variety of smart city projects. Important topics include citizen participation and digital citizen services. Geestland makes it possible for civil society to experience the smart city in a City Lab, sets up co-working and co-learning spaces and operates a participation bus, while in Vari-Voula-Vouliagmeni, municipal certificates are simply made available to citizens online.

Great progress has also been made in the area of sustainable mobility. Vari-Voula-Vouliagmeni has set up a city-wide e-car sharing scheme. Geestland not only offers a car-sharing service, but also a smart mobility hub.

In the smart environment field, Geestland can boast many different projects aimed at making the city more environmentally friendly. These include a biomass power plant with a digital twin and wind turbines for hydrogen production to create an autonomous urban supply network. Vari-Voula-Vouliagmeni is responding to its specific challenges with "zero waste" QR codes on bin bags that enable recycling to be tracked and rewarded, or the use of thermal imaging cameras and drones as a fire detection system to protect woodland areas.

Project Members of Geestland-VVV during their onsite meeting in Vari-Voula-Vouliagmeni

Source: Municipality of Vari-Voula-Vouliagmeni, Municipality of Geestland

Results of the Cooperation

Vari-Voula-Vouliagmeni and Geestland each contributed knowledge in areas in which the other municipality wanted to learn, for example in terms of technical expertise. On-site appointments were supplemented by instructive excursions. Geestland and Vari-Voula-Vouliagmenifocused on mobility, the environment and participation as part of the partnership, with the most important points being the following:

> ***We agreed on maintaining the exchange between our cities. Even though the exchange is going to be informal for the moment, we are not averse to a more formal partnership in the future. The ongoing topics of the partnership will be the use of LoRaWan and possible use cases for implementing drone technology in Geestland.***
> *(City of Geestland)*

- **Intelligent mobility:** Geestland presented its concept of a subsidised taxi service to complement public transport and the mobility hub with an integrated station for borrowing, charging and parking e-bikes. Inspired by the hub, Vari-Voula-Vouliagmeni developed an initial rough concept and examined possible locations for a smart mobility hub.
- **Intelligent environment:** Vari-Voula-Vouliagmeni contributed its experience in the use of drones to locate forest fires. In Geestland, drones can be used for delivery services, for example, if they are used in compliance with data protection regulations. Further areas of drone application in large-scale municipalities will be discussed in the future. In addition, both municipalities are working intensively on the implementation of LoRaWAN (Long Range Wide Area Network). Vari-Voula-Vouliagmeni has already installed the corresponding sensors and gateways and, among other things, will use them for smart waste management. In Geestland, an installation is being planned for the efficient management of energy consumption in public buildings. During the exchange, Vari-Voula-Vouliagmeni was able to pass on some practical knowledge to Geestland regarding the purchase and installation of the hardware.
- **Participation, citizen science and education:** The successful extracurricular Robotics Club for children and young people in Vari-Voula-Vouliagmeni, which has been expanded into the Robotics Academy "The Inventors", serves as a role model for Geestland. Specifically, two Greek supervisors visited a local secondary school and organised workshops with the pupils. The cooperation between the high schools will continue after the end of the the project.

The collaboration between Geestland and Vari-Voula-Vouliagmeni on digital urban development is to continue after the end of the project and result in a joint guideline for the implementation of LoRaWAN, which offers considerable potential for transfer to other municipalities.

Insights for Other Municipalities

The co-operation between Vari-Voula-Vouliagmeni and Geestland shows how European cities can learn from each other and jointly develop innovative solutions. The following lessons for successful town twinning can be learnt from the cooperation:

- **Secure political support:** Support from the political leadership of the local authority not only conveys the importance of cooperation to its own administration, but also strengthens cooperation with the partner town.
- **Strengthen personal contacts:** Good personal relationships between the people involved in the partnership have a positive effect on the intensity of the exchange and the motivation to participate.
- **Targeted public relations work:** Smart City tandems not only serve to transfer knowledge from one administration to another, but can also be used for broader public relations work.
- **Practical exchange:** A practical exchange on specific technological issues opens up the possibility of identifying and implementing cost-effective solutions (e.g. LoRaWAN solutions).

4 European cooperation in the digital, urban transformation – Findings

with significant contributions from Enoh Tabak and Sandra Schett

The project enables conclusions to be drawn about how municipalities in Europe can jointly master the necessary digital urban transformation and what synergies emerge in the process. The following chapter examines these findings.

4.1 Social and institutional innovations

The effectiveness potential of social and institutional innovations is often underestimated, but may be important as a complement to the technical improvement or innovation potential of Smart City developments, for instance by means of better data management, new sensor technology and measurement options or automation processes.

The project has repeatedly shown that – in addition to network meetings with many municipalities (see Chapter 2.2) – targeted networking with another city can be an incentive to initiate activities at European level and to obtain more detailed information. This is particularly relevant for medium-sized and small towns that have limited resources in terms of European networking and activities. By learning directly from a partner town with similar conditions, such municipalities can grasp new opportunities. One city which was able to benefit from this is Hamm, which received recommendations for topic-specific European networks and EU tenders through its bilateral exchange partner Arezzo. The low-threshold exchange between the cities opens up new opportunities that more formal information events are often unable to provide.

Another interesting aspect highlighted by the European networking project concerns city twinning schemes. Formalised twinning schemes often serve the purpose of political or cultural dialogue. A practice-orientated, technical exchange can add a new level and more flexible forms of cooperation to existing twinning schemes. In the best-case scenario, this can lead to joint projects and long-term cooperation. Following the project, the partnering municipalities of Geestland and Vari-Voula-Vouliagmeni as well as Hamm and Arezzo are considering a city twinning scheme in order to formalise the exchange and mark the binding nature of the cooperation. In the case of the Arnsberg and Alba Iulia partnership the joint activities are based on a city twinning scheme that has already existed for 50 years, which has characterised both the content and the design of the cooperation. It has revitalised the city twinning scheme within the framework of the project and supplemented the cultural exchange with cooperation on the topics of "Smart City" and "Climate Change".

In future, the municipalities expect more flexible, project-based cooperation with each other, as is often the case with digital topics and also within the framework of the project, and are therefore increasingly relying on networks for intermunicipal cooperation (see also Chapter 2.2). In addition to events – such as those offered and implemented in the project– higher-level networks, for example within the framework of the MPSC funding programme or city associations such

> ***"At 50 years of friendship between Alba Iulia and Arnsberg (established by an official partnership back in 1974), we commit ourselves, by signing a Memorandum, to continue our collaboration, our both smart city direction of development and to commonly fight against climate change in various common projects. […] Thus #connectedinEurope programme "upgraded" the existing partnership and took it to the level where we are talking about common open data platform and a possible future digital twinning.***
> *(Alba Iulia representative)*

as Eurocities, can therefore generate a basic trust that is otherwise often only gained from long-standing bilateral city twinning schemes. Building on this, specific activities can be established such as the short-term and spontaneous sharing of code bits, software solutions, templates for tender documents, joint tenders or subsequent uses.

4.2 Digital twins

Different strategic paradigms and cloud infrastructures for the development of urban digital twins are technically compatible, meaning that joint developments and solution transfers are possible in some areas despite different strategies.

In particular, the cooperation between Utrecht and Munich has shown that the two digital twins and their rendered data are fundamentally technically compatible despite different principles and strategies with regard to digital infrastructures. While Utrecht and the Netherlands in general tend to use commercial SaaS (software as a service) approaches and public-private partnerships for implementation, Munich and Germany rather rely on digital sovereignty approaches and internal developments. These different approaches are also continued in the handling of data, some of which is sensitive, and the identity management for access to the digital twins. Utrecht decided early on in the process to open the twin by making it available in a browser interface in the hope that this will not only encourage participation by civil society, but also application proposals and explorations by companies and start-ups. Munich, on the other hand – like many other municipalities in Germany – is initially pursuing an internal development programme with its specialist departments. The digital twin should therefore initially prove itself for specialised processes. The opportunities for public participation are event-driven. At the same time, open interaction with 2D geodata and the use of specialised maps has already been established for some time, for example through the master portal or with the digital participation system DIPAS.

In principle, for both sides the question arises to what extent the aim should be a build-up of expertise within the city administration. For some specialised processes, the aim is to achieve comprehensive capability for working and controlling with the digital twin, for example in early construction planning. For very computationally and data-intensive simulations, on the other hand, in some cases it seemed more obvious to the cities to award contracts to companies and start-ups.

The exchange between the two cities also highlighted the particular potential of a more supportive role for higher levels of governance in the development of digital twins. Dutch cities, for example, can already easily access a nationwide building register and many other data via the public platform "PDOK". Many German municipalities also found this very helpful when developing their solutions. The BMWSB's "Smart Cities Model Projects" funding programme has created an ecosystem of smart cities at federal level that facilitates the transfer of knowledge between municipalities.

4.3 Implementation LoRaWAN

Despite all the differences, local knowledge can also be applied in other EU municipalities. This can be seen, for example, in the Geestland-Vari-Voula-Vouliagmeni partnership, which intensively discussed the topic of LoRaWAN (Long Range Wide Area Network), questions of network expansion and possible areas of application. In the context of technology-orientated urban development, many municipalities are increasingly relying on LoRaWAN for the energy-efficient networking of IoT devices. This technology makes it possible to fully utilise the diverse potential of sensors and expand their range of applications in various areas.

Vari-Voula-Vouliagmeni was able to pass on numerous experiences with LoRaWAN to its partner city. One of the key findings from this exchange was the importance of local knowledge and in-house expertise. Although the installation of gateways is often carried out through tendering, it is crucial to have a permanent contact person within the municipality. This ensures that the installation corresponds to the local conditions and is tailored to the specific use cases.

It was also found that focusing on specific problems and their solutions contributes significantly to the success of such measures. In Vari-Voula-Vouliagmeni, the technology will be used in future to increase the efficiency of waste disposal. This is to be achieved by using fill level sensors and optimising route planning. Geestland, on the other hand, is planning to use the sensors to optimise energy consumption in public buildings. In both cases, the optimum positioning of the sensors is of central importance in order to achieve the best possible results. In addition, the question of the maturity of the applications was also discussed as part of the cooperation between the cities. Ideally, the applications should result in a dashboard that visualises and analyses the collected data. This could enable automated decision-making, such as determining waste disposal routes or regulating heating in public buildings.

Overall, the exchange between the two municipalities showed that the practical examination of specific tenders not only helps to increase transparency, but also opens up the possibility of identifying and implementing more cost-effective solutions. In addition, a structured and open exchange, such as the one between Geestland and Vari-Voula-Vouliagmeni on the technical requirements and specifications of the use cases, creates a better information basis for making well-founded decisions and exploiting synergies. It became clear that particularly the basic infrastructures for LoRaWAN can also be implemented cost-effectively by smaller municipalities, as the installation and operating costs are relatively low.

> ***Thanks to the knowledge exchange and the expertise of our tandem partner Vari-Voula-Vouliagmeni, we were able to get new insights on the topic of LoRaWan and evaluate new future use cases for modern technologies, such as drones.***
> *(Geestland representative)*

4.4 Open data, data sharing and data spaces

"Open data" is often still rooted in the idea of unidirectional and unidimensional publication and provision. Other development paths point to better curating and presenting open data (e.g. by means of visual communication). This also includes stronger cross-references to twin cities or like-minded actors. There is also great potential in the better linking of open data on a semantic level and in stronger interaction options with the open data.

Open data is increasingly becoming established and the amount of available data is constantly increasing, albeit at different speeds. At the same time, for large sections of the population, the provision of open data is not easily accessible and understandable. There is a lot of room for narrative support for data provision. Furthermore, the connection of open data as "linked open data" is often still a blank space, as is the curated and interrelated processing. To the authors' knowledge, there is no case of city-city referencing of open datasets on municipal open data platforms. Only the city's own data is provided or referred to higher aggregation levels.

In this respect, the project approach of Arnsberg and Alba Iulia is an innovation that adds digital aspects to the still very analogue framework of town twinning: Both cities would like to reference open datasets of their twin on their own platform and thus make the respective twin city digitally accessible to citizens.

During the programme, Implementing Regulation (EU) 2023/138 on the definition of certain high-value datasets (HVD) and the modalities of their publication and re-use entered into force. The discussions and workshops organised by the network revealed that in many municipal administrations there are still no clear

and unambiguous responsibilities that would make implementation efficient and effective. At the same time, the implementing regulation was perceived as an opportunity and additional argument to motivate internal administrative bodies to share data across departments.

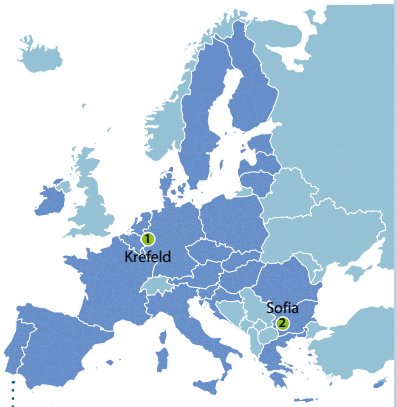
The sharing of data beyond individual organisations has also gained in importance during the project period and has particularly shaped the exchange of the trilateral partnership between Freiburg, Basel and Mulhouse. It became clear that the generation of ideas and development of data spaces must be driven forward by the municipality and its specialist departments as well as the "market" and stakeholders in urban society, including companies, universities, start-ups and citizens. While it is true that municipalities are suitable actors for initiating cross-border projects due to their important coordination function, the creation of a collection of use cases for the cross-border data space between Basel, Freiburg and Mulhouse has shown that this only makes sense in cooperation.

In this sense, setting up a data space can follow two development paths. In the supply-related development path, the cities, as first movers directly oriented towards the common good, provide a number of datasets in data spaces, the existence of which induces the creation of use cases on the part of the users of the data space – analogous to window shopping. Only if start-ups, for example, know what data is available for sharing in the catalogue, they can develop use cases and offers on this basis. At best, this approach is based on a systematic cataloguing of the data available in the city or municipal administration. However, complete data catalogues of this kind are still rare. As a workaround, data can also be entered into the data space in a semi-structured and iterative manner (see also Chapter 5.4). Under a needs-based development path, specific use cases are pre-formulated by specialist departments or other stakeholders, which then motivate the provision of corresponding data in the data space. This means that the specific need for a use case triggers the search for corresponding data records. This increases the chance that they will actually be made available in the data room, as the added value is clear from the outset. The challenges with this approach are that some needs and ideas may not be expressed, either because it is not assumed that the relevant data is available or because the request and disclosure are perceived as being too complicated.

City Partnership Krefeld – Sofia

Challenges in Urban Development

Krefeld and Sofia have different starting conditions: while Krefeld, neighbouring the metropolitan Ruhr area, has a long tradition as industrial site still undergoing structural transformation, Sofia is both the capital and largest city of Bulgaria and destination of domestic migration. Both its eventful past and its political significance have left their mark on the city. Nevertheless, sustainability (e.g. in the area of mobility) and strengthening the cities as economic locations are focal points in their respective urban development policies. For both aspects, digitalisation is expected to make a key contribution.



1 **Krefeld, Germany**
Population: 228,550
→ Smart City Strategy 2023

2 **Sofia, Bulgaria**
Population: 1,286,965

Digital Projects and Solutions

Sofia's tagline is "Tech City of the Future". Accordingly, the city actively promotes digital transformation. Central topics are data governance, participation (e.g. in the form of innovation labs for children), and various pilot projects such as the "Sandbox for Innovative Solutions". The latter supports scalable smart city projects from business and civil society organisations. Sofia aims at becoming a test bed for innovative products and services.

Krefeld, is also very active and has developed the smart city strategy "SMARTKREFELD: for all – liveable – connected" in a co-creative process. The city is implementing a series of smart city projects in all relevant fields of action, such as the digitalisation of administration, the implementation of a digital twin, the expansion of digital education and support for start-ups. Together with the neighbouring city of Mönchengladbach, they have also established a data ethics board.

Both Sofia and Krefeld have similar organisational units at the intersection between smart city and economic development: "KREFELD BUSINESS" – as the head organisation of smart city and economic development – and "Innovative Sofia". In addition, Sofia has a Digital Board, acting as a supervising committee, and the Sofia Development Association.

Night view of Linn Castle in Krefeld Source: City of Krefeld

Source: Sergio Formoso via Getty Images

Results of the Cooperation

The exchange between Krefeld and Sofia concerned various topics, such as data governance, civil society engagement, participation and cooperation, and smart city pilot projects. The exchange partnership organised several virtual and on-site meetings. Here, the preparation of these meetings through third parties proved useful for the cooperation, both in terms of organisation and content.

> ***Learning about the shared structures and challenges between Krefeld and Sofia underlined how similar Smart City efforts truly are. European cities share both a responsibility and an opportunity to drive and steer digital transformation at the local level.***
> *(Krefeld representative)*

There was great potential for both cities to learn from each other. Sofia, for example, was interested in topics such as enhancing digital competences, data ethics and data security. Krefeld, in turn, was interested in understanding how Sofia promoted its communication on smart city topics, how it structured digital participation and implemented pilot projects.

There was an intensive exchange on collaborative problem solving and agile cooperation with the local environment, focusing on Sofia's "Sandbox for Innovation Solutions". The goals of this approach were promising and included developing the city as a test area for innovations and fostering the support of collaboration with local businesses such tech start-ups and small and medium-sized enterprises. Inspired by this approach, Krefeld developed the idea of an "Urban Challenges Platform", which was intended to gather tailored smart city solutions from civil society, local businesses and other actors and to connect these ideas with an ensuing procurement process.

Despite these potentials, the exchange partnership faced several challenges. For example, the change of project participants resulted in several delays. In the end, a lack of resources on the part of Sofia resulted in the mutual decision to end the collaboration mid-term. Krefeld, thus focused its remaining time in the project on exchanges with other cities from the project, particularly Utrecht and Munich. Krefeld also invested in networking activities with its Dutch neighbour, Venlo.

Insights for other municipalities

The Sofia-Krefeld exchange was an impressive demonstration of how European municipalities can learn from each other in the field of smart cities, despite their differing conditions in terms of size and political and economic importance. Having similar approaches and interests in digital urban development helps to make the exchange fruitful. The invitation of experts to the on-site meetings was also beneficial. Overall, experience from this partnership lead to the following insights:

- **Make added value visible:** The motivation to participate in a city partnership increases if participants can see added value for their own work, by developing a project outline, for example.
- **Personnel resources are critical:** The partnership can be successful if municipalities provide adequate personnel resources. Additionally, it is important to ensure continuity of personnel.
- **Demonstrate and use potential for replication:** The discussed methodology of proposing evidence-based and scalable pilot projects of the local business community to solve urban challenges offers particular potential for replication by other European cities. Being open to other exchange partners during the exchange partnership can strengthen network effects.

5 Citizen-centric Smart Cities: Advancing Participatory Problem Solving

by Markus Lewitzki, City of Krefeld

5.1 Thoughts and experiences from a #connectedinEurope-tandem

Europe is currently experiencing a period of poly-crisis, wherein political and administrative systems are confronted with relentless challenges on multiple fronts simultaneously. The array of issues facing municipalities may appear overwhelmingly vast, compounded by budget constraints. Among the most critical tasks is the transformation of urban and rural systems to address climate change, requiring both CO2 mitigation and adaptation to fluctuating conditions of heat, drought, and water excess. This transformation must be achieved while maintaining, if not enhancing, the current level of service to local residents. Additionally, demographic changes present further challenges.

In these circumstances, the journey towards "data-driven smart sustainable cities of the future" (Bibri 2021) is not a straightforward path but rather a narrow passage through a dense jungle of challenges. Navigating this complex terrain seems impossible without leveraging all available local capacities—a trend that has already been observed: The rigid distinction between public and private sectors is dissolving for some time, giving rise to intersectoral governance as the management paradigm of the moment. As noted by DHBW (2024), "the government, in its independent role, cannot master these challenges alone, nor can the business sector or civil society assume this task solely. These challenges require communication and collaboration on a new level."

The municipal area is particularly significant in this collaborative view due to its close interactions between various sectors within a comparatively small geographical space. The public spaces in our cities are shaped by numerous challenges, yet they also provide opportunities to negotiate and implement solutions. These spaces are part of a legacy system, formed in response to past challenges and solidified in local institutions and networks. In the context of European smart cities, there is no "blank slate" in an untouched environment to construct a future city from scratch. Instead, we must, or rather, we are fortunate to, work with the existing resources and population within the city.

Furthermore, the challenges and technological disruptions characteristic of the digital transformation era do not adhere to national borders, making international cooperation imperative in efficiently tackling these challenges. Beyond international and national governance, the regional framework of the European Union and the existing connections between European cities provide an ideal foundation for initiating more intensive cooperation in the area of smart cities. This framework also facilitates the search for overarching elements that could define the European approach to municipal digital transformation.

In the most recent paper by the Smart City Standards Forum of the German standardization organization DIN, Krefeld contributed insights gained from this project and other European (and international) collaborations on smart city concepts. One passage emphasizes the idea of structural commonalities between smart cities:

> ***"The international discourse on the climate-friendly smart city has led to a noticeable uniformity of topics (sustainability goals, resilience), methods (agile, collaborative, cross-silo), and techniques (sensing, urban data platforms, automation) in various areas of government, especially in municipal governance. The similarities of smart city efforts around the world are striking. We find uniformity in terms of efficiency, calculability, standardization: To call this a momentum of a "McDonaldization" of urban management, would (still) be going too far. Nevertheless, this tendency toward urban harmonization, which can be explained against the backdrop of the global challenges of climate change that have a similar effect locally, not only offers enormous potential for standardization, but is also an imperative to actually leverage the efficiency potential of 'one for all' in the area of digital systems. The basic structures of digital systems should be planned from the outset with the aim of interoperability"***
> *(DIN e.V. 2023: 22)*

In addition to the global development, the question arises: What can be said about the governance of European smart cities – does a strong connection between 'smart' and 'participatory' exist across Europe? How do cities deal with integrating issues raised by citizens and ideas offered by them against the backdrop of smart city? Are there similarities in new structures or processes?

Based on the project and the interactions within the smart city tandem Krefeld – Sofia, this article names some elements of citizen participation and innovation as possible common denominators for smart cities across Europe.

5.2 Examples for Participatory Smart Cities

In the course of the different meetings between Krefeld and Sofia, we focused on the challenge of "participatory idea creation and engagement management" in smart cities. And looking into other European smart cities, it seems to be common to put effort on participatory elements:

- As part of the national funding program "Model Projects Smart Cities" Germany, the "Connected Urban Twins" project develops digital twins for urban development in cooperation between Munich, Hamburg and Leipzig. The goal is to digitally map cities and enable what-if scenarios for liveable and sustainable cities. Core to the project is to usefully supplement analogue instruments for the participation of the urban society with new digital forms of cooperation. The aim is to reach a broader range of target groups. For example, the transparent presentation of urban geodata using 3D (visualisation of dimensions, heights and materials) and AR as a basis for citizen participation should increase understanding of complex urban changes.

  In the context of the German funding programme "Model Projects Smart Cities", a variety of participatory measures and tools are tested and implemented in German smart cities.

- Another approach to increased citizen participation in (smart) city development is the combination of analogue and digital participation processes and tools. One exemplary case can be found in Terrassa, Spain. The municipality has successfully launched its online participation platform "Participa a Terrassa" which enlists all projects and processes in which citizens can become involved, ranging from inputs to strategy documents such as the city's mobility plan for 2026-2031 to the specific redesign of city quarters. The platform is one tool to engage citizens in important decisions, accompanied by on-site working groups, advisory and municipal councils. With nearly 50.000 participants, the platform has attracted considerable attention among the citizenry.

- The City of Vienna has "committed to opening up administrative processes and introducing innovative measures for democracy that are geared to the citizens' own needs and ideas" (City of Vienna n.d.a). This strong focus on citizen participation and bringing citizens into co-creation processes also applies for the "Smart Climate City Vienna Strategy" (City of Vienna n.d.).

- In Denmark, e.g. in the capital of Copenhagen, there was and is a strong emphasis on citizen participation when it comes to smart city developments (Yasuoka 2023). There were also experiments with "Citizen Sensing", as inhabitants were equipped with sensors Hviid Trier/Jenkins 2020).

- In the Dutch City of Utrecht exists a project "Measuring together" ("Samen Meten Utrecht") (Samen Meten Utrecht n.d.). More than 100 inhabitants measured temperature, humidity and heat stress in the summer of 2024.

5.3 Smart Cities as Collaborative Cities: What do we know from research?

These examples and many more examples to be found make clear: Many European smart cities are developed in a participatory, co-creative manner – at least this claim is often made in smart city strategies. However, "good participation" is easier said than done, as research shows (Engelbert et al. 2019).

First, there is still the challenge of not limiting social participation and inclusion to social groups that are already digitally proficient (e.g. Mariën/Prodnik 2014; Cardullo 2020) or restricting participation to predefined goals and projects (Bauriedl 2018; Engelberta et al. 2019). Conventional participation procedures tend to mobilize only the more affluent segments of the population. Thus, better-off groups of people with higher formal educational qualifications, higher incomes and flexible time budgets are clearly overrepresented in municipal participation processes (Selle 2017: 19f.). At the same time, groups with lower digital literacy are increasingly marginalized in digital urban transformation, limiting their ability to utilize municipal digital services and participation tools (Schüle et al. 2021).

Cardullo and Kitchin (2019) present a systematic typification of forms and levels of participation in a smart city using the Irish City of Dublin as an example. Here, at least two perspectives on municipalities and citizens are to be distinguished:

- Participation and inclusion in particular include options for gaining access to information. In this context, "participation" describes the possibility of being able to fully make use of local data and digital information services. Three municipal approaches can be identified: access to public digital data, information provision via digital screens, and direct information provision via citizen apps. Cardullo and Kitchin call this form of participation "tokenism" (information/recipient).

- A more active role for citizens is opened up through direct participation in urban development projects. This includes participation in digital planning processes. In Cardullo and Kitchin's system, this can be either categorised as "tokenism" (consultation/tester) or as "citizen power" (partnership/co-creator), depending on the participatory design.

5.4 Aspects of participation and innovation to derive from the #connectedinEurope-project

How was participation and (civic) innovation discussed in the project "Connected in Europe"? What administrative elements and processes are witnessed in the (European) municipal reality when it comes to participation and innovation and in which way could these forms of participation be structured?

The following observations result from talks between representatives of the City of Krefeld and the City of Sofia and additional sources. This might deliver ideas to further develop and amend the academic typification of forms and levels of participation.

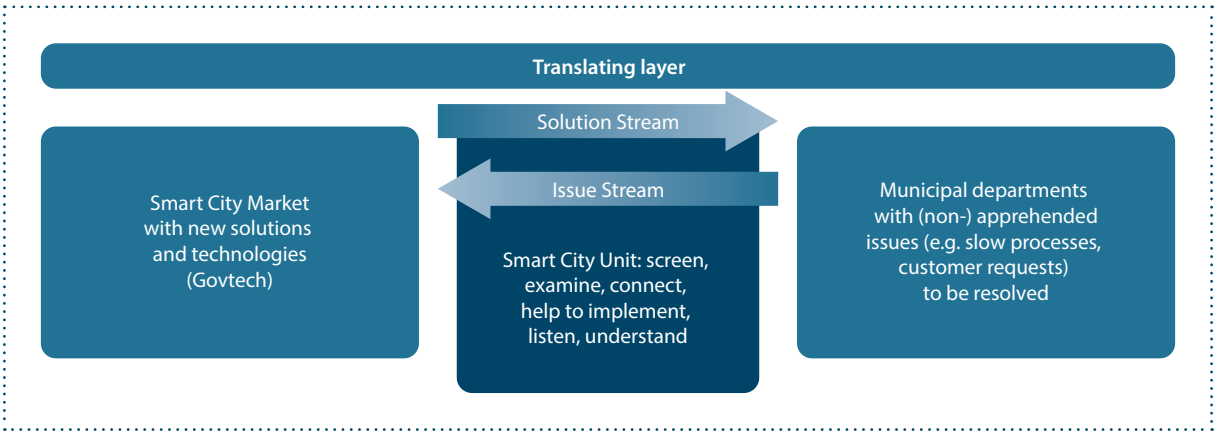
Aspect 1: Streams of issues and solutions meeting locally

First of all, there seems to be a common development all over Europe that is driven by global technology trends (e.g. IoT, AI) and builds a background for local actors: The enormous influx of new technological solutions being offered within the Government-Technology (GovTech) market. GovTech has emerged as one of the fastest-growing industries in Europe (Codagnone 2024). It presents a significant opportunity for finding innovative solutions to integrate into local administrative processes. However, this also poses a substantial challenge: sorting through the vast array of solutions to identify those that genuinely address and really solve locally felt issues. Therefore, it is important to differentiate between local issues and (bigger than local) ideas/solutions – these don't always naturally match. As these areas continuously change, this paper addresses them as "streams". For the challenge of issue tracking and agenda setting, citizens do recognize and are able to raise awareness for many issues in their local environment – and are therefore our most important asset in the strive for citizen-centric smart city development.

Interestingly, both the cities of Krefeld and Sofia independently built new forms of administrative structures that aim to streamline the check and possible adaptation of market-based solutions and citizen-driven ideas. For example, the City of Sofia established a "Digitalization, Innovation and Economic Development department" (Sofia Municipality 2020) and Krefeld integrates its smart city efforts in a unit for "Economy, Digital Transformation and International Relations". Both departments were established in 2020.

Many local governments have established forms of these "innovation units", i.e. smart city units (see figure 5). These units seem to serve as a vital "translating layer" between internal expertise and external ideas. Their task

Figure 5
Two-way-stream of smart city solutions



Source: Markus Lewitzki, Stadt Krefeld

is to match the ongoing issue stream within the organization with the (digital) solution stream emerging from outside, whether from businesses, tech startups, or citizen initiatives. By acting as intermediaries, these units are tasked to facilitate the integration of external innovations into local governance structures, ensuring that solutions are both relevant and feasible. This administrative integration of (civic) innovation is often further developed than in classical forms of citizen participation, as there are stronger elements of co-creation and collaboration. Further, the topics addressed go beyond classical questions of urban planning (see Aspect 2).

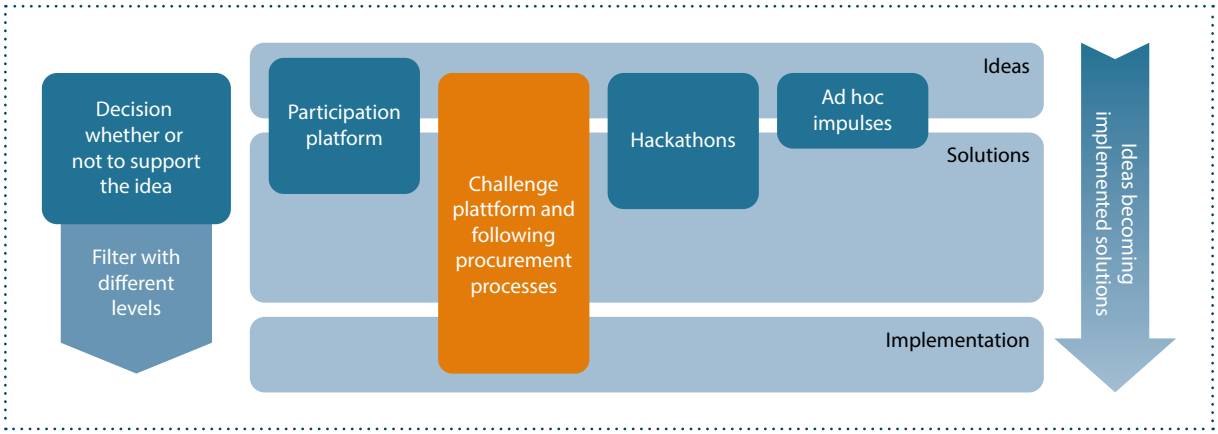
Aspect 2: From issue to solution implementation – structuring the process

Cities must strategically identify and implement the most effective ideas to enhance public service delivery. The first step in this process is incentivizing and expanding the pool of solutions from citizens, businesses, and external innovators. Encouraging an open flow of ideas fosters a culture of collaboration and innovation, tapping into a wide range of potential solutions. Cities can collect ideas through various platforms, such as participation portals, hackathons, challenge platforms, and events. These methods generate a spectrum of ideas - from conceptual proposals to concrete, actionable solutions.

Once ideas are collected, they need to be matched with local challenges and capacities (see figure 6). Not all ideas will be applicable or feasible given the city's resources and infrastructure, so a filtering process is necessary, which might be implemented within the innovation unit. This mechanism should help decision-makers objectively assess which ideas have the highest potential for impact and align with the city's strategic goals. Criteria such as scalability, cost-effectiveness, and sustainability can guide this evaluation. While some ideas remain at the conceptual stage, others may make it through the filtering process to implementation, either by the city or through partnerships with external entities.

Ultimately, the success of citizen-driven innovation relies on a transparent, efficient filtering process that ensures the most promising solutions are prioritized for action. This builds trust among citizens and maximizes the potential impact on public services. Here, Sofia has a proposal selection mechanism and a sandbox system in place that might be of interest for other cities (Sofia Municipality 2021).

Figure 6
Identifying the best suited ideas



Source: Markus Lewitzki, Stadt Krefeld

Aspect 3: Forms of participation in the current municipal reality

There are various ways to categorize the impending changes in cooperation and collaboration. The following proposal for differentiating forms of participation is derived from municipal practice (see table 2). It is organized around various forms of participation specifically used in smart city development and might amend the differentiation developed by Cardullo and Kitchin (2019).

Table 2
Forms of participation in the current municipal reality

Form of Participation	Description	Key Characteristics	Examples	Primary Stakeholders
Participation in urban development	Identifying optimal solutions for urban planning that strengthen political and citizen majority support	▪ Inclusive decisionmaking ▪ Use of participation platforms ▪ Offline discussions ▪ focus on spatial topics	▪ Town hall meetings ▪ Online voting platforms ▪ e.g. "Participation Platform Northrine Westphalia"	▪ Citizens ▪ Local government officials ▪ interest groups
Event-/policy-oriented cooperation and collaboration	Developing ideas/ solutions for specific questions through targeted events	▪ Focused on specific issues ▪ Time-bound events ▪ Collaborative environment	▪ Hackathons e.g. "KReate Future" or KReathon ▪ Innovation challenges	▪ Tech enthusiasts ▪ Developers ▪ Problem solvers
Unsolicited solutions	Citizens offering (IT) solutions for societal or public issues without prior solicitation	▪ Voluntary contributions ▪ Immediate problem-solving ▪ Proactive approach	▪ Community-driven apps ▪ (e.g. "MeetGiveGet") ▪ Open-source projects	▪ IT professionals ▪ Civic hackers
Issue-oriented agile formal cooperation	Seeking assistance from communities to identify Minimum Viable Product (MVP) solutions	▪ Agile methodology ▪ Small contracts ▪ Collaboration with start-ups and / or local experts	▪ Pilot projects ▪ Co-Development ▪ Minimum Viable Product (MVP) development ▪ (e.g. "Eventhub")	▪ Start-ups ▪ Local experts ▪ Municipal authorities
Data-driven engagement	Utilizing open data to facilitate machine-readable participation in issue tracking and development ideas	▪ Open data access ▪ Data transparency ▪ Machine-readable formats	▪ Open data portals ▪ Data hackathons	▪ Data scientists ▪ Civic tech communities
Citizen science and data donations	Encouraging public involvement in scientific research and the donation of data for communal benefit	▪ Public participation in research ▪ Data contribution ▪ Community-driven initiatives	▪ Environmental monitoring ▪ (e.g. "Cycling Sensors" in Krefeld) ▪ Health data collection	▪ Citizens ▪ Researchers ▪ Non-profits

Source: Markus Lewitzki, Stadt Krefeld

5.5 Conclusion

This article implicates some assumptions on how to address the extensive array of municipal challenges mentioned at the beginning:

1. The demand for effective and efficient solutions to urban issues is continuously increasing. We must recognize that the complex and interconnected major challenges of our time need new approaches to work within and between organizations, as well as with citizens and companies.

2. As the complexity and number of issues rise, it is essential to incorporate citizen-driven issue tracking and solution proposals. To avoid being overwhelmed by ideas, it is crucial to identify and implement viable solutions for genuine issues.

This article provides evidence supporting the existence of a potential fundamental building block for (European) smart cities through the incorporation of newly-rising and mainly technology-driven participatory elements. This could contribute to advancing the discourse on inter-municipal cooperation in Europe: Not only smart city solutions as such might be transferable, but also ways of generating locally fitting solutions through participatory processes such as events.

The proposed framework for structuring these phenomena should lead to: a) increased scientific research into these forms of participation to foster the analysis of real-life participation processes, and b) the pursuit of potential universal software solutions for managing participatory processes. For instance, the federal state of North Rhine-Westphalia, Germany, offers all its municipalities free membership in a central participation platform to reduce implementation costs in cities. What could open-source european software solutions for participatory processes look like?

However, it is crucial to acknowledge that significant work remains to be done at the local level to fully realize the potential of these participatory elements. Local governments must invest in building the necessary infrastructure and fostering a culture of participation among citizens. This includes providing education and training to both municipal staff and the public to ensure effective engagement and utilization of participatory platforms and processes. Additionally, local authorities need to address potential barriers such as digital divide issues, ensuring that all citizens have equal access to these participatory tools.

In sum, the success of these initiatives heavily relies on the willingness and ability of local governments to adapt and integrate these new participatory elements into their existing governance structures. This may require revising local policies, reallocating resources, and establishing new partnerships with various stakeholders, including private sector entities and non-governmental organizations. By addressing these challenges at the local level, European cities can create a more inclusive and collaborative environment, ultimately leading to more effective and sustainable urban development.

6 Summary and outlook

The national implementation of European directives and funding instruments in the EU member states as well as technological developments, for example in the field of artificial intelligence, play an important role in developments relating to the "Digital Europe" programme. Enabling the implementation of sustainable, digital urban development in EU member states and empowering the local level across the EU to drive forward the digital transformation in terms of integrated urban development require an inter-municipal exchange across borders. In addition to the transfer of knowledge on innovative and best practices in digital urban development in other European countries, the network offers stable partnerships, peer-to-peer advice and opportunities for specialist exchange on replicable projects. It can also form the basis for joint applications to EU funding programmes.

The experiences from the project provide valuable impetus for future projects in the field of European municipal cooperation and smart cities. The dynamic developments at EU level illustrate the many points of contact for municipalities and the importance of cross-border cooperation. There is already a wide range of initiatives, networks and projects that can serve as valuable resources for German municipalities. However, despite numerous positive effects, the utilisation of these resources is not a matter of course for municipalities: Personnel, financial and time bottlenecks, staff discontinuities and political resistance can be some of the reasons that make successful cooperation between municipalities in Europe more difficult. In order to fully utilise their potential, it is necessary to support the municipalities with cross-cutting events that are not only thematically interesting, but also promote networking among them. The selection of topics for such events should be closely oriented to the needs of the municipalities in order to ensure commitment, but also to facilitate the implementation of ideas and measures on site.

In addition to financial and thematic support, there are other aspects that future funding and networking programmes can take into greater consideration:

- **Political support** is important for the success of all networking efforts. The occasional presence of the mayor can emphasise this. Existing town twinning programmes are helpful in obtaining political support.

- **Organisational support** is a decisive success factor for municipal cooperation. This includes the organisation, support and follow-up of exchange appointments by a programme coordinator. On the one hand, many municipalities lack the resources to orchestrate the at times complex coordination processes themselves. On the other hand, the use of external moderation allows municipalities to concentrate on the agreed upon content and specific goals can be set and recorded. At least at the beginning, but also in the long term, this type of support contributes to the success of Smart City cooperation between European municipalities.

Furthermore, the project has made it clear that municipalities across Europe are facing very similar challenges, but are developing different approaches to solutions. An intensive exchange of knowledge and experience is therefore crucial in order to accelerate the achievement of common goals. The exchange of specific technical solutions is also possible. The EU offers a common framework for this, which makes it easier to deal with different legal frameworks. The development of shared infrastructures is therefore not only necessary, but also feasible – also across national borders. There is therefore a continued need for targeted support for the participation of German municipalities in joint European digital infrastructures. Approaches to creating improved framework conditions for German municipalities to participate in European Smart City initiatives should focus on the following aspects:

- **Strengthening strategic participation in European discourses:** The field of digital urban transformation in Germany is largely characterised by developments at European level. It is crucial that Germany becomes more present and strategically involved in the relevant discourses at European level. Conversely, this also applies to the communication and publication of German Smart City developments at European level.

- **Strengthen accessibility to concrete solutions:** In addition to networking, it is clear that municipalities across Europe are facing similar challenges. In addition to the exchange of knowledge and experience, it therefore seems necessary to make concrete solutions available throughout the EU so that small and medium-sized municipalities in particular can benefit from existing successes. Here, the German approach of making publicly funded Smart City measures available as open source software can serve as a good example of sustainable and efficient re-use.

- **Strengthening the participation of small and medium-sized municipalities in European initiatives:** The relevance of developments at European level for the field of digital urban transformation is not necessarily reflected in the actions of small and medium-sized municipalities in Germany. Against this background, further promotion of networking and information events is relevant, for example in cooperation with municipal umbrella organisations. It is also important to provide well-prepared information material in a targeted manner.

In future, programmes should also be initiated to actively promote and support municipal networking in the EU. Furthermore, the resulting partnerships and cooperation should be stabilised in order to enable municipalities to address the long-term challenges of digital urban transformation in terms of integrated, sustainable urban and regional development.

Bibliography

Bauriedl, S., 2018: Smart-City-Experimente: Normierungseffekte in Reallaboren. In: Bauriedl, S.; Strüver, A. (Eds.): Smart City. Kritische Perspektiven auf die Digitalisierung in Städten. Bielefeld: 87–98.

BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung (Ed.), 2017: Webbasierte Medien in der Stadtentwicklung: Bürgerbeteiligung und Bürgerengagement in der digitalen Gesellschaft. BBSR-Online-Publikation 28/2017. Bonn. Access: https://www.bbsr.bund.de/BBSR/DE/veroeffentlichungen/bbsr-online/2017/bbsr-online-28-2017-dl.pdf;jsessionid=4C2D6553EDCFEA89C8030ACE8FF3D2B5.live21322?__blob=publicationFile&v=1 [retrieved on 07.07.2024].

Bibri, S., 2021: Data-driven smart sustainable cities of the future: An evidence synthesis approach to a comprehensive state-of-the-art literature review. Sustainable Futures 3: 100047. htttps://doi.org/10.1016/j.sftr.2021.100047.

BMI – Bundesministerium des Innern, für Bau und Heimat (Ed.), 2019: Europäische Vernetzung - ein Treiber für die Entwicklung vor Ort. Ideen und Ansätze für COMmunen, wie europäische Vernetzung gelingen kann. MORO Praxis 14. Berlin.

Cardullo, P., 2020: Citizens in the ‚Smart City". Participation, Co-production, Governance. London.

Cardullo, P.; Kitchin, R., 2019: Being a ‚Citizen" in the Smart City: Up and Down the Scaffold of Citizen Participation in Dublin, Ireland. GeoJournal, 84. Jg. (1): 1–13.

Codagnone, J., 2024: GovTech Momentum: Revolutionizing Public Administration. Access: https://interoperable-europe.ec.europa.eu/collection/govtechconnect/news/key-drivers-govtech-growth [retrieved on 26.03.2025].

DHBW – Duale Hochschule Baden-Württemberg, 2024: Intersectoral School of Governance Baden-Württemberg. Access: https://www.isog.dhbw.de/en/ [retrieved on 07.08.2024].

DIN e.V. (Ed.), 2023: Technologie und Mensch in der COMmune von morgen. Impulspapier III zu Normen und Standards – Smart City. Access: https://www.din.de/resource/blob/917304/37e0005bc95a98cbe3e1aa23ead45e06/smart-cities-impulspapier-iii-2023-web-final-data.pdf [retrieved on 07.08.2024].

Engelbert, J.; van Zoonen, L.; Hirzallac, F., 2019: Excluding Citizens from the European Smart City: The Discourse Practices of Pursuing and Granting Smartness. Technological Forecasting and Social Change 142: 347–353.

EU – European Union, 2019: Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (recast). Access: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019L1024 [retrieved on 14.02.2025].

Gill, A. S., 2024: Can cooperation trump tech wars and help build a better world? UN has an answer. HandelsblattJournal: Eine Sonderveröffentlichung von Euroforum Deutschland 02/2024: 16–17. Access: https://veranstaltungen.handelsblatt.com/journal/pdf/P6200185.pdf [retrieved on 07.08.2024].

Hessisches Ministerium für Digitalisierung und Innovation, 2025: Geschäftsstelle Smarte Region. Wer wir sind. Access: https://www.smarte-region-hessen.de/geschaeftsstelle/wer-wir-sind/ [retrieved on 14.02.2025].

Hviid Trier, S.; Jenkins, T., 2020: Participatory Sensing in the Speculative Smart City. Access: https://pure.itu.dk/ws/portalfiles/portal/85541711/Participatory_Sensing_in_the_Speculative_Smart_CIty.pdf [retrieved on 13.05.2025].

Kahlenborn, W.; Janßen, P.; Weidner-Jashi, M., 2023: Smart Cities befähigen (#vernetztinEuropa). Auf dem Weg zur digitalen Souveränität für COMmunen: Europäische Strategien und Regelungen. Publisher: BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung. BBSR-Online-Publikation 37/2023. Bonn.

COM – European Commission, 2020: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A European Strategy for data. Access: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0066 [retrieved on 14.02.2025].

COM – European Commission, 2023: Proposal for a European Interoperability Framework for Smart Cities and Communities (EIF4SCC). Access: https://digital-strategy.ec.europa.eu/en/news/proposal-european-interoperability-framework-smart-cities-and-communities-eif4scc [retrieved on 14.02.2025].

COM – European Commission, 2024a: EU Missions to address climate change in cities and regions. Luxembourg. Access: https://research-and-innovation.ec.europa.eu/document/download/04c8d003-6818-476f-8d15-cb54f4aa97e5_en [retrieved on 14.02.2025].

COM – European Commission, 2024b: European Data Governance Act. Access: https://digital-strategy.ec.europa.eu/en/policies/data-governance-act [retrieved on 14.02.2025].

COM – European Commission, 2024c: Funding for Digital in the 2021-2027 Multiannual Financial Framework. Access: https://digital-strategy.ec.europa.eu/en/activities/funding-digital [retrieved on 14.02.2025].

COM – European Commission, 2024d: The Cybersecurity Strategy. Access: https://digital-strategy.ec.europa.eu/en/policies/cybersecurity-strategy [retrieved on 14.02.2025].

COM – European Commission, 2025a: 2014-2020 European structural and investment funds. Access: https://commission.europa.eu/funding-tenders/find-funding/funding-management-mode/2014-2020-european-structural-and-investment-funds_en [retrieved on 14.02.2025].

COM – European Commission, 2025b: About the Digital Markets Act. Access: https://digital-markets-act.ec.europa.eu/about-dma_en [retrieved on 14.02.2025].

COM – European Commission, 2025c: AI Act. Access: https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai [retrieved on 14.02.2025].

COM – European Commission, 2025d: Data Act explained. Access: https://digital-strategy.ec.europa.eu/en/factpages/data-act-explained [retrieved on 14.02.2025].

COM – European Commission, 2025e: Digital Europe Programme (DIGITAL). Access: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/programmes/digital [retrieved on 14.02.2025].

COM – European Commission, 2025f: EU Mission: Climate-Neutral and Smart Cities. Access: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/climate-neutral-and-smart-cities_en [retrieved on 14.02.2025].

COM – European Commission, 2025g: European Innovation Partnerships (EIPs). Access: https://research-and-innovation.ec.europa.eu/strategy/past-research-and-innovation-policy-goals/open-innovation-resources/european-innovation-partnerships-eips_en [retrieved on 14.02.2025].

COM – European Commission, 2025h: Horizon Europe. Access: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en [retrieved on 14.02.2025].

COM – European Commission, 2025i: The Digital Services Act. Ensuring a safe and accountable online environment. Access: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/digital-services-act_en [retrieved on 14.02.2025].

Libbe, J.; Lange, K., 2023: Smart Cities befähigen (#vernetztinEuropa). Analyse COMmunaler Vernetzungsansätze im Handlungsfeld digitale Transformation. Publisher: BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung. BBSR-Online-Publikation 36/2023. Bonn.

Mariën, I.; Prodnik, J. A., 2014: Digital Inclusion and User (Dis)Empowerment: a Critical Perspective. Info 16: 35–47.

Samen Meten Utrecht, n.d.: Samen Meten Utrecht. Access: https://samenmetenutrecht.nl/ [retrieved on 13.05.2025].

Schüle, R.; Güleş, O.; Räuchle, C.; Schweitzer, E., 2021: Digitale Gerechtigkeit in der Smart City. Ein Referenzrahmen für COMmunale Digitalisierungsstrategien. Publisher: BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung. BBSR-Analysen COMPAKT 10/2021. Bonn.

Selle, K., 2017: Partizipation 8.0 – Bürgerinnen und Bürger in Prozessen der Stadtentwicklung. IzR – Informationen zur Raumentwicklung, 45. Jg. (6): 12–24.

Sofia Municipality, 2020: The Digitalization, Innovation and Economic Development department of Sofia Municipality. Access: https://innovativesofia.bg/en/ [retrieved on 13.05.2025].

Sofia Municipality, 2021: Innovative Sofia to Apply a Specially Developed Methodology for Assessment of Projects in the Field of Digitalization and Intelligent Urban Solutions. Access: https://innovativesofia.bg/en/news/innovative-sofia-to-apply-a-specially-developed-methodology-for-assessment-of-projects-in-the-field-of-digitalization-and-intelligent-urban-solutions/ [retrieved on 13.05.2025].

City of Vienna, n.d.b: Smart Klima City Strategie Wien. Zielbereiche: Beteiligung, Engagement & Kultur. Access: https://www.wien.gv.at/spezial/smartklimacitystrategie/zielbereiche/beteiligung-engagement-und-kultur/ [retrieved on 13.05.2025].

City of Vienna, n.d.a: Vienna is the European Capital of Democracy. Access: https://www.wien.gv.at/english/politics-administration/european-capital-of-democracy.html [retrieved on 13.05.2025].

Yasuoka, M., 2023: How Citizens Participation Begin and Continue in Developing Smart Cities. In: Streitz, N. A.; Konomi, S. (Eds.): Distributed, Ambient and Pervasive Interactions: HCII 2023. Frankfurt am Main, Fukuoka: 182–192. Access: https://rucforsk.ruc.dk/ws/portalfiles/portal/100481748/HCII_PDSmartCity_2023.pdf [retrieved on 13.05.2025].