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Data strategies for common good-oriented urban development

National Dialogue Platform
Smart Cities



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National Dialogue Platform Smart Cities

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1 Introduction

These guidelines and recommendations for action reinforce the objectives of Germany's Smart City Charter. The federal government, federal states (Länder) and municipalities are called on to join forces in using and harnessing data purposefully to achieve an integrated, sustainable, common good-oriented urban development. Local data strategies and applications need to be developed continually and dynamically based on – and tailored to – the requirements established by local urban development goals.

Developing and further enhancing data literacy within municipal administrations and municipal enterprises first requires the (further) training of municipal employees, the recruitment of digitally savvy management staff and digital experts, the establishment of partnerships with educational institutions, and the integration of the capabilities of civil society and the private sector into urban development. Centres of excellence and digital facilitators, such as data stewards or digital scouts, can assist with this transformation both within and outside the authorities. Data advisory councils comprising members from civil society need to be set up to make decisions related to data policy. To promote data literacy in urban society, appropriate content needs to be incorporated into training measures, and inclusive services tailored towards certain demographics need to be created. Digital (learning) communities should also be promoted to add to existing target-group-specific services and spaces.

The use of value-based data requires governance according to shared basic values and principles that define how personal and non-personal data should be handled across the entire data process chain. To achieve this, questions on the topic of data

ethics, data protection, the right to informational self-determination, data security and data stewardship need to be addressed and answered.

To safeguard their digital sovereignty, municipal administrations and enterprises require permanent access to data which are needed for the performance of municipal tasks related to public services and the advancement of digital services. The (shared) use of data from private-sector stakeholders is a necessary and essential step in making evidence-based decisions and pursuing forward-looking, sustainable urban development and planning. It is thus crucial that corresponding concerns on the topic of common good-oriented urban development be adequately reflected in European legislation and its implementation. A level playing field needs to be ensured for municipal and private-sector enterprises in terms of data disclosure obligations.

If we are to generate municipal value through data, improve public services and open the door to local business models, all data-supplying stakeholders in smart cities need to participate in sharing data. Clear guidelines and framework conditions first need to be introduced for all participants to minimise the cost and liability risks for public and private stakeholders with regard to data processing and sharing, and ensure the required data quality.

Data partnerships can add substantial value to common good-oriented urban development – within municipal administrations and enterprises, within urban society, between municipalities and across regions. Each partnership needs to establish a culture of data sharing and take into consideration input from municipal administrations and enterprises. Central elements

for implementing these goals may include urban data platforms (UDPs), data donations, data altruism, and (intermunicipal) data stewards and custodians.

Data strategies need to be developed constantly in close cooperation with all members of urban society. Data provide a knowledge base and tool to foster trans-

parency and facilitate participation and co-creation. Municipal administrations and enterprises need to act as enablers to promote consulting skills, partnerships, co-creation and self-governance within administrations and urban society, and provide intermediary systems for networking, exchanges and collaborative work in the digital realm.

2 Preamble

Municipalities are currently faced with pressing ecological, economic and social challenges on a global scale. As a cross-cutting issue, digitalisation has substantially changed the way we live and affected all aspects of sustainable urban development. It has the potential to bring real benefits in terms of politics, society, the environment and economy, and offers a spectrum of opportunities when it comes to transforming cities. Digital solutions can be used to offer citizens and enterprises innovative services, i.e. smart urban mobility, energy efficiency, sustainable living, public services, educational services, retail, and digital administration and participation.

However, digitalisation also comes with a number of unprecedented fundamental challenges: i.e. maintaining social cohesion; involvement and access to avoid a digital divide, both socially and geographically; guaranteeing freedom and transparency in terms of democratic decision-making processes and ethical principles; avoiding dependencies; and ensuring local self-governance and public services. To unlock potential while minimising risks, the use of data needs to be purposeful and in the public interest, and municipal data sovereignty must be ensured. The coronavirus pandemic has heightened awareness on what can be achieved through the analysis and use of data. Viable data strategies are required to facilitate the global trend towards growing quantities of data and increasing requirements in terms of data management.

In the Smart City Charter, the National Smart Cities Dialogue calls for a normative framework to shape digital transformation in municipalities. It outlines ways in which we can harness the potential of digitalisation for integrated and sustainable urban development to counter the associated

challenges and risks. This guideline on data strategies for common good-oriented urban development substantiates the Smart City Charter. The goal: strategic use of data in the public interest. All levels of European cities need to be accounted for: from districts, municipalities and regions to framework conditions for local action at national, European and international level.

These guidelines on data strategies build on the New Leipzig Charter, a key policy framework document for sustainable urban development in Europe. They follow the principles of good urban policy outlined in the charter: a public, integrated approach, participation and co-creation, multi-level governance and a local approach. In addition, the following relevant documents were referred to during the preparation of these guidelines:

- The Data Strategy of the German Federal Government;
- The Berlin Declaration on Digital Society;
- The European Data Strategy;
- The Declaration of Cities Coalition for Digital Rights; and
- The EUROCITIES Principles on Citizen Data.

For the purposes of these guidelines, data strategies pursue the goal of ensuring that municipalities and urban societies have the ability and the power to act. This requires data sovereignty – the power of individuals and municipalities to control, manage and use data. At the same time, data strategies need to address and answer questions related to how to handle the opportunities and risks posed by the

availability and use of increasingly large quantities of data. These guidelines aim to contribute to the sustainable transformation of cities. They should be used to make digitalisation processes environmentally friendly, inclusive and fair.

‘Data strategies for common welfare-oriented urban development’ is aimed at all stakeholders in urban society and stakeholders at various levels who are in a position to contribute to urban development. This includes, but is not limited to, citizens, administrations and municipal enterprises, civil society, the private sector, educational, scientific and research facilities and institutions at EU, federal and state government level.

The following guidelines provide guidance on the establishment of a framework policy and the implementation of the joint development of data strategies. These strategies aim to enhance municipal sovereignty, serve the greater good and contribute to making integrated and sustainable urban development a reality. The data strategies will be developed in a highly dynamic environment: dedicated monitoring is required for their implementation, application and modification. They are subject to regular modification as part of a co-creation process between all named

stakeholders. To reflect the dynamism of urban digitalisation, this report should be viewed as a ‘living document’ that requires regular modification and additions.

The National Dialogue Platform Smart Cities has established the following seven guidelines for urban development:

1. a purposeful use of data
2. the development and enhancement of data literacy
3. a value-based approach to data
4. creating access to data
5. adding value to municipalities through data, improving public services and facilitating local business models
6. establishing data partnerships to create added value for common good-oriented urban development
7. fostering a culture of transparency and enabling participation and co-creation

The individual guidelines are explored in more detail below.

3 Guidelines and recommendations for action



In terms of research, we are currently experiencing an increasingly complex world of data combined with the growing number of technological opportunities afforded by advances in digitalisation. For example, we are grappling with the use of artificial intelligence (AI) and cloud data for the entire scope of local politics. Research conducted by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) has indicated that adopting an integrated approach towards data use can make a significant contribution to solving these new issues.

Orhan Güleş

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Federal Office for Building and Regional Planning (BBR)

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3.1 A purposeful use of data

Data strategies need to be tailored to meet the requirements of urban society. They need to be prepared in a joint, consensus-based process involving all relevant stakeholders. Data must always be used in pursuit of integrated, sustainable, common good-oriented urban development. Local data strategies are to be understood and used as a tool for achieving normative goals. Data strategies and data-based applications need to be evolved continually and dynamically based on the needs of urban society. Data-based applications may be used to improve local and public services along with decision-making processes, trigger innovative processes, increase resource efficiency and resilience, contribute to transparent communications leading to more inclusion and participation, and enhance value creation.

Recommendations for action

- The European Union, federal and state governments are called on to create the framework policies and funding

opportunities to channel efforts towards the requirements of integrated urban development and enable the purposeful use of data.

- The federal and state governments along with municipalities need to join forces to use and harness data purposefully to achieve integrated, sustainable, common good-oriented urban development (see Smart City Charter Guideline 3.2). The same applies to civil-society and private-sector stakeholders. All these parties should question the purpose behind the use of data and provide answers from the perspective of local urban development objectives.
- Overarching and integrated urban development strategies can contribute actively to shaping digital transformation if digitalisation is integrated and pursued in all the necessary areas in the future. Local data strategies may be included in these strategies or build on them.

[...] municipalities are facing a dramatic rise in the number of requirements they need to fulfil, e.g. in terms of infrastructure. These new challenges are not restricted to mobility, but cover a whole range of aspects, including the environment, energy, healthcare, changes in demographics and digital management, to only name a few. Data provides the key in all these areas. [...] Data strategies for public urban management and [...] the Smart City Charter represent key policy papers to support this development.



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City of Heidelberg*

3.2 The development and enhancement of data literacy

A responsible and purposeful use of data in relation to common good-oriented urban development requires digital skills and comprehensive data literacy on the part of European, national, state and municipal authorities and urban society. The aim should be to develop and enhance expertise and methodological skills in addition to the required staff capabilities. Not until this has been achieved will we be able to recognise the potential of digital databases, assess and modify structures and processes used to collect, process and disclose data, and apply them for integrated urban development.

The European Union, federal and states governments need to incorporate the specific requirements related to integrated, sustainable, common good-oriented urban

development when preparing educational and training services.

Recommendation for action

- The European Union, federal and state governments, and municipalities, together with the scientific community and civil society, are called on to develop sound data literacy in relation to urban development. In addition, the required expertise and staff and the necessary technical and financial resources need to be obtained. Only then can we exploit the potential of data use. Furthermore, they are also called on to develop, assess and align structures and processes for the collection, processing and provision of data to achieve the objective of integrated urban development.



3.2.1 Developing data literacy within municipal administrations and enterprises

Recommendations for action

Municipalities need to pursue new approaches and forge partnerships to acquire qualified digitalisation experts. This may include, for example:

- A focus on the training and qualification for staff. The recruitment of data-savvy staff as a key component of the recruitment strategy, supported by target-specific funding from the EU, federal and state governments.
- The development of tailored tools to help disadvantaged stakeholders and districts. For example, institutionalised support and assistance and the special promotion of expert staff and digital infrastructures.
- Partnerships need to be established with universities or educational institutions, including internships, dual training and study programmes. This will further strengthen collaboration between the authorities and educational institutions.
- Recruitment and educational measures to target primarily data-savvy staff with the following attributes:
 - digital experts for the development of data architectures, among other tasks, or specialised in law and digital data processing.
 - Digital literacy needs to be pursued at both local and macro level. Once implemented, it will allow municipal stakeholders to use digital centres of excellence as general advisory and service institutions for data use and landscapes, for example.
 - Digital facilitators such as data stewards or digital scouts need to share and pass on operational, legal and technical knowledge within municipal administrations and urban society.
 - Co-creation methods (hackathons, competitions etc.) and financial backing from open-source communities can be used to integrate the expertise of the digital civil society into digital urban development.
 - Many data policy decisions are highly complex and can have a significant impact on society. So it is important for municipal administrations to establish data advisory councils including experts from civil society to provide assistance to administrative staff.

Case study: digital scouts in the City of Heidelberg

The City of Heidelberg has developed its own qualification concept for training its staff: transforming staff members into digital scouts. The modular structure of the training allows it to focus on particular aspects tailored to individual needs. This project aims to enable members of staff in the City of Heidelberg selectively to act as points of contact for colleagues on the topic of digitalisation, drive the purposeful and gradual digital transformation of the office forward as scouts, and represent the office as disseminators and advocates of digitalisation in the City of Heidelberg.

Accordingly, the work carried out by the Heidelberg digital scouts primarily concerns familiarising colleagues with digital solutions at work and encouraging them to use those solutions for work performed in their individual departments. Digital scouts act as experts and points of contact in equal measure for all queries related to the digital transformation of the city administration. Click here to read more about the project: <https://bit.ly/2Vjg46a>

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3.2.2 Promoting data literacy in urban society

Recommendations for action

- The federal and state governments, chambers of trade, industry and commerce, and professional associations need to work closely with educational providers to achieve the required level of data literacy. This entails integrating the teaching of data literacy in vocational training, study programmes and training courses for the main professions related to urban development.
- The federal and state governments, municipalities along with municipal and private enterprises are called on to promote the self-determined and informed use of data. This approach needs to be adopted for individuals and all aspects of urban society – including the local economy and social institutions. Inclusive training courses aimed at specific demographics offer a way to guarantee digital participation within urban society.
- Digital participation encompasses the creation of inclusive and accessible spaces that promote the establishment of digital (learning) communities and technical framework policies. The federal and state governments along with municipalities should build on existing, low-threshold content services tailored to certain demographics. Existing facilities such as neighbourhood libraries and youth centres can be used by the municipality to this end.
- To ensure that citizens are able to become vocal shapers of the digital community and not just remain users of the services it provides, key data policy decisions must be discussed openly and ruled on with participative procedures. This is particularly crucial when the decisions concern behavioural data taken from wide swathes of urban society.



The recently published guidelines and recommendations for action have confirmed that we, the City of Freiburg, are on the right path with the digitalisation strategy adopted in 2019. Nevertheless, the recommendations do highlight the difficulties faced by municipalities when it comes to managing data use independently. Therefore, I hope that we will improve data protection, data sovereignty and trust-based data use by establishing partnerships at municipal, state and government level.

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City of Freiburg im Breisgau

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3.3 A value-based approach to data

A value-based approach to data entails pursuing jointly determined fundamental values and principles. These values and principles define how personal and non-personal data should be handled. In addition, they need to achieve more than simply providing the required knowledge and ensuring compliance with existing legal requirements. It is important that they pay particular attention to areas that remain unregulated and plagued by uncertainty. A value-based approach needs to answer, rule on and document issues related to data ethics, data protection, data security, data stewardship and informational self-determination across the entire data process chain: from the

generation and collection of data to its use and (further) processing.

Accordingly, it is important to establish practical knowledge and an awareness of the potential of digitalisation among the stakeholders involved. They need to be capable of recognising the risks and challenges posed by the use of personal and non-personal data. Only then can responsible use be ensured. To achieve this, a consensus-based process first needs to be established for the development of implementable support for the greater good at EU, national, state and municipal level.

3.3.1 Data ethics

Recommendations for action

- Data must only be collected and stored under certain circumstances that ensure the self-determination of the individual in terms of his or her personal data through transparency and control. Municipalities are thus called on to use privacy-by-design solutions. The more complex the information collected about individuals is, i.e. the more detailed the conclusions that can be drawn about their identities, the more strictly the municipalities need to check compliance with transparency and control requirements.
- In principle, all data collection, processing, sharing and analysis should be in the interests of the municipality's greater good. Municipal administrations and enterprises must aim to achieve the maximum possible degree of sovereignty when it comes to contractual negotiations. They need to determine which access and utilisation rights apply in each specific case and establish the level of transparency and oversight required for the use of data generated by the municipality.
- Actions that constitute unjustified unequal treatment/discrimination, or that

steer the behaviour and decisions made by individuals or groups of people in an unsolicited manner, must not be permitted in relation to the use of data. Accordingly, municipalities are required to check the integrity and adequacy of the data on which their decisions are based. They also need to conduct an impact assessment for the processing and use of those data.

- Automated decision-making systems used for digital administrative services must be publicly documented and outlined with a description of the data used. To prevent the use of algorithmic systems (e.g. machine learning systems) resulting in algorithmic discrimination and subsequent infringements of a data subject's autonomy, checks must be carried out by independent specialists.
- Municipalities need to introduce suitable risk assessment measures to guarantee effective transparency along with institutional oversight and control. For example, municipalities should develop new feedback and complaints procedures to control data systems. They could also establish a petitions committee consisting of civil-society stakeholders.

3.3.2 Data protection and informational self-determination

Recommendations for action

- All public, private and civil-society stakeholders must ensure compliance with, and the implementation of, the EU General Data Protection Regulation (GDPR) across all levels of government (EU, national, state, municipality) with regard to the conception and application of smart city solutions.
- Germany and the European Union are called on to develop strict and pioneering standards for data protection in relation to the development of open data approaches that take account of municipal perspectives.
- As data protection pioneers, cities and rural areas should also test new concepts to strengthen the fundamental right to informational self-determination. This can be achieved through the establishment of independent data custodians or certification mechanisms and codes of conduct in accordance with Art. 40 and 42 of the GDPR.

IRMA-App Digital Passport

DECODE aims to give individuals the opportunity to determine which data they want to share and with whom. Users can actively decide what happens to their data. DECODE provides tools that put individuals in control of whether they keep their personal data private or share them for the public good. DECODE aims to provide a free, open-source ecosystem of tools that will be validated in practice.

The IRMA app is a tool developed using DECODE. The abbreviation stands for I Reveal My Attributes. The app acts as a digital wallet for all types of document. Users can add their postal address, personal information, e-mail address, bank information, phone number and even information on their healthcare coverage. Users are free to decide which information they upload and share with others.

This form of digital wallet is also used by fairbnb, a non-profit vacation rental platform. Users are able to make bookings securely using their DECODE wallet. The platform is only granted access to pooled, anonymised data to this end, unless the data subject consents to the disclosure of his or her data. Fairbnb allows its members to maintain a balance between security and privacy. It does so using community-based mechanisms which specialise in a local context. As a result, the transfer of information helps to build trust. DECODE can be used in this way to develop other solutions tailored to specific regional requirements, for example.

Click here to learn more about DECODE, the IRMA app and fairbnb in English:
<https://bit.ly/3nl1mHU>, <https://bit.ly/38VjiQV>, <https://bit.ly/3BWZ8CMv>

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3.3.3 Data security

Recommendations for action

- Warranted confidence in the fulfilment of protection objectives is a key prerequisite for establishing sustainable and relevant use scenarios, particularly in relation to the integrity and availability of data. The implementation of suitable IT security requirements and their verification along the entire process chain, in addition to transparent communication of the level

of security, are of pivotal importance in this regard. Baseline security (IT Grundschutz), established by the Federal Office for Information Security, offers an expedient way to determine suitable security requirements.

- Accordingly, the security level of the disclosed data should be based on the level of protection required for the planned uses.

3.3.4 Data stewardship

Recommendations for action

- All urban society stakeholders must ensure that data are handled responsibly and in a clearly accountable way with regard to their collection, compilation, use and processing, and algorithmic systems.
- Increasing quantities of data and the sharing of those data have given rise to questions related to analysis and interpretation (see Smart City Charter Guideline 3.2). In principle, if a stakeholder is in charge of an increasing quantity of data, that stakeholder will be subject to stricter requirements in terms of responsible data use, primarily with regard to the analysis, further processing and publication of those data.
- In cases where municipal administrations and enterprises pass on data to third parties or permit the collection of data, e.g. in the public sphere, responsible use of the data must be ensured. Appropriate regulations must be introduced to maintain sovereignty over municipal data, for example by the issuance of licences (see Smart City Charter Guideline 3.2).

- Municipal administrations and enterprises must also ensure that data are handled responsibly when they use third-party data (e.g. from companies, citizens or the scientific community). This requires the origin and calculations of the data to be checked and the primary data and formulae on which the data are based to be presented in a transparent way.
- The EU, federal and state governments along with municipalities are called on to ensure that the use of data and algorithmic systems does not result in the emergence of new monopolies that circumvent democratic control (see Smart City Charter Guideline 3.2). In order to prevent the risk of monopolies, antitrust legislation may need to be revised.
- The use of data-based applications in smart cities must not infringe on any fundamental rights or on the security, civil liberties or privacy of individuals. Algorithmic systems must not replace democratically elected bodies or the accountability of natural persons or legal entities. This constitutes a collective national task at all levels of government.

- Accountability, objectives and data used for automated decision-making systems must be disclosed (see Smart City Charter Guideline 3.2).

Case study: Municipal Data Office Barcelona

The Municipal Data Office (MDO) is responsible for the management, quality, governance and use of data relating to Barcelona City Council and all its associated bodies (public and private) that provide services to the general public.

The MDO oversees responsible data management in accordance with current legislation concerning privacy, through coordination with the data protection officer (DPO) and the implementation of the data strategies enacted by the city council. In addition, the MDO is responsible for the integration of data generated by new contracts and services into the municipal structure.

The Commission for Technology and Digital Innovation (CTID) was established to oversee the responsible and ethical use of data. The CTID requires data security and privacy to be completely integrated into the system of data use and evaluation measures at municipal level. It can recommend that an organisational unit modify, stop or finalise any purchase, investment or activity that includes significant IT components, based on the CTID's evaluations of the terms of the contracts and current legislation. Click here to access more information in English: <https://bit.ly/3icrO3K>

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I personally associate the data strategies for common good-oriented urban development with the aim of supporting current major developments in modern urban development. In short: fair and sustainable global economies that allow people to have a good quality of life and that pursue climate protection targets and sustainable urban development. Access to data is a crucial element in this regard.



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3.4 Creating access to data



Municipal administrations and enterprises need to have access to the data required to perform their tasks and develop innovative services to ensure their digital sovereignty. It is particularly important that they maintain sovereignty over these data, especially with regard to public services (see Smart City Charter Guideline 3.2). A variety of approaches can be taken to implement this: using data that are already available to the municipal administrations, their bodies and enterprises; securing access to data from third parties beyond the direct control of the authorities through regulations; integrating user-generated data, and establishing mutually beneficial data partnerships.

Recommendations for action

- Municipal administrations and enterprises should be aware that their choice of organisational structure/business model for municipal services may have an impact on data access when carrying out their tasks. The legislators (federal and state governments) need to support organisational structures for municipal administrations and enterprises that permit the granting and maintenance of access to data collected and generated in relation to the respective services.
- In cases where services are contracted out to third parties, access to and processing of data must be ensured in the public interest. The public authorities should create guidelines, sample contracts and sample contractual clauses to facilitate this. These measures would make it easier for municipalities to procure services and goods related to data use in the public interest. A collaborative effort with the worlds of research, science and practice is crucial in this regard.
- The federal government is thus called on to ensure that corresponding concerns on the topic of common good-oriented urban development are adequately reflected in European legislation and its implementation. The (shared) use of data from private-sector stakeholders is a necessary and essential step in making evidence-based decisions and pursuing forward-looking, sustainable urban development and planning. In addition, efforts to promote voluntary data partnerships and the advancing of corporate social responsibility standards that support the public interest in the private enterprise sector should be encouraged, e.g. data donations or data-philanthropic approaches.

- At the same time, municipalities should facilitate data access for civil-society stakeholders who contribute to public services and common good-oriented urban development. An obligatory data access clause must be included as part of a formal contractual agreement in cases where third parties are appointed to operate critical urban infrastructure.
- The federal and state governments are called on to involve municipalities as early and extensively as possible in their own data regulation processes and work towards their involvement at EU level.
- In order to continue enabling municipal administrations to use their own resources to perform tasks related to digital services, a level playing field with fair competitive conditions for municipal and private enterprises needs to be ensured at policy level in terms of data disclosure obligations. This applies particularly to sectors in direct competition, e.g. municipal transport services and private providers/shared mobility.

Case study: IsarTiger (MVG – Munich Transport Corporation)

IsarTiger has been plying the streets of Munich since 2018. IsarTiger is an on-demand bus service operated by the Munich Transport Corporation (MVG) to offer travellers flexible mobility. The platform does away with scheduled routes and fixed timetables, instead allowing customers to book their personalised trip on the app. Passengers simply need to enter their current location and destination. The IsarTiger app then calculates the quickest and most efficient route, searches for nearby vehicles and suggests a pick-up time and location. IsarTiger operates according to the ride-sharing principle, whereby each passenger's route is combined with routes taken by other customers travelling to a nearby destination. With several passengers sharing a vehicle for one journey (section), IsarTiger not only helps to reduce the amount of traffic in Munich, but also contributes actively to climate protection.

Many private on-demand providers focus solely on profit and operate primarily in areas with high demand. These are often areas already well served by conventional public transport. Departing from this trend, IsarTiger contributes to public services with its mobility platform, which covers the mobility requirements of many residents in Munich and the surrounding areas.

IsarTiger does much more than just demonstrate how on-demand transport concepts can be incorporated and implemented practically into existing public transport services. The service also addresses the following conflicting priorities: growing demand placed on municipal transport companies for a modern and digitalised public transport system on the one hand, and the demand for a public, inclusive, socially and environmentally responsible mobility service that offers an economically sustainable alternative to the increasing number of on-demand providers for local public transportation on the other.

Click here to learn more about IsarTiger: <https://bit.ly/3faHVg3>

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Case study: data-sharing agreements in the transport industry

Dynamic travel and traffic data provide municipalities with key information on the demand for certain transport links. Municipalities enter extensive data-sharing agreements with mobility providers to receive mobility data in a machine-readable and consequently processable format. These data facilitate simpler location-based management of the services on offer. The Mobility Data Specification (MDS) was established as a technical standard to this end, and has since been introduced in numerous cities around the globe. The Los Angeles Department of Transportation (LADOT) launched the MDS as an open-source project in November 2019 and is now a member of the Open Mobility Foundation. In short, the MDS consists of three interfaces (APIs):

- The provider – data altruism uses historical data to provide cities with a standardised policy. This policy is then implemented by mobility operators or providers and used by the regulatory authorities.
- The agency – this API is implemented by the local government for mobility operators. It monitors status updates, e.g. when a user starts a new route on a scooter or locks a car-sharing vehicle before leaving it.
- The policy – this API allows municipalities to communicate provisions and rules to operators. It then checks whether these rules have been received and allows operators to adjust their services accordingly.

As stationless sharing systems such as electric scooter and bike-sharing services are not subject to authorisation, a number of German municipalities (e.g. Hamburg and Ulm) have concluded voluntary agreements on data sharing and on where these systems are allowed to operate these services. In addition, the Association of German Cities and the German Association of Towns and Municipalities have concluded a corresponding framework agreement with electric scooter providers. They have also published practical guides with recommended actions for municipalities. You can download these guidelines at <https://bit.ly/2W-mgclZ>. For the agreements made by the City of Hamburg and the City of Ulm, go to <https://bit.ly/3lg7Tm2> and <https://bit.ly/2URUvKt> respectively.

G4



We want to build cities for people! New digital technologies have great potential to reform municipal services radically and make them more accessible and efficient. The guidelines and recommendations for action provide an excellent basis when it comes to making cities more livable for people in terms of public services, by enabling municipalities to use data in the public interest and thus help us move towards our overarching goals such as protecting our climate and planet.

Sonja Schmutzer
Head of Politics and Associations
SWM – Stadtwerke München
City of Munich

G5

3.5 Adding value to municipalities through data, improving public services and facilitating local business approaches

Data sharing by all data-supplying stakeholders in smart networked cities holds significant potential for innovation and added value. A joint approach can make a substantial contribution to the socially responsible, environmentally and economically sustainable development of digital public services and benefits offered by municipalities. At the same time, collaborations between stakeholders can add value to societal development and help us achieve the global and local objectives of sustainable urban development. However, legally regulated data disclosure obligations can often lead to significant costs and liability risks for municipal administrations and public and private enterprises. Clear regulations are required for all parties involved. The necessary framework policy conditions also need to be clarified. Once this has been achieved, the added value and potential within the municipal administrations and the agencies associated with them or enterprises working on their behalf will increase.

At the same time, measures need to be introduced at EU, national and state levels of government to promote the necessary

infrastructures and development of adequate open-source solutions and data platforms. The digital activities and specialised knowledge of local enterprises and stakeholders can make a meaningful contribution to a European initiative. In addition, local enterprises can do their part to push ahead with digital transformation at municipal level.

Recommendations for action

- The federal and state governments need to provide financial backing for municipal administrations and enterprises, and for (inter)municipal data partnerships, with regard to the use and sharing of data in compliance with strict data protection standards, or introduce refinancing opportunities.
- The federal and state governments along with municipalities need to join forces to create framework policy conditions that permit municipal administrations and enterprises to develop data-based business models independently or by pooling resources.

- Publication obligations stipulated by law (i.e. those stipulated in the Open Data Directive or the EU INSPIRE directive) should require authorities to provide the corresponding data in sufficient quality, quantity and availability. Subsequent stakeholders will then be able to benefit from the added value. The provision of data should only be subject to fees in duly justified exceptional cases.
- Legislators must ensure that municipal administrators and enterprises are entitled to appoint external service providers to process data through data processing agreements. However, they should not be required to disclose those data to third parties. The same applies to data transfers within municipal companies, between the authorities, i.e. between individual enterprises, and the municipal administration.
- The federal and state governments are called on to provide additional financial resources for costly data standardisation processes to enable cross-facility interoperability of citizen-based digital services.

Case study: Upstream Mobility – municipal mobility platform in Vienna

Digitalisation and mobility as a municipal responsibility: Upstream Mobility, a white-label platform owned by Vienna’s public infrastructure, and a digital partner of the City of Vienna, provides all the data required to use the mobility services the city offers. A communal mobility platform facilitates this data sharing. The public IT provider merges information from transport companies with data from other sources. This allows enterprises and private organisations to establish their own applications or business models based on this infrastructure. All mobility providers can thus be connected on a municipal platform with customised applications and tailor-made features. With the local public transport system as its backbone, the platform is united with all mobility services in terms of public service provision, and thus ensures mobility for all.

Upstream Mobility provides information on modes of transportation, reservations and billing on a digital interface and allows users to combine public transport services with those offered by private providers – helping to boost the appeal of public transport.

Click here to read more about the project: <https://bit.ly/3fb0VLk>

G5



We will only be able to achieve good solutions for urban development if we succeed in using data provided from a wide variety of locations and stakeholders jointly. Urban development in the public interest requires the use of all available information.

*Dr. Jens Libbe
Director of the Infrastructure,
Economy and Finance Department
at the German Institute of Urban Affairs (DIFU)*

G6

3.6 Establishing data partnerships to create added value for common good-oriented urban development

Data partnerships offer a beneficial way of pressing ahead with the targets of integrated, sustainable public urban development. This includes data partnerships between various stakeholder groups: within the municipal administration, between municipal administrations from different municipalities (intermunicipal partnerships), between the municipal administration and municipal companies, between the municipal administration and private-sector companies, with scientific communication bodies, between the municipal administration and organised civil society or individuals, and between various municipalities.

A culture of data sharing¹ provides the foundation for data partnerships. It builds on existing partnerships, understanding, trust and exchange. It also needs to account

for organisational, structural, legal, administrative and economic requirements that define the respective frameworks for data partnerships. This culture of data sharing can be established in the long term when co-created, supported and constantly developed by all collaborative partners. It needs to go hand in hand with a willingness to learn from one another.

Input from municipal administrations and enterprises should be taken into account for data partnerships at municipal level, because the stakeholders are more familiar than anyone with the living situation of people in their municipality and are required to act in the interests and service of the general public. Furthermore, partnerships and trusting collaboration can also provide valuable lessons for other aspects of public services.

¹ See Section 7.1 on the provision of open data by municipal administrations and enterprises.

Case study: data stewards

Data stewards are individuals and teams within organisations who are empowered through policy to initiate, facilitate and coordinate data collaboratives proactively in the public interest.

Firstly, data stewards work with other stakeholders to unlock the value of data when a clear case of public interest exists. Secondly, they protect customers, users, as well as relevant private and public organisations from any harm that might come from the sharing or use of data. Thirdly, they actively ensure that the relevant parties put the insights generated by the partnership to use with concrete action.

To assume these responsibilities, data stewards have 5 key roles:

- They take care of urban development and establishing partnerships. To this end, they inform potential partners and stakeholders about partnerships and their potential benefits.
- They manage internal processes and coordinate collaborations between various teams and organisations.
- As auditors, they develop processes for the collection, analysis, dissemination, use and ethical, legally compliant handling of data. They assess the potential value and risk of using existing data and monitor that use.
- As the face of the organisation with regard to data projects, data stewards work to raise awareness of the value and risks of data use and partnerships. They work together to communicate the results achieved to the outside world.
- Data stewards help to scale efforts for data partnerships by working with other stakeholders on the long-term establishment and expansion of applications, services and business models.

Click here to learn more about data stewards in English: <https://bit.ly/3lav5An>

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3.6.1 Data partnerships within municipal administrations and enterprises

Recommendations for action:

- Municipal administrations need to define the accountabilities and technical responsibilities for data partnerships clearly. They should ensure consistent data use and sharing between individual government departments.
- Municipalities need to join forces with federal and state governments to push ahead with the development of integrated and consistent data architectures. This would ensure the availability of digital information across government departments and organisations.
- Municipalities need to establish mutually compatible urban data platforms (UDPs). Once introduced, these platforms will enable the quick and easy integration and sharing of municipal data from various fields of action via open, standardised interfaces based on standardised data models. These fields may include zoning law, surveying, energy, the environment, mobility, the economy and society. As a result, municipalities would be able to make urban data more accessible from a technical, organisational, regulatory and participatory standpoint.
- UDPs need to provide the technical and organisational architecture to harness the potential offered by municipal data responsibly – for urban data, services and applications. To ensure maximum interoperability, the pertinent data-sharing standards need to be applicable to all UDPs irrespective of the provider.
- Municipal administrations and enterprises need to create (digital) project spaces for employees to develop innovative data-based solutions for e-government and e-services. This will require the creation of a joint adaptive organisational and process model for the ongoing development of innovations.

Case study: Urban Data Platform Hamburg

The task of the UDP Hamburg is to open data silos and combine IT applications. Allowing users “not only [to] learn from one another and share data, but also collaboratively use logistical and analytical expertise in interactive processes in order to provide information, prepare decisions, assist in the process or make decisions”.

The platform needs to work in the interests of the entire urban society along with municipal administrations and bring added value to the municipality. To date, over 50 specialised processes have been linked on the platform. This has paved the way to improved and innovative partnerships between different municipal administrative and operating entities. It has also enabled administrations to offer new services to citizens and the private sector. An open-source approach was pursued for the rollout of UDP Hamburg, whereby other municipalities could continue to use all the components.

Find out more and access the UDP cockpit here: <https://bit.ly/3yZeyEq>

G6

3.6.2 Data partnerships within urban society

Recommendations for action

- Municipal administrations and enterprises are called on to join forces with private-sector and civil-society stakeholders to develop and establish a system for the management, integration and analysis of all data relevant to urban development. A corresponding system would lay the foundations for improved solutions and services for the urban population. It would also allow civil society to initiate partnerships. To transform this idea into reality, the stakeholders involved first need to agree on common data formats and models.
- Accordingly, municipal administrations and enterprises should introduce organisational and technical requirements for

data donations and altruism among the urban population and companies that operate within the city. They should encourage local businesses, civil society and research communities to develop and use innovative data-based applications. At the same time, these applications will ensure that individuals are able to learn and control how their data are used and by whom. Any legal issues will need to be addressed and clarified by the EU, federal government and municipalities.

- Public, private and civil-society stakeholders in urban society are called on to join forces and establish joint data partnerships to promote sustainable business models, digital services, public urban development and digital public services.

3.6.3 Data partnerships between municipalities and across regions

Recommendations for action

- Municipal administrations and enterprises need to network actively to facilitate intermunicipal data partnerships. Above all, they should promote close cooperation between cities, municipalities and the surrounding areas.
- Municipal administrations and enterprises are also responsible for ensuring data security, protection and transparency when data are shared within data partnerships. Accordingly, they need to introduce security standards for the data infrastructure, participate in the overarching definition of data formats and models, and establish functioning interface management for IT systems.

- Municipalities also need to appoint intermunicipal data stewards and custodians, who will be responsible for ensuring compliance with the rules agreed in the data partnership and required by law. In addition, they will help to ensure that municipal administrations and municipal companies remain independent of external service providers.
- If municipal providers hope to prevail over global platform providers, they will need to achieve economies of scale through municipal partnerships and federal structures to pool expertise at a higher level. They need to bolster efforts to establish partnerships (so-called economies of scope) and, most importantly, act quickly. Interoperability and common standards are the overriding objectives.

Case study: City as MyData operator project (Finland)

The City as MyData operator project is a joint project that has been launched in four Finnish cities: Helsinki, Espoo, Turku and Oulu. The MyData principles aim to promote a fair, sustainable and prosperous digital society. The emphasis in this innovative project is on a people-centred approach to personal data and striking a balance between the greatest possible use of data in the public interest and maximum freedom for the individual.

The Six City Strategy (2014–2020) paved the way for the shared use of data, joint projects and principles along with collaborations between cities. Building on this, the MyData approach outlines the principles for data management that need to be defined and implemented. The City as MyData operator project focuses on:

- making people's lives easier
- working in a consistent manner according to the MyData principles, and
- proactively improving services by analysing data.

The project offers three major benefits to the municipalities involved and their urban societies:

- MyData solutions make life easier for residents through the aggregation of data collected by various departments/city organisations.
- When uniform work practices and services are provided in accordance with the MyData principles, this paves the way to digital services and the availability of services beyond city and state boundaries. Services will then be accessible to companies and civil society.
- The data analysed facilitate the proactive improvement of municipal services.

A central aspect of the successful rollout of the project was strong regional and intermunicipal collaboration. Learn more about the City as MyData operator project and the MyData approach in general with information provided in English here: <https://bit.ly/3rDhViv>, here: <https://bit.ly/2WXSX21> and here: <https://bit.ly/3zYpcNc>

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Co-creation in the development of a data strategy can forge synergies through the collaboration between various stakeholders at federal, state and municipal level. [...] The ways of establishing data partnerships between all stakeholders in urban society outlined in this publication create a pool of data that is instrumental in putting municipalities and other constitutional bodies in a position to make informed decisions.



*Prof. Elke Pahl-Weber
Chair of Urban Development and Regeneration,
Institute for Urban and Regional Planning
at the TU Berlin*

3.7 Fostering a culture of transparency and enabling participation and co-creation



A data strategy that works towards the greater good and the sustainable development of the municipality requires constant modification to cater to the fast pace of development. This requires a collaborative effort on the part of all the members of urban society. Publicly accessible data on the municipality or region can create transparency – as regards the actions of stakeholders within the municipal administration or as regards social, economic and environmental developments in the municipality. At the same time, those data can also provide

a shared basis of information and a tool for co-creation, enabling municipalities to satisfy the strict requirements in terms of democratic processes and fair participation. This information is a solid foundation for the execution of participatory and co-creative processes within urban society. Affordable, free or publicly accessible infrastructures, services and goods are also required for the provision of public services: especially intermediary systems for networking, sharing and collaborative work in the digital realm.

3.7.1 The provision of open data and information through datasets and data insights

Recommendations for action

- In order to promote transparency, administrations at federal, state and municipal level, depending on their capabilities, should consider making as great a quantity of data as possible publicly accessible in a vendor-independent, machine-readable and open-standard manner. This would also prompt the development of applications, solutions and apps by private-sector and civil-society initiatives (civic tech). Breaking down data silos within the administrations would also help in this regard. However, public welfare concerns and legal requirements, particularly in relation to the use of personal data, can result in restrictions. Municipalities are free to make their own decisions here, but simultaneously required to consider all aspects (refer to Smart City Charter Recommendation for Action).
- When it comes to web-based media or data, the mindset needs to shift from “everything is confidential” to “everything is open, except for ...”. Once implemented, this would ensure data transparency and availability. However, constantly evolving data security requirements need to be catered to (refer again to Smart City Charter Recommendation for Action).
- The value of the data provided is only sustainable if the federal and state governments along with municipalities keep their datasets up to date. They must also be in a position to provide information on the datasets at their disposal (data inventory) and which specific data they are permitted to make accessible for further processing by third parties. As much raw data as possible must be provided, particularly for research purposes. At the same time, compliance with statutory data protection requirements must be ensured.
- Municipalities need to describe their data and services with metafiles and grant research access to them via meta-data catalogues.
- In order to promote transparency and provide citizens with a sound basis for discussions and decisions, municipal administrations and enterprises need to display publicly accessible data visibly (e.g. in the form of a dashboard).
- Municipalities require funding from federal and state governments for the processing and use of data to perform these tasks. This should simultaneously encourage the development of standardised and interoperable solutions.

3.7.2 Guidelines for participation and co-creation with regard to municipality-related data in urban society

Recommendations for action:

- Municipalities are advised to continue providing the required infrastructures and resources to facilitate joint development projects based on equal partnership. Furthermore, they should promote consultancy skills, partnerships, co-creation and self-governance actively within administrations and urban society.
- Municipal administrations and enterprises need to act as enablers for urban society. They need to offer the solutions, means and formats for participation and co-creation. As a result, they can promote transparency and increase the degree of cooperation among stakeholders.
- Municipal administrations and enterprises need to offer solutions and platforms to provide information, answer questions, issue advice and ensure the participation of urban society. However, the degree to which these solutions can be implemented depends on the capabilities and specific requirements of the municipality in question. Large municipalities in particular need to provide reliable on-line participation platforms. In addition, low-threshold and outreach services need to be developed to involve groups who are not necessarily versed in digital topics and the use of digital solutions.
- Along with isolated participation initiatives, municipalities are called on to consider an ongoing form of citizen involvement through the development of digital urban infrastructures. Digital advisory councils, local councils and institutionalised participatory budgeting approaches can help prevent digital transformation from taking on a life of its own, ensuring instead that it corresponds to the needs of urban society. Accordingly, the development, implementation and evaluation phases of digital urban projects should be included in participatory processes.
- Municipalities can support transparency and data provision by pursuing a strategy based on the development and use of open-source and standardised platforms, data models and formats, interfaces and solutions, all of which initiatives or the administration need to be able to control (i.e. in a formative, structuring and moderating role).
- A joint digitalisation framework policy needs to be established as part of a collaborative effort between the municipalities, federal and state governments for implementation at municipal level.



In the City of Haßfurt, we can use these guidelines and recommendations for action to promote participation and transparency, not only externally, but also within the administration, to initiate a process of change.

*Diethard Sahlender
Chief Technical Officer
City of Haßfurt*

3.7.3 Collaborative development of data strategies in the public interest

Recommendations for action:

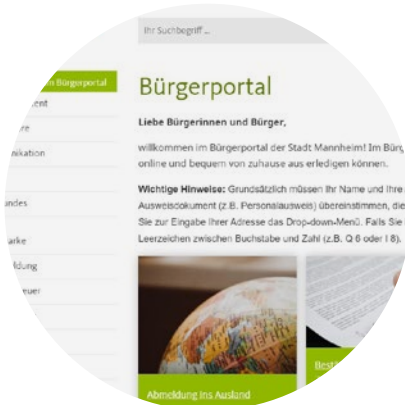
- The development of an integrated data strategy needs to be at the top of the agenda for municipalities. Responsibilities need to be defined to facilitate the central management and participatory development of the data strategy.
- Municipal administrations and enterprises need to involve urban society increasingly in the conceptualisation and implementation of data-based projects and strategies for urban development. In turn, this will promote the greater good and help to ensure that the enacted strategies meet the needs of all parts of society.

Case study: Stadtmacher Hamburg

Stadtmacher is a platform for realising citizens' projects by means of a crowdsourcing and crowdfunding platform. Citizens are able to post project ideas related to current issues on stadtmacher.org. Stadtmacher supports citizens with project development, offers expert advice and its own crowdfunding platform, which enables citizens to raise the necessary funds for the whole project or its initial stages. Stadtmacher is driven by a team of experienced urban planners and activists from Hamburg. As a spin-off of the citizens' think-tank Nexthamburg, the Stadtmacher team utilises its rich local and international experience in creating and running local crowdsourcing platforms for urban development projects.

Click here to read more about the project: <https://bit.ly/2X0LXlv>

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Source: Stadt Mannheim



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4 Expert contributions

Harnessing digital literacy for urban development

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Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)

Digitalisation is creating a number of opportunities for municipalities, e.g. more efficient administrations, increased citizen involvement and more flexible public transport services. The pace at which digital technologies are launched on the market and infiltrate everyday life has also required increased data literacy among citizens. Discussions have been held among experts from the field and researchers on how to address the digital divide and determine how urban society can get involved in the digital transformation, and who stands to benefit (Schweitzer 2017). The majority of Germans already use the internet (88%). However, as this would indicate, 12% remain off-line. 44% of the German population are considered digital pioneers, while 40% are keeping pace with the digital transformation and 16% are in the dark when it comes to digitalisation. These figures mean that the degree of digitalisation among the German population is currently at an average level compared with other countries (Initiative D21 2020).

Background

Research has identified a number of individual factors that have been found to influence digital literacy (Schweitzer 2017):

- First, age and technological socialisation are major factors when it comes to the use of digital services.

- It has been found that general and specialist technical expertise, whilst not solely dependent on age, has a significant impact on the use and acceptance of digital media.
- Furthermore, educational and social inequality play a role – in terms of internet use and also access to digital devices, which is often determined by income level.
- Language, gender-specific and cultural barriers, and physical or mental disabilities, have also been cited as reasons for the marginalisation of certain segments of the population.

These social and class-based aspects also play a socio-spatial role in urban society (Schweitzer 2017). Primarily individuals in disadvantaged neighbourhoods are at risk of being left behind in terms of opportunities to participate in society when it comes to the digital transformation of urban environments, in all aspects from e-government and e-health to smart energy and transport systems.

Digital literacy in urban society

In the light of the situation outlined above, the development of digital literacy within municipalities is a crucial aspect for the digital development of urban society. With

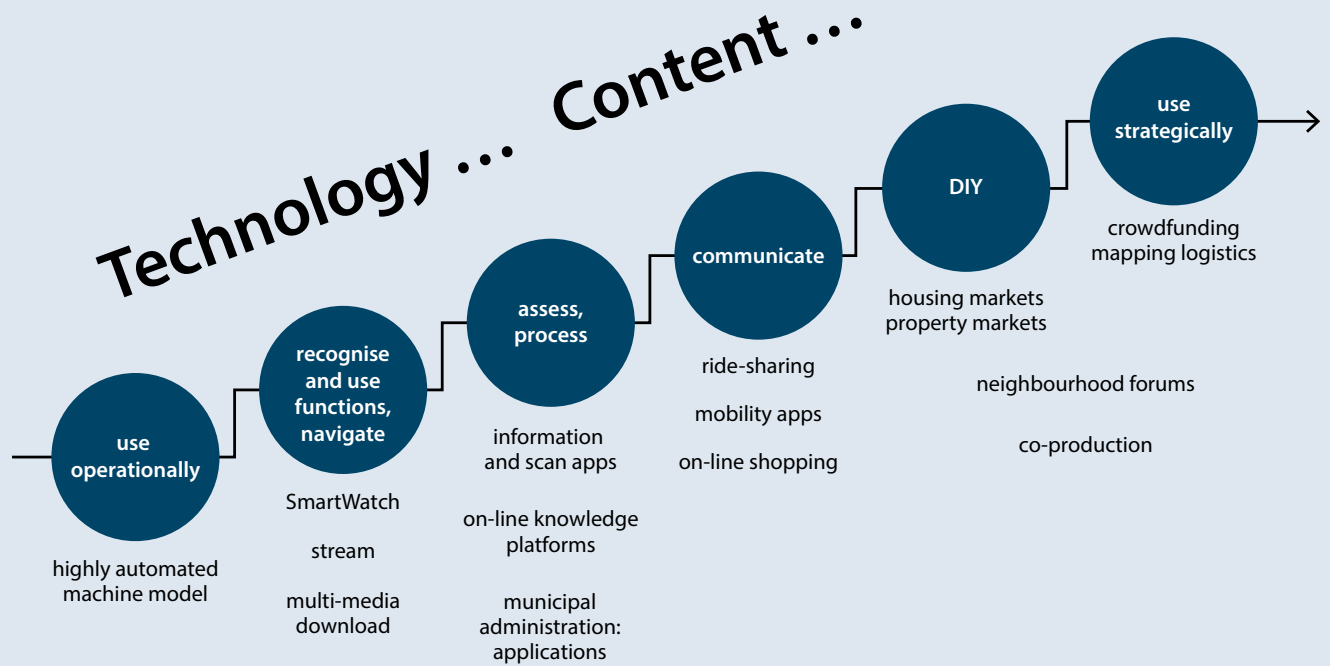


Figure 1: Levels of digital literacy and examples of their application in urban development. Source: BBSR (from: Schüle et al. 2021)

regard to digital literacy, Van Dijk (2012) differentiates between internet skills related to the technical operation of the internet and the ability to effectively navigate through content found on the internet. The former, for example, includes the simple use of menus, input tasks and on-line navigations, whereas the latter deals with using information, designing on-line content and strategic internet use. Figure 1 illustrates an adaptation of Van Dijk's model of digital skills for potential applications in urban development. Previous research has demonstrated that only a small percentage of the populace maintain the high skills required to use the internet in a purposeful, target-specific manner. Internet users primarily use the internet for entertainment and consumption, but not so much for the purpose of developing their own social capital (Schweitzer 2017).

A range of measures can be introduced to counter the digital divide and improve

data literacy in urban society. The development of digital learning centres is of particular relevance in this regard. Digital learning centres generally take the form of low-threshold drop-in centres situated in the local area and often deeply rooted in the community (e.g. community centres, libraries or neighbourhood organisations). They offer digital devices and qualified staff along with specialised services for demographics with low digital skills or less access to digital equipment (e.g. the elderly, individuals with a migration background and minimal German language skills, or young people from low-income households) (Schüle et al. 2021). The strategic goal of these centres is to develop inclusive communal educational infrastructure that integrates relevant formats of lifelong learning for civil society and all demographic target groups, and adapts to keep up with ever-changing digital technologies and formats (BBSR/BMI 2021a).

Digital literacy in municipal administrations

The dialogue platform teamed up with experts from the field and research community to develop these data guidelines as part of a dialogue maintained over a year and a half. The guidelines reflect the current status of research in the field and focus on key tools that can be used to promote digital literacy in urban society and municipal administrations (see Section 3.2). The findings have also highlighted the clear need for the development of digital skills in municipal enterprises and city administrations, particularly for municipal administrations and enterprises. On the one hand, this concerns the use of data and the (further) development of infrastructures (e.g. data platforms); on the other, the municipal administrations as organisations and the digital skills of employees (BBSR/BMI 2021a). In addition to the development of organisational processes and skills to render administrative organisations fit for the future, the individual training requirements of municipal staff are also a top priority. The federal and state governments have developed suitable funding structures to support training, such as competence centres at state (i.e. v) level. Other approaches include partnerships with educational providers, the recruitment of digitally savvy management staff and the appointment of digital facilitators such as data stewards or data pilots. It is also crucial to integrate expertise from the private sector and civil society into urban development in a purposeful manner by the establishment of data advisory councils including members from civil society for decisions on data policy, for example.

Latest research

Extensive research is required to develop the digital skills of citizens and within administrations. The BBSR conducts internal and external research, practical projects

and studies to this end. The Digital Learning Lab in Oldenburg (BBSR/BMI 2021b) is also working on tools to develop skills in urban society. Working closely with citizens, the project develops concepts to promote digital literacy, train IT experts to help the elderly enter the digital world, and hosts competitions for software development (hackathons). Furthermore, the learning labs in Cottbus and Oldenburg both work to improve municipal competences with regard to data collection and processing (see Lebhart on p. 38 of this publication). The aim of these initiatives is to improve strategic decision-making and courses of action for integrative urban development with the assistance of digital data and data infrastructures. Launched in 2021, the research project "Digitale Stadt gemeinwohlorientiert gestalten durch kommunale Datenkompetenzen" (BBSR/BMI 2021c) (KoDaKo) ('the development of smart cities in the public interest through data skills within the municipalities') has developed a number of action approaches and recommendations for practical application, primarily aimed at mid- and small-sized municipalities. The project aims to gain new insights into the required data skills that municipalities can use to develop their own organisation and training. As well as players within the municipality, this also requires the involvement of external stakeholders, partnerships and organisation structures.

The BBSR plans to conduct further research on the topic of digital literacy in urban society. Above all, the analyses will address the question of which social groups have already been reached by digital services offered by municipalities and which groups are less likely to use these services. Based on this information, the researchers will then determine the need for socio-spatial and district approaches and produce guidelines for municipal action. The analysis of both lines of research

– digital literacy in municipal administrations and in urban society – is required to establish recommendations for data strategies and derive specific strategic tools and examples for the digital transformation of the municipalities. To this end, it is important for the existing approaches and concepts for training and empowering municipal administrations and urban society to be evaluated in terms of their benefits and suitability. This requires the use

of technical tools and processes (e.g. virtual formats, AI-supported digital twins, digital participation systems etc.) Only in this way will we be able to achieve the goal of the digitally inclusive participation of all urban citizens in sustainable, common good-oriented urban development. Data strategies for common good-oriented urban development provide important stimuli and approaches for both theory and practice.

Innovative data management as the foundation for the sustainable use of administrative data

Dr. Gustav Lebhart

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(former CIO at the City of Cottbus)*

The development of innovative data management for an interdisciplinary partnership was tested as part of the IT strategy and digital agenda pursued by the City of Cottbus/Chósebuz and as part of the ExWoSt (Experimental Housing and Urban Development) research project 'Digital Learning Labs'. The Digital Learning Labs project, funded by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), focuses on considering how the organisational and institutional integration of municipal data management can be implemented successfully in a smart city, and how the provision of both data and information can be ensured for strategic urban planning and the development of empirically based decision criteria used by the municipal administration on a sustained basis. The objective of the project was to curate digital services offered by the administration using data-based solutions to solve specific issues related to integrated urban development with the help of data.

Data strategies for the City of Cottbus/Chósebuz

The National Dialogue Platform Smart Cities has established a number of guidelines for urban development. The strategic objectives aim to achieve the gradual implementation of the administrative potential pursued by the guidelines. They have been derived from the visions and guidelines, and summarised in fields of action.

They emphasise the critical importance of data as a necessary element for transparent and comprehensible decision-making. With its fields of action, the data strategy enacted by the federal government clearly demonstrates that innovative data management bolsters the digital sovereignty of government institutions and provides quality-checked information for regional planning tasks. The conceptual focus of the ExWoSt research project 'Digital Learning Labs' Cottbus/Chósebuz corresponds in technical, organisational and legal terms with the data strategies of the National Dialogue Platform Smart Cities and the federal government. The ExWoSt research project 'Digital Learning Labs' pursues three data strategy objectives.

Data strategy 1 | Data management and IT platform

This required the development of a well founded, varied and modern concept for the establishment of a data warehouse (DWH). A conceptional and methodical framework was created for a criteria catalogue. These criteria were based on a survey completed by project participants to highlight the needs and target requirements in the three areas. The weighted process evaluation provides insight into the challenges and technical solutions. The findings can then be submitted to the city officials as a basis for decision-making to allow the tendering process to begin promptly in accordance with public procurement rules. With the

development of a DWH, the project aims to enable differently structured data from the administration to be pooled in the future and processed to make them available for analyses and thus serve as a basis for planning. Three guidelines were also created to orchestrate the strategic orientation of data acquisition, collection and quality.

Data strategy 2 | Analysis and data literacy

The current fragmented data landscape in the City of Cottbus/Chósebus administration does not permit effective or efficient analyses with the potential to add substantial value to agile urban development projects. Awareness needs to be raised among employees and interns on the importance of data management, and data analysis standards need to be implemented sustainably. Alternatives for the data governance structure have been defined as part of the initiative. Mandatory regulations for data administrative processes have provided the foundation for the pioneering development of skills in the city administration. The policy paper has underlined the various roles in a data governance committee (DGC), which will oversee the implementation of the data strategy in the future. The DGC, yet to be formed, is thus already responsible for a number of important tasks. Two guidelines on data analysis and data security further emphasise the conceptual focus of this data strategy.

Data strategy 3 | Data visualisation and communication

A user-friendly visualisation tool needs to provide quick access to manageable information for politics and administration. Data visualisations utilise the ability of humans to register and process visual information. Using representation (lines, bars, circles etc.) and presentations of data (colours, labels, interactive elements etc.), data visualisations enable us to establish

contexts and use data to generate findings and knowledge. The objective is to create an interdisciplinary software platform to provide access to previously collected municipal data through various architectures, technologies and products and to enable them to be used for the purpose of analyses and evaluations. The guidelines offer a multi-step description of the process for developing an information portal. The process descriptions refer to data protection and security on the one hand, and to the selection of software on the other. Both processes are outlined and underpinned with specific recommendations for the City of Cottbus/Chósebus.

Summary

The objective of generating questions in relation to urban development and finding answers through data in Digital Learning Labs constitutes a pivotal element in the path towards the digital transformation of administrations. The results obtained in Cottbus/Chósebus will shorten the process for the upstream step of establishing a DWH, acquiring tools for data preparation and analysis etc., and using these tools to establish compatible data governance structures in other municipalities. As things currently stand, the technical implementation of the specific administrative application(s) will be finalised in 2021.

Public administrations can achieve more value for urban and regional planning by implementing controlled data and information management. The knowledge gained from the Digital Learning Labs research project provides a basis for the implementation of innovative data management to facilitate well founded, transparent, data-based decision-making. Ultimately, in the age of digital transformation, mastering data and information management is rapidly becoming a mandatory requirement for legitimate public action.

A comparison of data strategy perspectives

National Smart Cities Dialogue Platform	Fields of action from the federal government's data strategy	Data strategy Cottbus/Chósebus
IT data management		
Purposeful use of data	Improving data provision and ensuring data access	Data management and IT platform <ul style="list-style-type: none"> ▪ Data acquisition guideline ▪ Data collection guideline ▪ Data quality guideline
Creating access to data		
Establishing data partnerships to create added value for common good-oriented urban development		
Data literacy		
Development and enhancement of data literacy	Increasing data literacy and establishing a data culture	Analysis and data literacy <ul style="list-style-type: none"> ▪ Data governance policy paper ▪ Data analysis guideline ▪ Data security guideline
A value-based approach to data	Promoting responsible data use and enhancing innovative potential	
Data information		
Adding value to municipalities through data, improving public services and facilitating local business approaches	Making the state the front runner	Data visualisation and communication <ul style="list-style-type: none"> ▪ Data visualisation guideline
Fostering a culture of transparency and enabling participation and co-creation		

Figure 2: A comparison of data strategy perspectives. Source: presentation by Dr. Lebhart

Data partnerships to tackle heavy rainfall in cities

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Kompetenzzentrum Wasser Berlin gGmbH

The innovative and collaborative use of various sources of data is becoming increasingly important when it comes to addressing the different challenges faced by cities. This entails the collection, provision, processing and restriction of data required for a specific application, and the inclusion of those data in decision-making processes. The specific need for relevant data and their availability often remains unclear. However, customised data partnerships can bridge the gap when it comes to access to required data and ensuring the availability of those data for other issues. This paper highlights the relevance of data partnerships and underscores the potential of a needs-based approach based on the specific example of heavy rainfall in cities.

The issue of heavy rainfall

Municipalities are increasingly confronted with the effects of heavy rainfall due to climate change, particularly in urban areas (Fletcher et al. 2013; Zhou 2019). On the one hand, this can lead to local floods; on the other, heavy rainfall can often have an impact on aquatic ecology and bathing water when (mixed water) pipes overflow and untreated wastewater enters bodies of water.

Potential solutions lie in detecting the problem (e.g. through hazard maps), preventive measures (e.g. multifunctional retention basins or blue-green infrastructure) or predictive systems (e.g. early warning systems based on real-time data). These solutions generally require the processing of a range of data from public and non-public owners (see Guideline 1 in this publication).

Case study of a data partnership to protect bathers

One example of the successful implementation of a data partnership in relation to heavy rainfall is provided by the FLUSS-HYGIENE (river hygiene) project launched by Kompetenzzentrum Wasser Berlin gGmbH to develop an early warning system to protect bathers in Berlin (Seis et al. 2019). The project focuses on hygienic pollution experienced by the River Spree during heavy rainfall, which can reach bathing sites located downriver in the Lower Havel. As the monitoring of bathing sites on an event-related basis is not feasible, a model-based early water warning system needed to be introduced.

Along the schematic flow of data cooperatives (Fig. 3, centre), precipitation data from radar systems provided by Germany's National Meteorological Service (DWD), as well as data relating to wastewater treatment plant effluents from the Berlin waterworks companies and waterbody flows, are validated and published by the Federal Waterways and Shipping Administration. These data flow into a data-driven model that predicts the current water quality at bathing sites. Many years of measured data on bathing water hygiene provided by the Berlin State Office for Health and Social Affairs (LAGeSo) are used to train and validate the model. The results of the model are then incorporated into a web tool (badestellen.berlin.de), which provides daily reports on whether the water is safe for bathing or when people are advised not to bathe. LAGeSo makes the final decision

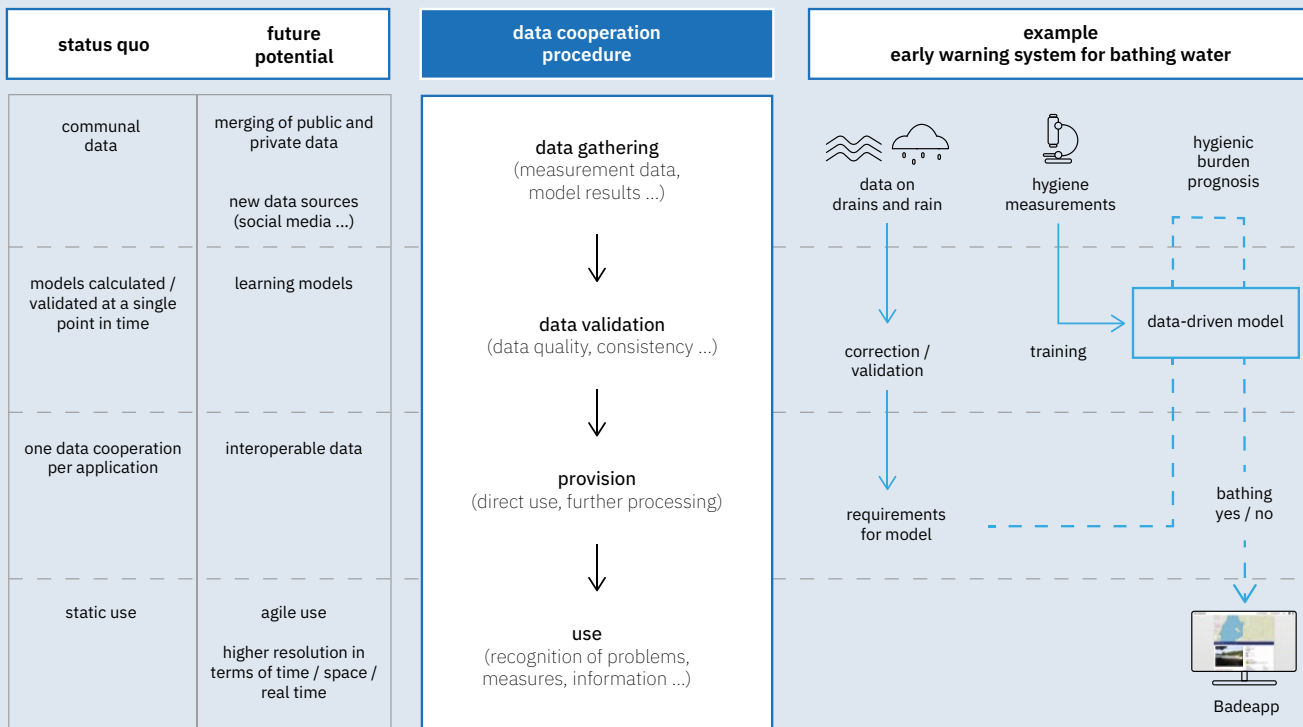


Figure 3: Schematic flow of data partnerships (centre), with the specific example of a bathing app (right) and related potential for the future. Source: Kompetenzzentrum Wasser Berlin gGmbH

as part of its responsibility to implement the EU Bathing Water Directive in Berlin.

The importance of data partnerships

The example of the bathing water app in Berlin has already provided impetus for other municipalities. Similar projects using bathing water quality predictions have since been implemented in other municipalities such as Munich and Essen. The findings from the FLUSSHYGIENE project have also provided the basis for the creation of an early warning system for the forthcoming Olympic Games in Paris as part of the EU project Digital Water City.

The success of the data partnership relied on (i) the aggregation of the required municipal data on a data platform, (ii) the establishment and use of a reliable, data-driven model, and (iii) direct use by the

end users. These aspects were facilitated by the specific need to protect the health of bathers, and, ultimately, confidence in the model on the part of the health authorities played a critical role in its official adoption.

However, future data partnerships can and need to achieve far more (Fig. 3, left). For example, daily early warnings are sufficient for the slow-flowing Berlin waterways; but other applications, e.g. for Paris, require real-time predictions in practice. This will require the incorporation of data from on-line sensors in addition to predictions from the early warning system. As well as municipal data, other data sources, which may include non-public sources, will become increasingly important, also in terms of water. Non-public sources may include image data obtained from social media or precipitation data from private monitoring stations and telecom signals.

Outlook

The successful implementation of data partnerships consists of individual solutions related to data platforms and interfaces. Overarching guidelines, as proposed in this publication, could enable these individual solutions to be merged into municipal data platforms in the future to allow the interoperable use of data for additional applications (compatible UDPs, Guideline 6).

Experience has shown that data partnerships can be established successfully when a specific municipal need for a data-driven

solution arises, and the end users are involved in the development of that solution from the beginning. The first major hindrance is identifying which data partnerships can assist municipalities with known issues. Other hurdles are also expected to be encountered with regard to the aggregation of public and non-public data, the use of new and personal data, data protection issues, and the careful evaluation of data and model approaches. A simple method that links municipal needs with the necessary data partnerships, and positive case reports, could enable us to overcome these challenges and implement overarching data strategies.

Localising European data governance: developing urban data strategies for a sustainable, data-driven society

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A sustainable and digital European policy agenda

Rapid technological advances and the Covid-19 pandemic show the potential of digital technology to help overcome barriers, and the need to engage citizens in this. The European Commission has formulated a comprehensive policy agenda to address major future challenges: the Green Deal³, with a biodiversity strategy for 2030⁴; a zero-pollution ambition⁵ and a circular economy action plan⁶; and more specifically for cities, the mission for 100 climate-neutral cities⁷ and the recent update of the Leipzig Charter⁸, all contribute to the sustainable transformation of Europe. Additionally, Europe's Digital Decade⁹, the European data strategy¹⁰, and the Commission's proposal on ethical and legal requirements for the use of AI¹¹ should support a safe 'twin digital and green transition', creating scaled advantages on Europe's road to sustainability. Data are a central aspect of this twin transition, and European cities play a vital role in safely and effectively leveraging their potential. The Smart Cities Dialogue Platform's 'data strategies guidelines' provide a comprehensive starting point for cities to create effective data strategies that align with the European goals and activities.

Cities and the European Data Strategy

Cities are crucial actors in local and regional ecosystems; they are hubs of data production that combine people, connected devices, sensors and objects to produce,

collect and transmit growing quantities of personal and non-personal data. Digital services driven by data can be used to provide innovative and high-quality services to citizens and businesses, as mentioned in the preamble to this publication. Cities are typically where innovation, creativity and smart development happen and they provide an ideal experimenting ground for ecosystem players to co-develop advanced data-driven applications and services.

The European Data Strategy is an ambitious, wide-ranging communication plan published by the European Commission in February 2020. The strategy and the cities are intrinsically linked. Its aim is to make the European Union a leader in a data-driven society. Implementing a cross-sector data governance framework must allow the free flow of data within the EU through a single market for data. This will benefit businesses, researchers, public administrations and, ultimately, the citizens.

Three recent legislative proposals by the European Commission, expressly addressing public sector bodies, form the basis for this harmonised European data governance.

1. The Open Data Directive¹² aims to make more publicly funded information available for new information products and innovation, particularly AI, and defines a list of priority 'high-value' dataset categories (e.g. mobility, statistics and geospatial) held by the public sector to be made available for reuse.

³ <https://bit.ly/37hf3hS>

⁴ <https://bit.ly/3Chwnl2>

⁵ <https://bit.ly/3fuRLK0>

⁶ <https://bit.ly/3yo80ji>

⁷ <https://bit.ly/3imKgqq>

⁸ <https://bit.ly/3fv5Tme>

⁹ <https://bit.ly/3xoYift>

¹⁰ <https://bit.ly/3AaKEhO>

¹¹ <https://bit.ly/3yoEtpz>

¹² <https://bit.ly/3CcmuoO>

2. The Data Governance Act¹³ aims to open the value of data by providing conditions for reusing data held by public sector bodies and introducing a supervisory framework for providing data-sharing services.
3. The Data Act¹⁴ aims to ensure fairness in how the value from using data is shared among businesses, consumers and public bodies, facilitating access to and use of data, including business-to-government data-sharing.

Urban data strategies: cities as data hubs

To build on this European data governance framework and contribute to the twin transition, cities should work to develop their own, urban, data strategies. The Smart Cities Dialogue Platform guidelines cover urban data strategies for the creation of added value through data cooperation, a principle that is also expressed at European level.

European initiatives whereby cities serve as regional connectors for private, public, and personal data to promote sustainable development include the establishment of a local data platform for sustainable citizen engagement through Urban Innovative Action¹⁵; the promotion of several data platforms through the 100 Intelligent Cities Challenge¹⁶ supporting intelligent, green and socially responsible recovery; and the announced Digital Europe Programme funding for the implementation of novel data-based solutions such as ‘digital twins’ for sustainable city design¹⁷.

Additionally, actions on interoperability, such as the European Interoperability Framework for Smart and Sustainable Cities (EIF4SCC)¹⁸ and the Minimal Interoperability Mechanisms (MIMs)¹⁹ developed with the Living-in.EU network support the reuse of existing solutions and provide a broader framework for pan-European collaboration between cities on cooperative, data-based solutions.

Urban data strategies: promoting digital citizenship

Increased access to and use of data promoted by the European Data Strategy also brings additional responsibility to local authorities. Europe’s Digital Decade sets targets for 2030 to empower people in a human-centred, sustainable, more prosperous future. It focuses on digital citizenship, ethical principles, accessibility of digital services and digital rights. Urban data strategies that enhance data literacy and have a value-based approach to dealing with data consider these responsibilities and align with the European policy agenda.

Eurocities’ Knowledge Society Forum collaborates with European networks and cities to understand how local administrations can manage the value flowing from personal and city data safely and securely to create smart, livable, democratic cities. Eurocities’ Citizen Data Principles²⁰ support data strategies to enable a value-based approach for data and help leverage ‘the transformative power of cities for the greater good’ (New Leipzig Charter).

Additionally, urban data strategies should include actions for data protection and informational self-determination. In the Cities Coalition for Digital Rights²¹, global cities are working to support the fair and just implementation of technology and the use of digital tools. An international AI observatory contributing to the transparent use of algorithms and a digital rights helpdesk are part of a strategy to empower citizens and safeguard their digital rights.

The Smart Cities Dialogue Platform guidelines for urban data strategies provide a tool for cities to create, manage and support safe and valuable local data ecosystems. Additionally, they connect with the European agenda and reflect a larger role for cities to become interconnected data hubs in a single market for data in Europe.

¹³ <https://bit.ly/3fulwdZ>

¹⁴ <https://bit.ly/3xpctkk>

¹⁵ <https://bit.ly/3fseUgc>

¹⁶ <https://bit.ly/3rUgKLR>

¹⁷ <https://bit.ly/3jjzpNe>

¹⁸ <https://bit.ly/3rTz7Af>

¹⁹ <https://bit.ly/37hrE11>

²⁰ <https://bit.ly/3xpcF32>

²¹ <https://bit.ly/3jlmSZU>

Establishing transparency and enabling participation and co-creation in India with Mu City Savior: a contribution to the discussion on Guideline 7

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Bhubaneswar is the capital of the Indian State of Odisha. It is also frequently considered as an emerging hub for digital innovation for development and digital governance. Like other Indian cities, the city has also experienced sharp growth in population and currently has over a million inhabitants. Bhubaneswar is also one of 100 cities that have been considered under India's Smart Cities Mission by the Ministry of Housing and Urban Affairs (MoHUA).

Being a coastal city, Bhubaneswar is prone to cyclones. However, in the past decade urban flooding has emerged as one of the biggest challenges for the city. Erratic rainfall due to climate change, inadequate infrastructure and poor management of stormwater drains are all considered key reasons for floods.

To address the issue of urban flooding in the city, an interactive digital solution has been developed called 'Mu City Savior'. This digital solution facilitates real-time data exchange between citizens and the Bhubaneswar Municipal Corporation (BMC). Primarily, it provides information about the condition of stormwater drains, which helps the corporation in proactively maintaining them throughout the city. At the local level, cooperation occurs between the BMC and Bhubaneswar Smart City Limited (BSCL).

Mu City Savior was conceived in the framework of activities of the global programme

'ICT-based Adaptation to Climate Change in Cities (ICT-A)' implemented by the GIZ on behalf of the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) as part of their International Climate Initiative (IKI), in cooperation with the German Federal Ministry for the Interior, Building and Community (BMI).

Mu City Savior allows citizens to report on identified critical points in the urban drainage system in real time. These data in turn promote an evidence-based cleaning schedule to be implemented by municipal staff, which also considers data relating to affected population, business, health and traffic, and hydrological data like normal predictions and regular rainfall data, type of drainage etc. Over time, the data accrued provide decision-makers with evidence to adapt future urban planning in a climate-resilient and sustainable manner.

The algorithm developed analyses the crowdsourced and statistical data, which are then sent to the BSCL command and control centre, where the digital solution has been integrated. Consecutively, the developed dashboard is used by municipal employees to enhance their drainage cleaning activities. Digitally enhanced public services and citizen-led science have great potential to increase climate resilience in cities, providing platforms for data exchange and improving the dialogue between the city's administration and its citizens.



Figure 4: The Mu.CitySavior app in use: The application allows citizens to report on identified critical points in the urban drainage system in real time. Source: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Mu City Savior was nominated as the Best Climate Smart City Project under Smart City Empowering India Awards 2020 by the MoHUA, Government of India (The Economic Times 2020).

Components

- 1. Crowd Reporting App
The crowd reporting application engages city officials and citizens as volunteers. Users are guided to critical points in the drainage system. Here, the volunteer identifies the current status of water flow and the debris levels in the drain.
- 2. Geographic Information System (GIS)
GIS data provide basic information about topography, hydrology, land use and population. Specific layers provide data on the status of the hydrological network and the vulnerability of specific urban areas.

- 3. Analysis System (ranking model)
The analysis system embodies the core of the overall solution. Its algorithm analyses the input data from the Crowd Reporting App, the GIS data and statistical data about affected population, business, health and traffic, as well as hydrological data like normal predictions and regular rainfall data, type of drainage etc. With these data, the algorithm creates a ranking of the critical points to be cleaned as recommendations to the city officials. This output is displayed on the BMC dashboard (see Component 4).
- 4. Display Dashboard and Supervisor App
The dashboard displays the recommendations of the analysis system to BMC officials. Each critical point is visualised with a cleaning priority ranking, and a colour code for a specific ac-

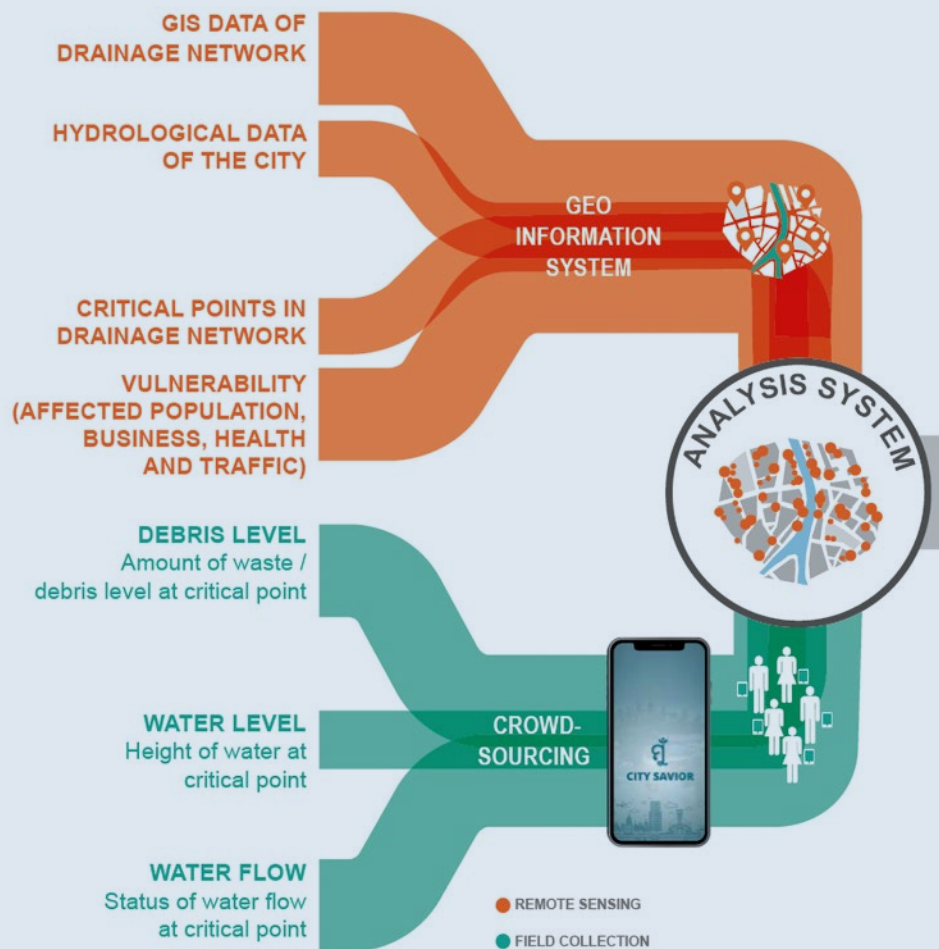


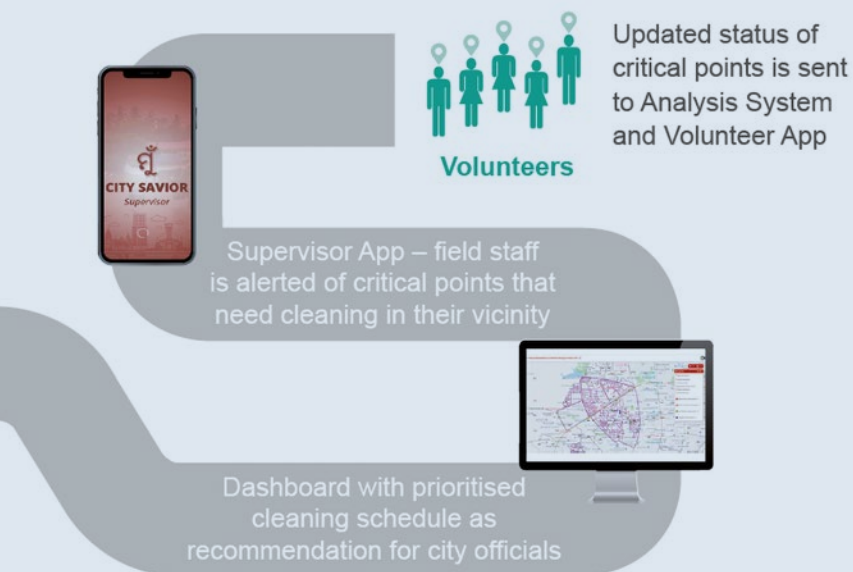
Figure 5: Underlying function of the supervisor app. Source: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

tion. The information depicted on the dashboard is sent to a mobile app that supports supervisors in checking the critical points and flagging the cleaning status of the drain. Once the critical point has been cleared, the information is reported back and the system as a whole updated.

The Project ‘Climate Smart Cities (CSC)’ is currently supporting Bhubaneswar in the scaling up and further anchoring of Mu City Savior within its digital ecosystem. This programme is being implemented by the GIZ in India on behalf of

the BMU as part of their IKI, in cooperation with the BMI.

This article aims to contribute to the international discussion on data strategies in smart cities, which is a crucial yet relatively new topic with many different components that need to be considered in order to provide a better quality of life for citizens and achieve urban development oriented to the common good. India’s Smart City Mission’s Data Smart Cities Strategy “aims to lay down the basic premise, foundational pillars and a suggested road map for cities to improve their readiness for intelligent



use of data in addressing complex urban challenges” (Smart City Mission, 2018). The city of Bhubaneswar also aims to “leverage tools of data and new technology for government efficiency” (BSCL, 2018).

Mu City Savior was conceived as an instrument that puts citizens – not technology – at the core of its development. The digital solution is the result of an innovative co-creation process carried out under a citizen-centred innovation approach. This is the first time the city of Bhubaneswar has developed a public service solution using such an approach.

The co-creation process included design thinking sprints – a multi-stakeholder method to develop digital solutions, meeting the city’s and citizens’ needs and desires in a technologically feasible and iterative problem-solving manner. The co-creation process fostered cross-sector collaboration among several city departments. It brought together representatives from different areas including the environment, urban planning, health, disaster management etc., as well as universities, training institutes and citizens’ associations. This process promoted an inclusive process building on local strengths.

5 Case studies

From data silos to open data – Haßfurt’s data strategy for a smart urban society

Data are often collected, processed and stored for daily tasks carried out by the municipal administration. This leads to overlapping datasets that are not adequately correlated, resulting in the loss of potential synergies and improved efficiency. To tackle this issue, the City of Haßfurt has developed a digital strategy aimed at breaking down these data silos, examining, consolidating and preparing datasets for interoperable use, ultimately making them accessible. Working closely with the municipal IT department, the data storage process was analysed using systematic guidelines to categorise data. The resulting data catalogue acts as an index for a UDP which provides civil society, interested municipalities and stakeholders with access to the data collected – in compliance with a municipal open data policy – to supply the basis for new services offered by private, civil-society and public stakeholders.



Source: City of Haßfurt

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Paving the way to a digital strategy for the Smart City of Wolfsburg

As part of the Smart Cities Pilot Projects funding programme launched by the Federal Ministry of the Interior, Building and Community (BMI), the City of Wolfsburg has created a smart city strategy to provide the basis for municipal action and to serve as a common framework. On the path towards becoming a smart city, the city plans to improve data retention and develop the use of data, among other tasks. The first projects to receive funding, for example, included a newly developed central data repository for the administration, an open data platform and the initiation of a ‘digital twin’ vision. A data working group was established to coordinate project development and work on a common vision for the Wolfsburg data ecosystem. One of the first tasks undertaken by the working group was identifying key challenges faced by the City of Wolfsburg in terms of data use. Building on this, the next step involves the development of a data strategy to establish a holistic data ecosystem.

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Source: City of Wolfsburg



G2



Source: City of Bad Hersfeld



Source: City of Bad Hersfeld

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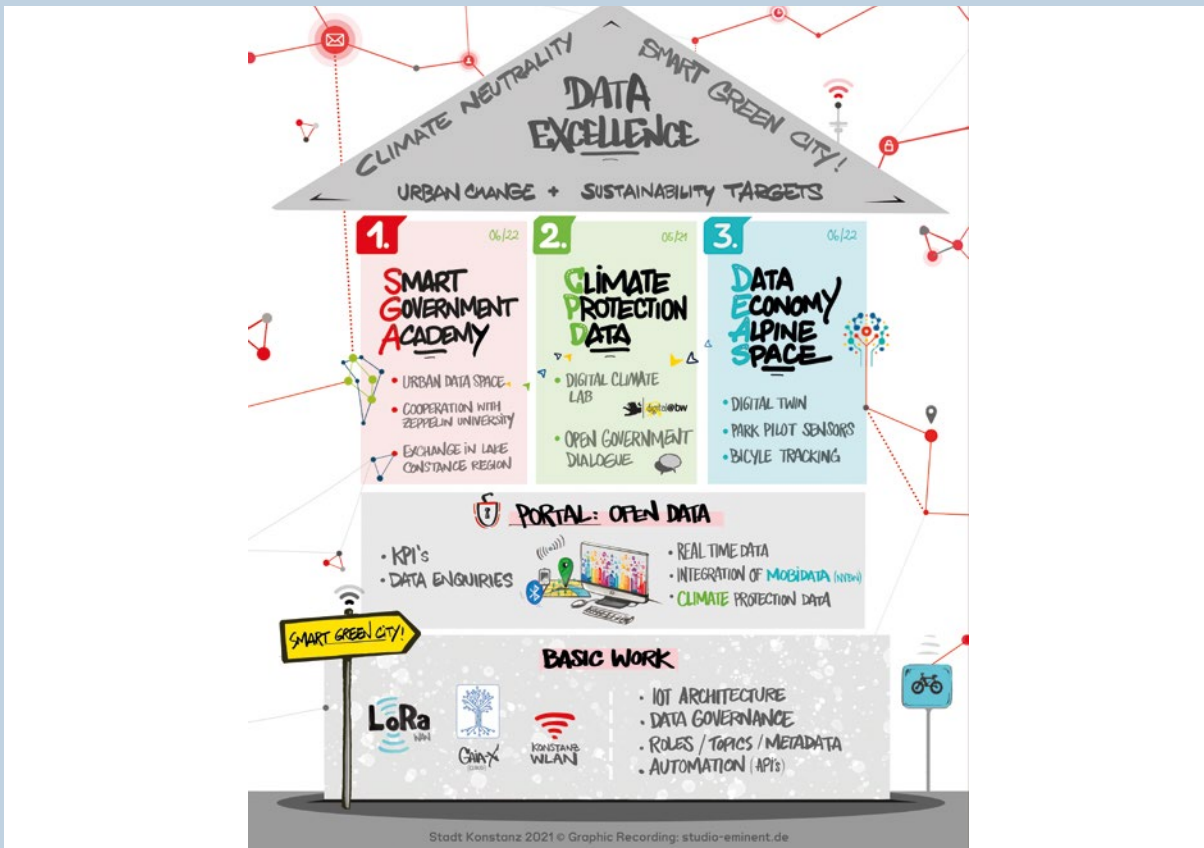
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Smart City Cockpit Bad Hersfeld

The East Hessian town of Bad Hersfeld has been digitalising its administrative processes since 2014 according to the motto “Intelligence doesn’t stop at the city walls!” A key component of the town’s smart city strategy, established in 2017, is the Smart City Cockpit Bad Hersfeld, which was developed in close collaboration with the urban institute.

The Smart City Cockpit is an extensive open data platform that processes data in a wide range of formats for subsequent public access. It provides real-time information on available parking spaces, data collected by environmental sensors (particularly noise pollution), the energy consumption of municipal buildings along with traffic flows, delays caused by roadworks and survey data round the clock. The findings from data collected by the Smart City Cockpit have helped Bad Hersfeld, not just in terms of analysing incidents in the short term, but also with managing the long-term challenges faced by urban development.



Source: City of Konstanz / www.studio-eminent.de

Open data portal for the City of Konstanz

The City of Konstanz relies on the involvement of a number of departments and stakeholders, among other actors, for the future development of the city's Smart Green City strategy with regard to the development of communal data literacy. The city has emphasised that this topic must not be viewed as an isolated issue. Instead, it is deeply rooted as a cross-cutting issue in all areas currently pursued by the city. For example, it also relates to issues such as whether Konstanz can become climate-neutral in the future.

Municipal efforts have received support from the interdisciplinary open data working group, which includes representatives from various administrative bodies, departments and municipal enterprises, and meets on a regular basis. This working group is responsible for making centralised decisions on the promotion of data literacy and implementing the resulting measures. In the light of these tasks, the working group has made a valuable contribution to acceptance of the topic within the administration and raised awareness of the work carried out by the departments.

The experiences to date in Konstanz further exemplify the benefits we stand to gain from consolidating the diversity of municipal expertise and establishing working groups like our open data group.



Source: City of Konstanz

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Barleben's IoT strategy – challenges faced by small municipalities

The development of a digital infrastructure with open data will mark a major step on the path towards smart city status for the town of Barleben. In this context, open data include existing data from the administration and local businesses along with newly generated information from environmental sensors and geodata. An accessible Long Range Wide Area Network (LoRaWAN) network has enabled the municipality to start selectively collecting environmental data for test purposes. This has involved equipping an electronic cargobike with an environmental sensor box and using it in all three villages within the municipality. The sensor box has enabled the digitalisation centre to assess the impacts of traffic on noise pollution and air quality. The values recorded and their benchmark values were graphically displayed on the open-source platform 'ThingsBoard', allowing users to consult the information. An extension to the features, including measures to integrate existing datasets, is currently in the works. A cross-departmental working group has been formed to identify and use relevant data from the administration and raise awareness among employees with regard to data use and municipal data sovereignty.

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Source: City of Barleben

FREIBURG. DIGITAL. GESTALTEN.

gemeinwohlorientiert & nachhaltig

Source: City of Freiburg

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Developing municipal data spaces

Data provide the basis for digital value creation. This also applies to municipal service applications. As part of its municipal digitalisation strategy Shaping.Digital.Freiburg, the City of Freiburg is promoting innovation through sharing and collaboration. The Daten:Raum:Freiburg (Data:Space:Freiburg) project aims to create a data architecture that intelligently combines existing and new platforms offered by the municipality. The new municipal data space will act as a launch pad for innovative business models and host various service applications for citizens, guests, companies and the scientific community. The project focuses on how data can be used purposefully in terms of public services and sustainable urban development. Digital information, booking, experience and service options are currently in development and being coordinated to help achieve this goal. The City of Freiburg administration have played a crucial role in the project. They have joined forces to further expand their capabilities and use digital data for novel administrative action.

Essen and Mülheim an der Ruhr – KomMonitor

KomMonitor – Kommunales Monitoring zur Raumentwicklung: Demografie, Sozialstruktur, Wohnen und Umwelt in der Stadt ('municipal monitoring for spatial development: urban demography, social structure, living and environment') is a project conducted by the Cities of Essen and Mülheim an der Ruhr in collaboration with geoscientists from Bochum and real estate professionals between March 2017 and March 2021.

The innovative aspect of the KomMonitor project is the interdisciplinary and ongoing linking of datasets from various urban sectors. This has made it possible for the cities to identify trends in demographic changes, both for the entire city and for individual districts, for example. The findings can then be used by municipal administrations and their enterprises, the real estate industry and local civil society in projects related to sustainable, integrated urban development. This small-scale overview has been made possible thanks to a GIS, which provides data on specific locations.

An analysis including the current situations and needs of both cities has resulted in the creation of a list of indicators that illustrate the key priorities of the monitoring system. After a field test, and once the research project has been completed, the information will be made available to other municipalities that want to use the monitoring system.



KomMonitor
Kommunales Monitoring
zur Raumentwicklung

Source: KomMonitor - Hochschule Bochum

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Cities Coalition for Digital Rights

The Cities Coalition for Digital Rights is a global network of cities that receives support from the United Nations Human Settlements Programme (UN-Habitat), United Cities and Local Governments (UCLG) and Eurocities, in the pursuit of its aim to protect digital sovereignty and promote digital futures in nations around the world. The network brings together cities and regions across borders and promotes the global exchange of knowledge and information. Member states pledge to share their knowledge, experience and practical examples of their work as part of the collaborative effort. This has fostered a culture of knowledge sharing among member states, encouraged collaborative learning and led to the establishment of collective approaches to digital challenges.

Since its establishment in 2018, the coalition has amassed a community of over 50 member cities worldwide. This includes the German cities of Berlin, Leipzig and Munich, which have committed to pursuing digitalisation in the interests of urban society and integrated, sustainable urban development by joining the coalition. The coalition has also provided a normative framework for these efforts with its Declaration of Cities Coalition for Digital Rights.

Cities for Digital Rights

To protect and uphold digital rights
at the local and global level

Source: Cities Coalition for Digital Rights

Cities Coalition for Digital Rights

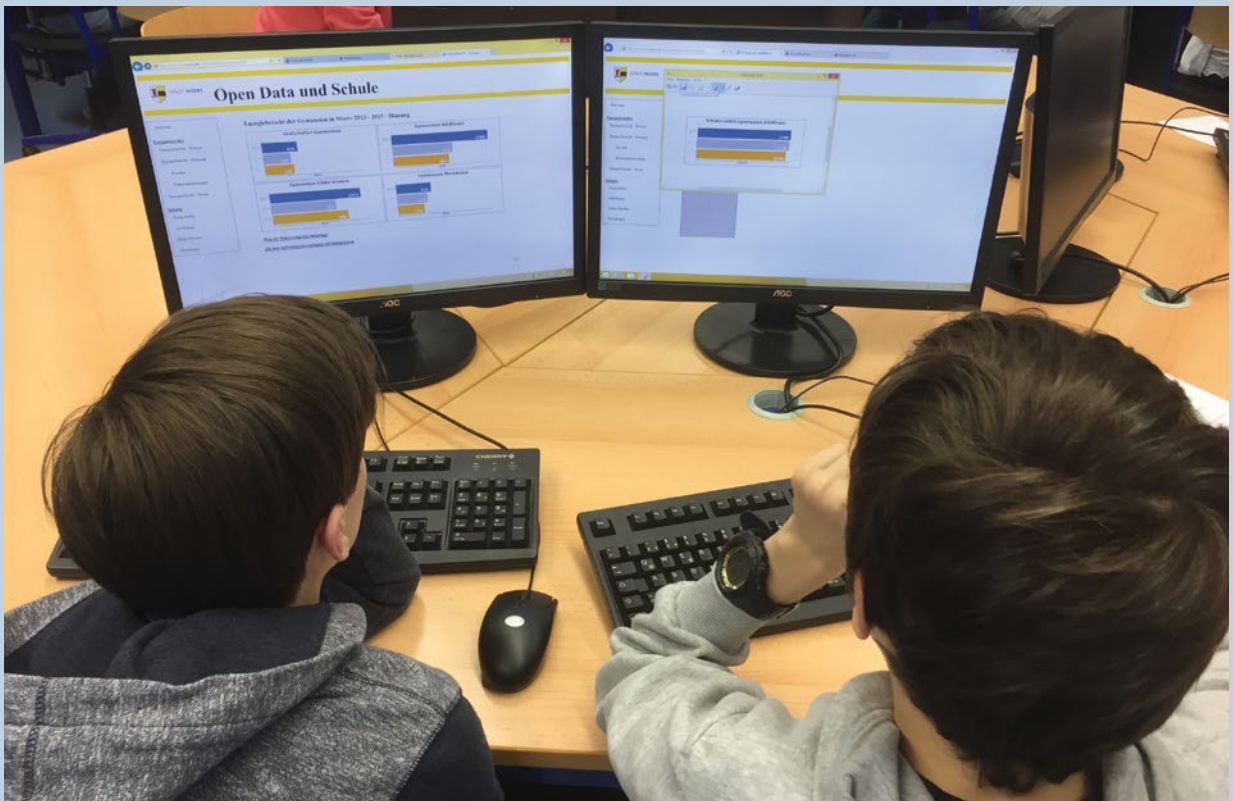
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Source: City of Moers

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Source: City of Moers

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Open data in schools – City of Moers

As part of its DatenmachenSchule project, the City of Moers has formed a partnership with the Gymnasium Adolfinum in Moers, the Rhine-Waal University of Applied Science, the Open Knowledge Foundation Deutschland and the OK Lab Niederrhein to test the use of open data in the classroom. During the pilot project, the partners pooled information and resources to enable schools to run applications based on open data. Among other tasks, this involved the relaunch of the OffenerHaushalt.de website to display data on tax expenditure in a clear and accessible format for students.

The objective of the project was to teach educational institutions to use open data to dispel reservations when it comes to digitalisation and demonstrate ways in which teachers, including those without programming skills, can use open data in the classroom.

With the DatenmachenSchule project, the City of Moers has demonstrated how momentum can be created for innovative educational formats, and how a sensible approach to open data in the classroom can play a major role in the digitalisation strategy pursued by the education sector.

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Working together with sound judgement – data-based citizen involvement in Oldenburg

The City of Oldenburg has a clear vision: to give all inhabitants the opportunity to shape the future of Oldenburg. To achieve this, the city launched the on-line participation platform www.gemeinsam.oldenburg.de in September 2020. As a completely novel approach, the digital platform offers a number of features and participation formats in one space. This allows inhabitants of the city to participate digitally in meetings held by municipal committees or get involved in formal participation procedures via the platform, to notify the city administration of identified issues in the city using the on-line tool Stadtverbesserer ('city improvements'), or submit proposals to shape the future development of the city. For example, throughout 2021, proposals will be collected on 12 different future issues as part of a competition for ideas. Inhabitants of the city have been invited to submit ideas and visions for the future of topics such as culture, health, society, the environment and energy, education and schools, and the development of city districts. Their suggestions will then be judged and ranked by the public. The ideas and visions that receive the most votes will be reviewed by the city and consequently impact the future urban development of Oldenburg. By launching its digital platform, the City of Oldenburg has gained a valuable tool in enabling community-based participation. The informal nature of this approach represents an attempt to involve more people in shaping the future of the city and to minimise the number of initial hurdles when it comes to getting involved in local policy.



Bürgerbeteiligung. Made in Oldenburg.

Source: City of Oldenburg

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6 Glossary

6.1 Definitions

API

Application programming interface: the programming interface that allows programmes to communicate with one another.

Data altruism

The voluntary provision of data by individuals, organisations, administrations or companies for the greater good.

Data strategy

A tactical and planned use of data to achieve or implement a goal.

Data literacy

The ability to collect, manage, analyse and use data in a critical manner.

Level playing field

A concept of fairness, i.e. fair competition, whereby everyone is subject to the same rules and competitive conditions. Government regulations provide the framework for fair competitive conditions.

Urban society

The entire population of an urban area linked by common interests and an undefined sense of belonging. Urban society is an integrative and inclusive term in this sense and involves all stakeholders from civil society, politics, the administration and business.

6.2 Data classification

The objective of integrative, sustainable urban development is to establish the complexity of economic, environmental, climate, social and demographic challenges and consequently develop and implement suitable integrated solutions. Accordingly, data from all fields of urban development need to be taken into consideration for the devel-

opment of guidelines for data strategies in municipalities. In addition, urban development involves many different types of data. This glossary provides a general outline of the typology of the data types with examples of applications relating to digital urban development.

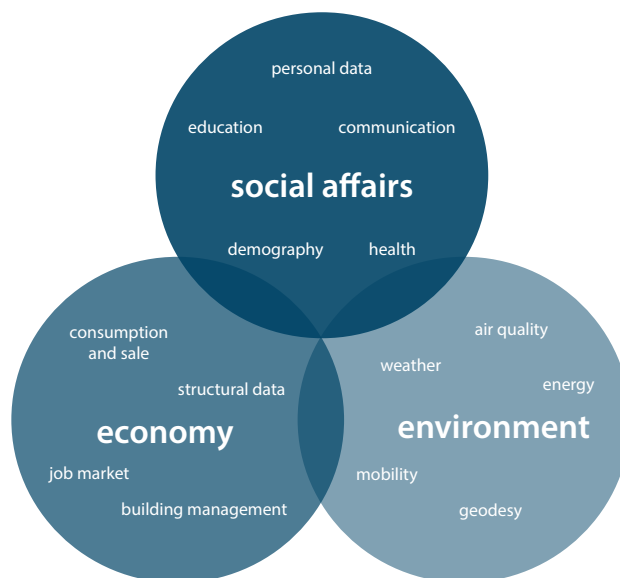


Figure 6: Aspects of a comprehensive data strategy. Source: ifok GmbH

6.2.1 Typology of data types

6.2.1.1 Data authorship

Administrative data

All data available within the political and administrative system.

Research data

Data generated in scientific studies and experiments.

Data from organisations

Data accrued in associations or civil society organisations.

Company data

All data stored by a company. These data may be collected by the company itself or by external providers.

Private data

Data created by an individual.

6.2.1.2 Data semantics

Unstructured data

Data with semantics that do not correspond to predefined rules.

Structured data

Data with attributes that are semantically standardised with corresponding domains. Stakeholders, i.e. national and international standardisation organisations (DIN,

CEN, ISO) and political institutions (the IT Planning Council and the EU) have agreed on uniform designations and domains for the use of data in a predefined model at different territorial and sectoral levels. Structured data permit the definition of uniform conversion rules that enable the conversion and processing of data in various data models and formats across sectoral field boundaries.

6.2.1.3 Degree of enrichment

Raw data (primary data)

Data collected from a source but not yet analysed or processed by a person, software or machine. Collected data which can be associated with a single element in a sample are called individual data.

Processed data/secondary data

Raw or primary data that have been processed to obtain information from the material. A distinction is made between (a) processed data and (b) data obtained from an analysis.

(a) Processed data have been debugged, aggregated or individual attributes have been transformed/recoded. Aggregated data are also referred to as 'big data'.

In addition to aggregation there are a variety of ways in which data can be processed, e.g. consolidation, sorting, censoring, verification, weighting or deletion. However, the processing of data does not constitute an analytical step.

(b) Secondary data may be generated by a data analysis, e.g. a cluster analysis. This involves identifying clearly definable groups from raw or processed secondary data through a cluster analysis.

Metadata

Structured data that contain information about collected data which describe the attributes of datasets and services.

6.2.1.4 Access

Open data

Data that are accessible without restrictions and which can be further used, processed or distributed by the general public. Open data can be provided by various stakeholders in various formats. They are typically published on platforms. Open data are freely accessible, but they may be subject to certain restrictions on further use and processing in individual cases.

Shared data

Data that can be shared if certain requirements are satisfied, e.g. commercial data that can be acquired for mon-

etary payment (purchasing a licence or a paywall) for use or further processing, or public sector data that can be viewed under the Freedom of Information Act following the submission of a request. Both the access and use of shared data may be subject to certain limitations.

Closed data

Data that are not publicly accessible and which can only be viewed by their owner, e.g. internal data that are available but not accessible for a number of reasons. Police investigation files are an example of closed data.

6.2.1.5 Data dynamics

Master data

Highly static data that rarely change. They remain valid and the same for a long time, but can still change under certain circumstances. Examples of master data include street names and fingerprints.

Static data

Static data are data that do not change after being recorded and are therefore fixed. They contain information for a defined period.

Data streams

Data that reflect a live status and are continually updated. They enable direct feedback, e.g. real-time data or transaction data.

Manually collected data

Data that are collected individually and manually without automated processes, e.g. social data from a survey, or document and company data collected by the authorities and companies.

6.2.1.6 Type of collection

Automatically collected data

These include data such as those collected via sensors that provide information about the surrounding area. Data generated by communications between sensors are referred to as machine-to-machine data.

Crowdsourced data

Crowdsourced data are obtained from a large group of individuals. This approach offers a cost-effective way of compiling large datasets. Crowdsourced data can be collected manually or automatically. A decentralised network of weather stations on private property is one example of manual collection.

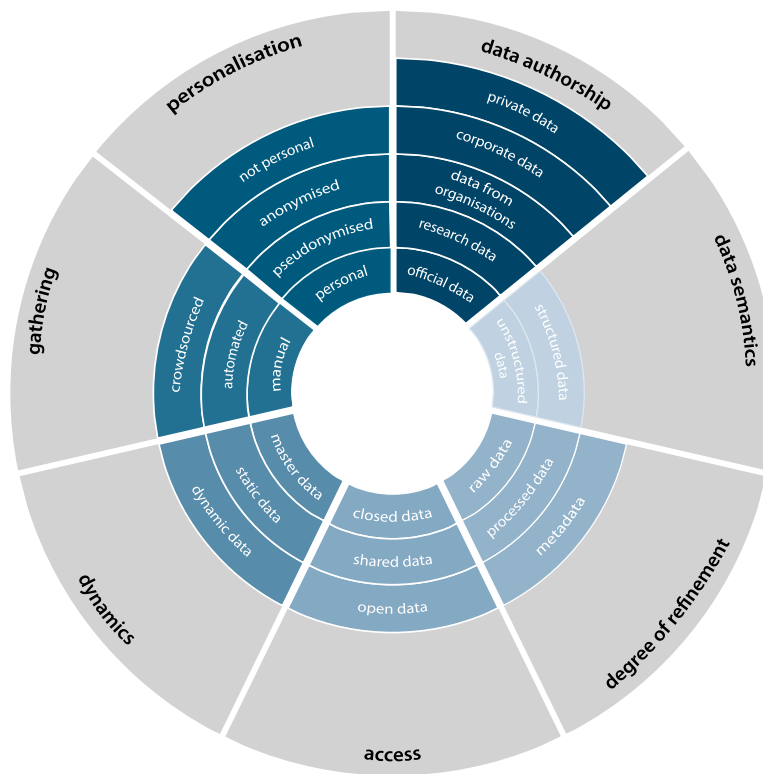


Figure 7: Typology of data types. Source: ifok GmbH

6.2.1.7 Degree of personalisation

Personal data

Personal data consist of all data pertaining to a uniquely identifiable person. A clear relationship and identifiability must exist between the information and the individual.

Pseudonymised data

Pseudonymised data involve the replacement of names and other personal attributes with pseudonyms, consequently erasing any references to an individual. This pseudonym may take the form of a code or a randomly generated combination of letters or numbers. In contrast to anonymisation, pseudonymisation maintains certain references between the information and the datasets. See Art. 4 (5) of the GDPR for more information on this topic.

Anonymised data

Data that cannot be allocated to their origin, which renders them anonymous. Anonymisation is the process of modifying personal data in a way that prevents individual details on personal or factual circumstances from being assigned to an identified or identifiable natural person, or these attributes can only be assigned with a disproportionate amount of time, money and effort. These data are not personal data.

Non-personal data

Data that cannot be assigned to an identifiable person and do not contain any personal data, e.g. weather data or anonymised data.

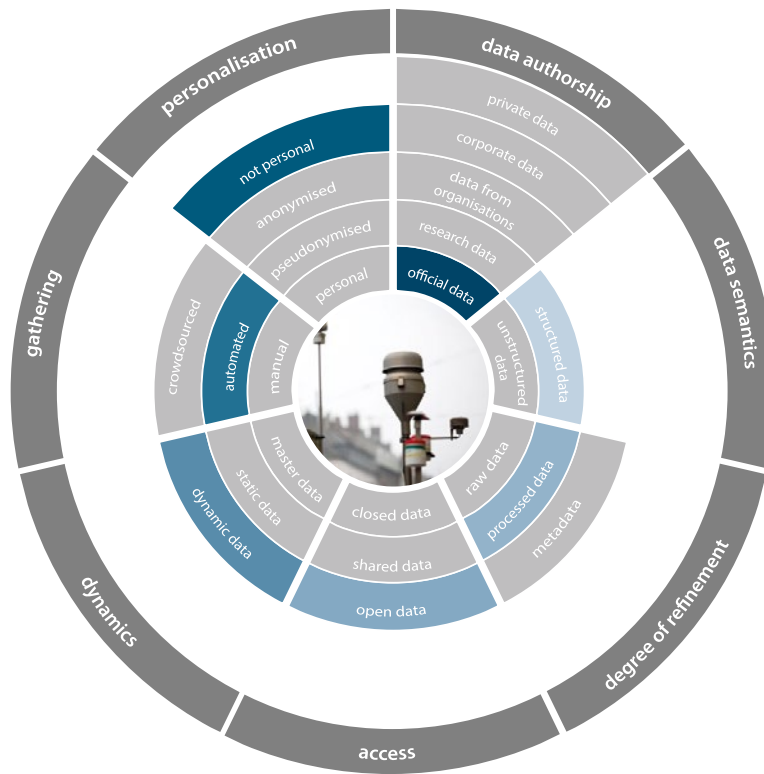


Figure 8: Data types in smart cities – air monitoring network. Source: ifok GmbH

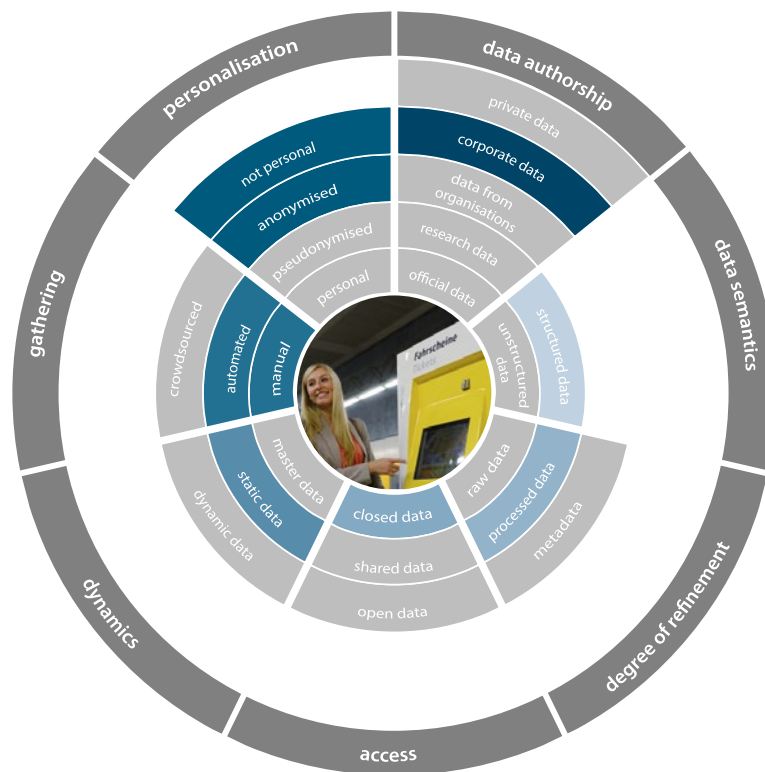


Figure 9: Data types in smart cities – passenger surveys conducted by public transport operators. Source: ifok GmbH

Examples of data types used in digital urban development

Air monitoring networks are one example of data used in urban development. In this context, data are used to:

- calculate the parameters of air pollution to determine the air quality on the basis of threshold and guide values;
- geographically locate potential pollution in connection with the use of other location-based data;
- determine the concentration of noxious substances for various approval processes;
- establish the causes of air pollution;
- track the success of air pollution control measures, and
- keep the public informed.

This requires the automatic and digital collection and processing of values for relevant substances in the air with 5-minute granularity. The values measured include the concentrations of sulphur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), benzene (C₆H₆) and ozone (O₃) along with particulate matter (PM10) and black carbon. Once the data have been measured and processed (consolidated, checked for relevance etc.), they are published on a page of the city's open data initiative as publicly accessible real-time and historical data in a readily understandable form.

Another use of data for urban development comes in the form of passenger surveys conducted by public transport operators. These surveys are used to:

- determine the capacity of certain routes at predefined periods (rush hour, weekends, periods with a small number of commuters) in combination with the use of location-based data;
- establish common connections in combination with the use of location-based data;
- gain improved insight into the types of ticket used by various passenger groups, and
- facilitate a qualitative survey of customer needs, e.g. according to changes to transport intervals, stop relocations or track expansion.

To this end, passengers are targeted by appointed teams within a predefined period (e.g. a calendar week) in the regions under review or network sections for modes of transport. Participation is voluntary. Passengers are asked to provide information on their departure and destination station, whether their journey required them to make any connection, and which ticket type they have purchased (single, week, monthly or annual). They are also asked whether they experienced any issues during their trip, e.g. whether they thought there might be a more convenient route or a more appropriate timetable. In this case, data are collected manually through analogue paper surveys. They are then merged by the transport operator with data collected automatically and digitally from ticket machines and other sources for further processing. As this involves an individual collection operation, in contrast to master or real-time data, these data are classified as static. They are collected for commercial reasons and used to improve operations. The data collected thus remain within the transport company.

6.3 Data security

Data security is a particularly important topic for all types of data. Three requirements in particular, i.e. confidentiality, integrity and availability, need to be fulfilled:

Confidentiality

Confidentiality entails safeguarding data against unauthorised disclosure. Confidential data and information must only be made accessible in an approved manner to those who are authorised to access them.

Integrity

Integrity refers to ensuring the accuracy of data and the correct operation of systems. When the term integrity is used in relation to data, it means that the data are

complete and unaltered. However, in IT, it has a broader interpretation and is also applied to information. In this context, information refers to data to which certain attributes can be assigned, such as author, time or creation, depending on the context. As a result, when the integrity of information is lost, this information could be altered without permission, information on the author could be falsified, or the time at which the information was created could be tampered with.

Availability

Services, IT system features, IT applications, IT networks and information are considered available if they can be used at all times by the user as intended.

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