Monitoring
for a smart city
Research project
results

SMART...
MONITOR

SMART
CITY
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SMART.MONITOR
exploratory project

Development of a monitoring concept for the Smart City Wien Framework Strategy

The goal of the exploratory project was to develop a monitoring concept for the Smart City Wien Framework Strategy – a long-term, city-wide umbrella strategy. Key steps included the development of indicators for the targets defined in the framework strategy and the conceptualisation of a monitoring process.

Duration:
September 2015–October 2016

Funding body:
Federal Ministry for Transport, Innovation and Technology (bmvit)

Call for tenders:
City of Tomorrow/Second call

Processing agency:
Austrian Research Promotion Agency (FFG)

Project co-ordination:
Municipal Department 18 – Urban Development and Planning

Project partners:
• AIT – Austrian Institute of Technology GmbH
• denkstatt GmbH
• TINA Vienna GmbH
• WWTF – Wiener Wissenschafts-, Forschungs- und Technologiefonds GmbH

Contents of this booklet

This lessons learned report summarises the key results and findings of the SMART.MONITOR project. In addition to information about the background and content of the Smart City Wien Framework Strategy, it provides details about the monitoring concept that was developed, in particular regarding the procedure and the defined indicators. The basic principles for the execution of the SMART.MONITOR project are described and an outlook is provided regarding the further development and implementation of the monitoring system by the City of Vienna.

This booklet may be of interest to you if you

- work for cities or research institutions in the field of smart cities and want to learn more about smart city monitoring.
- are looking for tips for the conceptualisation of a city-wide, interdisciplinary monitoring process.
- want to know more about the City of Vienna's experiences in the development of a smart city monitoring process with the support of a funding project.

Monitoring in SMART.MONITOR – What does this entail?

The monitoring process is intended to verify whether the targets defined in the Smart City Wien Framework Strategy are being achieved. To this end, the employees of the City of Vienna and its affiliated institutions are tasked with evaluating the achievement of these targets from a quantitative and qualitative standpoint (see example on p. 17). These efforts are focused on mutual, interdepartmental reflection on the developments of the City of Vienna and the introduction of improvement measures. The goal is to optimise the implementation of the framework strategy and boost the level of efficiency.

Benefits of a city-wide smart city monitoring process

Why do we need a monitoring process?

Long-term strategies such as the Smart City Wien Framework Strategy can make it tempting to put necessary steps off until the future. However, the monitoring process ensures that the strategy and the defined targets have to be examined on a regular basis, it measures and keeps track of their progress, and it sheds light on areas where action is needed.

Regular monitoring …

- provides a well-founded strategic information and decision-making basis for policymakers and authorities and facilitates the timely management and co-ordination of resources.
- gives insight into a broad range of policy fields in the city due to the tremendous variety of topics encompassed by a smart city.
- identifies interdisciplinary topics and interfaces and provides motivation for networking and collaboration.
- reveals development tendencies in all important policy areas of the city and promotes objectivity, transparency, and discussions on the basis of the underlying data and facts.
- serves not least as a basis for mutual discourse.

Regular monitoring puts especially relevant issues in a new context and raises awareness among the city administration and the city's residents with regard to the joint implementation of the Smart City Wien Framework Strategy.

Background
and initial situation
How did this come about?

Vienna in context
How is Vienna confronting the challenges of the future?

Climate change, the drastic shortage of natural resources and especially fossil fuels, and rapid population growth in urban areas represent the challenges of the present and the future. As important living spaces for people, cities in particular have to react to these trends. The City of Vienna is facing these challenges head-on and has defined its objectives for the coming decades in the Smart City Wien Framework Strategy. Vienna frequently ranks among the most successful cities in the world in many areas, such as quality of life, infrastructure, and innovation. It is crucial to secure and further improve upon this status for the future, as well. In order to provide residents with credible prospects, the City of Vienna is focusing on the concept of the smart city – for an intelligent, future-ready, and opportunity-oriented city. The Smart City Wien Framework Strategy was developed in co-operation with many experts and stakeholders in order to establish a concrete plan for this initiative. It was adopted by the Vienna City Council in June 2014 and sets targets for all of the city's important policy fields until 2050.

Smart City Wien Framework Strategy
The strategy document for the Smart City Wien initiative

The Smart City Wien Framework Strategy supports the interlinking of the three key target areas for the future development of the city: quality of life, resources, and innovation. The basic topics of each target area are assigned to target segments.

QUALITY OF LIFE:
• Social inclusion
• Healthcare
• Environment

RESOURCES:
• Energy
• Mobility
• Infrastructure
• Buildings

INNOVATION:
• Education
• Economy
• Research, Technology, and Innovation (RTI)

Figure 1: The Smart City Wien principle – target dimensions and target areas

Quantitative and qualitative targets were formulated for the target dimensions and target areas with a long-term horizon for achievement until 2030 or 2050, thus facilitating strategic and sustainable political action.

Smart City Wien's guiding objective for the year 2050 is as follows:

It is thus the key goal for 2050 of Smart City Wien to offer optimum quality of life, combined with highest possible resource preservation, for all citizens. This can be achieved through comprehensive innovations.

As a comprehensive umbrella strategy, the Smart City Wien Framework Strategy provides a long-term perspective for the City of Vienna's sectoral strategies, plans, and programmes. The strength of the Smart City Wien Framework Strategy lies in its focus on interlinking the individual functional strategies, which promotes interdisciplinary planning and development.

Figure 2: The Smart City Wien Framework Strategy as a blueprint for Vienna's sectoral strategies

Monitoring in the context of the Smart City Wien Framework Strategy

When the Smart City Wien Framework Strategy was adopted by the Vienna City Council, the city administration was tasked with analysing the implementation status of the strategy in a periodic monitoring process. In order to enable the basic aspects for this monitoring process to be developed in detail by an interdisciplinary team, the SMART.MONITOR exploratory project was created and successfully submitted under the City of Tomorrow research programme.

SMART.MONITOR
at a glance
Submission and progression
of the exploratory project

Motivation for project submission
Advantages of funded projects
from the City of Vienna's perspective

Thanks to the additional resources provided by funded projects, urban tasks can be analysed in greater detail and examined from multiple perspectives by interdisciplinary project teams.

With funded projects, cities can work with relevant stakeholders from the scientific community, the research sector, and industry on an equal playing field, thus generating applicable research findings that are geared towards the needs and issues of cities. At the same time, they enable thinking that goes beyond the specified conditions and thus support the integration of innovative approaches and products in the city.

As the co-ordinator of this project, the City of Vienna makes sure that the results are oriented towards the requirements and structures of the city, ensures the interface between the project team and the administration, and thus guarantees the implementation of the project results.

Project structure

The goal of the project was to develop a monitoring concept for evaluating the target achievement status of the Smart City Wien Framework Strategy, with focus being placed on both the identification of suitable indicators and the conceptualisation of the monitoring process.

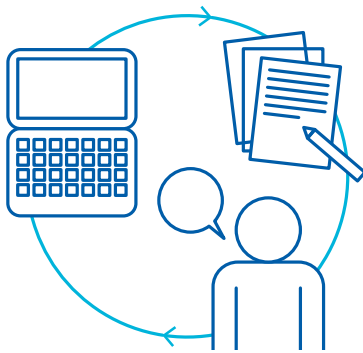The project schedule was divided into three phases:

PHASE 1 Sep. 2015 – Dec. 2015
Identification of the potential users' requirements for a monitoring system and review of existing data and processes of the City of Vienna

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PHASE 2 Jan. 2016 – Mar. 2016
Development of indicators for the targets of the framework strategy – based on the results of the basic groundwork and in co-operation with the city agencies involved

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PHASE 3 Apr. 2016 – Aug. 2016
Conceptualisation of the procedures for the monitoring process and development of a target group-oriented communication concept

Sharing experiences
The regular exchange of experiences with the reference cities of Berlin, Graz, Munich, and Salzburg allowed the team to reflect on its own work and provided new approaches.

Figure 3: SMART.MONITOR project phases

Principles for
project implementation

What were the points
of particular emphasis?

Co-operation as a guiding principle

For a city-wide and interdisciplinary monitoring process to be success-ful, intensive co-operation with the future users is essential. To this end, every step of the project – particularly the development of the indica-tors – was completed with the involvement of the agencies and affili-ated institutions of the City of Vienna. Thematic focus groups, structured interviews, one-on-one conversations, and themed workshops facilitated the extensive examination of content- and process-related issues.

The plans and interim results were the subject of broad discussions at the launch and mid-term workshops.

Catering to the users' requirements
and needs

The principle of collaboration and co-operation directly resulted in another important aspect of the project: From the outset, emphasis was placed on identifying the requirements and needs of the potential users and participants in the monitoring process in detail and ensuring that they were reflected in and integrated into the project.

The key requirements for the monitoring process:

- Built upon existing data, reports, and structures
- Networking between the agencies involved should be supported, thus providing a city-wide knowledge exchange platform for initiating joint measures.
- It should lead to clear outcomes and learning processes. Therefore, results and content must be prepared in a way that allows them to be communicated to the relevant target groups.
- A clearly organised, "automated" process should facilitate the smooth exchange of data and keep the effort required from everyone involved to a minimum.

Built upon existing data and reports

The City of Vienna has a comprehensive reporting system and can therefore draw on a wealth of data, reports, and studies. In order to prevent the creation of parallel structures and keep the effort required from everyone involved to a minimum, the process must be built upon these resources. At the same time, this approach allows the situation regarding the existing data set to be examined and any needs to be identified. Therefore, one of the requirements for the development of the monitoring and indicator concept was to conduct a thorough analysis of the city administration's data set and reporting system in co-operation with the responsible specialist departments so that they could be utilised appropriately.
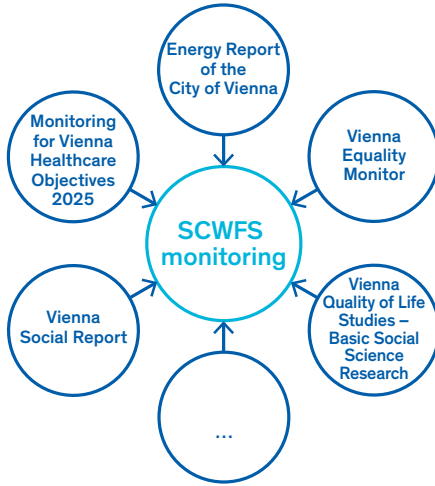
Figure 4: Examples of data sources upon which the monitoring process for the Smart City Wien Framework Strategy is built

Integration of the monitoring concept in the City of Vienna's processes and structures

In order to ensure the application of the project results, a steering group was established at the city level and decision makers were informed about the project status on an ongoing basis. Regular feedback cycles allowed adjustments to be made to the approaches and concepts whenever necessary and yielded results that are transferable and suitable for the given application. This made it possible to test interim results in the Vienna city administration, adapt them in line with the specific requirements, and refine them in a parallel process outside of the project. This ensured that a monitoring system that is scheduled to be used by the City of Vienna starting in 2017 can be developed further based on the project results.
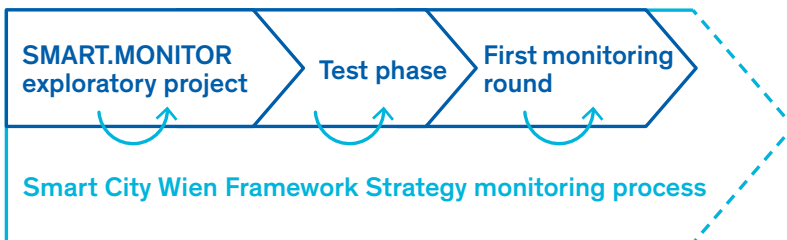
Figure 5: Ongoing co-ordination with decision-making bodies of the City of Vienna

SMART.MONITOR results
Monitoring process

The targeted monitoring process was thoroughly discussed and prepared in the SMART.MONITOR exploratory project and is intended to make it possible to integrate monitoring into the city administration's workflows.

Monitoring as part of strategic management

The strategic management cycle approach was adopted in order to ensure that monitoring can serve as an enabler for the efficient implementation of the Smart City Wien Framework Strategy. This comprises the four basic elements of "planning", "implementation", "monitoring", and "controlling".

In this context, monitoring serves to measure and verify target achievement on a regular basis.
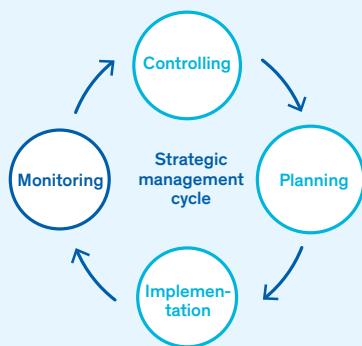
A strategic management cycle for the Smart City Wien Framework Strategy was developed in line with the process management principles of the City of Vienna. This focused on the monitoring process, which was documented in detail and in a process description.

Figure 6: The strategic management cycle and the integrated monitoring process

Procedure for the monitoring process

The implementation and management of a city-wide monitoring process requires a senior monitoring administrator who commissions monitoring and is responsible for its implementation. In addition, the co-ordination of the monitoring process requires a co-ordination team, which collects the evaluations and prepares the final results. Its job is to ensure the regular implementation of the monitoring at a high level of quality and the communication of relevant results to the various target groups and to serve as a liaison between the reporting units and the senior monitoring administrator.
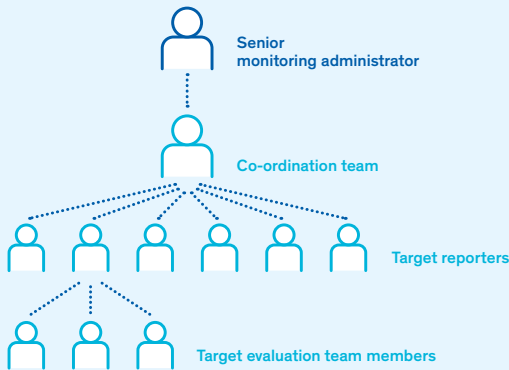
Figure 7: Recommended communication flows in the monitoring process

A reporting unit (target reporter) within the City of Vienna or its enterprises was recommended for each of the targets defined in the Smart City Wien Framework Strategy. However, reporting does not necessarily mean taking on responsibility for achieving the target, but rather developing a joint assessment of the target achievement together with a target evaluation team made up of relevant stakeholders from the city. Because some of the targets are formulated very broadly, the joint expert assessment of developments pertaining to the target and an interpretation of the measured data are essential. This expert assessment and joint evaluation represent the true core of the Smart City Wien Framework Strategy monitoring process.

Tasks of the reporting unit (target reporter) in co-operation with the target evaluation team:
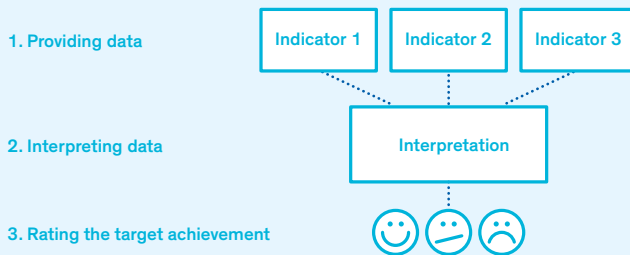
Monitoring as a tool for dialogue

The Smart City Wien Framework Strategy monitoring process is intended to offer a knowledge exchange and networking platform for the topics covered by the strategy. Particularly the formation of target evaluation teams promotes communication and interdisciplinary co-operation between various agencies and institutions of the city administration and makes cross-disciplinary focuses and interfaces visible. This can be seen as a quality assurance tool. Thus, the monitoring process serves as a sounding board for the target evaluation teams for interdisciplinary topics and challenges and as a platform for the development of joint project ideas and cross-disciplinary visions.

Indicators and target evaluation

Procedure for the indicator development

First, standardised indicator fact sheets were prepared in order to ensure that all of the necessary information, such as the definition, data source, and release interval, is identified and uniformly documented for each indicator.

Next, one or more indicators were developed for each target defined in the framework strategy. Due to the broad formulation of the targets in some cases and the principle of joint preparation, emphasis was placed on maintaining ongoing feedback cycles with the various specialist departments.

The following work steps were completed during indicator selection:

1. Preliminary research and discussions
- Target analysis – analysing the possible interpretation of the target
- Screening of sectoral strategies, reports, and studies in the context of the target
- Clarification of the concepts related to the target
- Extraction of important aspects from the target formulation
- Preliminary discussions with experts from relevant specialist departments: clarification of how to proceed, identification of additional contacts, etc.

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2. Development of indicator recommendations
- Development of indicator recommendations (including data sources)
- One-on-one discussions with potential users: Discussion regarding potential indicators and their data sources on the basis of the indicator recommendations
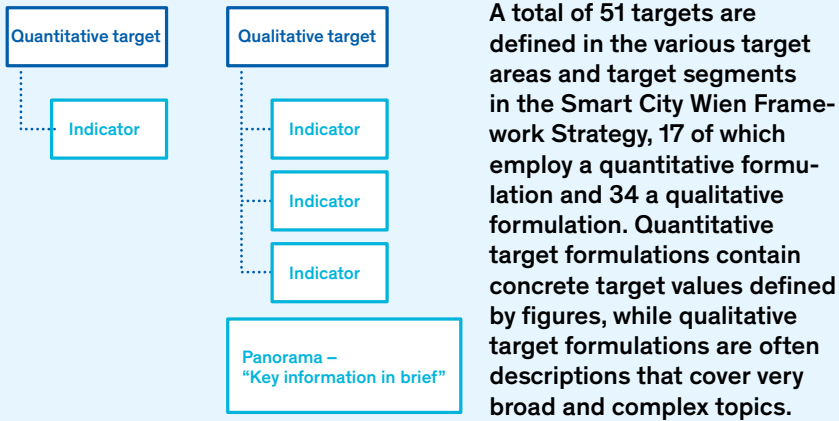
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3. Selection and preliminary draft of the indicators
- Reduction/simplification: Focus groups with relevant stakeholders for final indicator selection (pragmatic approach!)
- Addition of missing information to the indicator fact sheets and clarification of open questions
- Final discussion of the preliminary results during the mid-term workshop with 60 subject matter experts from 43 agencies and affiliated institutions of the City of Vienna

Indicators and indicator sets

No universal solution for all targets

The examination of the various characteristics of the targets (e.g. quantitative/qualitative) at the beginning of the development of the indicators is crucial. Different types of targets require different approaches in the development of the indicators.

Quantitative target

Indicator

Qualitative target

Indicator

Indicator

Indicator

Panorama – "Key information in brief"

A total of 51 targets are defined in the various target areas and target segments in the Smart City Wien Framework Strategy, 17 of which employ a quantitative formulation and 34 a qualitative formulation. Quantitative target formulations contain concrete target values defined by figures, while qualitative target formulations are often descriptions that cover very broad and complex topics.

Figure 8: Different approaches for quantitative and qualitative target formulations

- **In most cases, a single indicator was able to be identified for quantitative targets that represents the target value that is to be achieved.**
- **For the qualitative targets, on the other hand, it was necessary to first extract the most important aspects from the target formulation in order to subsequently develop an appropriate indicator set. In order to support the evaluation of the target achievement, the key findings from this indicator set are to be summarised in a "panorama" (brief abstract) and interpreted in the context of target achievement.**

Thus, the developments pertaining to each target are registered using either an indicator or a "panorama", which ensures that the results can be prepared in a compact form.

Evaluation of target achievement

Evaluation categories
Four evaluation categories were developed for the target evaluation teams to rate target achievement on the basis of the indicators. The simple colour-coded rating system allows for the overall results to be presented in an appealing graphical form.

- ● Target fully achieved/fully on course to be achieved
- ◉ Target largely achieved/largely on course to be achieved
- ○ Target partially achieved/partially on course to be achieved
- ○ Target not achieved/not on course to be achieved

Figure 9: The four evaluation categories for rating target achievement

Evaluation criteria
Pre-defined evaluation criteria can help ensure that the rating is transparent and make the assessment easier for the reporting unit. These define the basis for rating target achievement.

The definition of target paths and evaluation criteria can be particularly helpful and expedient for quantitative targets. By contrast, it can be assumed that the evaluation of qualitative targets will generally be based on a qualitative expert assessment. Examples of such evaluation criteria were developed for selected targets in the course of the SMART.MONITOR project.

Selected examples

TARGET "Increase of energy efficiency and decrease of final energy consumption per capita in Vienna by 40% by 2050 (compared to 2005)"

- **Quantitative target:** (target value, target year, and base year present)
- **One indicator:** Final energy consumption [kWh per capita]
- **Source:** Energy Report of the City of Vienna (released annually)
- **Evaluation criteria:** Analysis of the trend for previous years and linear extrapolation until 2050. "Target fully achieved" = when the estimated value reaches the target value
- **Reporting unit:** Municipal Department 20 – Energy Planning

TARGET : "Vienna maintains its quality of life at the current superlative level and continues to focus on social inclusion in its policy design: as a result Vienna in 2050 is the city with the highest quality of life and life satisfaction in Europe."

- **Qualitative target:**
  (target year present, but no target value or basis year)
- **Indicator set:**
  - Subjective satisfaction with living conditions in general [%*]
  - Subjective rating of life in Vienna [%*]
  - Subjective rating of quality of life in comparison with other European cities [%*]

    * Percentage of respondents who agreed with the statement with ratings of "very" or "quite"
- **Sources:**
  - Basic Social Science Research – Vienna Quality of Life Studies
  - Austrian Health Survey
  - Urban Audit Perception Survey (UAPS) of the European Commission (2009)
- **Summary – "Key information in brief"**
  EXAMPLE: "Various surveys of the city's residents in recent years show a high level of life satisfaction for the majority of the population. Most residents of Vienna are happy to live in the city. A comparison with other European cities confirms Vienna's position at the very top of the list. Thus, the target can currently be considered achieved. Since no negative trends can be identified, there is nothing from today's perspective to indicate that the target will not be achieved in 2050."
- **Evaluation criteria: Qualitative expert assessment**
- **Reporting unit:** Municipal Department 18 – Urban Development and Planning

Making use
of the results

Further development and implementation of the monitoring process

The results of the SMART.MONITOR project form the basis for the further development and implementation of the Smart City Wien Framework Strategy monitoring process by the City of Vienna. Starting in May 2016 – parallel to the SMART.MONITOR exploratory project – the results were further developed by the Smart City Wien Project Office in Municipal Department 18 in co-operation with the Smart City Wien Agency, co-ordinated with policymakers, and put through a test phase. The first full round of monitoring is planned for 2017.

The monitoring process is intended to be a learning process and will thus be evaluated and improved on an ongoing basis and will also serve as the basis for the further development of the framework strategy over the long term.

Outlook for future activities

The co-operation of the various participants in the monitoring process resulted in the creation of new interfaces within the city administration and the identification of mutual needs and interests such as a lack of current data or an insufficient overview of existing data sets. These issues will now be pursued and dealt with by the City of Vienna.

In addition, the SMART.MONITOR exploratory project revealed the potential and importance of an interdisciplinary monitoring approach that is more strongly interlinked between various fields. One of the next steps will be to work on fleshing out the interdisciplinary analysis – in line with the holistic approach of the Smart City Wien Framework Strategy. After all, the smart city can only become a reality when all of the various areas are linked with one another, understood, and developed further. The comprehensive monitoring process will be developed gradually through the inclusion of the established network of monitoring participants.

In addition, the current monitoring concept for the Smart City Wien Framework Strategy applies to the city as a whole and is thus in no way a substitute for monitoring at the city district level. Accordingly, it would make sense to break down the Smart City Wien Framework Strategy to the city district level in the future, in order to ensure that smart city qualities are implemented at all levels. This requires adapted objectives and quality criteria at the city district level, which should also be subject to a monitoring process.

Additional information

Links to additional information
(only available in German)

- Smart City Wien – web site:
  smartcity.wien.gv.at/site
- Smart City Wien Framework Strategy:
  www.wien.gv.at/stadtentwicklung/studien/pdf/b008380a.pdf
- SMART.MONITOR – web site:
  www.wien.gv.at/stadtentwicklung/projekte/smartcity/
  smart-monitor/index.html
- SMART.MONITOR – project flyer:
  www.wien.gv.at/stadtentwicklung/studien/pdf/b008447.pdf

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Do you have additional suggestions or questions?
E-mail them to us at: smartcity@ma18.wien.gv.at.
We look forward to hearing your feedback!

10 key findings
Recommendations from a city perspective

The lessons learned in the SMART.MONITOR project were shared with other cities on an ongoing basis. Discussions with Graz, Salzburg, Cologne, Munich, and Berlin resulted in ten recommendations for the development of a smart city monitoring process:

1. Use funded projects as an incentive and trigger.

2. The city should act as a partner to ensure that the results can be implemented.

3. Include users and other stakeholders in the process from the very beginning.

4. Build upon the city's existing data and structures.

5. Avoid complexity and don't be afraid to admit what you don't know.

6. Test, test, test – ongoing feedback cycles and reality checks help ensure success.

7. Establish clear responsibilities and structures.

8. Standardisation simplifies the process (e.g. fact sheets).

9. Use appealing visual presentation to provide information.

10. Continuous exchange with other cities offers high learning potential.