
triangulum

DEMONSTRATE · DISSEMINATE · REPLICATE

# *D6.8 Revised implementation plan Leipzig_Update*

*WP 6, Task 6.7*

*January 2020 (M60)*

H2020-SCC-2014-2015/H2020-SCC-2014: "Smart Cities and Communities solutions integrating energy, transport, ICT sectors through lighthouse (large scale demonstration - first of the kind) projects"

Collaborative Project – GRANT AGREEMENT No. 646578

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| | | | |

This implementation plan is an update of "iD6.7.5" that was submitted in month 36 and was accepted. The update especially refers to sections, 3.1.2, 3.2.4 (new) and 3.4 as well as an update of the implementation status of the projects in chapter 4. Also, a new chapter (chapter 5) was added with an outlook on the planned activities beyond Triangulum.

# Executive Summary

The City of Leipzig is one of the most dynamic cities in Eastern Germany with around 600,000 (10/2019) inhabitants today. Leipzig's economy is successfully turning from a post-industrial to a modern, knowledge-based economy. The city has long-term experience in using European and national funding for urban regeneration projects. In the past, Leipzig successfully took part in the URBAN initiative, and it uses the European Regional Development Funds and European Social Funds (ERDF/ESF) in combination with national subsidy programs for the regeneration of multiple districts. The inclusion of citizens and civil initiatives in urban regeneration processes has been one of the key success factors for Leipzig's positive development in the last decade.

The adequate reaction to the city's fast-growing population - in the face of limited financial resources - is one of the biggest challenges the City of Leipzig is facing today. Smart and integrated solutions are crucial in order to master these challenges of a growing city. The Horizon 2020 Smart Cities and Communities project Triangulum proved to be of utmost importance for the development of smart solutions within the city. In an extensive participation process, relevant stakeholders have been identified and possible solutions developed. With the support of businesses, science and the public this implementation strategy has been written in order to guide the future implementation of smart city solutions in the City of Leipzig. It addresses the sectors energy, ICT and mobility in an integrated way. The revised implementation strategy describes the area Leipzig West, used for the implementation of smart city solutions. The developed solutions themselves are listed and their costs, the funding and business models applied for implementation are addressed. Furthermore the reference to the lighthouse cities, the key timescales, the lead partners, and the local governance & coordination structure are indicated, if possible.

This implementation strategy is aligned to the implementation structure within the Lighthouse Cities and includes further measures for citizen integration and participation. Effective implementation is envisaged to start on year 4, but depends on the availability of funding.

This implementation strategy is an update of the version of month 36. The update especially refers to sections, 3.1.2, 3.2.4 (new) and 3.4 as well as an update of the implementation status of the projects in chapter 4. Also, a new chapter (chapter 5) was added with an outlook on the planned activities beyond Triangulum. Updates are written in blue.

# Table of Content

## Content

# List of Figures

# List of Tables

# 1 City context and definition of the policy challenge

## 1.1 Overview of current state of the city

The City of Leipzig, located in the Free State of Saxony in Germany, is a regional centre with great importance for the economic, social and cultural development of the region. In cooperation with such cities as Halle, Dresden, Chemnitz and Zwickau the City of Leipzig form the metro area Mitteldeutschland (Mid-Germany) which is of great importance to the economic competition on a European level.

At the beginning of the 20th century, Leipzig was one of the four biggest cities in Germany with a prosperous and diverse economic structure. With the centralistic structure of the former German Democratic Republic (GDR), the city lost its importance as well as a significant amount of its population. With the turnaround in 1989 and the German reunification in 1990, Leipzig faced multiple challenges: to redefine and fill the city with life in a transformed system, an open world and a globalized economy.

Today, the City of Leipzig is one of the most dynamic cities in Eastern Germany with around 600,000 inhabitants (2019). After years of population decline and an above-average unemployment rate, Leipzig started to regain popularity in the last years. The number of inhabitants is increasing continuously. Population forecasts anticipate around 665,000 inhabitants in the year 2040 (2000: ca. 493,000 inhabitants).[1]

Leipzig's economy is successfully turning from a post-industrial to a modern, knowledge-based economy. The city's economic strategy focuses on five clusters: automotive & suppliers, healthcare & biotech, energy & environment, logistics & services and media & creativity. Although three large companies of the automotive industry (Porsche, BMW) and logistics (DHL, Amazon) are located in Leipzig, the small and medium enterprises (SMEs) form the backbone of the local economy. Two out of three employees in Leipzig work for companies with less than 250 employees. Despite the very positive employment development of the past decades, the employment rate in 2017 read 7.0 % and with that well above the Germany-wide average.[2]

Traditionally the City of Leipzig is home of a variety of high-level education institutions such as the Leipzig University or Handelshochschule (HHL) Leipzig. About 39,000 students were enrolled in fall term 2018/2019.[3] Although there's a great variety of subjects which can be studied in Leipzig, the different universities also see the need to adjust their range of offers towards digitization. E.g. the HTWK Leipzig (Leipzig University of Applied Sciences) will establish a new faculty "Digital transformation" including 17 chairs with approx. 500 students in 2019.[4]

Leipzig has long-term experience in using European and national funding for urban regeneration projects. In the past, Leipzig successfully took part in the URBAN initiative, and it uses the European Regional Development Funds and European Social Funds (ERDF/ESF) in combination with national subsidy programs for the regeneration of multiple districts. Including citizens and civil initiatives in urban regeneration processes has been one of the key success factors for Leipzig's positive development in the last decade. Leipzig's tradition of strong civic engagement is very much valued and plays an important part in any further development.

The adequate reaction to the city's fast-growing population - in the face of limited financial resources - is one of the biggest challenges the City of Leipzig is facing today. This includes all relevant sectors: provision of affordable housing, energy consumption, waste management and sustainable mobility. Smart and integrated solutions are crucial in order to master these challenges of a growing city. However, the integrated urban development approach

[1] Data: City of Leipzig, Population Register.
[2] Data: City of Leipzig.
[3] Data: City of Leipzig.
[4] https://www.htwk-leipzig.de/no_cache/hochschule/aktuelles/newsdetail/artikel/1642/

was and continues to be one of the most important tools for shaping the future of the City of Leipzig. Therefore, it is of utmost importance to integrate this Smart City Implementation Strategy into plans and strategies existing today (INSEK – see next chapter 1.2.1).

## 1.2 Strategies and concepts

### 1.2.1 Integrated Urban Development Concept (INSEK) Leipzig 2030

In 2009, the City of Leipzig endorsed the Integrated Urban Development Concept "SEKo Leipzig 2020". It incorporated all significant topics and provided an overarching future strategy. The strategy was developed by a special taskforce within the city administration with contributions by civil society, science institutions and the local economy. However, it couldn't foresee the rapid growth of Leipzig which followed. In 2010, the first indication for a trend shift became visible as Leipzig turned from a shrinking city into a rapidly growing city. The strategy no longer suited the reality Leipzig was facing, and in 2015 the revision of the strategy now called the INSEK Leipzig 2030" (Integrated Urban Development Concept Leipzig 2030) was endorsed in May 20185. Since then a comprehensive strategy has been developed, again with the active involvement of the public. The Smart City process – more specific, the Triangulum project – has been closely linked to the revision. The new INSEK Leipzig 2030 includes a section on the "Digital City" ("Digitale Stadt"6) which illustrates cross-cutting topics in the development strategy. Leipzig action priorities within this context are:

- Development of digitization concepts and strategies for all parts of city administration including data security, data protection as well as participation and communication,
- Deployment of smart services and infrastructures,
- Improvement of media competences and capacity building for teachers and educators as well as
- Improvement of communication and participation.

The neighbourhood Plagwitz/Neulindenau (see also green area in Figure 1), which is part of the Triangulum project area of Leipzig-West, is declared as a "development area" in the INSEK. This means that this area has the potential to become a priority area for innovation and Smart City solutions in Leipzig.[7] Therefore, pilot projects for smart infrastructures, energy or smart mobility shall be developed and tested in this area. The area functions as an example for other neighbourhoods in Leipzig.

### 1.2.2 Overview of activities relevant to the Smart City Implementation Strategy

The protection of the environment has always been of high priority to the City of Leipzig. To fulfil the goal of reducing the $CO_2$-emissions per capita on a sustainable level of 2.5t until the year 2050, an Energy and Climate protection Concept (2011) and based on this, the Energy and Climate protection Work Program (2014) have been implemented. The later is currently updated, i.e. goals are revised together with partners and stakeholders from within and outside the city administration. The updated Energy and Climate protection Work Program shall be endorsed in spring 2020.

The local utility companies ("L-Group"), responsible for e.g. energy and heat supply, water supply and public transport, play an important role in the Smart City development in the city. The L-Group issued their strategy paper *Impulspapier leipzig.leben.morgen.* (*leipzig.living.tomorrow.*) in 2016 which delivered valuable input on possible

[5] The final document is available under: https://www.leipzig.de/bauen-und-wohnen/stadtentwicklung/stadtentwicklungskonzept-insek/ (only in German).
[6] See Part C.3, p. C 3 – 8 till C 3 – 10.
[7] See Part B p. 4 and p. 11.

projects and helped intensify the cooperation between the City of Leipzig and the utilities. The concept also includes various measures for efficient use of resources with the help of innovative technologies and the possibilities of digitisation.

In 2019 the Leipziger Stadtwerke (local energy provider) endorsed their new strategy for the further development of the central heating system of the City of Leipzig which will include the construction of solar thermal plants, biomass plants as well as a gas combined cycle power plant until 2023. From the mid-2020s onwards, the target portfolio of generation technologies will be supplemented by energy recovery from waste with a high calorific value. A key element of the transformation is the construction of a flexible gas combined cycle power plant by the end of 2022. Planning for this has already started and the ground-breaking ceremony is scheduled for the third quarter of 2020 at the latest.

Additionally, the Leipziger Stadtwerke is a partner in the SCC 1 project SPARCS (see 3.4) in which they will develop innovative digital solutions for the further development of the Leipzig energy and district heating system.

The City of Leipzig is engaged in the national "Dialogplattform Smart Cities" (Dialogue platform Smart Cities), initiated by Federal Ministry of the Interior, Building and Community[8]. Within the framework of the dialogue platform representatives of different German cities, ministries, science institutions, NGO's and industry representatives developed the Smart City Charta Germany in 2016 and 2017, which has been adopted at the 11th "Bundeskongress Nationale Stadtentwicklungspolitik" (National Congress for Urban Development Policy) in June 2017 and is the relevant guideline regarding Smart City development for German cities today.

The City of Leipzig contributed to the innovative and relevant Charta with the knowledge it gained during the Triangulum project. The "Dialogplattform Smart Cities" continues its work even after the endorsement of the Charta. The City of Leipzig is still an active member of the exchange.

The Smart City Charta Germany will be the basis for the city's own Smart City and digitization guidelines which will be developed in 2020.

## 1.3 Project area Leipzig West

Leipzig's activities within the Triangulum project focus on the district of Leipzig West with a special focus on the premises of the Baumwollspinnerei (a former cotton mill). The focal district Leipzig West includes the statistical districts of Lindenau, Neu- and Alt-Lindenau, Schleußig, Plagwitz, Leutzsch and Kleinzschocher which form the historic part of Leipzig West.

[8] Before September 2017 the Dialogue platform Smart Cities was organized by the Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety.

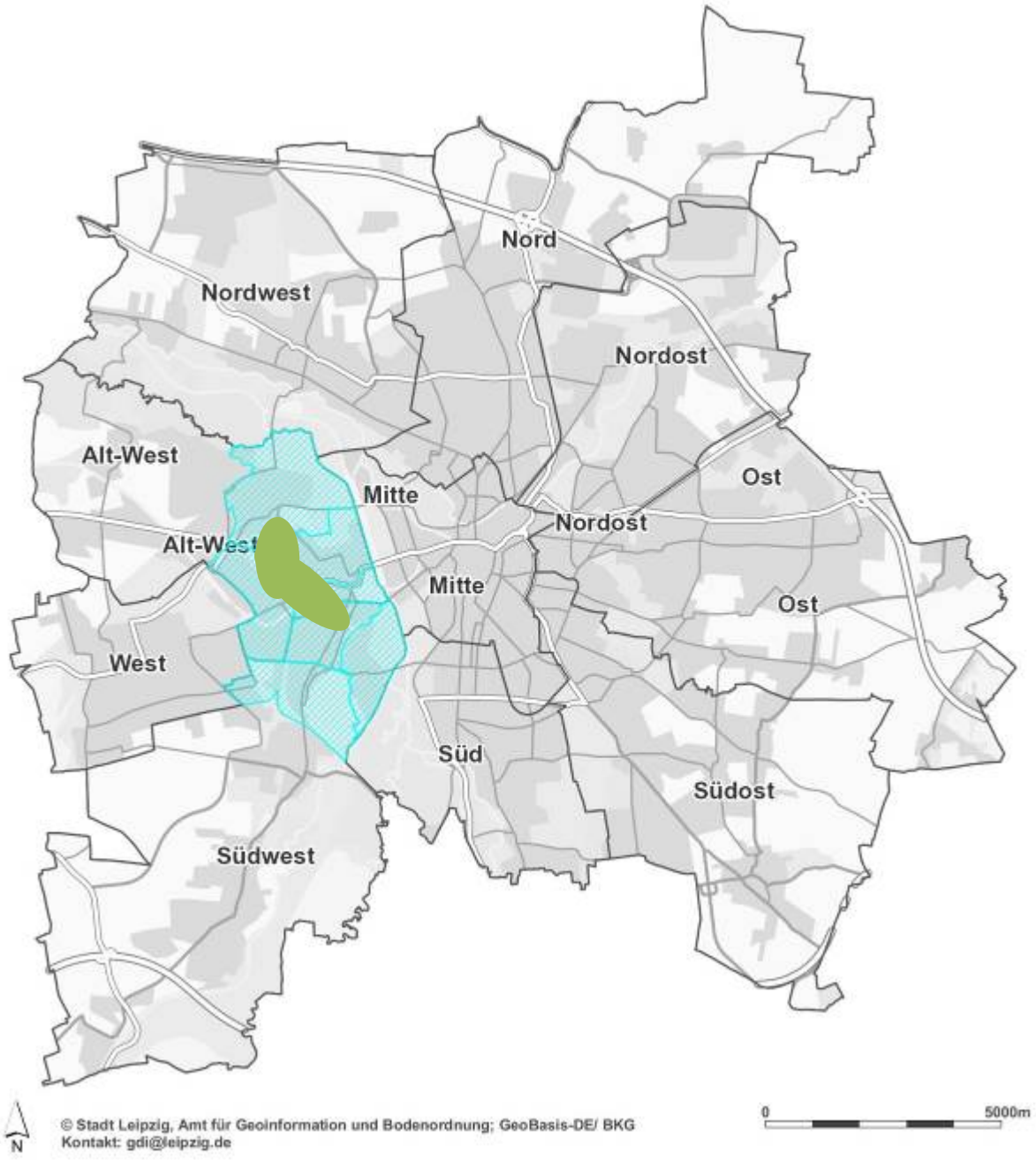



Figure 1: Map of the City of Leipzig, Project area "Leipzig West" in blue[9]

The area is dominated mainly by buildings from the Wilhelminian era and used to be one of Leipzig's most industrialised neighbourhoods. After 1989 many industrial sites fell derelict and the vacancy rate of the housing stock was rising.

Leipzig West has therefore been and continues to be one of the focus areas of urban regeneration with the support from different EU and national funding programs. After years of decline, the district is now one of the fastest growing districts in Leipzig (2016: 78,000 inhabitants, 2030: 95,000 inhabitants expected) and a cultural and

9 The area in green is the development area of Plagwitz/Neulindenau as described in the Integrated Urban Development Concept Leipzig 2030. City of Leipzig, Office of Geoinformation and Land Management, GeoBasis-DE/BKG.

innovative district within the city – and with that, it is home of many innovative small businesses and start-ups. Today the Karl-Heine-Kanal, as well as various attractive open spaces and heterogeneous building stock, contribute to Leipzig West's image of a vibrant housing area. Although several of the former industrial sites, such as the Baumwollspinnerei, Tapeten- and Westwerk have been in re-use again mostly by cultural and creative industries or have been turned into housing (e.g. Buntgarnwerke, Globus-Werke), there are still derelict or under-used sites waiting for commercial or housing development.

Figure 2: Images from Leipzig West[10]

As Leipzig West is increasingly the home to start-ups and SME's in the cultural field, a supporting structure for innovation and development evolved in the past years, ranging from business accelerators such as the SpinLab which received up to 17 million euros in funding for their start-ups, the Social Impact Lab and the Business Innovation Center to several co-working spaces. Multiple local subsidy programs of the city's economic development department aim at supporting innovation and promoting cooperation between different branches and enterprises.

Especially the premises of the Baumwollspinnerei (est. 1884, formerly one of the largest cotton mills in Europe) has undergone an exemplary development from "cotton to culture". After the breakdown of the production after 1989,

[10] Credit: City of Leipzig.

most of the brick buildings (area 6 ha) fell derelict. But already in the early 1990s a transformation process started, and the premises became home to new users - mainly artists - which opened their galleries there. Around 1,000 people are working in the area and about 200,000 visitors come to the Baumwollspinnerei every year. As the area faced the typical problems of deindustrialization, it has been a role model for other cities (see also Interreg project "SECOND CHANCE"). Due to the existing structures and the past and ongoing developments the area will be one focal point for Smart City developments within Leipzig West (see also chapter 3.3.3). Previously it was planned that the Natural History Museum would move to hall No. 7 on the premises. Construction works had already started but due to static issues which occurred during construction the concept of the new museum cannot be implemented in this building as planned. Hall No. 7 is being evaluated if hall No. 7 as home of the new "Smart Infrastructure Hub Leipzig" (see chapter 4.2.1).

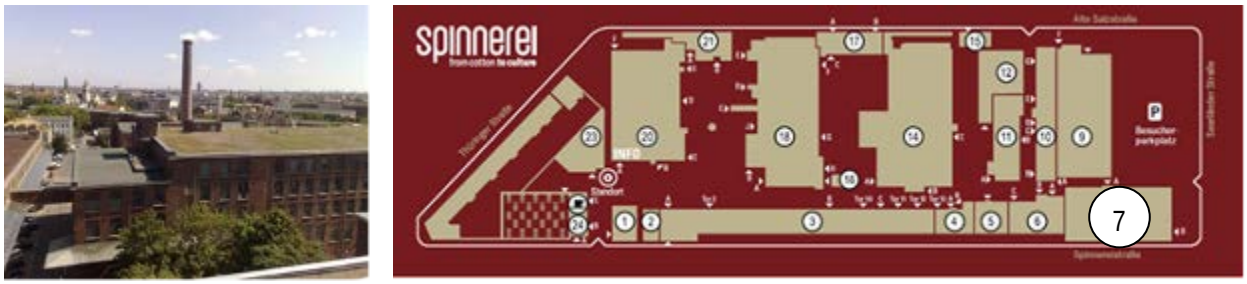



Figure 3: Image and map of the Baumwollspinnerei Leipzig (former cotton mill)[11]

Implementing smart city solutions within a compact, partly historic and dense neighbourhood bears multiple difficulties. Framework conditions like protection of cultural heritage buildings, very complex ownership structures and a socially mixed population increase the challenges of Leipzig West to become an energy efficient and smart district and prevent invasive interventions.

Leipzig West has always functioned as a role model and test case for urban development processes in Leipzig. The challenges of implementing smart city solutions within a compact, partly historical and dense neighbourhood are faced in different cities all over Germany and Europe. Leipzig West plays the role of a forerunner within the city, which makes it a well suited focal district for the Smart City implementation strategy.

### 1.3.1 Social structure

Since the year 2000, Leipzig West is growing noticeably faster compared to all of Leipzig (+43%, whole city: +14% in the period of 2000 until the end of 2015). At the end of 2015, around 78,000 people or 14% of the whole city population lived in the quarters of the project area. It is expected that the population in Leipzig West will grow constantly until the year 2030.[12]

[11] Image credit: City of Leipzig. Map from www.spinnerei.de (last accessed 31.05.2017).
[12] Data: City of Leipzig.

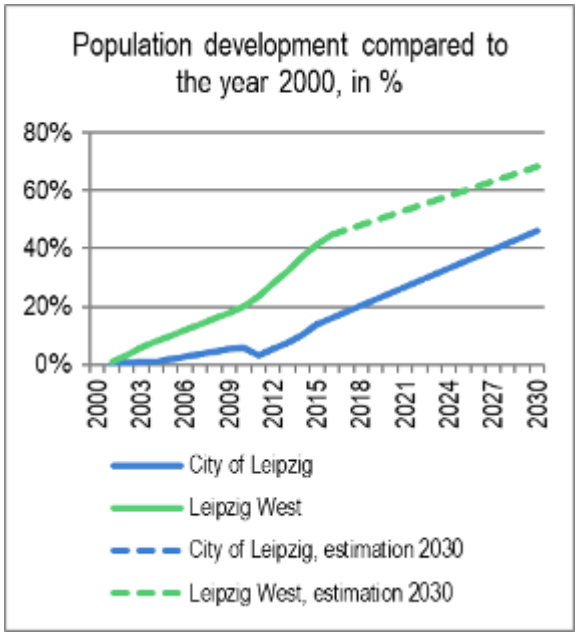



Figure 4: Population development, City of Leipzig and Leipzig West[13]

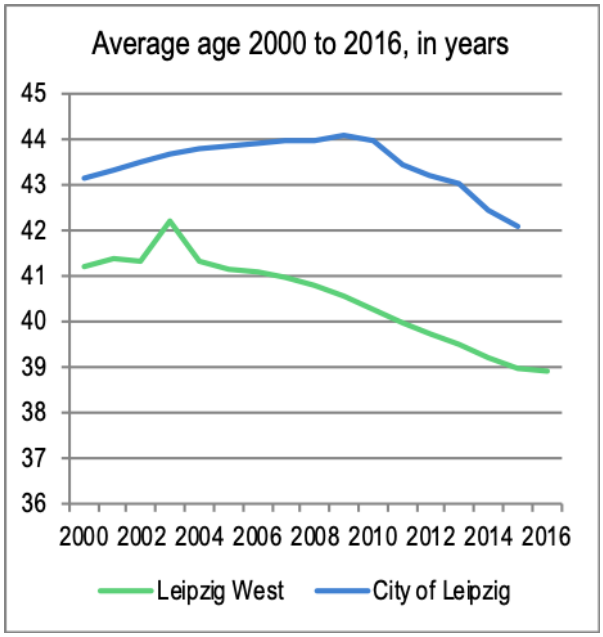



Figure 5: Average age of population, City of Leipzig and Leipzig West[14]

Besides the population growth, the average age in Leipzig West decreased in the last decade. Besides an increased influx of families, the rejuvenation of the local population is an expression of the influx of artists, students, tradespersons and employees middle-aged.

If compared to the whole city, the inhabitants of Leipzig West are at a disadvantage when it comes to the economic situation. With 7.7%, the unemployment rate for the project area Leipzig West is above the citywide average of 6.8% (both values for 2015). The most affected districts are Kleinzschocher and Altlindenau with an unemployment rate of 9.8% and 9.4%, respectively.[15]

### 1.3.2 Energy infrastructure

The urban pattern in Leipzig West is heterogeneous and carries the potential for improved energy efficiency. Some of the heat supply is provided by Leipzig's central district heating, especially in the southern parts of Neulindenau as well as in the southern parts of Plagwitz. An extension of the central district heating network in Leipzig West was realized (2017 – 2019). Overall, the Leipziger Group will invest 7.7 million EUR, from which 1,5 million EUR are supported by EFRD funds. The central district heating system in Leipzig plays a crucial role regarding a green energy future, as it can use renewable and conventional energies, distribute them according to demand and balance changing heating requirements. This is especially relevant considering the goal of the City of Leipzig to make its heat supply independent of coal.

For buildings in the eastern parts of Neulindenau, in the western parts of Lindenau and in the southern parts of Altlindenau however, local heating systems appear to be more efficient. Energy-saving measures within buildings

[13] Data: Free State of Saxony, Statistical Office.
[14] Data: City of Leipzig, Population Register.
[15] Data: Federal Employment Agency.

across the district have much room for improvement and carry the potential for a vastly improved overall energy balance.

### 1.3.3 Mobility

The thriving development of population and businesses in Leipzig West is not without consequences for transport development. The number of motor vehicles increased in the last years and at the end of 2015, 22,713 privately owned cars have been registered in Leipzig West. Around 80% of these vehicles are privately owned cars. This equals to a density of around 292 cars per 1000 inhabitants (at the end of 2015), which is below the average for the whole city (380 cars per 1000 inhabitants)[16], but shows an increase of privately owned the of 34% since 2001. Considering the unchanged road infrastructure, this means an actual load increase in roads, parking spots as well as pollution. The increase of privately owned cars in Leipzig West – especially Plagwitz (since 2001: +55%), Lindenau (+43%) and Neulindenau (+36%) – is considerably higher than in the whole city (+15%).[17]

Overall, the traffic in Leipzig and Leipzig West is dominated by cars. Due to population growth and the positive economic development, a further increase in passenger and freight traffic is to be expected in the coming years.[18] This coming increase in cars is seen as the main issue in the area of mobility, as the existing road network will not be able to bear the traffic and stationary traffic.

The bike is a popular mean of transportation in Leipzig West. Around 80% of all households owned a bicycle in 2014. It is well above the city average of 71%.[19] Nonetheless, the satisfaction with quality and supply of bicycle infrastructure in Leipzig West is well below average. Around 35 % of the population[20] in Leipzig West is satisfied or very satisfied with the quality and supply of bicycle infrastructure in the districts of Leipzig West.

The mobility infrastructure in Leipzig West is of adequate density and features multiple modes of transportation (see Figure 6). Besides very good tram infrastructure and frequent bus connections, multiple sharing options are available. This includes the local car sharing service teilAuto and the bike sharing service nextbike. The density of the sharing stations is good and above average when compared to the whole city.

In order to improve the interconnectivity and accessibility of all modes of transportation, four mobility hubs have been set up on highly frequented junctions in Leipzig West. They are part of a city wide network of 26 mobility hubs, following a city council resolution from the beginning of 2015. The mobility hubs are operated by the Leipziger Verkehrsbetriebe (LVB), which are part of the L-Group. These hubs provide a place where one can find a variety of mobility services in one spot, including bike sharing, car sharing and public transportation stops. Additionally, the mobility hubs feature the possibility for charging of electric vehicles. The idea of the mobility hubs is to advertise multimodal transport and ease interconnections between multiple modes of transportation.

The City of Leipzig aims at a further reduction of motorized private transport and a modal split with 20% bicycle usage in 2020 the latest. Considering the expected population increase, a drastically reduced usage of private motorized transport is necessary in order to prevent congestion as well as increased pollution.

[16] City of Leipzig/Office for Statistics and Elections (2016), “Ortsteilkatalog 2016”.
[17] Data: Federal Motor Transport Authority.
[18] City of Leipzig/Office for Economic Development (2017), „Leipzig – Stadt für intelligente Mobilität“.
[19] City of Leipzig/Office for Statistics and Elections (2014), “Kommunale Bürgerumfrage 2013”.
[20] Data: City of Leipzig.

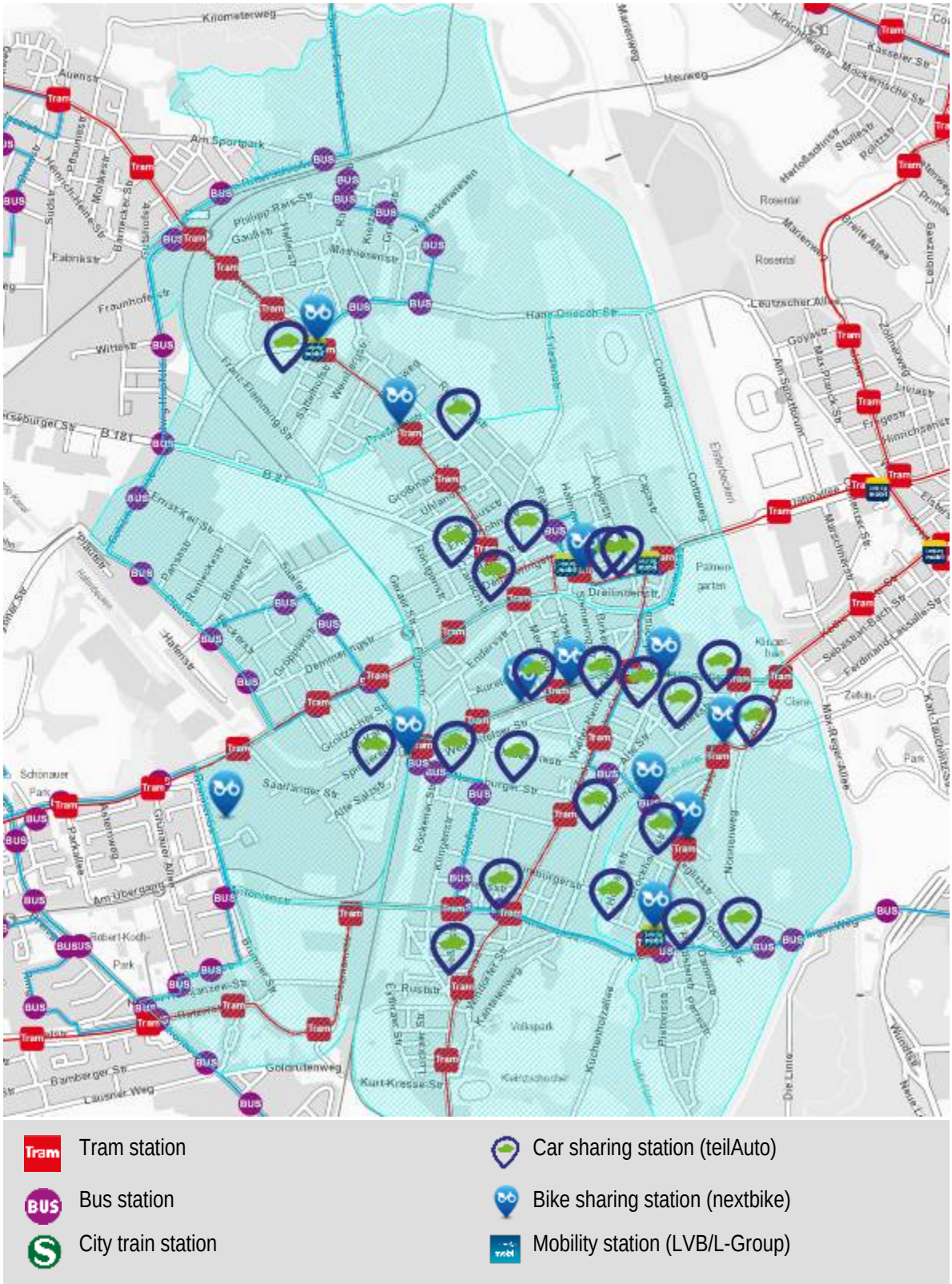



Figure 6: Detailed map of mobility services in project area Leipzig West[21]

[21] Map based on: City of Leipzig, Office of Geoinformation and Land Management, GeoBasis-DE/BKG.

# 2 City assessment based on the Morgenstadt methodology

## 2.1 Brief Overview of the Morgenstadt Methodology and the process[22]

The Triangulum Methodology builds strongly on the Morgenstadt assessment framework developed by the Morgenstadt City Insights ("m:ci") Innovation Network. Throughout the Triangulum project this framework was adopted and improved to support the Follower Cities in developing their own Implementation Strategies. The Morgenstadt assessment framework for sustainable urban development is a multidisciplinary methodology for analysing complex urban systems and transferring this knowledge into integrated concepts and innovative solutions for future cities[23]. The Model was developed in the course of Phase I „m:ci“ and is based on the deep-dive analyses of Freiburg, Berlin, Copenhagen, Singapore, New York City and Tokyo City Labs. In order to achieve an in-depth understanding of the sustainability performance of cities both qualitatively and quantitatively, the Morgenstadt Model is structured into three levels of analysis: 1. performance indicators (quantitative analysis); 2. key action fields (qualitative analysis); 3. impact factors (qualitative analysis). The first two levels of analysis, namely performance indicators and action fields are generic, meaning that they are to be applied with no variations to the sustainability performance assessment of every city partaking in the City Lab project. The third level of analysis – impact factors – is aimed at identifying drivers and barriers that are specific to each city and conditioned by its unique historical, cultural, economic, climatic, morphological, etc. characteristics. In this way, impact factors replenish the generic model and adjust it to the unique needs of each city thus providing for an objective performance profile and at the same time laying out the basis for an individual sustainability roadmap. In this way, the combination of quantitative and qualitative means of analysis ensures the generation of an objective performance profile of Leipzig. More detailed information about indicators, action fields and impact factors can be found in the Triangulum Replication Framework.

The second Triangulum on-site assessment in the year 2016 was held in Leipzig, one of the three Triangulum Follower Cities, on February 15th-24th. During the on-site assessment, a group of researchers from Fraunhofer and TÜV Süd interviewed 25 local experts in the fields of energy, mobility, city planning, economics, governance and ICT in order to analyse challenges and demands for the future of Leipzig as a smart city. Additionally, some of the interviews were conducted with experts who work specifically on the development of the district Leipzig West (Plagwitz / Lindenau). The district functions as the city's laboratory for intelligent and integrated urban transformation. It also serves as a blueprint for further smart district developments within the city. Leipzig West has undergone several significant stages of development which include the transformation induced by industrialization, a decline in population numbers along with political changes and de-industrialization, and, since the reunification of Germany, an ongoing urban renewal process giving the district a new vigour. Leipzig West is a mixed-used district featuring a high liability factor, engaged residents and continuous revitalization efforts which makes it a perfect demonstration area for future urban development. With the support of Triangulum, the City of Leipzig is developing the first Smart City Implementation Plan for Leipzig West.

[22] Fraunhofer IAO (2015), “Morgenstadt: City Insights, City Lab Report Prague”.
[23] Fraunhofer IAO. (2013).”Innovation Network "Morgenstadt: City Insights". Final Report.

## 2.2 Results of Fraunhofer On-Site Assessment[24]

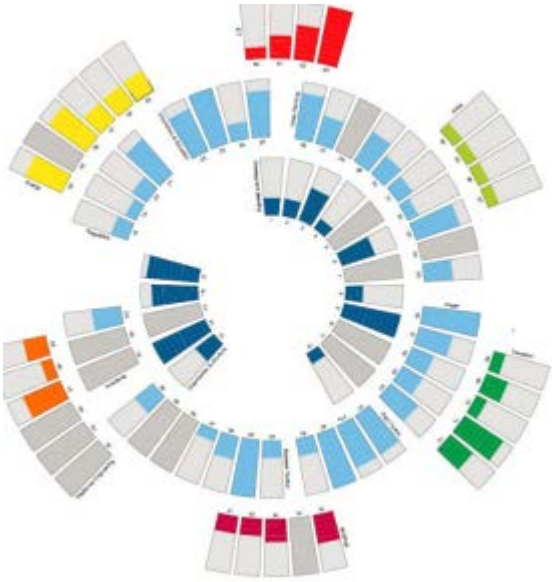
### 2.2.1 First Insights – Challenges and Potentials

The first insights into the required actions and potentials and evaluation of possibilities for Smart City Solutions on the city level could be revealed analysing the collected data. In spite of having to deal with certain challenges, Leipzig has also demonstrated great potential. The city is turning from a shrinking into a booming one. At the same time Leipzig is the 2nd poorest regional capital city in Germany with ageing infrastructure and lack of financial resources. Despite these challenges, the population is very actively involved in urban design and the sharing culture of the city is remarkable.

In the energy sector, there is a lack of concrete objectives and a future energy concept is currently under development. In the building sector, energetic refurbishment of the old buildings is lagging behind. Moreover, energy consulting for the tenants and landlords should be offered.

In the mobility sector, public transportation needs to be promoted and the emerging bicycle trend needs to be supported since the share of motorized private transport in the modal split is high. Leipzig should make use of its innovation potential for new mobility concepts (i.e. sharing culture, strong and dynamic automotive sector with Porsche and BMW) in order to become a central innovation hub for new mobility concepts. In the ICT sector, there is a lack of an overarching digitization plan and sectoral use of IT systems is a remarkable challenge.

### 2.2.2 Data Collection Leipzig – First Insights Action Fields[25]



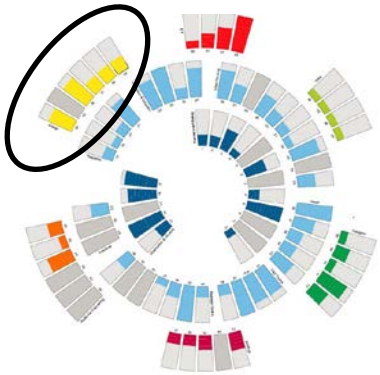
| | |
|---|---|
| Urban Leadership | Strategy and Planning |
| | Organization & structure |
| Levers | Regulations |
| | Information & Education |
| | Urban Planning |
| | Image / Brand |
| | R&D Tactics |
| | Business Tactics |
| | Incentives |
| Points of Action | Energy solutions |
| | ICT solutions |
| | Water solutions |
| | Solutions for Mobility and Transport |
| | Building Solutions |
| | Resilience Engineering |

[24] Fraunhofer IAO (2016), Presentation „Leipzig Follower City - Ergebnisse des On-site Assessments von 15. bis 24. Februar 2016“.
[25] Fraunhofer IAO (2016), Presentation „Leipzig Follower City - Ergebnisse des On-site Assessments von 15. bis 24. Februar 2016“.

## First Insights – Energy

- Braunkohlekraftwerk Lippendorf dominates the discussion
  - Cost-effective heat-extraction reduces CO2-Emissions
  - Uncertainty due to the fossil-fuel phase out –debate
- EEX-stock market and innovative energy trading companies
- Energy association with the first PV System (86 kWp)
  - Availability of roof surfaces criticised
- Old buildings hamper energetic restoration
- Municipal utilities reposition themselves
  - Energy concept is being developed

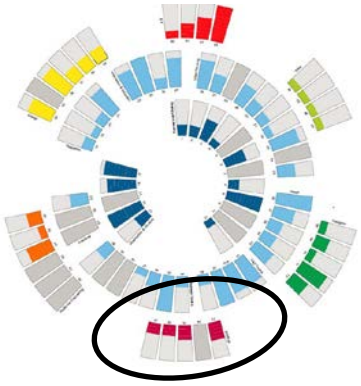
➔ Lack of concrete objectives / goals and energy concept (under development)



## First Insights – Buildings

- Problematic ownership conditions /-structures
- High price sensitivity of the tenants
- City Administration has limited possibilities to influence
- The energy system of the old buildings can rarely be renovated
- Often moderate renovation done in the 1990s (not energy related)
  - Barriers for the renovation of the energy system exist
- PV-Installation problematic
- High living quality (green)
- Mixed-use of industry / habitation areas

➔ Energy advice service for the tenants and landlords needed



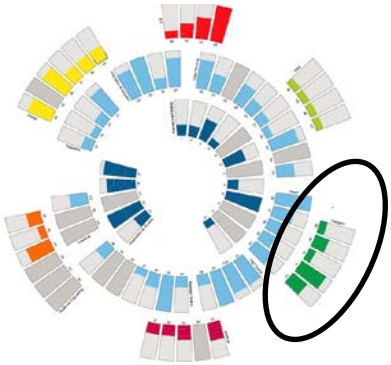
## First Insights - Mobility

- Traffic and Public Space Development Plan, Update 2015
- Data use being discussed
- E-Ticketing
- High share of motorized private transport
- High private transport convenience (e.g. parking spaces)
- PT relatively expensive (Indicator S27)
- Remarkable Sharing-Culture
- Cycling Trend(~900 Bikes/ 1000 Inhabitants)

➔ Boost PT and bicycle traffic

➔ Leipzig as the central industry location for E-Mobility

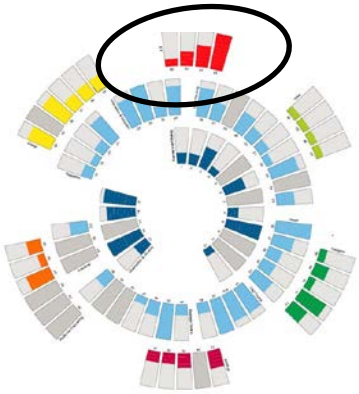
➔ Expand intermodality



### First Insights – ICT

- Traffic management based on real-time data (potential for improving)
- Sectoral use of IT-Systems
  - IT-Systems of different administrative bodies separate
  - Shared access not possible
- Creation of spatial data infrastructure since 2012
  - EU Initiative INSPIRE (Infrastructure for Spatial Information in the European Community)

➔ Lack of overarching digitization plan



### 2.2.3 Hypothesis

As a result of the data analysis, six hypotheses were developed for the future smart city development of Leipzig.

#### Hypothesis 1: Governance Structures

To become sustainable, the city of Leipzig needs to link the cross-sectoral themes and adjust its existing administrative structures to meet the needs of flexible governance structures.

E.g. through:

- Interdepartmental working groups for the cross-sectoral themes
- Locating the overriding themes in the administrative department of the Mayor of the City
- Setting specific goals for each department connected to the cross-sectoral themes (shared responsibilities)

#### Hypothesis 2: Innovations

The Know How of the research institutes in Leipzig is to be put to a greater use, in order to nudge innovations in companies and city infrastructures.

E.g. through:

- Shared research projects focusing on applicability and feasibility
- Innovations-Think Tank (Quadruple Helix: City, industry, research, civil society)

#### Hypothesis 3: Smart City Profile Leipzig

Leipzig can become the forerunner city in the development and implementation of „Low Budget Smart City“.

E.g. through:

- E-Cargo bikes instead of a van
- Focus on the development and application of favourable ICT-components and ICT-systems
- Evaluation of the IT-Low Budget Solutions (Raspberry Pi)
- Enabling low-value added Citizen-Sharing-Solutions through ICT-Platforms, still improving sustainable use of resources living qualities
- Create test field for low cost technologies (Leipzig West)

#### Hypothesis 4: Flexibility

The Smart City Approach creates additional flexibility and scopes of action for the city planning and service development, and makes it easier to deal with the future uncertainties.

E.g. through:

- Intelligent and interconnected planning and forecasting tools, creation of risk scenarios and development of more robust paths
- More efficient and flexible use of resources
- Demand driven solutions („traffic on demand“)
- Creation of flexibility within the Infrastructure, e.g. decentralized networks
- Expansion of the sharing infrastructure

### Hypothesis 5: Digitization

Digitization offers greater potential than the actors in Leipzig previously have assumed. Raising this potential provides additional development possibilities.

E.g. through:

- Digitization Plan / Data Strategy development
- Joint development by city administration, IT-Cluster, other companies, university and civil society
- Creation of infrastructures: Hardware (Broadband), Data-and ICT-Platform, which the city‘s different actors can use
- Shared platform for the data of the city administration, energy, mobility sharing / participation, tourism, economy, health.

➔ Establish a seed incubator / a Think Tank

### Hypothesis 6: Test Field

New solutions have to be tried out in the Smart City. The „Leipziger Westen“ will benefit from being specifically declared as the test field for new technologies and the companies are invited to try and demonstrate their newest ideas.

E.g. through:

- Addressing noticeably innovative companies and research units.
- Facilitating the implementation of the experiments (Permits)
- Targeted PR, to gain acceptance and attention
- Professional support (Research, Economy, Administration, Policy)

These hypotheses will be tested in the further implementation of smart city projects.

# 3 The Leipzig Smart City approach and participation process

## 3.1 Smart City working structures within the municipality

### 3.1.1 Framework conditions 2015 - 2018

The Office for Urban Renewal and Housing Construction Subsidies (ASW) of the City of Leipzig is the main local project partner within the Triangulum project. A coordination unit within this office is responsible for the participation process as well as the development of the Smart City Implementation Strategy. This unit is financed with funds from the Triangulum project. No further financial resources are available for implementing Smart City projects. The coordination unit is in an active exchange with other offices and departments within the municipality regarding Smart City topics (e.g. joint initiatives, perspective funding proposals) but also functions as a point of contact for the public utility companies (L-Group) and their Smart City activities. Furthermore, the ASW represents the City of Leipzig in various Smart City initiatives on the national level. The Smart City coordination unit is also responsible for the knowledge exchange with the international partners within the Triangulum project.

### 3.1.2 New working structures from 2019: The Digital City Unit

In 2019 a realignment of the working structures regarding Smart City and digitization issues within city administration took place.

During the duration of the Triangulum project and the knowledge exchange with the three Lighthouse Cities, it became clear that it is necessary to reorganise internal working structures regarding Smart City and digitization issues (see also measure 4.5.3). In spring 2018 (M38) a dialogue process between the Department for General Services, the Department for Economic Affairs and Employment, the Mayor's Office and the Triangulum team started to develop a new administrative structure for digitization issues within the City of Leipzig. As a result, a "Digital City Unit" was allocated in the Department for Economic and Labour in April 2019 (M51) which was renamed to "the Department for Economic, Labour and Digital".

The "Digital City Unit" started its work in April 2019 (M49). An initial team consisting of the Triangulum team in the ASW and other employees of the municipality now work on guidelines, draft first projects, build up different committees and networks within and outside the municipality as well as other topics.

The new Digital City Unit is:

- A competence centre for digitization within and for the city administration as well as external actors such as enterprises, civil society and science
- responsible for the development and implementation of innovation projects with the help of municipal budget but also financed by EU and national funding (incl. development of funding proposal and grant management)
- an internal service provider for the city administration offering advice and support regarding funding opportunities and grant management
- representing the City of Leipzig on national and international events and networks (e.g. German Smart City Network, EIP-SCC)
- an interface function between the municipality and its subsidiaries (public utilities and other enterprises).

The new unit is not responsible for drafting and implementing eGovernment solutions and the digitization of the city administration itself. Those tasks lie within the Department for General Services. This department will work closely together with the Digital City Unit.

The Digital City Unit benefits from the experiences and insights that the Triangulum team gained during the project duration and the exchange with the Follower and Lighthouse Cities, e.g.:

- That each city needs to develop its own objectives and strategies towards digitization and Smart City solutions that are linked to the concrete challenges of the city.
- That digitization/ Smart City developments need to be developed and implemented in collaboration between city administration, businesses, civil society and science and research institutions.
- That the digitization and modernization of city administration and city services is a prerequisite towards a Smart City.
- That a balance between strategies and concrete projects is necessary.
- That a city needs to think digitization in different directions (e.g. education, research, economic development, integration, environmental protection).
- That national and international exchange and networks with other cities and institutions are necessary and helpful to learn and benefit from each other's experiences.

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Figure 7: The team of the new Digital City Unit together with Burkhard Jung, Mayor of the City of Leipzig

The Digital City Unit supports digitization processes in Leipzig in different ways:

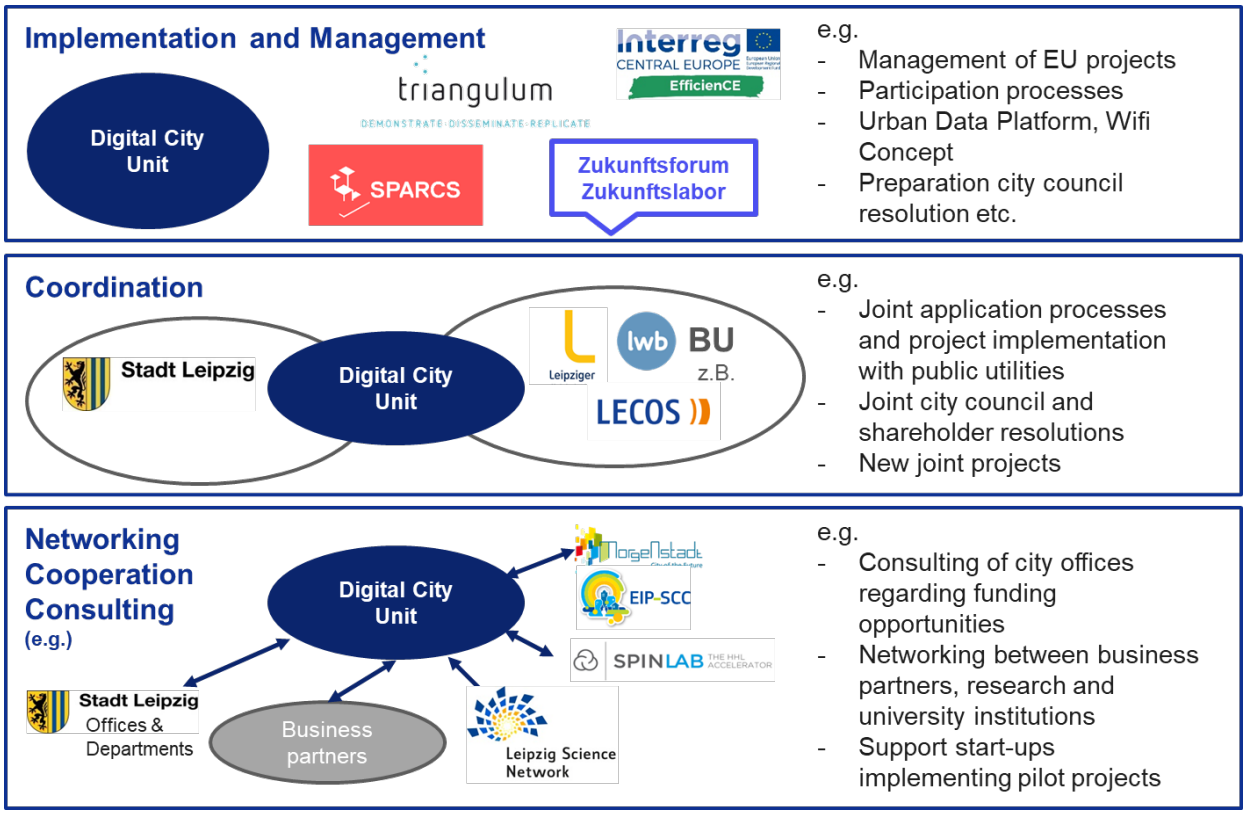


Figure 8: different working levels of the Digital City Unit

The Digital City Unit has its own budget[26] within the city administration. This budget will be used for example to develop and implement own projects, to set up a city-wide participation and discussion process with Leipzig's citizens and to participate in national and international events. Chapter 5 will give a short overview of the first projects of the Unit in 2019.

## 3.2 Participation process

Prior to the start of the Triangulum project within the City of Leipzig there have been discussions on Smart City issues. These discussions, however, mostly took place separately within the different concerned departments and offices, usually without involving other relevant stakeholders like the public utility companies, science institutions or the civil society.

New approach

To focus the discussions and involve various stakeholders, a wide participation process on the Smart City topic was initiated within the Triangulum project. In general, the participation process uses top-down and bottom-up approaches to involve different stakeholder levels but also to represent the Smart City topic within the Leipzig West district.

[26] For 2019: 300,000 EUR, for 2020: 500,000 EUR.

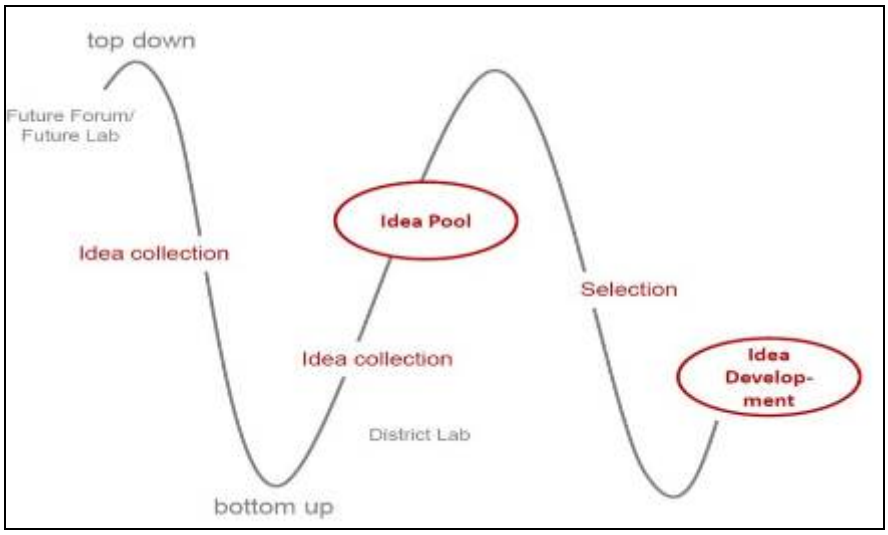


Figure 9: Counter-current principle of participation

To accompany the participation process and to secure the exchange within the different formats, the Kompetenzzentrum für Öffentliche Wirtschaft, Infrastruktur und Daseinsvorsorge (Competence Centre for public economy, infrastructure and public services) of Leipzig University was involved in the process from mid-2015 till the end of 2018.

The objectives of this process structure were:

- To involve a wide scope of Smart City stakeholders within the city,
- To discuss and develop a joint understanding and strategic approach for Smart City issues for Leipzig and conclude action fields that need to be addressed to become a Smart City,
- To identify and develop joint Smart City concepts and pilot projects on city-wide and Leipzig West level which are the basis for the Smart City implementation strategy for Leipzig West.

Three different participation formats (Future Forum, Future Expert Lab, SC Workshops) used in Leipzig for the Smart City process will be described in the following chapters.

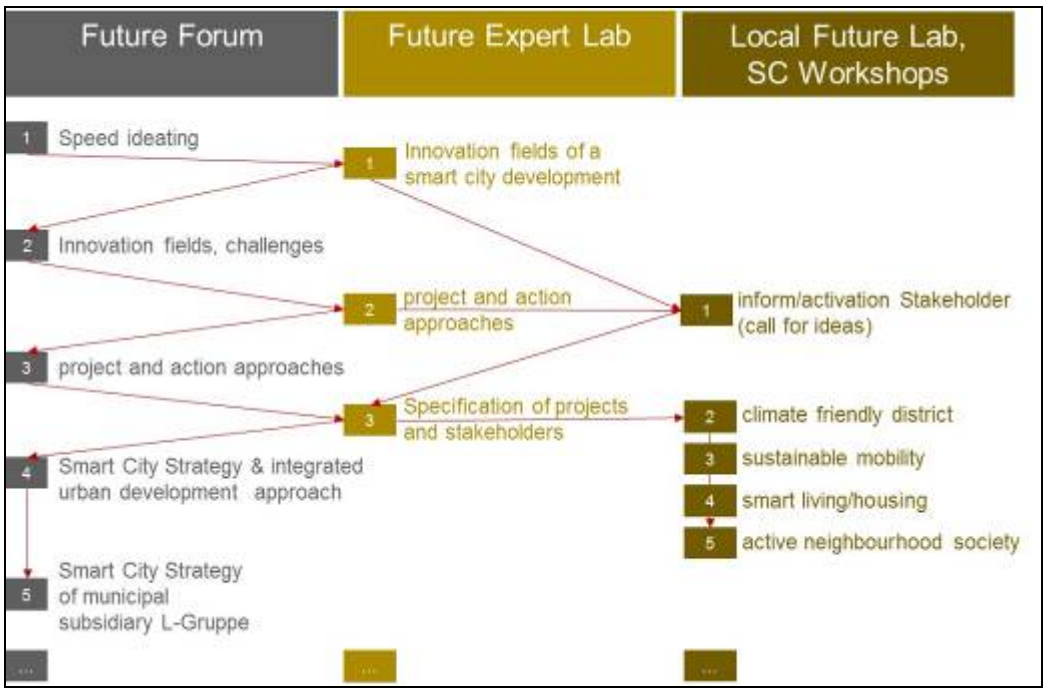


Figure 10: Three formats of participation (2015 – 2017)

### 3.2.1 Future Forum

The Future Forum was initiated as an advisory and decision making council in October 2015, following the initiative of the Leipzig Triangulum coordinators. The advisory council consists of about 20 representatives from the municipality (i.e. the Mayors for Urban Development and Construction, General Services, Economic Development and Environment), the public utility companies (e.g. CEO's of the L-Group: public utilities, public transport, water supply), representatives of the City Council and professors of related subjects at Leipzig University.

The main objective of the Future Forum is to secure the knowledge exchange between the municipality and its public utility companies and to set the framework for joint Smart City strategies and projects. The Future Forum meets every 3-4 months. Until 2020, 14 meetings of the Forum took place. The topics of the meetings ranged from developing a joint Smart City understanding and common innovation fields, the development of joint funding proposals to the discussion of specific innovation fields (such as mobility and energy). The Future Forum was linked to the revision process of the INSEK Leipzig 2030 (see chapter 1.2.1), e.g. to the workshop "Leipzig is growing sustainabely – the digital city" in November 2016 (M22). In this workshop around 50 participants with different backgrounds (civil society, science, economy, city administration as well as other municipalities) discussed opportunities and challenges of a "Digital City".

In the meeting of the Future Forum in March 2017 (M26) an evaluation of the progress of the Forum was discussed with its members. The participants came to the conclusion that after working on a joint definition for Smart City Leipzig and more strategic aspects, the focus now should be more on tangible innovation fields and joint projects. Therefore the format of the Future Forum was adopted slightly in May 2017 (M28) in order to secure the knowledge exchange with further participation formats.

The table below lists all Future Forums which have taken place until January 2020. The pictures show in an exemplary way the general setting of the Future Forum. Although it was planned to redesign participation

processes in Leipzig in connection with the constitution of the new Digital City Unit (see chapter 3.2.4), the Future Forum continued throughout the year 2019.

| Number | Date | Topic |
|---|---|---|
| 1. | 21.09.2015 | Constitution and Speed Ideating in order to identify Smart City topics and get familiar with the meaning of "Smart City". |
| 2. | 17.12.2015 | Smart City definition for Leipzig and innovation fields. |
| 3. | 25.05.2016 | Presentation of current project approaches and fundamentals of digitalization strategy of the City of Leipzig. |
| 4. | 28.09.2016 | Presentation and discussion of Integrated Urban Development Concept (INSEK) 2030. |
| 5. | 17.10.2016 | Presentation of Smart City paper "leipzig.leben.morgen" of the L-Group and presentation of smart city strategies from Morgenstadt cities. |
| 6. | 13.03.2017 | Presentation of InnoLEVER project application as well as discussion about further cooperation with Smart City topics between city administration and public utilities. |
| 7. | 29.05.2017 | Smart and sustainable mobility within a growing city. Presentations on current and prospective developments in the field of mobility in Leipzig, on the strategies of the public transport company LVB and on the measure and implementation concept "Leipzig – Stadt für intelligente Mobilität" (Leipzig – City of intelligent mobility) |
| 8. | 21.08.2017 | Water and wastewater management within a growing city. Presentations and discussion round tables on current and future development regarding water supply and wastewater management. Additionally, the needed change in rainwater management due to climate change has been discussed. |
| 9. | 11.12.2017 | Intelligent energy supply within a growing city. A major point for discussion was the further development and prospective decarbonisation of the district heating network in Leipzig. |
| 10. | 07.05.2018 | Innovative ways of business development: Smart Infrastructure Hub Leipzig. The group met at the Smart Infrastructure Hub (see 4.2.1) and discussed possibilities of new cooperation projects between municipality, subsidiaries and start-ups. |
| 11. | 27.08.2018 | Smart Living – new housing in the city. The group met at the premises of the Leipziger Wohnungs- und Baugesellschaft mbH, the municipal housing association and discussed potentials and challenges of digital transformation for the housing sector in the context of the growing city Leipzig. |
| 12 | 10.12.2018 | City administration in transition – Digitization strategy. The group met at the premises of the LECOS, an IT-company 90% owned by the City of Leipzig. The digitization strategy of the municipality, the new Digital City Unit and the plans for an Urban Data Platform were presented and discussed. |
| 13 | 07.03.2019 | Energy and mobility innovations in Leipzig – The group met at the local plant of BMW and was introduced to different projects within the Leipzig region addressing innovative issues in mobility solutions (e.g. INTERREG project LOW-CARB, autonomous bus project ABSOLUT). |
| 14 | 09.09.2019 | Networks for future – The group met at the new location of the Digital City Unit and discussed on the development and roll-out of different networks like WLAN, LoRaWan and 5G within in the City of Leipzig. |

Table 1: Future Forums dates and topics


Figure 11: Images from 12th Future Forum in December 2018[27]

### 3.2.2 Future Expert Labs (2016)

In addition to the strategic Future Forum, the practice-oriented Future Labs took place in October 2015 (M9) and February 2016 (M13) in order to bring together the working level of the involved city departments, the public utility companies and representatives of the project area Leipzig West.

Different meetings were held during which six thematic workshop groups (Energy; Housing; Water/Sewage/Waste; Businesses/Economy/Broadband; Mobility and Governance) with around 10-12 interdisciplinary experts each discussed Smart City issues. Mirroring the Future Forum, the first task was to develop a common Smart City understanding and identify relevant innovation fields. Furthermore, the working groups defined the challenges and opportunities of Leipzig West to become a smart district, developed first project ideas for the district and identified synergies/interfaces between the different innovation fields. Similar to the Future Forum, the Future Labs have progressed during their various meetings. Some of the developed project ideas were evaluated as not applicable for implementation; others were discussed more in detail and led to funding proposals.


Figure 12: Images from Future Expert Labs in 2016[28]

### 3.2.3 Participation process in the Leipzig West 2016 - 2017

In 2016 the participation and communication process within the test lab Leipzig West started. The objective was to involve the relevant local stakeholders - which includes the engaged neighbourhood as well as founders and

[27] Credit: City of Leipzig.
[28] Credit: City of Leipzig.

leaders of local businesses - inform on and explain Smart City developments to the general public and discuss possible pilot projects for the district. The kick-off event started as a joint meeting with the Future Lab and took place in February 2016 (M13). About 70 interested citizens, businesses and local initiatives took the chance to get to know the current Smart City developments in Leipzig West and discuss their project ideas for a smart district with the experts from the Future Lab.

After this kick-off meeting, a call for ideas was launched in March 2016 (M14). The objective was to get to know ideas for smart projects from the people directly affected by Smart City measures in the district. About 30 different project ideas coming from the different innovation fields (energy, housing, civil society) were submitted. Some of them were discussed and detailed further to prepare for possible funding proposals. In the discussions during the kick-off meeting it showed that there is still a need for further information on Smart City issues but also for discussing the challenges and opportunities of digitization and Smart City in the district. Therefore different other participation measures were introduced to satisfy these needs.

In September and October 2016 (M20+21) a series of four thematic evening events took place. Each event was dedicated to one Smart City topic: Smart Energy, Smart Mobility, Smart District and Active neighbourhood society. After an input speech by a member of the local Triangulum team on Smart Cities and on first ideas on a “smart” district in Leipzig West the participants got together in smaller groups. The groups discussed visions and obstacles for the further smart development of the district in addition to create and suggest ideas for new projects. The results contributed to the development of the LivingLab measure (see 4.4.1.) Additionally, the website *smartcity.leipziger-westen.de* was launched to document the Smart City Process in Leipzig West. The webpage is constantly updated with new information on events and other Smart City topics.



Figure 13: Images from different events in Leipzig West and the Smart City website (M14+M20)

The Triangulum team also informs regularly on the Smart City process in the Quartiersrat Leipziger Westen (District council Leipzig West). This council was set up in the scope of the national urban development program Stadtumbau Ost. It represents the civil society of the district including building institutions, businesses, NGO’s, social services etc. and functions as a multiplier within the district.

Besides, the local Triangulum team works closely together with other partners to engage people in Smart City topics. Together with the Institute of Urban Development and Construction Management of Leipzig University the Triangulum team contributed to the series of evening lectures “HOT SPOTS: DER STADTENTWICKLUNG” (“Hotspots of Urban development”) in 2016 and 2017 (M20-M29) The public lectures taking place in Leipzig West were held by experts from different cities, science institutions, NGO’s and other stakeholders to widen the view on Smart City related topics.

Citizen participation process

The participation process in the timeframe 2016 – 2017 delivered valuable insights into the expectations, needs and fears of local citizens. Some ideas have been developed further and are now part of the active project pool (see chapter 4: Projects and measures for implementation). In connection with the structural realignment of the city administration of Leipzig with regard to the Digital City Unit, a renewed citizen participation format is planned from 2020 and beyond. As the scope is increasingly shifting to a city wide level, participation formats will likely be aimed at all citizens in Leipzig.

### 3.2.4 New participation structures

With the new Digital City Unit and an enlarged scope of activities carried out by the team, it became clear that new participation structures become necessary. The Unit’s participation processes/activities can be divided into two categories: on one side there are bodies which accompany the units work regularly and give advice or recommendation regarding the activities and strategies of the Digital City Unit. On the other hand, all the projects (e.g. SCC1 SPARCS, pt. 3.4) which are carried out by the Unit will also have specific interventions (using the pentahelix approach) to include different stakeholders views in the implementation process.

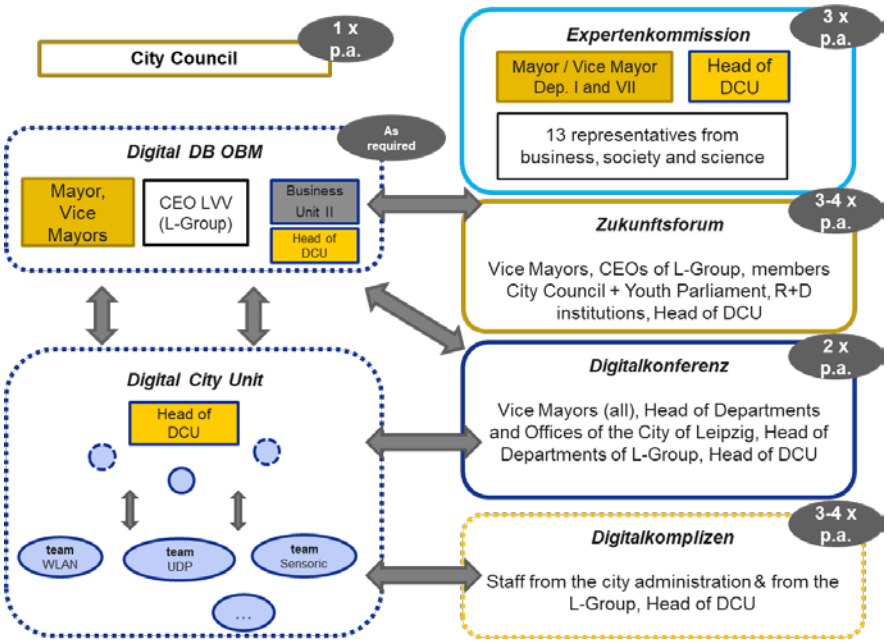


Figure 14: New participation structure

The following bodies will accompany the work of the Digital City Unit:

Expert council

The expert council was set up in fall 2019 and consists of 12 members representing civil society, universities, the local business ecosystem and urban innovation experts. The Mayor of the City is a member of the council. The council meets 3-4 times per year

The expert council "Digital City" advises on current issues and potentials of the digital economy, the digital transformation of society and the creation of better growth and future conditions for "Digital - made in Leipzig" and initiates joint projects.

The council's work is geared to the future guidelines of the City of Leipzig on digitisation, which the council will also help to shape.

The members of the council are experts from various sectors of industry, the public sector, regional SMEs, science, urban innovation and society with a particular vision.

### Strategic Meeting of City Leaders

The Mayor and the Vice Mayors of the City meet regularly (4-5 times p.a.) to discuss and decide on strategic issues and projects regarding the development of Leipzig in the digital transition. The Digital City Unit is responsible for the preparation of decisions and implementation of decided projects.

### Future Forum (Zukunftsforum)

The Future Forum was set up during the Triangulum project and continued its work throughout 2019.

### Digitalkonferenz ("Digital conference")

The Digitalkonferenz addresses the Heads of the different departments and offices within the city administration as well as the middle-management level of the public utilities (energy supplier, public transport company, etc.). It aims at empowering the cross-sectoral exchange on digitization issues. It will take place twice per year, and it happened for the first time in September 2019.

### Digitalkomplizen ("Digital accomplices")

This open format addresses all employees of the city administration and from public utilities concerned with or interested in digital transformation issues regardless of their professional function. It was carried out twice in 2019 focussing on promoting ongoing digitization projects (e.g. urban data platform, 3D model, EU-projects, energy transition etc.) and work on first use-cases for the internal use of the urban data platform. Usually, between 60 and 70 people will participate in the meetings.

Figure 15: Impressions from the 1st Digitalkomplizen event on 04.06.2019

## 3.3 Key findings of the participation process in the City of Leipzig

The Smart City participation process in Leipzig started in October 2015 (M9). It showed that intensive discussions with various stakeholders on different levels form a good basis for a Smart City development in Leipzig, i.e. to develop a sound implementation strategy and possible pilot projects. The following points will summarize the key findings of the participation process.

### 3.3.1 Smart City definition

The starting point for all participation formats was to define the meaning of „Smart City“ for the City of Leipzig. It became clear that in Leipzig's understanding, the term “smart” does not only refer to technology. Smart City also includes new ways of co-creation, cooperation and business models within a city.

In summary, the following Smart City definition was identified:

- Included in integrated urban development processes, the Smart City approach offers solutions for increasing quality of life and innovation to face future challenges of a growing city, e.g. population growth and climate change.
- Opportunities occur through the implementation of connected ICT technologies and new forms of cooperation, co-creation and financing between city administration, (local) businesses, science and civil society.
- The city administration acts as coordinator, initiator, enabler and partner for the civil society, science and (local) businesses to ensure an integrated urban development.
- Smart City processes aim at building an adaptable, responsive, user-friendly and innovative city.

In addition to those different innovation fields were defined that are addressed in the Implementation Strategy for Leipzig West.

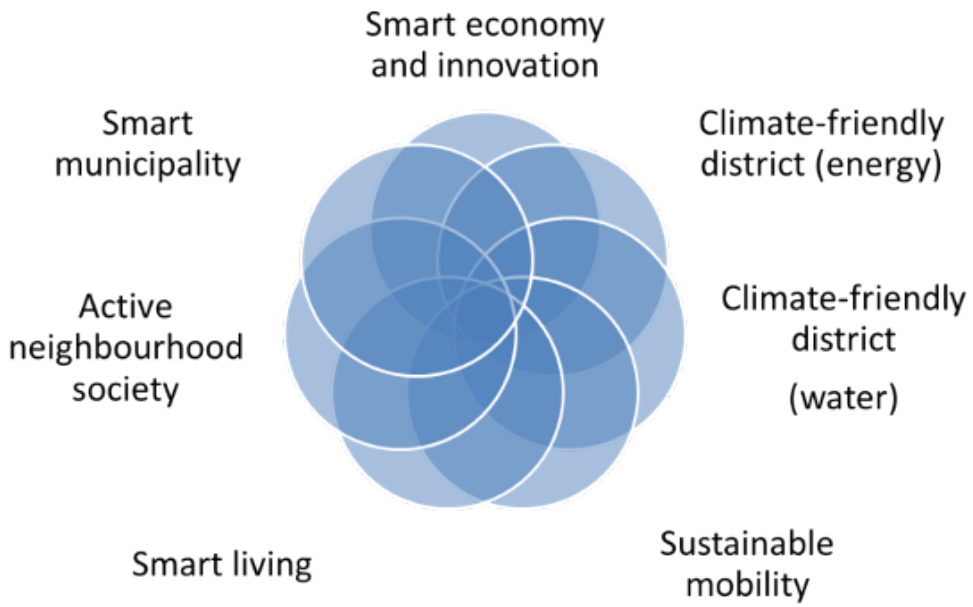


Figure 16: Triangulum Smart City innovation fields in Leipzig

Moreover, guidelines for the development and implementation of Smart City projects were discussed during the participation process. They should be respected when it comes to detailing and prioritizing Smart City pilot projects:

- to act ecologically,
- to invest and finance innovatively,
- to use and connect Smart Data technologies,
- to create synergies by sharing processes and
- to impart and communicate knowledge and experience as well as to build community.

### 3.3.2 Development of Smart City Implementation Strategy and pilot projects

For some of those innovation fields, first pilot projects to be implemented in Leipzig West were defined and detailed (see chapter 4). These are innovative approaches, developed in a participative and cooperative process, which have a high chance of being realised and contributing to an increased quality of life in the city. The focus of the process, therefore, is cooperation, composed of the following components:

- Synergies through sharing
- Communication
- Utilize technology
- Shape the community
- Innovative financing models
- The City as an enabler for new projects, cooperations and innovation.

One crucial issue for the implementation of Smart City projects is funding. So far, some of the possible pilot projects have a “test” character, i.e. a suitable business model is not in place but could be developed if the measure is implemented. Therefore public and private funding opportunities are of high importance for most municipalities, such as Leipzig, on their way to a Smart City.

So far, federal promotion programs of urban development in Germany cover different aspects of urban development ranging from housing development, technical infrastructure adjustment to social inclusion. Other funding schemes focus on single Smart City aspects (e.g. e-mobility, adaption to climate change, digitization) while the same is true for the funding opportunities on the EU level. Yet it is expected that the Federal Ministry of the Interior, Building and Community will issue a supporting scheme for digital urban development and promoting Smart Cities in 2019. It is the task of the local Triangulum team to research and evaluate funding opportunities suitable for pilot projects described in chapter 4. As an example, the two Horizon 2020 SCC1, as well as an INTERREG application that Leipzig participated in, are described in the following chapters.

## 3.4 HORIZON 2020 SCC1 Lighthouse project – SPARCS

As part of its Smart City Implementation Strategy, the City of Leipzig applied for Smart Cities and Communities Lighthouse Projects (SCC-1-2016-2017) by the European Commission in February 2017. In the InnoLEVER project proposal, the City of Leipzig joined forces with Dublin (Ireland) and Gdynia (Poland) to apply as a Lighthouse City. The consortium consisted of 40 partners from ten countries including the Fraunhofer Society, the follower cities Ostrava (Czech Republic), Lviv (Ukraine), Tbilisi (Georgia) and other business and science partners. In Leipzig, the proposal was led by the ASW that brought together a local consortium consisting of partners from the public utility companies, local SME’s and local science institutions. The proposal was rejected in May 2017.

The core element of the project proposal was the so-called LivingLab Leipzig West: an experimental district in which innovative solutions would be developed with the active involvement of the civic society. This would continue and intensify the Smart City participation process started within the Triangulum project. The planned co-creation process would have enabled the active collaboration of multiple stakeholders: besides the municipality, local businesses, universities, and citizens were all included in the process.

Despite the proposal was rejected, it was a helpful step to further develop project ideas, which are now also part of this implementation strategy. Especially the forming of the local consortium has been very helpful to drive the projects towards a possible implementation. As the proposal has been rejected, the developed project ideas are now in the need to receive funding through other channels. These options are currently explored.

Based on the knowledge gained in the InnoLEVER application the City of Leipzig decided to submit another application in February 2019 within the framework of the EU funding programme Horizon 2020 Smart Cities and Communiies with the application of SPARCS (Sustainable energy Positive & zero cARbon CommunitieS).

Building upon the knowledge gained, cooperation with local business formed and synergies with the Leipziger Stadtwerke established within the Triangulum project as well as during the InnoLEVER application preparation phase, SPARCS demonstrates technically and socio-economically viable and scalable solutions for the planning and implementation of intelligent and integrated energy solutions for the transition to resource-efficient economy and energy-positive urban neighbourhoods. The application was made in a consortium with Espoo (FI) as another Lighthouse City and a total of 31 partners from industry and research in 8 EU member states. The solutions developed in the Lighthouse Cities will be closely followed in five Fellow Cities: Maia (Portugal), Kifissia (Greece), Reykjavik (Iceland), Kladno (Czech Republic) and Lviv (Ukraine) with the aim of further replication.

The project was approved in May 2019 (M52) officially started on October 1st 2019 (57). Within the project, different measures from this implementation strategy will either be implemented or supported. As a new member of the European Lighthouse Cities family, the City of Leipzig is already in close exchange with the three Triangulum Lighthouse Cities in order to receive valuable insights and learn from their experiences with implementing smart city solutions within SCC1 projects.

The future development of integrated and regenerative energy systems in dense urban spaces is a complex undertaking. In addition to the right technological prerequisites, a suitable test field is needed in which these systems can be tested in everyday life and their benefit can be evaluated. The SCC project SPARCS enables the City of Leipzig to develop and test these intelligent energy systems beyond the current developments in the Smart City project Triangulum. A top priority will be to set up inclusive management and planning models as well as ecosystems and processes together with companies, city planning and technical departments, research organisations, and most importantly, work together with the citizens. In SPARCS, citizens are at the centre of the decision-making process and the project ensures that citizens are aware of all the activities.

In Leipzig, SPARCS enable a holistically orchestrated energy quarter in the west of Leipzig and beyond. Together with the expertise of Leipziger Stadtwerke and other Leipzig partners from industry and science, solutions will be demonstrated in the areas of ICT infrastructure, storage technology and intelligent building control that will lead to energy-positive neighbourhoods in the future.


Figure 17: Local SPARCS consortium (left) and associated partners (right)

## 3.5 INTERREG project – EfficienCE

The project application in the Interreg Central Europe Programme with the proposal "EfficienCE - Energy Efficiency for Public Transport Infrastructure in Central Europe" was submitted on 25.01.2018 and approved in February 2019. The cooperation project aims at reducing the carbon footprint in the region. Most Central European cities have extensive public transport systems, which can form the basis of low-carbon mobility services. More than 63% of commuters in the region use public transport. Measures to increase the energy efficiency and share of renewables in public transport infrastructure can thus have a particularly high impact on reducing $CO_2$. The City of Leipzig is Lead Partner of the project. On the local level, the team of the Digital City Unit works together with the Leipziger Verkehrsbetriebe (LVB, local public transport provider). In the course of the Smart City process in Leipzig, it has become apparent that a common data infrastructure is often a necessary prerequisite for further measures. Under the conditions of population growth, which the City of Leipzig faces in present and future, traffic volume increases in all segments. In this context, the aim of the project is to better exploit the potentials of data-based public transport planning and organisation. In particular, it is necessary to merge different data contents, formats and encryptions within the administration and the LVB. Within EfficienCE different use cases will be developed and implemented in order to facilitate the Urban Data Platform for a more energy efficient public transport infrastructure planning. Relevant knowledge for this project derived from the actions implemented in the Lighthouse Cities Stavanger, Manchester and Eindhoven as well as the results of the ICT Reference Architecture.

## 3.6 Other events with Leipzig participation since M36

### Urban Netzwerk Tagung

On 24th and 25th May 2018 (M40) the 68. URBAN-Netzwerktagung, an exchange platform for German and Austrian cities, took place in Leipzig. Stakeholders of different cities presented their individual approaches for a city between technological progress and social cohesion. The focus was on the question of how technological progress in the growing city and social issues can be combined. About 40 participants discussed this and further questions concerning different projects and strategies like housing, energy and funding opportunities. The conference ended

with a visit to the thermal storage system of the Stadtwerke Leipzig and the mobility stations of the Leipziger Verkehrsbetriebe as vital and functioning examples for smart infrastructure in the growing city.[29]

### Field trip with city council members to the Lighthouse City Stavanger

In April 2018 (M39) a delegation of 15 people from Leipzig visited the Lighthouse City Stavanger to learn more about the smart implementations in the Norwegian city. Politicians, city representatives, mobility and transport representatives first visited the county council and the Triangulum partner Lyse (P18), followed by an entire day at the municipality. During a joint dinner on the first evening, hosted by the county council, people from Leipzig and Stavanger had the chance to really get to know each other as well as each other's visions and to lay the foundation for an even deeper cooperation aimed at the replication of smart and innovative ideas.

Figure 18: Leipzig group at Stavanger

### Major cities conference

The annual conference of Major Cities of Europe (MCE) took place in Leipzig from May 28th – 30th 2018 (M40). It has been organized and hosted by the MCE organization in close cooperation of the City of Leipzig and the municipal IT supplier LECOS GmbH. Under the headline "Are we ready? Taking the digital city to the next level" multiple leaders, stakeholders and experts from across Europe came together for exchange. Different sessions with a variety of formats took place with topics ranging from open and big data to digital government in practice and required skills for digitization in governmental structures. The Major Cities of Europe conference have been a great success for the conceference organizers and for Leipzig, with close to 200 delegates for 18 countries gave unanimous very positive feedback. The 2019 conference was hosted by the City of Venice.[30]

### Workshop and conference "Smart City: Tomorrow is today"

On November 14th 2018 (M46) the Verbraucherzentrale Sachsen (consumer advice centre of Saxony) held a conference with the topic "Smart City: Morgen ist heute (Tomorrow is today)". The conference consisted of two parts: in the morning 120 students from a local high school discussed opportunities and challenges of digitization in different workshops. The local Triangulum team held one workshop on future mobility issues. About 50 students participated. In the afternoon there was an official conference program open to the public. Dr. Beate Ginzel from the local Triangulum team gave a presentation on the new Digital City Unit and Leipzig's way towards a Smart City. Later she participated in a panel discussion on innovation and entrepreneurship in a Smart City.

[29] Further information can be found here: http://www.deutscher-verband.org/aktivitaeten/netzwerke/urban-netzwerk/netzwerktagungen/netzwerktagungen/68-unt-leipzig.html (only German language).
[30] Further information, presentations and documentation of the conference can be found here: https://www.majorcities.eu/conferences/2018-leipzig/

Figure 19: Dr. Beate Ginzel at the panel discussion at the Smart City conference of Verbraucherzentrale Sachsen[31]

### Joint Venture BMW and Stadtwerke Leipzig

Due to the initiative of the Triangulum team, a cooperation between BMW and Leipziger Stadtwerke (LSW) started in 2018. In 2019 BMW renewed its battery storage at the premises of the Leipzig plant and gave their former 60-70 kW second-use storage to the Leipziger Stadtwerke (LSW). The Leipziger Stadtwerke moved the storage to its premises in the Arno-Nitzsche-Straße in Leipzig and uses it for test-cases for PV and their virtual power plant.

Figure 20: The second-life battery storage at BMW, Leipzig[32]

### 14th Forum for Sustainability of the Federal Ministry of Education and Research – "Stadt forscht Zukunft"

On 5th and 6th of June 2018 (M41), the 14th Forum for Sustainability of the Federal Ministry of Education and Research took place in Leipzig. Within that context, one workshop titled "Digital City – Smart City as a process" was hosted by the Municipality of Leipzig. Dr. Beate Ginzel from the local Triangulum team gave input about the Smart City process in Leipzig and was leading through a discussion about the integration of different stakeholders in the process and the role of research. Dr. Tanja Korzer from University of Leipzig, Kompetenzzentrum für Öffentliche Wirtschaft, Infrastruktur und Daseinsvorsorge (Competence Centre for public economy, infrastructure and public services) was representing the research part and also the accompaniment of the Smart City process from the research point of view. About 60 participants attended the workshop.

[31] Credit: Felix Abraham.
[32] Credit: BMW Leipzig.

Participation in international events

Dr. Beate Ginzel of Leipzig's Triangulum Team also participated in different international meetings in 2018 such as the Club of Three Meeting in London in November, and the 20-20 cities meeting – The club for urban leaders meeting – in Dublin in December. In these meetings, high-level representatives from European and on global level talked on issues such as data protection, citizen participation and digitization strategies.

## 3.7 Follower City events in 2019

### iCity Tender Workshop – 12.09.2019 (M56)

The iCity Tender workshop was organized by the Digital City Unit of the City of Leipzig. The Digital City Unit is representing the City of Leipzig as a Follower City in the Triangulum project, but also as a Lighthouse City in the new SCC1 project SPARCS – "Sustainable energy Positive and zero carbon Communities", which started in October 2019. The local SPARCS consortium consists of the following institutions:

- City of Leipzig (Digital City Unit)
- Leipziger Stadtwerke (local energy provider)
- WSL Leipzig Wohnen & Service GmbH (SME)
- Cenero Energy GmbH (SME)
- Seecon Ingenieure GmbH (SME)
- University of Leipzig
- Fraunhofer Center for International Management and Knowledge Economy

To shape the joint vision for the SPARCS project and to evaluate whether the Eindhoven quadruple helix approach could also be used for the implementation of SPARCS, the workshop was carried out. So all local partners from the SPARCS consortium were invited, all of whom attended the workshop.

Additional interest lies in the iCity tender process, which was carried out during the Triangulum project in Eindhoven. The City of Leipzig also plans an innovation procurement for 2020/2021 with local SME's. As a result, the City of Leipzig benefitted from the experiences in Eindhoven. Therefore, employees from the Office for Economic Development of the City of Leipzig, who were responsible for innovation management, were also invited to the workshop.

The colleagues from Eindhoven gave valuable insights into the 'quadruple helix' approach in Eindhoven and practical information relating to the iCity tender. When drafting the implementation of SPARCS with local partners as-well-as the upcoming working program for the Digital City Unit (Triangulum partner in Leipzig) the information will be used to draft and implement similar measures for Leipzig (subject to availability of funding).

The Digital City Unit is currently evaluating framework conditions for an innovation procurement competition similar to the iCity tender. Due to strict national and local procurement regulations, this kind of action needs an in-depth analysis and a detailed implementation concept to create legal certainty. The aim is to secure funding for this measure in the upcoming city budget for 2021/2022. Also, within the SPARCS project, the issue of innovation procurement will be raised. Thanks to the workshop, the Leipzig team has a sound knowledge-base to work on this task.

### FCIS Workshop in Prague – 16.10.2019 (M57)

The City of Leipzig had a replication workshop together with all Triangulum partners in Prague on 16.10.2019. As Leipzig is now a Lighthouse City in the SPARCS project, the workshop was also an exercise in cross SCC1 project exchange. Colleagues from the municipality of Kladno, a Fellow City in the SPARCS project, the local energy company and the Czech Technical University were invited to the workshop also to foster a cross SCC1 project exchange. It was a fruitful Triangulum - SPARCS exchange on the topics of energy and citizen engagement. Nadja Riedel gave an introduction to the SPARCS project in general and the Leipzig part, while the Triangulum partners were interested to see what the new project is about. “The partners really had the chance to discuss lessons learnt on project planning and implementation as well as the Lighthouse Cities’ “Do’s and Don’ts” regarding citizen engagement, local communication strategies, political commitment and how to secure the continuation of measures. It was great to have all the different partners gathered here in Prague to brainstorm together, which usually results in the best outcomes”, sayd Philipp Lämmel from Fraunhofer FOKUS, leader of the replication work package in Triangulum.


Figure 21: Impressions from the FC workshops in Prague 16.10.2019

### Webinar - Governance for Smart Cities - Developing Principles and Guidelines (30.09.2019)

The Webinar, which was perfectly adapted to support the replication process in Leipzig and put together following the needs formulated by the City of Leipzig. The Webinar provided valuable insight into Open Data Principles from the City of Eindhoven and Good Practice advice from Manchester on Using Data in the Smart City. It helped the City of Leipzig with the key guidelines around the development of the Urban Data Platform (see section 4.5.1).

Speakers and topics were:

- Delia Mitcan and Mieke van Schaik (City of Eindhoven): Open Data Principles – How it works in Eindhoven
- Adrian Slatcher (Manchester City Council): Good Practice in Using Data in the Smart City

### Webinar - Citizen Engagement in Positive Energy Districts (12.12.2019) (M59)

On 12 December 2019 Triangulum hosted a joint webinar together with the Smart Cities and Communities project +CityXChange on the topic of “Citizen Engagement in Positive Energy Districts”.

Speakers and topics were:

- May Endresen (Greater Stavanger): “How to make invisible projects visible for the citizens. The Stavanger Triangulum story communicated.”
- Marieke van den Weijngaard (Woonbedrijf, Eindhoven): “Tenants in Charge. Organising it digital” on citizens engagement and involvement
- Guest speaker from +CityXChange: Kieran Reeve (Limerick City and County Council), “Public Engagement: Do we really engage?”

The webinar was a great success, informing more than 30 participants from all across Europe and from several sister SCC1 projects about experiences from citizen engagement in the different Lighthouse Cities. The approaches how to involve the citizens in the different projects were diverse. The city of Stavanger used, among other things, a short advertising film that was shown in the cinema to inform the public about its existing projects. There were also measures in which citizens were actively involved in the projects in the form of creative competitions.

It became clear that the participation of citizens is not only an additional burden, but also an opportunity that can successfully advance one's own projects. The Leipzig SPARCS team was part of the audience and got valuable insights on the engagement of citizens in positive energy communities.

# 4 Projects and measures for implementation

The challenges for the City of Leipzig, as described above, are reminiscent of the challenges of most European cities. The Smart City Implementation Strategy takes up these challenges of the growing European city and has the central objective to find intelligent solution approaches which support a foresighted city development.

The following chapters outline the projects the City of Leipzig and their partners agreed to pursue further. The measures are grouped within the Smart City innovation fields defined in the participation process (see chapter 3.3). The colours (green, yellow, red) indicate the status of the project. Green indicates an ongoing project. Yellow indicates that the relevant stakeholders are involved and the implementation is agreed on, while the implementation of the project has not started yet. Commonly, this is due to a lack of funding sources. Red indicates that further discussion with relevant stakeholders is needed in order to implement the project.

The responsibility for implementing the Triangulum project and related measures was moved from the Office for Urban Renewal and Housing Subsidies to the new Digital City Unit in 2019. The Triangulum team itself stayed the same and continued working on the project.

The projects are grouped as follows:

| Climate friendly district and smart living | Smart economy and innovation | Sustainable mobility | Active neighbourhood society | Smart municipality |
|---|---|---|---|---|
| Baumwollspinnerei – Smart Grids and Energy Storage | Smart Infrastructure Hub Leipzig | Corporate e-car sharing | LivingLab Leipzig West | Urban Data Platform |
| Baumwollspinnerei - Smart Building | Smart City Tender | Mobility concept for Leipzig West | | Digitisation Strategy City of Leipzig |
| | | | | Smart City participation process and working structures |

Table 2: Overview status of projects and measures

Besides the realization of above-mentioned projects, the introduction of the new Digital City Unit and the set-up of working structures for the new projects EfficienCE (see 3.5) and SPARCS (see 3.4) were the main focus of the Triangulum team in M49-M60. While all projects with the status green seem to be on track, further work and resources will be needed to bring the projects with a status yellow and red into existence. A strategy for the city-wide engagement of citizens and other stakeholders in the Smart City and digitization process shall be developed in 2020 aside of the SPARCS project.

## 4.1 Climate friendly district and smart living

### 4.1.1 Baumwollspinnerei – Smart Grids and Energy Storage

| Baumwollspinnerei – Smart Grids and Energy Storage | |
|---|---|
| Target area | Baumwollspinnerei |
| Technologies & solutions to be implemented | Multiple measures will be implemented and the installation and integration of multiple energy infrastructures realised (measures in green have been realised):<br>• decentralised photovoltaic plant (50 kWp)<br>• a bio-methane-fired CHP plant (100 kWth; 70 kWel), pro rata powered by biogas estimated rate: 15%;<br>• modernisation of the district network,<br>• the construction of 2MW/2MWh of bulk battery storage;<br>• e-charging columns and metering infrastructure implemented with the participation of building owners, grid operator and energy supplier.<br><br>The distributed PV generation, 2MW battery storage facility and CHP represent the heart of the district's heat and power supply system. These will be economically optimised by intelligently coordinating their use considering on-site consumption, balancing energy with the local grid and optimising electricity import from the public grid. Power management between the local grid and the public distribution grid will minimise network overloads. Furthermore, the additional decentralized storage options presented by electric vehicles will be integrated into the area storage concept. Bi-directional power management between the district and public grids will be achieved using intelligent meters, sub-meters, sensors and controls.<br>The measures will provide an integrated view of all the consumers, stores and producers in the Spinnerei district. A high proportion of renewable energy will be generated, integrated and distributed in an energy- and cost-efficient manner between: 1) the local grid and the public grid, 2) connected buildings and 3) other facilities such as charging points for EVs.<br><br>Tasks related to the planning and preparation phase:<br>• Detailed technical survey of the buildings in the Spinnerei district (energy flow/ energy consumption and generation data)<br>• Installation of advanced measuring infrastructure<br>• Review of the legal framework including joint venture, duties / charges and data protection.<br>• Determination of the optimization potential for roof-installed PV with load profile analyses<br>• Selection of bulk battery storage and associated control technologies and suppliers<br>• Selection of generation, consumption monitoring and demand response technologies<br>• Analysis of the possible extension of the cities district heat network to the Spinnerei<br>• Intelligent simulation of the energy system on-site based on AMI data<br>• Project management, securing cross-sectoral applicability of planned measures<br>Tasks related to the implementation and operation phase:<br>• Construction phase of the RES infrastructure and its integration with the ICT platform: CHP, integration of RES (PV and/or geothermal systems), district heat network, modernisation of the district power grid, integration of AMI (smart meters and controls)<br>• Operational phase of the RES infrastructure: monitoring of end-users<br>• Construction phase of the district storage and its integration with the ICT platform<br>• Operational phase of the district storage: Network access, pre-qualification for balancing power market, storage management, inclusion of mobile storage in control system |

| | | | |
|---|---|---|---|
| | • Operational phase of mobile storage: optimize the bi-directional energy flows of EV stores with the district and public grid, network access, pre-qualification and commercialisation for energy exchange | | |
| Costs of planned implementation measures | CENERO Energy GmbH (staff, external services (supporting concepts)) | | 300.000 € |
| | LVV (staff) | | 150.000 € |
| | Stadtwerke Leipzig GmbH (staff + investments (see below) | | 1.500.000 € |
| | energy storage -1-2 MW with 2-1 MWh=35-70 BMWi3 battery-modules incl. battery management system | | 540.000 € |
| | power electronic components for the energy storage, voltage source inverter, casing | | 540.000 € |
| | energy building connection | | 120.000 € |
| Funding & business models applied | Looking for private & public investments (Hall 7, Natural History Museum)<br>Marketing of local energy tariffs to tenants. To this end, a business model based on local generation and consumption of electricity and heat as well as suitable billing concepts are developed. Development, simulation and evaluation of cooperative business models allowing for a holistic optimization of the various assets operated by various independent companies based on the simulation of the energy system | | |
| Reference to lighthouse cities (replication) | Energy storage unit in Manchester; Smart Home and public building management via Smart Gateways in Stavanger; Smart Office Management in Eindhoven | | |
| Key timescales | 2020-2024 | | |
| Lead partners | Public utilities: LSW, LVV Private: Cenero Energy GmbH | | |
| Risks & risk mitigation measures | Failure of individual building owners/operators to participate | medium | Additional interested parties to be approached from an early project stage |
| | Delivered infrastructure not to the standard required by project | medium | Oversight by project leader regarding grid concept design, detailed design, specification, construction and commissioning. |
| | Data not in the correct format for modelling, measuring and verification | low | Effective communication and integration |
| | Toolbox outputs not suited to stakeholders and other end users | low | Stakeholder engagement will form part of the toolbox requirement specification process to ensure alignment with user needs |
| Local governance & coordination structure | Coordination: City of Leipzig: Digital City Unit<br>Project lead: Cenero Energy GmbH | | |
| Replication | Manchester: Energy Storage System<br>Strijp-S: Innovative infrastructure | | |
| Current status | During M 37 - 48 the involved partners worked on the implementation of the mentioned measures. All measures highlighted in green were implemented in 2018. Further implementation will take place as part of the SPARCS project starting in 2020 (see chapter 3.4). | | |

### 4.1.2 Baumwollspinnerei - Smart Building

| Baumwollspinnerei – Smart Building | | |
|---|---|---|
| Target area | Baumwollspinnerei | |
| Technologies & solutions to be implemented | The Baumwollspinnerei consists of over 20 mainly brick-buildings dating from the late 19th till the early 20th century. Extensive refurbishment works are not suitable as the buildings are under national heritage protection and the existing building stock is still in good condition. Therefore an increase in energy efficiency in the buildings can only be realized by small scale interventions such as Smart Building automatization technologies.<br>Five buildings of the Baumwollspinnerei with about 20,000m² of mixed usage for offices, artist studios and storage, will be included as a demo site.<br>The main demonstration will be the use of a low maintenance wireless sensor and actuator network not relying on batteries, using wireless charging and energy harvesting. The wireless solution will be deployed as a mesh network, allowing for cost-efficient deployment in existing buildings, and will also integrate with the wired network and the BMS already existing. To collect the needed data, a decentralized energy management system will be installed.<br>The buildings within the demo sites will be able to forecast their own consumption, and what changes in their usual behaviour are possible to act according to the need of the grid while still keeping their comfort within comfort bounds. They will accomplish this via a distributed sensing and control network using LoRa / IoT as a technological basis. This allows for cost-efficient retrofitting of building energy management systems.<br>This will show the feasibility of monitoring of consumption and production for control and billing purposes as well as control for smaller units. | |
| Costs of planned implementation measures | provedo Automation GmbH | 150.000 € |
| | cenero Energy GmbH | 240.000 € |
| Funding & business models applied for implementation | Possibility of using private investments are being checked<br>Operational phase: reduced price of operation and cost of operation due to efficiency gains | |
| Key timescales | 2020-2024 | |
| Lead partners | cenero Energy GmbH, provedo Automation GmbH | |
| Local governance & coordination structure | Lead by local businesses | |
| Reference to Lighthouse Cities (Replication) | Eindhoven: Strijp-S building autonomization<br>Smart Grid Controller in Manchester Siemens,<br>Smart Gateway and corresponding sensors from Stavanger (Lyse),<br>Energetic analysis of public buildings (University buildings, student accommodations (Siemens) in Manchester,<br>Eindhoven Office Management App (Volker Wessels) | |
| Current status | Due to the approval of the SPARCS project, the smart building activities within the Baumwollspinnerei can be implemented, starting in 2020. It is currently checked which solutions will be implemented and if and how the two lead partners (cenero and provedo) can work together. | |

## 4.2 Smart economy and innovation

### 4.2.1 Smart Infrastructure Hub Leipzig

| Smart Infrastructure Hub Leipzig | |
|---|---|
| Target area | City of Leipzig (whole city region) |
| Technologies & solutions to be implemented | Together with Dresden, Leipzig won the bid as a Digital Hub, provided by the Federal Ministry for Economic Affairs and Energy (BMWi). The City of Leipzig, SpinLab Accelerator GmbH and HHL Leipzig Graduate School of Management applied as one of twelve Digital Hubs in Germany.<br>The special focus of Leipzig's application is on environmentally friendly energy generation and usage, Smart City concepts in an interconnected and intelligent city as well as e-health systems including the mobile processing of patients data.<br>The Smart Infrastructure Hub is a brand that links many players and projects in the fields of energy, smart city, e-health and cross-sectional technologies. A regional hub agency links and moderates between those actors, building a strong network that is open for new partners and projects as well.<br>Projects planned include:<br>- accelerator with focus energy, Smart City & eHealth<br>- Building a new technology and startup centre<br>- Cross-university Research Center for Smart and Sustainable Infrastructure (RCI)<br>- Establishing an early stage venture capital fund |
| Costs of planned implementation measures | No further costs attached. The brand Smart Infrastructure Hub allows for easier access to regional and national funding. So far, 836.000 Euro could be raised from regional funds for the establishment of the hub. |
| Funding & business models applied for implementation | The Digital Hub is operational due to a mix of private investment, PPP, and regional funds by the Free State of Saxony. |
| Key timescales | Ongoing<br>01/2018 Establishing of a local network (done)<br>06/2018 Agreeing on the construction of Smart Infrastructure Hub building<br>01/2019 First Digital Hub event (see: Smart City Tender) |
| Lead partners | Public: City of Leipzig, Department for Economic Development; Digital City Unit<br>Private: SpinLab Accelerator GmbH<br>Science/Education: HHL Leipzig Graduate School of Management |
| Local governance & coordination structure | Coordination: City of Leipzig, Department for Economic Development<br>Lead partner: SpinLab Accelerator GmbH |
| Reference to Lighthouse Cities (Replication) | - |
| Current status | The implementation of the Smart Infrastructure Hub took place in 2018. Several start-ups joined the Hub, investors and venture capital were fund to support the development of businesses and products (https://smartinfrastructurehub.com/). |

| | |
|---|---|
| | The Future Forum in May 2018 took place at the SpinLab, the current location of the Smart Infrastructure Hub. The start-ups in resident had the possibility to pitch their projects to the participants of the Future Forum.<br>As there is a high demand for office and co-working spaces by the start-ups (from the Hub as well as the ones that have finished the accelerator program) a new (larger) location is needed. As the Natural History Museum won't move to the Baumwollspinnerei (see chapter 1.3) it is currently evaluated if the premises can be used for the Smart Infrastructure Hub.<br>The Digital City Unit works together closely with the management team of the Smart Infrastructure Hub und supports the start-ups with setting up pilot projects within Leipzig (e.g. as a contact point to other departments within the city administration or a networking partner to established businesses). |

### 4.2.2 Smart City Tender

| Smart City Tender | |
|---|---|
| Target area | Event: City of Leipzig |
| Technologies & solutions to be implemented | One of the main obstacles while implementing smart city technologies is the missing knowledge of existing solutions and the missing bidirectional communication channel towards regional technology businesses. In order to change that, the City of Leipzig plans on organizing a challenge in cooperation with NEU e.V. and the Office for Economic Development. Regional "smart" businesses and start-ups are motivated to develop and provide solutions for challenges which will help the City of Leipzig and the utilities to tackle existing problems. Possible topics include mobility, energy and smart municipality. The competition will aim at local and regional start-ups in order to foster their innovative potential. |
| Costs of planned implementation measures | 300.000 € with long term return of investment |
| Funding & business models applied for implementation | City of Leipzig, Office for Economic Development<br>Funding will be secured for upcoming household period 2019/2020<br>Planned is the model of a grant for winning applicants, however, this might change with future planning |
| Key timescales | 06/2018 – 12/2018 Secure funding<br>First event in 01/2019 in cooperation with the Digital Hub initiative |
| Lead partners | City of Leipzig, Department for Economic Development; Digital City Unit<br>Private: NEU e.V. (Network for Energy and Environment), SpinLab GmbH |
| Local governance & coordination structure | Coordination: City of Leipzig, Office for Economic Development |
| Reference to Lighthouse Cities (Replication) | Eindhoven: i-City Tender,<br>Eindhoven innovation fund (TU/e) |
| Current status | In September 2019 with iCity Tender Workshop (see 3.7) took place in Leipzig. The partners from Eindhoven gave valuable insights into the implementation of the tender competition in Eindhoven. The Leipzig team anticipated this information yet a concept on how to implement such kind of competition in Leipzig is still in elaboration. Key elements of this concept will be to evaluate municipal procurement procedures and the possibilities to have a joint tender process with the L-Group, the local universities and/or other local companies. |

## 4.3 Sustainable mobility

### 4.3.1 Corporate e-car sharing

| Corporate e-car sharing | | |
|---|---|---|
| Target area | Baumwollspinnerei | |
| Technologies & solutions to be implemented | Currently, one company on the premises of the Baumwollspinnerei uses two electric cars for business trips and has two charging points. The project builds on this and will implement e-carsharing based on the pooling of additional 7 e-cars and 5 e-bikes from different companies and open up for more users and other cars from other providers.<br>In the first step, eight SMEs, as well as start-ups located at Baumwollspinnerei with around 85 employees combined, will take part in the corporate e-car sharing. The aim is to involve at least 300 people in the e-car pool (many freelance artists are willing to commit to the e-car sharing and the local artist supply shop will use the corporate e-car sharing as a transport service for its customers). Prospectively, the e-car sharing concept could be transferred to other venues with multiple businesses and organisations in Leipzig West (e.g. Westwerk, Tapetenwerk).<br>The installation of additional charging facilities at the Baumwollspinnerei premises (e.g. fast-charging) will be checked. | |
| Costs of planned implementation measures | Econtact GmbH (staff for managing customers, software etc. for 3 years) | 145.000 € |
| | Strominator.de (provision and management of e-vehicles for 3 years) | 130.000 € |
| Funding & business models applied for implementation | InnoLEVER grant application (rejected), Public and private resources of funding are currently being checked for their suitability<br>Strominator.de will own and operate the vehicles. During the operational phase, their fully operational business model will apply | |
| Key timescales | 2018: Seeking agreement with local stakeholders<br>2019-2021 Implementation | |
| Lead partners | Public: City of Leipzig, Office for Economic Development<br>Private: econtact GmbH, strominator (local e-car sharing provider), businesses located at Baumwollspinnerei | |
| Local governance & coordination structure | The project is part of the measure and implementation concept "Leipzig – Stadt für intelligente Mobilität" (Leipzig – City of intelligent mobility) which has been acknowledged by the city council in April 2017 (bill Nr. VI-DS-03289-NF-02 „Leipzig – Stadt für intelligente Mobilität") | |
| Reference to Lighthouse Cities (Replication) | Eindhoven: Corporate e-car sharing Strijp-S/Mobility concept Strijp-S<br>Charging in office-buildings/apartments (Lyse/Stavanger) | |
| Current status | Part of Strategy paper "Intelligent Mobility" by the Office for Economic Development; further discussions with Stakeholders necessary. No update in M49-M60. | |

### 4.3.2 Mobility concept for Leipzig West

| Mobility concept for Leipzig West | |
|---|---|
| Target area | Leipzig West |
| Technologies & solutions to be implemented | Increase in traffic and the increased necessity to shift towards public transportation have been identified as the most pressing issues concerning mobility in Leipzig West. Therefore, a mobility concept is planned in order to rearrange traffic and make biking and public transportation more convenient. This task is closely related to the establishment of an Urban Data Platform (see 4.5.1). |
| Costs of planned implementation measures | ca. 150.000 EUR |
| Funding & business models applied for implementation | Grant application following the 3rd INTERREG Central Europe Call; decision approximately January 2019 |
| Key timescales | 2018: Coordination and agreement with several departments and offices within the municipality, and the LVB as the public transport agency<br>2019-2020: Analysing data gathered on the Urban Data Platform (Action 4.5.1)<br>2021-2022: Develop Mobility Concept |
| Lead partners | City of Leipzig, Digital City Unit, LVB |
| Local governance & coordination structure | Coordination: City of Leipzig, Digital City Unit |
| Reference to lighthouse cities (replication) | Manchester: Corridor traffic management |
| Current status | This activity was included in the EfficienCE proposal. Yet as the Leipzig activities within the project now have a stronger focus on the development of use cases of the Urban Data Platform and due to some project budget cuts this activity will not be carried out in the EfficienCE project. So further discussion with responsible partners is necessary to secure funding for implementation. |

## 4.4 Active neighbourhood society

### 4.4.1 LivingLab Leipzig West

| LivingLab Leipzig West | | | |
|---|---|---|---|
| Target area | Leipzig West | | |
| Technologies & solutions to be implemented | In Leipzig Living lab governance structures will help initiate the transition management procedures within the city administrations and improve their collaboration with the demonstration area stakeholders. This will be complemented and pushed by urban innovation challenges, searching for innovative solutions based on open urban data. The measure will build on the TRIANGULUM participation process and include the continuation of the established participations formats (see chapter 3.2) and intensify the test-field for smart urban solutions. The LivingLab Hub will work closely together with ongoing projects in Leipzig West, e.g. the Innovation Network (ERDF-founded), the SME Network (Unternehmerstammtisch) (ERDF-founded) and the Smart Systems and Smart Infrastructure Hub Dresden/Leipzig (see chapter 4.2.1).<br><br>The project contains the following measures:<br>• Set up a Living Lab Hub (Local onsite office where regular events will be organized and that will also serve as an info point for the interested public. The urban restructuring management in Leipzig West has its offices in the centre of Leipzig West. The offices will also be used for the LivingLab hub)<br>• Run a series of co-creation and participation formats and events (user-centred design), enable innovative procurement process as innovation push for challenge-based pilots for smart urban services<br>• Set up experimental fields for piloting and testing new smart urban solutions<br>• Set up a website/online catalogue for co-creation/solutions mapping | | |
| Costs of planned implementation measures | City of Leipzig, Office for Urban Regeneration and Housing Construction Subsidies (ASW) – staff costs for local innovation manager, communication and participation activities for 3 years | | 150.000 € |
| | Budget for local business accelerators | | Approx. 100.000 € |
| Funding & business models applied for implementation | InnoLEVER grant application (rejected), grant application of the Urban Innovative Actions (UIA-Initiative) in April 2016 (rejected), Public and private resources of funding are currently being checked for their suitability | | |
| Key timescales | | | |
| Lead partners | Public: City of Leipzig, Digital City Unit, Department for Economic Development<br>Private: business accelerators in Leipzig West (e.g. SpinLab Accelerator GmbH, Social Impact Lab) | | |
| Risks & risk mitigation measures | Lack of stakeholders' interest in the living lab development | Medium | Integration of stakeholders from the very beginning into the LL design process. Strong communication and dissemination strategy |
| | Lack of citizen participation | High | Co-creation formats designed in the local context to address the local participation culture |
| | Co-creation activities within | High | Public procurement of smart |

| | | | |
|---|---|---|---|
| | the LC living labs will not result in the development of market-ready smart city solutions. | | products and services via challenge-based calls |
| Local governance & coordination structure | Lead: City of Leipzig, Digital City Unit | | |
| Reference to Lighthouse Cities (replication) | Eindhoven: Strijp-S triple/quadruple helix approach<br>Manchester: LivingLab from the University of Manchester | | |
| Current status | Engaging civil society in digital transformation processes is one of the key issues on the agenda of the new Digital City Unit. Several activities have been carried out in 2019:<br>- iCityTender workshop and webinar on citizen engagement (see 3.7)<br>- the Digital City Unit is currently drafting a concept of a "competence center "connected society" which will support and interlink NGO's and other civil associations in the digitization processes. Also, funding will be available for the direct support. The concept will be finalized in 2020, and the network will start its work approx. at the end of 2020, funding should be available from 2021 (new household period).<br>- Within the SPARCS project, the engagement of civil society (e.g. tenants, inhabitants of the focal area in Leipzig-West) in the implementation of positive energy districts and the increase of the acceptance of Smart Home solutions is one key element. A respective engagement concept will be set up until 09/2020, and the implementation will start after that. | | |

## 4.5 Smart municipality

### 4.5.1 Urban Data Platform

| Urban Data Platform | | |
|---|---|---|
| Target area | City of Leipzig (whole city region) | |
| Technologies & solutions to be implemented | The Urban Data Platform Leipzig will be an aggregation and combination of existing data within the municipality as well as data from the utilities and from different private data sources. This includes data about the infrastructure of a district (energy, water, traffic/mobility, smart building) and infrastructure analysis in order to plan, simulate and optimize infrastructure systems. The Urban Platform integrates communal and external data sources. It is based on open protocols and respects the relevant DIN (DIN SPEC 91357: "Open Urban Platforms"). A common data platform will serve many purposes. One main advantage will be the improved efficiency of administrative processes. As indicated by the Morgenstadt indicators on ICT, the IT-systems are rather segmented. This leads to inefficiencies in the aggregation and usage of data in multiple bodies of the municipality.<br><br>The first application of the platform will be better public transportation planning due to expanded data sources, as the City of Leipzig and the LVB will join their data on traffic. This follows the findings and recommendations made by the Mobility indicator of the Morgenstadt assessment.<br><br>The combined data will not be open to the public by default. However, it is planned to connect the urban data platform to the existing open data portal and enable the possibility of making existing data public. | |
| Costs of planned implementation measures | LVB (staff) | 155.500 € |
| | City of Leipzig (staff, licenses, subcontracting) | 829.920 € |
| Funding & business models | Grant application following the 3rd INTERREG Central Europe Call; submitted proposal on January 25, 2018.<br>Alternatives: part of the digitisation strategy and funded by communal funds. This would delay the start of the implementation phase to Q4/2019. | |
| Reference to lighthouse cities (replication) | The well-equipped and operational open data platforms in Manchester and Eindhoven together with the logic of the ICT Reference Architecture (D6.2) help to focus the efforts during development. | |
| Key timescales | 2018: Preparation<br>01/2019: Start of implementation phase<br>01/2020: Urban Data Platform expected to be operational<br>2021: Extending the data sources beyond traffic data | |
| Lead partners | City of Leipzig: Digital City Unit, Office for Geoinformation and Land Management, Office for Environmental Protection, Office for Building Management<br>Public utilities: LVV GmbH, LVB mbH, Leipziger Stadtwerke GmbH, Leipziger Wasserwerke GmbH, Netz Leipzig GmbH and others | |
| Local governance | Information bill Nr. VI-DS-02884 for city council „Information zur Zusammenarbeit/Kooperation | |

| | |
|---|---|
| & coordination structure | der Stadtverwaltung mit der Leipziger Gruppe zum geplanten Infrastruktur\|Kataster“ (Information about the cooperation of the municipality with the L-Group on the planned infrastructure cadastre). |
| Current status | From M49-M60 the development of the Urban Data Platform took further important steps:<br>- A working group, consisting of the City of Leipzig (Digital City Unit, Office for Geoinformation and Land Management) and the public utilities (L-Gruppe: LVV, Leipziger Stadtwerke, Leipziger Verkehrsbetriebe, Leipziger Wasserwerke, Netz Leipzig) was established.<br>- A schedule for the setup of a joint strategy for joint urban data platform was agreed on (strategy will be finalized in 2020).<br>- An official decision by the Strategic Meeting of City Leaders (see 3.2.4) was taken.<br>- First funding (staff, licenses) is secured by the EfficienCE project. Further funding should be made available with the new household 2021/2022 and budget from the public utilities.<br>- First use-cases for the benefit of the Urban Data Platform were developed and discussed a) in the working group, b) between the public transport company and the city (EffiicenCE project) as well as c) with the participants of the Digitalkomplizen (see 3.2.4) |

### 4.5.2 Digitisation Strategy City of Leipzig

| Digitisation strategy City of Leipzig | |
|---|---|
| Target area | City of Leipzig (whole city region) |
| Technologies & solutions to be implemented | As part of the ongoing digitization, the municipality of the City of Leipzig is in the process of modernizing its structures and develops central measures for the coming years. A digitization strategy[33] was developed and endorsed. The implementation started in 2018.<br>Central measures and new technologies implemented (e.g.):<br>• Generation of conditions in order to use central, standardized services city-wide<br>• Gradual optimization of process operations (digital records management)<br>• Central control of the digitization process |
| Costs of planned implementation measures | In the current draft of the strategy, the implementation costs for 2019/2020 are estimated to be 4 million EUR. |
| Funding & business models applied for implementation | Communal budget is secured in budget 2019/2020 |
| Key timescales | 2017-2020 |
| Lead partners | Public: City of Leipzig, Department for General Services<br>Private: LECOS GmbH (municipal IT-provider) |
| Local governance & coordination structure | Coordinated by Department for General Services of the City of Leipzig, the concept was acknowledged by the city council. |
| Reference to Lighthouse Cities (Replication) | During the visit to Stavanger in May 2018, the Triangulum team, as well as other members of Leipzig City administration, met with Gunnar Crawford, head of the Smart City Unit Stavanger. As the legal framework conditions for eGovernment solutions in Norway differ to those in Germany, only general approaches on bringing innovation to the municipality were discussed. |
| Current status | Several measures of the digitization strategy have been implemented since mid-2018, e.g.:<br><br>Digitale Werkstatt (digital workshop)<br><br>In 2018 the Department for General Services of the City of Leipzig and the LECOS GmbH[34] drafted the concept for the so-called “Digitale Werkstatt” where employees from the municipality and the IT-company will work together in a fablab atmosphere to develop solutions for the multiple eGovernment solutions and processes that the municipality will have to implement till 2022. The Werkstatt started its work at the beginning of 2019 and has developed several pilots, e.g. chat-bots for several citizen services, VR-applications for the 3D model and developing sensor projects for the urban data platform. |

[33] https://www.leipzig.de/fileadmin/mediendatenbank/leipzig-de/Stadt/02.1_Dez1_Allgemeine_Verwaltung/Vorlage-Digitalisierung-der-Verwaltung.pdf
[34] IT-company 90% owned by the City of Leipzig.

### 4.5.3 Smart City participation process and working structures

| Smart City participation process and working structures | |
|---|---|
| Target area | City of Leipzig (whole city region) |
| Technologies & solutions to be implemented | One key aspect of the development and implementation of Smart City strategies and projects in Leipzig is co-production: partners from the municipality, the L-Group, local businesses, science institutions and neighbourhood society.<br>A resolution with the information about the necessity to reorganise internal working structures regarding Smart City measures has been acknowledged by the Lord Mayor. It has been decided that a new strategic Digital City Unit will be established. |
| Costs of planned implementation measures | Staff costs |
| Funding & business models applied for implementation | At the moment, the Smart City coordination unit at the ASW is financed out of the HORIZON 2020 project Triangulum. In order to secure the continuation of this unit and to intensify participation processes new financial resources are necessary. They can either be secured by the city's own budget or with the help of different funding programs (e.g. funding proposals HORIZON 2020 Lighthouse InnoLEVER (rejected) or (partly) by the Smart Systems and Smart Infrastructure Hub Dresden/Leipzig). |
| Key timescales | Mid-2018 – open end |
| Lead partners | Public: City of Leipzig, Office for Urban Regeneration and Housing Construction Subsidies (ASW), Office for Economic Development, Department of General Services<br>Private: public utility companies L-Group |
| Local governance & coordination structure | City of Leipzig, Department of General Services; Office for Urban Renewal and Housing Subsidies |
| Reference to lighthouse cities (replication) | Eindhoven: The City of Eindhoven made changes in their administrative structures to become the centre of the Brainport region and to enable innovation development in the city.<br>Manchester and Stavanger: Strategic Smart City teams |
| Current status | ongoing. The new Digital City Unit started its work in April 2019 (M51) (see chapter 3.1 for more information).<br>Following projects (e.g.) are currently being carried out by the unit:<br><br>- EU-projects Triangulum, SPARCS, EfficienCE<br>- Development of an Urban Data Platform<br>- Development of a concept for a city-wide free Wi-Fi<br>- Development of a concept for a competence centre "Connected society"<br>- Development of a concept for infrastructure needs for new networks (e.g. 5G, lamp posts)<br>- Development of guidelines for digital transformation in the city together with civil society, businesses, universities (quadruple helix approach)<br>- Set-up of participation structures (see 3.2.4) |

# 5 Conclusion and next steps

The City of Leipzig is on its way to becoming a Smart City. The Triangulum Project continues to have a very relevant impact on the propulsion of the topic within the city's municipality and among Leipzig's citizens. Along the way and with the help of an extensive participation process, relevant stakeholders from industry and science have been involved with the development of solutions which form the basis of the implementation strategy.

The project area Leipzig West has been described in detail. Due to its historical development, social and economic structure, it is an ideal testbed for smart city solutions within Leipzig. Multiple of the developed projects aim at implementation within the borders of Leipzig West first. With the new SCC1 project SPARCS, the area will continue to play a prominent role when it comes to innovative solutions across all sectors (ICT, mobility, energy).

Overall, the analysis provided by the city assessment based on the Morgenstadt methodology gave valuable insights into the strengths and weaknesses of the city. The challenges and potentials have been described and multiple hypotheses have been formulated. The hypotheses will be tested during the further implementation of the multiple projects and actions (see chapter 4). Within the SPARCS project, Fraunhofer IAO (as SPARCS project partner) will again carry out a city diagnosis based on the Morgenstadt methodology (probably end of 2020). The City of Leipzig is looking forward to this repeated evaluation which is expected to illustrate the benefit that the Triangulum Project had to the digital transformation process of Leipzig.

The participation process with its three different formats (Future Forum, Future Expert Lab and local citizen engagement) contributed widely to the acceptance and understanding of smart city processes within the city of Leipzig. Furthermore, the context of the events was used to seek the support of relevant stakeholders such as the city's utilities company for some of the project ideas. Due to the new Digital City Unit, new formats for participation and innovation have been developed and implemented. Yet the Future Forum, one of the key participation formats of the Triangulum project, is highly accepted among its participants and will, therefore, be continued after January 2020.

The ten project ideas formulated within this strategy are spread out across the smart city sectors defined along the participation process, namely climate friendly district and smart living, smart economy and innovation, sustainable mobility, active neighbourhood society, and smart municipality. In each sector, they address the most pressing challenges identified by the city assessment based on the Morgenstadt methodology.

The approval of two new projects (EfficienCE and SPARCS) not only offer the financial support needed for the implementation of the planned activities but are also a valuable measure to secure and intensify the cooperation between the City of Leipzig, its public utilities, local universities and SME's and most importantly to further broaden and deepen the European exchange and replication of cities shaping the digital transformation.

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