

## Co-Creation for Smart City Solutions – a Peer-to-Peer Process

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### 1 ABSTRACT

The development of sustainable smart cities builds upon integrated and inclusive societies that allow inhabitants to co-create their living environment, fostering consistent dialogue among all stakeholders. It is equally based on modern ICT technologies as well as citizen engagement and institutional governance to deliver smart and inclusive solutions.

The paper is based on an Horizon 2020 Project SMARTER TOGETHER, which is a joint project that aims to develop co-created smart and integrated solutions for low energy districts, sustainable mobility, integrated ICT infrastructures and citizen engagement within three lighthouse cities, further providing recommendations for follower cities and for all cities which are willing to support sustainable and resilient development.

Within this project "being smart together" implies the need for a joint co-creative process within and between city and regional administrations and all relevant stakeholders. Therefore it is necessary to design a process and project structure allowing for a continuous organizational and peer-to-peer learning process and knowledge exchange between them.

The questions that arise are how to get there and how to set up such a process? Therefore, the paper first presents the research methodology, consisting of the process itself as well as outlining the analog and digital peer-to-peer exchange vehicles developed for this purpose. On the one hand, so called "Project books" will provide the knowledge base for a fruitful peer-to-peer knowledge exchange among the cities and all local stakeholders and experts on an analog basis. On the other hand, the "Knowledge carrier" will be the major digital peer-to-peer "capsule" for information exchange and as measure for "information growth" within Smarter Together. The paper will exemplarily draw upon the e-mobility projects to be realized in the three project lighthouse cities Lyon, Munich and Vienna.

Finally, the paper discusses the transferability of the identified approaches and tries to illustrate possible strategies to replicate the co-creative process itself as well as the innovative solutions in the field of e-mobility with the help of the tools.

Keywords: Smarter Together, E-Mobility, Peer-to-peer, Co-creation, Knowledge exchange

### 2 SMARTER TOGETHER

#### 2.1 Project scope and objectives

In January 2016, the cities of Vienna, Munich and Lyon together with 30 partners from 8 countries (among those: key smart cities industrial players, dynamic SMEs, building owners, universities, research & technology organisations, major European networks and major standardisation institutes) were awarded with funds for a joint research and city development project within the EU SCC1 call. The title "SMARTER TOGETHER" can be taken in the literal sense of implementing "smart" and innovative actions in the three lighthouse cities and sharing their gained insights and knowledge in cooperation with three so called follower cities - Santiago de Compostela, Sofia und Venice.

SMARTER TOGETHER will deepen the knowledge and know-how in the fields of data management, eco-refurbishment and e-mobility through large-scale demonstration activities, user-centric innovation and sustainable smart city business models. Research and business stakeholders will benefit from the in-depth transfer of the results, which will prepare the ground for a large-scale replication of successful solutions in other cities, contributing to positive societal dynamics in European countries and beyond.

The project strives to demonstrate large-scale smart city solutions in six districts under various urban and governance conditions covering the European diversity. Therefore new business models will be developed to turn the demonstration activities into economically sustainable and replicable solutions for other cities. User-centric innovation will be fostered by involving even more people and stakeholders in the co-creation and

design of new services and solutions. Furthermore experiments with low energy districts will provide energy-efficient buildings with local renewable heat and electricity. Also existing data networks will be integrated into citizen-oriented open data platforms to deliver new services to locals. Finally new e-mobility solutions for local citizens and companies will be developed and implemented.<sup>1</sup>



Figure 1: SMARTER TOGETHER Lighthouse and Follower Cities

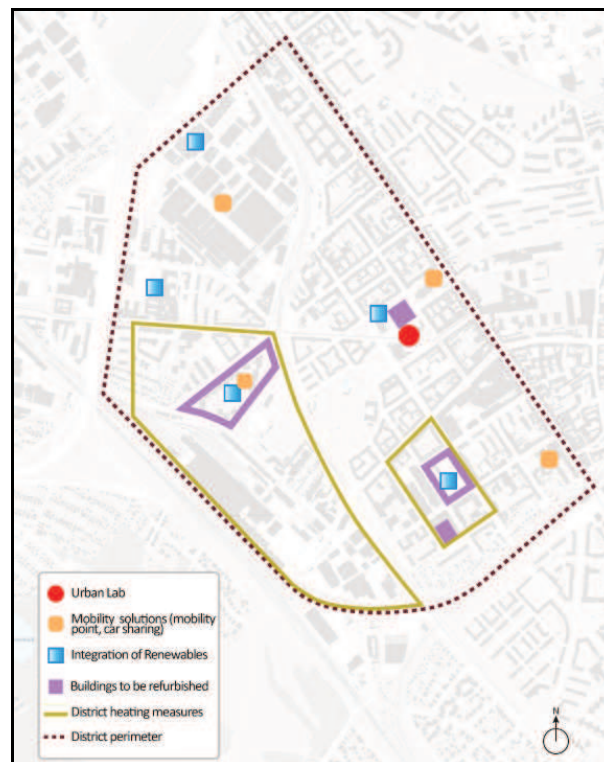


Figure 2: Vienna-Lighthouse project area

<sup>1</sup> Gaiddon, B. et al. (2016): Three Cities – Lyon, Munich, Vienna – Will be SMARTER TOGETHER.

## 2.2 The Lighthouse City Vienna

The project demonstration area in Vienna is located in the central part of the south-eastern district of Simmering between Simmeringer Hauptstraße and the eastern railway line. In total, 21 000 inhabitants will benefit from smart project solutions within the fields refurbishment, energy, mobility and information and communication technologies. An emphasis is made on dialogue, in line with the Vienna Smart City Framework Strategy where the human dimension of the Smart City is the focus of attention. Dialogue includes all generations and backgrounds aiming at contributing to an integrated societal dynamic. The local network of partners includes all actors, from government to citizens to business players, where everyone has a specific responsibility towards achieving the common goals.

Vienna strives to:

- refurbish three residential neighborhoods with 1,300 inhabitants and a total floor surface of 75,000 m<sup>2</sup>
- ensure savings of 6,000,000 kilowatt hours (kWh) per year in all refurbished housing complexes together. This corresponds to the energy use of about 700 housing units
- guarantee more sustainable and future-oriented energy supply with 9,000,000 kWh provided by renewable energy sources (thermic as well as electric energy), which will result in considerable savings for the tenants in energy and heating costs.
- save about 550 tons of CO<sub>2</sub>
- secure and/or create 900
- promote an intensive governance learning process by involving eight departments of the City of Vienna's administration, ensuring that the experiences and results of the project will be integrated in a sustainable way all over the city<sup>2</sup>

## 2.3 The Lighthouse City Munich

Neuaubing-Westkreuz/Freiham is the project district in which Munich is implementing the pioneering smart city solutions. Around 30,000 people live in this district on the western edge of the city. Whereas Freiham is a new housing development area, many of the residential properties in Neuaubing-Westkreuz were built in the 1960s and 1970s. Their energy-efficiency standards are comparatively poor.

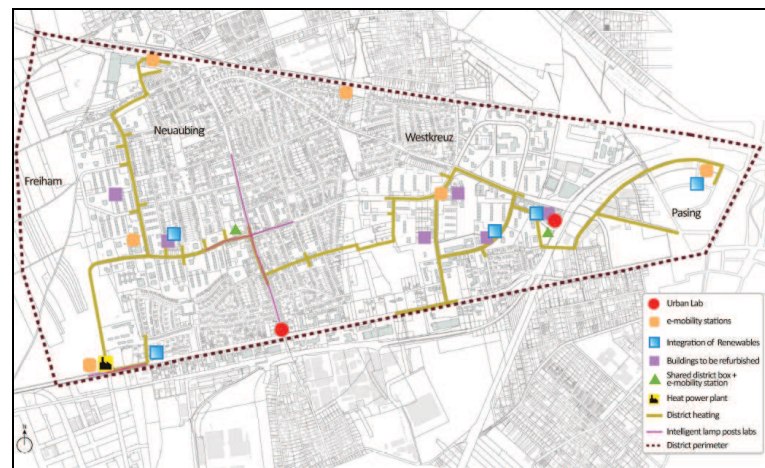


Figure 3: Munich-Lighthouse project area

Munich strives to:

- Refurbish houses in order to reduce energy consumption
- Construct multimodal mobility stations with multifunctional district sharing boxes that increase e-mobility and serve as exchange and delivery stations for goods
- Install smart street lamps that consume less energy and facilitate new services

<sup>2</sup> <http://smarter-together.eu/cities/vienna>

- Design a neighbourhood app which creates intelligent links between all services to drive better acceptance and wider use of the offerings described above<sup>3</sup>

## 2.4 The Lighthouse City Lyon

Lyon's demonstration area is Lyon Confluence - one of the largest urban redevelopment projects in France (150 ha – 600 000 m<sup>2</sup> existing floor area – 1.000.000 m<sup>2</sup> of new buildings). It is the first WWF approved urban development in France and it is the largest urban redevelopment area in France with such an ambitious target such as the zero carbon objectives: the annual greenhouse gases emissions at the end of the urban project must not be superior to the level of emission at the project start.

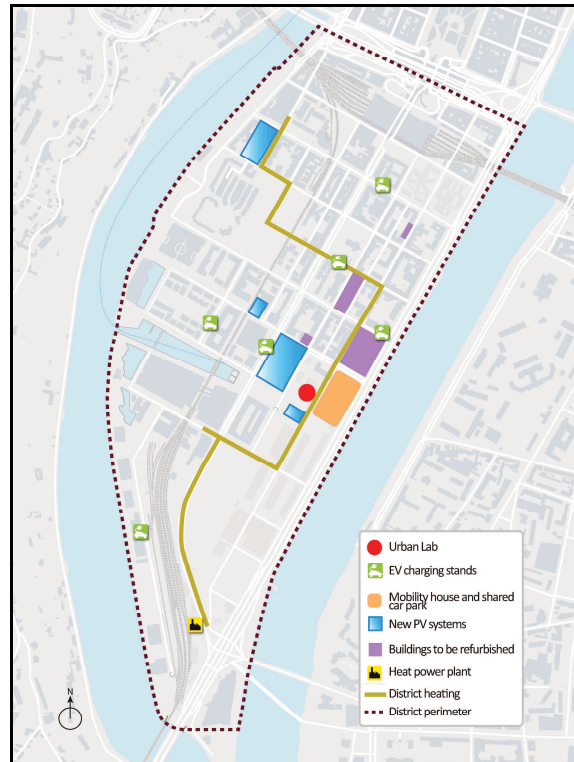


Figure 4: Lyon-Lighthouse project area

Lyon strives to:

- refurbish 35,000 m<sup>2</sup> of existing buildings to reduce their energy consumption
- develop local renewable energy production: photovoltaic systems (1MWp) and a wood-fired co-generation power plant (2MWe/4MWth)
- reduce the use of conventional cars by providing alternative means of transport for inhabitants: smart charging stands, electric-vehicle car-sharing system and an autonomous driverless electric shuttle
- develop a data platform to monitor energy production and consumption in the area, and the actual effects and benefits of measures implemented to reach the zero carbon objective
- involve citizens in the redevelopment of the Lyon Confluence area and the implementation of new services (creation of an urban living lab to allow citizens and users to co-design the smart city solutions).
- increase the quality of life of inhabitants through construction of comfortable and affordable dwellings and office places, convenient public spaces, easy access to the district, etc.<sup>4</sup>

## 2.5 Project Structure

The overall project is divided into ten work packages (WPs):

<sup>3</sup> <http://smarter-together.eu/cities/munich/>

<sup>4</sup> <http://smarter-together.eu/cities/lyon/>

- WP1 Innovation Action Framework provides a first action framework for the successful implementation of smart solutions, striving for capacity building, common perceptions and consistent workflows in the later Work Packages.
- WP2 Co-Creation for Smart City Solutions – a peer to peer process establishes reference processes and tools for co-creation, building on the inputs of WP1 to define thematic guidelines for successful implementation of co-created city solutions in cities.
- WP3 Lighthouse Demonstration Lyon implements the demonstration activities in the lighthouse target area of Lyon, ensures their monitoring during the implementation and prepares the replication phase.
- WP4 Lighthouse Demonstration Munich implements the demonstration activities in the lighthouse target area of Munich, ensures their monitoring during the implementation and prepares the replication phase.
- WP5 Lighthouse Demonstration Vienna implements the demonstration activities in the lighthouse target area of Vienna, ensures their monitoring during the implementation and prepares the replication phase.
- WP6 Monitoring & Evaluation ensures the 3-years post-implementation monitoring phase, running the monitoring infrastructures, collecting data and evaluating processes and impacts.
- WP7 Integrated strategies in Follower Cities supports the replication of successful demonstration solutions and services in the Follower Cities target areas.
- WP8 Replication of smart city solutions ensures the replication of results and outcomes of the demonstration phase as well as replication of monitoring actions both at the city level in the Lighthouse cities and in other cities and at commercial and industrial levels, allowing the scaling-up and deployment of the developed smart city solutions in Europe.
- WP9 Dissemination and Communication ensures effective communication actions and dissemination of project results, which will support transferability towards scientific, policy and industrial communities.
- WP10 Project Management ensures the steering and planning of all activities, time schedule, quality and cost management to meet the project's objectives from both technical and administrative perspective.

### 3 CO-CREATION FOR SMART CITY SOLUTIONS

#### 3.1 Main Challenges

Even though the three lighthouse cities seem to be very different, they do face very comparable challenges and problems. This is also reflected in the great number of highly different but in parts also very comparable projects within the Demonstration WPs. In order to be able to design co-created and integrated solutions and produce replicable results, particularly the following four main challenges need to be addressed when designing a general concept for such a project.

##### (1) Cross-Silo Thinking:

Overcome thematic silos in order to allow knowledge exchange between experts of projects with a highly diverse thematic orientation (e.g. IT-experts of e-mobility and smart district projects), helping to overcome specific emerging problems and generating a basic knowledge set of recommendations for co-created solutions.

##### (2) Cross-City Thinking:

Allow a knowledge exchange within a thematic silo but in between all respective experts of that silo (e.g. all refurbishment experts of all cities) in order to address and solve specific thematic problems.

##### (3) Stakeholder Involvement:

Involve relevant external stakeholders in order to include all available knowledge into the co-creation process. This step should include both local experts as well as external domain experts.



#### (4) Knowledge Transfer:

Disseminate generated knowledge in between the project and over its borders in order to actively perform a co-creation process and to provide a set of recommendations for co-created and integrated smart city solution for cities.

Naturally, the success of the co-creation process will depend on an adequate handling of all four outlined main challenges, allowing for Cross-Silo as well as for Cross-City-Thinking, including all Stakeholders and ensuring a transfer of the generated knowledge into project and cities.<sup>5</sup>

### 3.2 A concept for co-created smart city development

In order to encounter the outlined main challenges and to foster co-creation within the Smarter Together project, the overall concept of the project consists of two general groups of work packages. While the work packages 3 to 5 are dedicated to the demonstration projects to be implemented within the three cities, all other work packages are foreseen to enable the development of co-created and integrated solutions, addressing the organizational and peer-to-peer knowledge exchange, allowing for impact monitoring and striving for high replicability. Therefore, a strong interaction between the so-called Enabler and Demonstration work packages will be established.

The peer-to-peer knowledge exchange process of WP2 will try to bring together the experts and affected stakeholders of the demonstration projects at different stages of the implementation process (months 18, 24 and 30) in order to overcome common challenges and to benefit from lessons learned. WP2 will develop the recommendations further, finally aiming for a set of proven recommendations ready to be used by other interested cities, specifically by the follower cities in WP7.

The organizational and peer-to-peer knowledge exchange to be established within the Enabler WP2 is of utmost importance to develop co-created and integrated solutions within the project itself and to develop recommendations based on the lessons learned during the implementation process.<sup>6</sup>

### 3.3 Project Books – Analog peer-to-peer exchange

As outlined above the aim of WP2 within the Project Smarter Together is to learn from other cities on an expert level. Therefore a learning method is necessary and needs to be developed within the project. A first step is to provide information about the different projects and solutions and find a “common ground” for further discussions. After having a better understanding of the single projects and solutions it will be easier to find similarities in between the projects, raise questions and look at the own project(s) from a different point of view. This may influence upcoming projects and solutions as well as specific activities within the ongoing project development processes. This way the peer-to-peer learning can be supported very efficiently.<sup>7</sup>

#### 3.3.1 Introduction to the project book

The so-called “project books” provide the knowledge base for a fruitful peer-to-peer knowledge exchange among the cities and all local stakeholders/experts. Peer-to-Peer is a key method of knowledge management that addresses the “human dimension of learning” through a very personal exchange of process based formal knowledge and subjective project experiences of practitioners. The respective knowledge is always related to a context and very concrete challenges. Furthermore it is a result of the subjective exchange process and the dynamics of the dialogue itself. The personal exchange provides also an emotional level of communication linked to the very subjective experience of concrete communication, which allows the unlocking of (sensitive/subjective) information that would never be written down. A major added value are the establishment informal knowledge networks that last in time. They also contribute to the development of organizational culture.

The project books and their respective contents are – besides the very personal experiences and knowledge exchange of the SMARTER TOGETHER partners – central part of WP2 and its respective outcomes. For

<sup>5</sup> Gaiddon, B. et al. (2016): Three Cities – Lyon, Munich, Vienna – Will be SMARTER TOGETHER

<sup>6</sup> Gaiddon, B. et al. (2016): Three Cities – Lyon, Munich, Vienna – Will be SMARTER TOGETHER.

<sup>7</sup> ibidem.

each WP2 task a project book will be developed, describing all projects (including the development status) of one of the five Smarter Together key topics:

- City Engagement
- Holistic Refurbishment in Smart Districts
- District Heating & Renewables
- Data Management Platform & Smart Services
- E-Mobility

The five project books will be iteratively developed until 2020, offering an insight in the development process of the innovative city development projects in the lighthouse cities. By presenting challenges and experiences the projects are facing over the project lifetime and respectively their conceptualisation and implementation phase, the project books will provide a highly informative set of lessons learned.

Each project book will provide a general overview over all projects in the context of the respective thematic field and its solutions, developed and implemented within the HORIZON 2020 Lighthouse Project Smarter Together.

### 3.3.2 Main objectives

The project book tries to accomplish three main objectives:

- Documentation for all project partners (everyone gets to know the other projects and is enabled to understand current challenges and best practices)
- Support Peer-to-Peer processes, the report feeds into the task “Knowledge exchange network and recommendations design”, which will bring together experts of the different projects in order to work on yet unresolved problems and on how to get newly acquired knowledge shared among all partners
- Help to understand the applicability of the best practices and recommendations gathered in workpackage 1 of the SMARTER TOGETHER project. Based on this, the recommendations will be adapted and potential focus questions can be addressed.

### 3.3.3 Data collection process

The collection of information for the project books is integrated within a project internal common reporting process. Not only workpackage 2 is collecting specific project information, rather workpackages focusing on monitoring or external dissemination also seek for specific project information. Therefore a common reporting questionnaire was developed, integrating all questions to be reported and allowing for an easy information sharing among all workpackages. Accordingly the reporting periods were aligned among all workpackages.

The reporting on the project development status will occur three times during the project lifetime in the months 16, 22 and 28 exactly two months in advance of the peer-to-peer knowledge exchange workshops. By that, all the results can be taken into account, being able to address identified common problems (cross-silo and cross-city).

## 3.4 Knowledge Carrier - Digital peer-to-peer exchange

Based on identified, evaluated and tested existing tools and approaches for Co-Creation a set of tools for subsequent use within the Co-Creation Processes for implementation in all three cities was defined. These tools and processes built the foundation to foster the collaboration and knowledge exchange between experts and local stakeholders in the lighthouse projects on a digital basis. As an important measure a mobile “knowledge carrier” is being designed and realized which acts as “capsule” for information exchange and as measure for “information growth” within SMARTER TOGETHER.

### 3.4.1 Introduction to the Knowledge Carrier

The “knowledge carrier” provides the knowledge base for a fruitful peer-to-peer knowledge exchange among the cities and all local stakeholders/experts at predefined points in time during the course of the project

(Month 0, 18, 24 and 30) with the focus on visualization. Therefore the carrier and its respective content builds upon the information basis of the project books which will be updated in the same time steps.

For the frontend development and design the german provider for 3D spatial data infrastructures virtualcitySYSTEMS was contracted. Anyways, as final outcome of the conceptualisation of the knowledge carrier a set of mock-ups was developed (compare figure Figure 5 below).



Figure 5: Mock-Up of the Knowledge Carrier [modified]<sup>8</sup>

The final design of the web interface will consist of two main elements. First, a three-dimensional map of the respective lighthouse city district, allowing for a free movement within the model for the user. The second part of the screen is designed as an overlay and will consist of the contextual knowledge collected with the help of the project books, providing the user information on the project status of all projects in the district.

Further, by including a timeline, the user can track the changes and process steps of the projects visually (in the 3D-model) and content wise (project book information).



<sup>8</sup> <https://i.ytimg.com/vi/9NhyDiiaXic/maxresdefault.jpg>



Figure 6: Reference interface Berlin Business Location Centre by virtualcitySYSTEMS

The knowledge carrier will visualize three different levels of information:

- (1) City level: General information on the concepts, goals and visions of Lyon, Munich and Vienna
- (2) Thematic level: Specific information such as recommendations, challenges or best practices on City Engagement, Holistic Refurbishment in Smart Districts, District Heating & Renewables, Data Management Platform & Smart Services and E-Mobility
- (3) Solution level: Presenting the project status over the whole development cycle for all projects.

The operation of the system is designed as easy and intuitive as possible, providing a webbased frontend; allowing for multi-touch navigation and offering multiple languages (German, English, French). According to the common reporting process, the project developed a common content management system (CMS) based on DRUPAL, allowing all project partners to use the gathered information for their services and needs (e.g. Web-page or knowledge carrier). The content management system was developed by the project partner Gopa.com.

### 3.4.2 Main objectives

The Knowledge Carrier tries to accomplish the following main objectives:

- Visual preparation of the documentation for all project partners and local experts (everyone gets to know the other projects and is enabled to understand current challenges and best practices in an illustrative visual form)
- Supports Peer-to-Peer processes, which will bring together experts of the different projects in order to work on yet unresolved problems and compare them with similar ones
- Helps to understand the three different levels of action (city, thematic field, project) and allows to track their development over the course of the project

Besides that the Knowledge Carrier will be a very powerful tool, providing cities and experts of all cities of the world a deep insight in development and implementation processes of innovative city development projects and therefore enabling them to understand potential challenges and to identify promising solutions.

### 3.4.3 Development of to the Knowledge Carrier

In order to be a useful tool, the cities were deeply involved in the design process of the Knowledge Carrier. This included both lighthouse cities as well as follower cities, naming different demands and use-cases.

First of all, both sides defined particularly experts and city employees as key end-user group. Anyways, the lighthouse cities set a focus on staff that works on the field, being responsible for the implementation of the projects themselves. The main hope: If other cities face the same problems, we could either way try to solve challenges together or learn from a city that solved an issue already. On the other side the follower cities named a key audience which is located at a more strategical level, trying to prepare decisions and to proactively prevent possible challenges in designing the future city.

Anyways, the Knowledge Carrier needed to match both perspectives in order to be a tool that is useful for all kinds of cities, regardless of their specific state of development in a topic area.

## 4 TRANSFERABILITY OF APPROACHES

SMARTER TOGETHER seeks to develop methods, solutions and processes that are transeferable to all kind of other cities. As a first step, the replicability of the solutions to be developed in the SMARTER TOGETHER lighthouse cities will be tested by transferring them towards the follower cities. As outlined, the project books and the knowledge carrier are the key tool within the project to forward deep project insights towards these cities.

Within the reporting process, the follwoer cities are informed about the identified common challenges a month before the peer-to-peer workshops in order to allow them to identify topics of interest and to delegate key personel for the workshop sessions.

## 5 OUTLOOK AND CONCLUSION

Since SMARTER TOGETHER is an ongoing project and the first reporting period just ended, the full capacity of the process is not yet proven. First benefits (e.g. strengthening of partner network) as well as shortcomings (e.g. high reporting efforts) have already been identified.

Anyways, a set of interviews with responsables of the cities is planned in order to optimize the reporting process. Further by analysing the outcomes of the common reporting and the first peer-to-peer workshop a final adaptation of the reporting questionnaire is foreseen.

Although the project books are planned to be project internal, the knowledge carrier is intended to be opened after the project lifetime if proven to be a helpful tool for the partner cities. By that other cities could learn from the insights of the SMARTER TOGETHER projects and even share their own knowledge.

## 6 REFERENCES

- Gaiddon, B., Girardi, J., Neumann H.M., Thielen, K., Vignali, E., Wendt, W. (2016): Three Cities – Lyon, Munich, Vienna – Will be SMARTER TOGETHER, REAL CORP 2016 Proceedings, Manfred SCHRENK, Vasily V. POPOVICH, Peter ZEILE, Pietro ELISEI, Clemens BEYER (eds.), 22-24 June 2016, Hamburg.
- <http://smarter-together.eu/cities/vienna/>, project website of the SMARTER TOGETHER project, gopa.com (eds.), 2016, Brussels
- <http://smarter-together.eu/cities/munich/>, project website of the SMARTER TOGETHER project, gopa.com (eds.), 2016, Brussels
- <http://smarter-together.eu/cities/lyon/>, project website of the SMARTER TOGETHER project, gopa.com (eds.), 2016, Brussels

