SMART CITY GUIDANCE PACKAGE FOR INTEGRATED PLANNING AND MANAGEMENT

Planning and implementation of Smart City projects: phases, common obstacles and best practices, key performance indicators, upscaling, and replication.

Action Cluster Integrated Planning/Policy and Regulation

Intermediate version June 2017

NTNU
Norwegian University of Science and Technology

EIP-SCC

J. Borsboom-van Beurden, J. Kallaos, B. Gindroz, J. Riegler, M. Noll, S. Costa, R. Maio

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Contact info:
Judith Borsboom-van Beurden
judith.borsboom@ntnu.no

James Kallaos
james.kallaos@ntnu.no

Design: synlig.no
Print: Skipnes
Photo: synlig.no / Shutterstock

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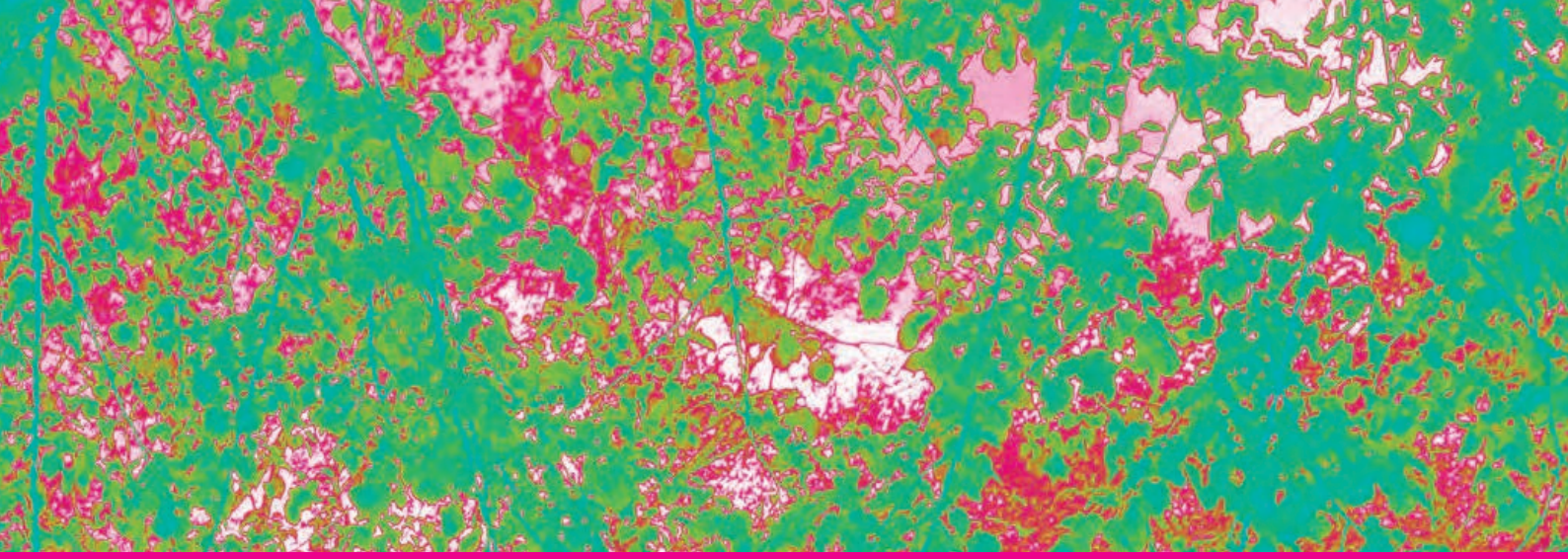
CONTENTS

FOREWORD



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1 INTRODUCTION & BACKGROUND

Many cities are currently exploring the possibilities to make better use of the current urban fabric and its infrastructure, with the aim of enhancing local quality of life and improving urban sustainability. The wealth of urban data, the increased connectivity of urban objects through the Internet-of-Things and advanced energy and mobility technologies have opened up new avenues for the application of smart solutions and the transition to clean energy and mobility in cities. Numerous cities across the world are now looking into the potential of smart solutions, experimenting in living labs and applying smart technologies in ambitious integrated projects, such as the Horizon2020 lighthouse projects.

European Innovation Partnership Smart Cities and Communities

The European Innovation Partnership Smart Cities and Communities (EIP-SCC), established in 2012 as an initiative from the European Commission, has strived to build a broad community of cities, industries, SMEs, banks, knowledge institutes, citizens, NGO's, and other smart city actors. It intends to improve citizens' quality of life and reach energy and climate targets, while increasing the competitiveness of Europe's industry and innovative SMEs. Knowledge sharing to prevent the repetition of mistakes, and facilitating connections between people and solutions, are essential to achieve these goals. To this end, the EIP-SCC Market Place brings together those who

are active in the field of Smart Cities and willing to know more about ongoing and foreseen activities throughout Europe. Networking, partnering, and exchange of information help to develop and implement smart city solutions at the intersection of Energy, ICT and Transport.

In the EIP-SCC, the Action Cluster of Integrated Planning/Policy and Regulation focuses on what is needed to plan smart city projects in an integrated way. 'Integrated Planning and Management' involves spatial, temporal and technical coordination of diverse policy areas and planning resources to achieve defined goals using specified (financial) instruments. Its success requires the comprehensive and early involvement of all governmental and non-governmental players, private sector, and citizens. This is particularly challenging as it involves managing long-term planning perspectives and short term actions, addressing domains as diverse as transport, energy, ICT and beyond – in both existing (retrofit) and new urban territory. Most current approaches are insufficiently agile to cope with a more entrepreneurial approach and to respond to the pace of change in demography, societal expectations, and technology. This requires technical planning capabilities, more inclusive participatory and consultation processes, and greater collaboration within and across traditional policy and administrative boundaries within and between cities and communities.

In the EIP-SCC Strategic Implementation Plan (2013) and Operational Implementation Plan (2014), specific actions were recommended for integrated planning and management and for policy and regulation to respond to this challenge, such as improving collaborative governance at city-scale or higher, and maximal use of city-wide data for a more dynamic and informed planning process combining both short and long time horizons. In addition, using urban simulation models to demonstrate impacts of urban development that can be linked to urban operational systems, and the use of multi-sectorial energy models and mapping at district and city scale, were advocated. Further, it was recommended to improve engagement of stakeholders through visualisation and decision support tools, and develop innovative governance forms for integration of different stakeholders. Finally, identification and mapping of conflicts/gaps/hurdles and training and education for city stakeholders were thought very useful, next to encouraging cities to develop smart city plans and implement them, reinforcing integrated planning and thinking across policy domains.

Smart City Guidance Package

In the initiative "From Planning to Implementation and Upscaling of Smart City Projects", cities, industry, NGO's and knowledge partners collaborate on the exchange of experiences in the integrated planning and implementation of smart city projects, and their upscaling and replication afterwards to achieve the urban transition to smart and sustainable cities on an increasing scale across Europe.

This Smart City Guidance Package wants to support this exchange so other urban stakeholders can benefit from what has already been done by others.

Figure 1.1 EIP-SCC General Assembly May 2016, Eindhoven, workshop Initiative From Planning to Implementation and Upscaling

It offers inspiration and guides urban stakeholders by bundling experiences and best practices of cities working on ambitious smart city strategies and projects. It provides insight into obstacles frequently met during implementation, and explores what it takes to scale-up and replicate. Its final aim is to support building a community around development, implementation and replication of smart city plans and projects. In this way, it helps to prepare the next generation of smart city projects and to involve new cities and urban stakeholders within and outside the EIP-SCC.

Cities and communities that want to implement smart city strategies will benefit by learning from the successes and failures of others. Project leaders, consortium members, and city representatives that have already implemented energy efficiency strategies, emissions reduction approaches, or smart city strategies likely have a wealth of information on lessons learnt, which may be inaccessible to others due to its sheer volume, emphasis on successes and not on failures, and the fact that many interesting projects have not yet been finalised so information is not yet public.

This document attempts to systematize this knowledge base, draw generic conclusions on do's and don'ts, determine relevance for other actors, and make the findings accessible. It is intended for urban stakeholders who have the ambition to start developing and implementing their own smart city projects in the nearby future, and want to orient themselves on what to expect and prepare beforehand.

Approach

Several workshops have been organised involving commitments and other public authorities (EIP General Assembly May 2016 in Eindhoven, Norwegian Smart Cities and EIP SCC September 2016, Smart City Expo Barcelona November 2016, REMOURBAN Study Tour Nottingham March 2017, JPI Urban Europe conference May 2017). Based on the outcomes of these workshops, a preliminary outline for the SCGP was developed. This outline was subsequently filled in with an initial desk and literature research on phases of implementation and obstacles for implementation and replication, solutions, actors and their roles.

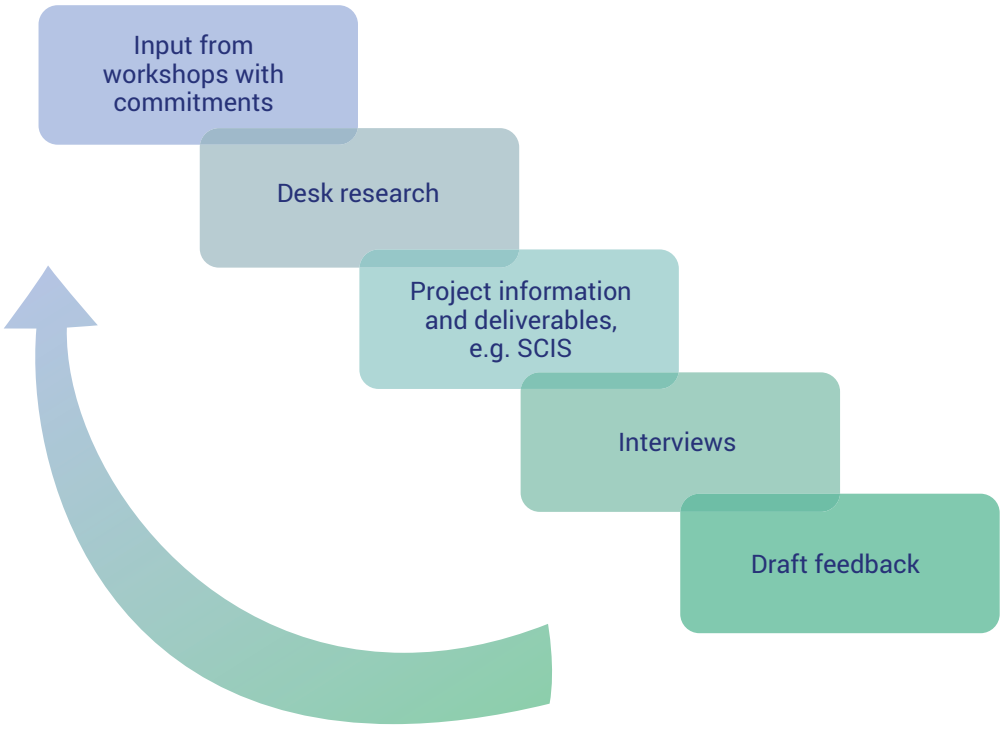

Figure 1.2 Approach to creating the SCGP – intermediate version

Nearly 50,000 FP7 & H2020 projects were scanned in order to find the relevant ones to connect and delve deeper. Further, the Smart City Information System (SCIS) proved to be an excellent source of information. However, to get more in-depth information on the implementation of smart city projects and the needs of follower cities, a more detailed understanding was needed. Therefore, city representatives, projects managers and researchers were contacted and about 20 were interviewed. These key players were asked to define and illustrate phases of implementation, and to map relevant actors and their specific roles. In addition, they were requested to provide details on obstacles and on solutions that had helped to overcome them. Finally, their experiences with replication and upscaling were discussed. Confidentiality of interview outcomes needs to be guaranteed to get usable outcomes. Privacy issues were protected by rules of the NSD – Norwegian Centre for Research Data.

Through ERANET and JPI Urban Europe, 17 additional medium-sized Smart Cities are involved, and have provided the findings on replication and upscaling. The initiative "Key performance indicators (KPIs) and tools for decision making and benchmarking", led by Bernard Gindroz (CEN/CENELEC), has bundled experiences and best practices in this field.

Next steps

With this intermediate version, the work is not finalized. It will form the point of departure for an extensive round where gaps are filled and reactions and additions are gathered in the second half of 2017. Foreseen activities will include:

- Improving the knowledge base of solutions and workarounds for specific obstacles and barriers;
- Enriching these preliminary findings with analyses of obstacles and potential solutions identified or performed by Horizon2020 lighthouse projects and other projects;
- Reaching out to commitments, follower cities and other cities who would like to test the SCGP and propose improvements for both content and approach;
- Linking the findings better to contextual information, local characteristics and presence of specific preconditions;
- Conducting another round of interviews with key players in the field;
- Incorporating reviews by experts, in particular in the field of integrated planning;

2 SMART CITY STRATEGIES, PLANS, AND PROJECTS

This chapter discusses the wide range of starting points for the development of smart city plans. Subsequently, we discuss how these plans can be part of an explicit smart city strategy. Finally, we explore how plans and strategies are further developed and concretised during different stages of implementation.

2.1 Smart City plans

The start of any smart city project planning process is a smart city plan or strategy. There is a wide range of highly diverging plans being the point of departure for development of concrete projects, often having different scopes and covering different fields of expertise. However, they all have in common that they want to reduce the carbon footprint of cities by using advanced ICT-based solutions in combination with measures addressing the physical energy and transport infrastructure and building stock of cities and the behaviour of its users. This section sketches the huge variety of plans which can be a starting point for implementation.

Overall smart city strategy: many cities have recently developed explicit strategies on how to become a smart city, with the aim of realising energy efficient neighbourhoods, clean mobility and integration of current infrastructures - working with local administrations, businesses, knowledge institutes and citizens while capitalizing on the potential of urban data and ICT. Cities such as Amsterdam, Barcelona and Helsinki were forerunners in developing and implementing such strategies.

Strategic Energy Action Plan (SEAP) and Strategic Energy and Climate Action Plan (SECAP): the Covenant of Mayors is a European initiative by which towns, cities and regions voluntarily commit to reducing their CO_2 emissions. When cities sign the Covenant of Mayors, it is mandatory to make a SEAP, for the 2020 covenant, or a SECAP, for the 2030 covenant. For the SEAP signatories the voluntary commitment is to reduce emissions beyond the EU's 2020 target of 20%, while the SECAP signatories pledge to reduce emissions by at least 40%, while increasing climate change resilience and access to sustainable energy. These formal commitments can be an important pillar of a smart city plan.

Figure 2.1 Cycle of creation of and follow-up on Sustainable Energy Action Plans (SEAPs) and Sustainable Energy and Climate Action Plans (SECAPs) by the Covenant of Mayors

Sustainability or environmental plan: environmental departments of local governments develop plans to improve urban sustainability and environmental quality. Topics dealt with are usually air and soil pollution, health, protection of nature areas, water and waste management. The focus in these plans has shifted from an approach focussed on immediate environmental quality towards the more holistic and long term consideration of sustainability: not only now and here, but also elsewhere and later. Energy efficiency, climate change and scarcity of resources have become integrated parts of most sustainability and environmental plans, and are therefore closely related to smart city plans.

Energy vision, energy plan: many cities have felt the need to develop local energy plans with the aim of reducing energy consumption by households and businesses, increasing the share of renewable energy, reducing greenhouse gas emissions, and organising energy supply in a smart, sustainable yet secure way, for example by upgrading urban heat networks and creating smart grids. Usually SEAPs, SECAPs, and other sustainable energy plans form the backbone of smart city plans.

Urban restructuring, rehabilitation, real estate project development: the intention to redevelop or rehabilitate parts of the city such as former harbour areas and industry premises or dilapidated housing, can be a reason to do this in a smart way and make the area an example of a smart, low energy district. Often, such restructuring offers the opportunity to make drastic changes to urban energy and mobility infrastructures, to create zero or low energy buildings and to improve energy efficiency of upgraded buildings, to build advanced digital networks and to improve quality of public space. Investment plans of private equity, pension funds, and insurance companies, can drive energy-efficient real estate development and maintenance.

Master plan and zoning plans for areas: from a spatial planning perspective, the development and updates of spatial plans for areas can be a trigger to improve the carbon footprint of these areas, for example by including collective energy solutions such as a collective photovoltaic (PV) array, or connecting to an upgraded district heating

network. It is mandatory to assess the possible environmental consequences of land use and transport changes in master and zoning plans beforehand, for example on air quality. However, opportunities to locally improve energy efficiency, to adapt to climate change, and to close resource and material loops, are often not an integral part of these spatial plans, what means higher costs to improve urban sustainability and energy efficiency at a later stage.

Refurbishment and renovation or maintenance plans for buildings and urban infrastructures as electricity networks: buildings are commonly undergo deep renovation every 25-30 years , which provides an excellent opportunity to improve the envelope of the building, and its energy supply and technical installations. When this is organised at district scale, for example because there is a cluster of similar buildings of the same owner and type in an area, it can be an excellent entry point for development of a smart city plan. The CONCERTO initiative of the EC (2005-2013) demonstrated that the energy-optimisation of districts and communities as a whole is more cost-effective than optimising each building individually. Existing buildings can cut their CO_2 emissions, at acceptable costs, by up to 50% by implementing renewable energy sources, innovative technologies, and an integrated approach. In addition, similar maintenance cycles for urban infrastructures as energy, transport and utility infrastructures, such as electricity grids, roads or sewage systems, can work out in the same way. For example, the renovation of natural gas networks can be an excellent opportunity to phase out this fossil fuel and make districts all-electric combined with clean generation of electricity.

Transport and mobility plans, Sustainable Urban Mobility Plans: accessibility, reduction of congestion and air pollution, and higher energy efficiency are often the main goals of transport and mobility plans. New technologies such as Intelligent Transport Systems and the wealth of urban data from smart phones and sensors, offer new possibilities to address these challenges in a smart way, thus contributing to clean, sustainable mobility. An important source of inspiration is the CIVITAS initiative from the EC (2002-2016), which tested over 800 measures and solutions to make urban transport in hundreds of European cities cleaner, better, and more sustainable. Many CIVITAS projects have been followed up recently by Smart Urban Mobility Plans, and more integrated smart city plans with a wider scope, also encompassing low energy districts and integration of infrastructures.

Framework Programme 7 (FP7) and Horizon2020 research and innovation based projects: many smart city plans are initiated as part of EU-funded FP7 and Horizon2020 research and innovation projects. FP7 projects such as CELSIUS, STEEP, and TRANSFORM have enabled cities to lay the foundation for more complex, highly integrated smart city strategies and projects. Cities could analyse the local potential for clean mobility and low energy districts by developing scenarios and what-if questions, simulating expected energy savings and CO_2 reduction. Many FP7 projects have served to study the feasibility of various solutions, narrowing down the number of options. Research and innovation projects have also boosted collaboration of local government with industry, citizens and local businesses, and research institutes, thus building a local ecosystem. In particular, the Smart Cities and Communities SCC-01 lighthouse projects have started to implement smart city projects since 2014. Due to their high level of ambition and integration, they are good examples of how smart city projects can be drafted and implemented.

Bottom-up initiatives: individual citizens, local businesses and NGO's concerned about climate change and the end of fossil fuel, have organized themselves and propose initiatives making neighbourhoods more energy efficient or increasing the share of renewable energy, for example by collective photovoltaic systems or exchange of energy between different energy consumers.

2.2 Ways to develop Smart City strategies and plans

At 24 May 2016, a workshop at the Eindhoven EIP-SCC General Assembly was organized as an interactive session where experiences on planning and implementation were shared and translated into content for this guidance package. One of the main topics was the development of smart city narratives and their translation into plans ready for implementation. The cities of La Spezia and San Sebastian, and the Scottish Cities Alliance highlighted how they developed their Smart City strategies and plans and how they planned to implement them (Garcia, 2016).

La Spezia

Chiara Bianchi presented the planning process developed in La Spezia (North of Italy) in the last years, leading to LA SPEZIA 20.20 planning to Smart City. La Spezia had two strategic plans (1999 and 2012), and developed in addition a series of sectorial plans aimed to a sustainable urban development. Among these, Integrated Mobility Plan, SEAP approved by Covenant of Mayors in 2012, broadband and WiFi deployment and several urban regeneration plans. However, the economic crisis imposed to redesign a strategy for a long-term city development, with the need of an integrated and achievable strategy aiming at recovery of competitiveness. The integrated approach should combine urban innovation, urban regeneration, energy efficiency, sustainable mobility, social housing and smart cities and communities as a result of both bottom-up (community driven) and top-down (municipal smart governance) policies.

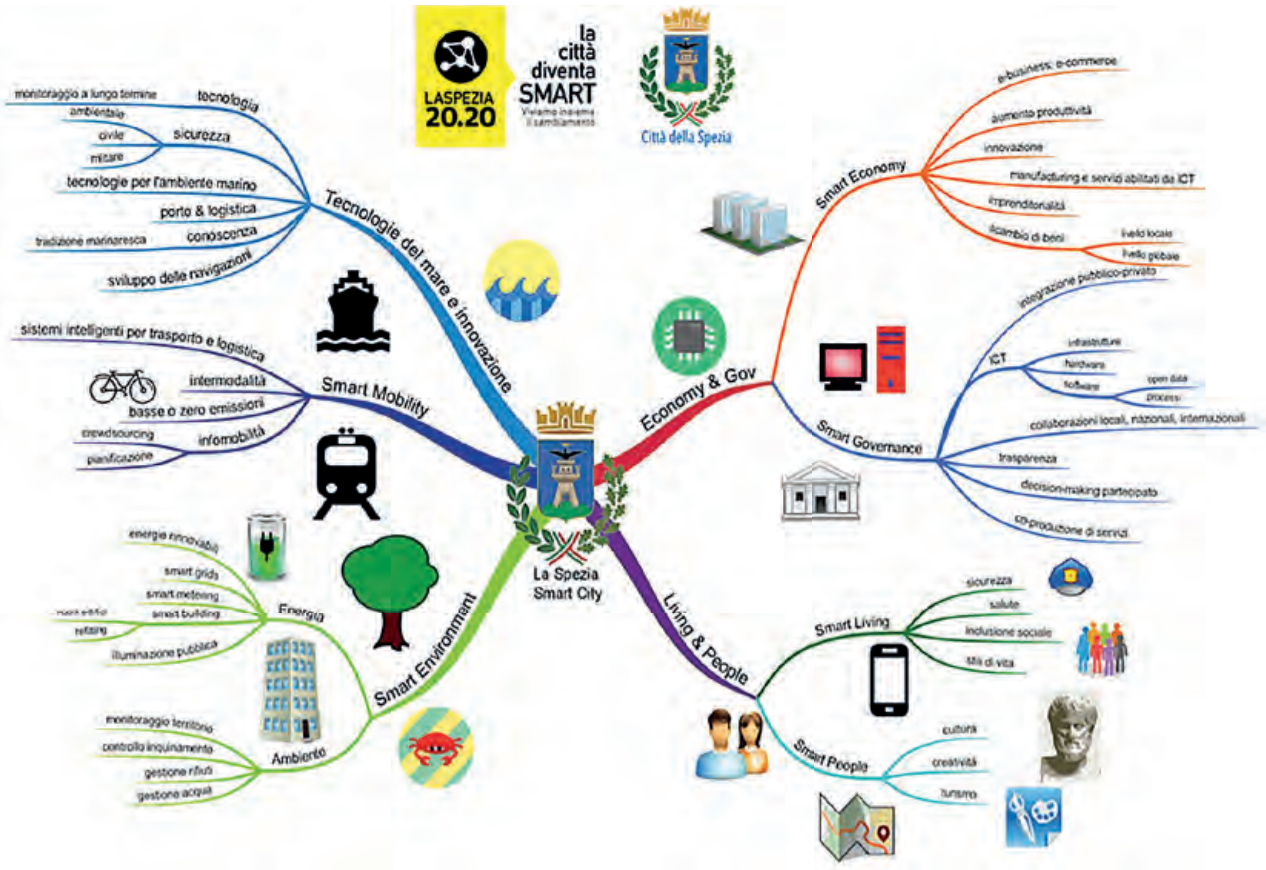

Figure 2.2. La Spezia 20.20 involves the local stakeholders around five thematic tables.

Key elements of the process were involvement and participation, use of innovative technologies, and public-private partnerships. An extensive participatory process in spring 2015 involved more than 100 local organisations, universities and industry, and focused on the specialization sectors of the region. Participation was organized around five thematic tables of qualified stakeholders: Smart Mobility, Technology of the Sea and Innovation, Smart Environment, Smart Economy & Governance, and Living & People. It resulted in a inspiring mind map (figure 2.2)

The Master Plan was approved in November 2015. Subsequently in Phase 2 (January-September 2016) the feasibility of the proposed actions was checked in order to start building projects with the actors:

- Develop experimental forms of public-private partnership and organise funding for the proposed actions;
- Make choices in line with the market, but also with the development strategies of the city;
- Maintain the sharing and co-planning method even at the stage of project development;
- Focus on human capital and territorial excellences.

Next steps (Phase 3) will focus on the definition of projects, with clear technical and financial feasibility of the proposed actions, continuity with actions already taken (coherence), synergy with the transversal themes (sea, tourism, ICT), availability of progressive investments, creation of partnerships, awareness and responsibility by each referent and its working group. At this stage, La Spezia needs funds but also knowledge: financial and contractual expertise (for instance on pre-commercial procurement), and case studies and lessons learnt by other local bodies.

San Sebastian

Nora Mendoza, from Donostia - San Sebastian (North of Spain) sketched the integrated planning process developed in the city and how it has been converted into strategic projects.

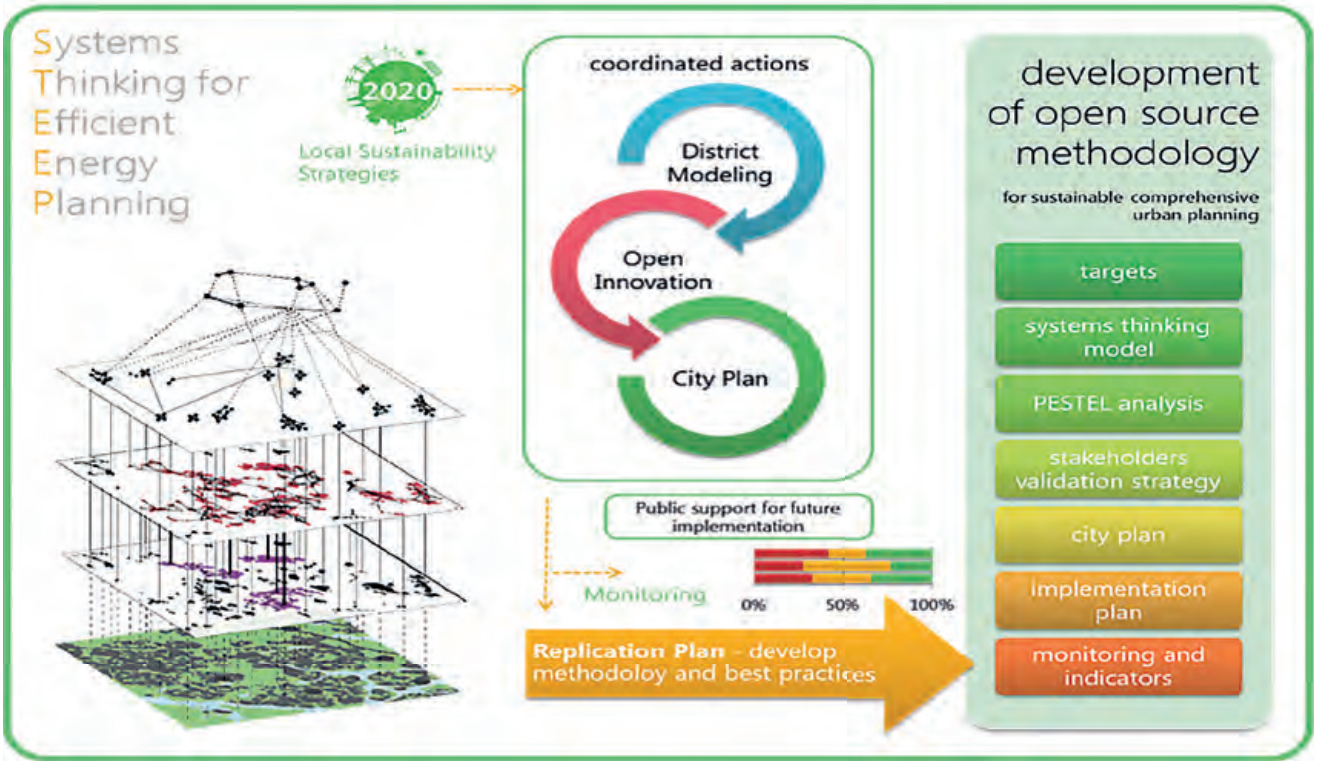

Figure 2.3 Outlook of the methodology defined in the FP7 Steep Project.

San Sebastian started a planning process following the methodology defined in the FP7 project STEEP – Systems Thinking for Efficient Energy Planning, together with the cities of Bristol (UK) and Florence (Italy). The development of the Smart City Plan involved all the municipal departments, but also 187 people from 96 different organisations (companies, universities, R&D centres, regional government bodies, and citizens). The process had two main goals:

- A main strategic line with shared objectives.
- Coherence (consistency) and Coordination in the Public Action.

The process defined several strategic projects, including among them the URUMEA RIVER SIDE project that focused on an area with social, territorial and mobility challenges. The city selected the project to apply for funding in HORIZON 2020 SCC-01 "lighthouse projects" call of 2014 without success, and finally succeed in SCC-01 call of 2015 with the proposal REPLICATE, together with the abovementioned cities of Bristol and Florence.

Figure 2.4. San Sebastian Process, from planning (Steep) to implementation (Replicate).

SCC-01 projects are examples of integration of ICT, Energy and Mobility, and in this case REPLICATE is also an example of integration of the citizens and local actors (industry, R&D, public authorities).

Smart Cities Scotland

Diana Milne represented Scottish Cities Alliance and the Dundee City Council. Since 2011, the Alliance involves seven Scotthish cities: Glasgow (the biggest one with near 500k inhabitants), Edinburgh, Aberdeen, Inverness, Dundee, Perth and Stirling (the smallest) and the Scottish Government. None of the seven cities are big, so they need collaboration. The Scotland's Agenda for Cities 2016 (refreshed in March 2016) has the objective of maximising the impact of cities as economic drivers of growth. The agenda is delivered through the Scottish Alliance Operational Plan priorities:

- Low Carbon
- Infrastructure
- Smart Cities

The operations priorities focus on innovative solutions and attracting investments, and work to create an environment to test new ideas, technologies and businesses. Collaboration across the seven cities is needed. ERDF funds were used to develop a common plan.
The Alliance has performed a Self-Assessment process for planning, thus identifying the shared priorities. The process has followed the NESTA CITIE[1] Scotland analysis. Each city has identified the level of Maturity on Strategic Intent, Data, Technology, Governance & Service Delivery Models and Citizen & Business Engagement, leading to the identification of opportunities.

Following the collaborative strategy, the brand Smart Cities Scotland has been created, widening the market size for smart city projects in Scotland and promoting the unique inter-city approach to develop Smart City solutions. Futhermore, the ERDF-funded Scotland's 8th City – The Smart City program has been launched in order to boost investments (public and private) and to assist the cities to make savings and achieve better outcomes via effective citizen-led innovation.

[1] City initiatives for technology, innovation & entrepreneurship

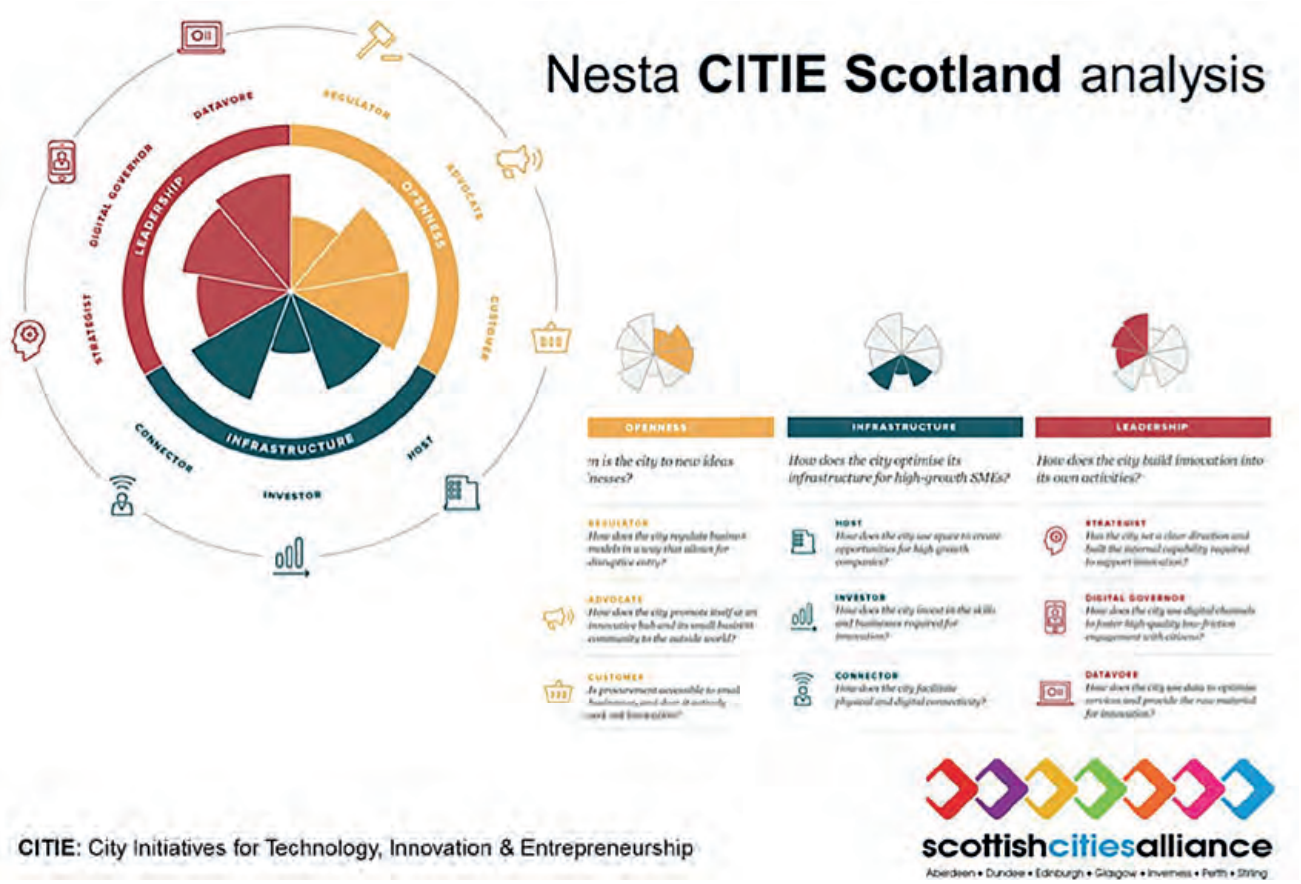

Figure 2.5. Overview of the Nesta Citie 9 Policy Roles that are the basis for the analysis.

Although the trajectories of La Spezia, San Sebastian and Scottish Cities Alliance have many elements in common, they emphasize different aspects of the process of drafting Smart City strategies and plans. La Spezia is an example of a predominantly bottom-up process where wide involvement of the local community quickly produced actions, which are later checked on feasibility, funding opportunities and alignment with current municipal plans. The case of San Sebastian shows how earlier European projects can lay the foundation for even more ambitious, integrated and complex smart city plans, such as lighthouse projects, by organizing the quadruple helix collaboration and defining the core elements for energy-efficient neighbourhoods. Finally, Smart Cities Scotland shows how a common approach of seven cities can act as a catalyst to strategy and plan development and securing investments in each individual city, for example by identifying shard priorities between cities in a self-assessment process.

2.3 Phases of implementation

Beforehand, based on information about common phases of implementation of comparable plans and project management literature it was expected that the implementation of smart city plans would follow a relatively static, more or less linear approach, as sketched below.

Expected phases in implementation of smart city plans:

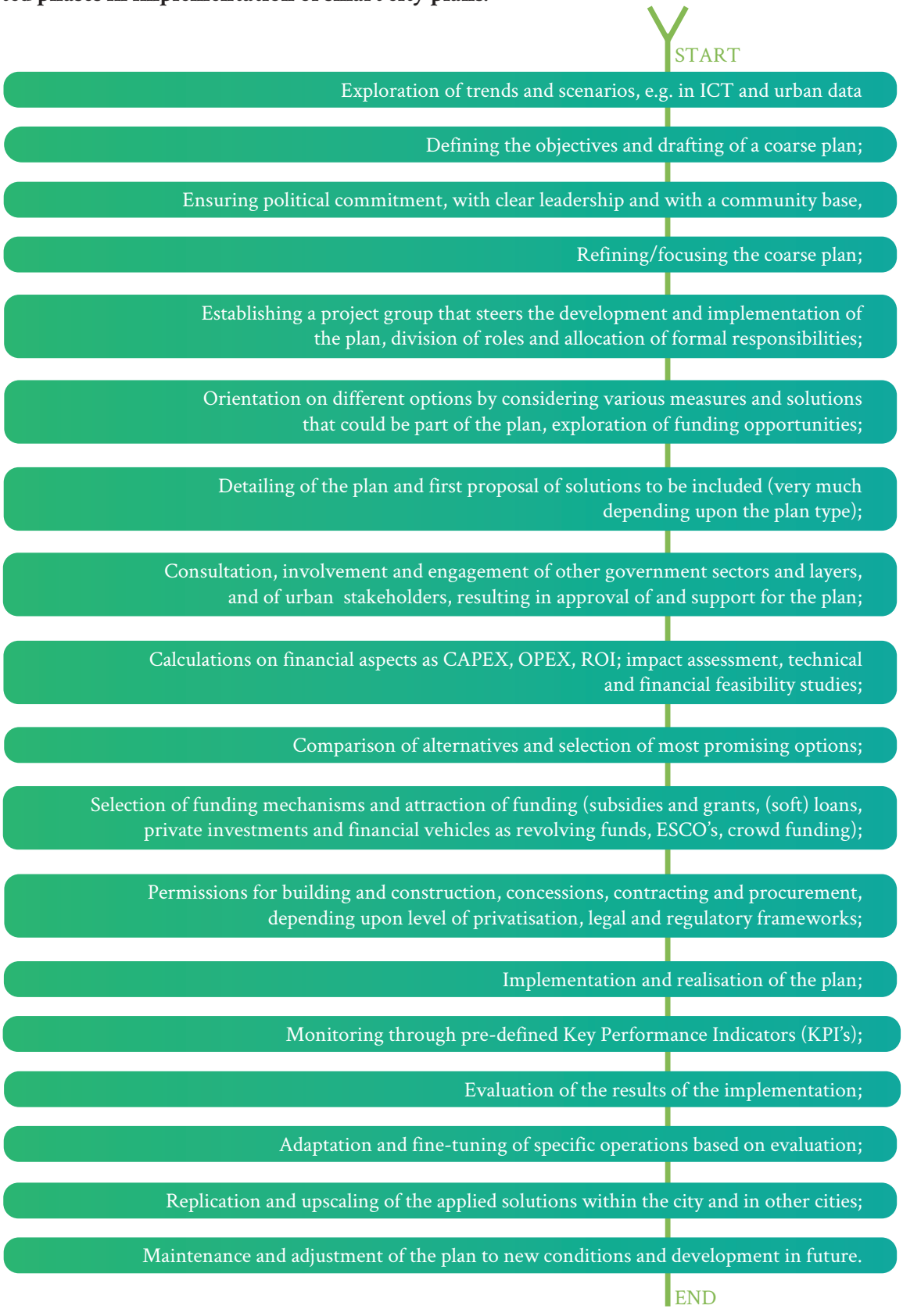

Figure 2.6 Linear approach to implementation of smart city plans

Complexity and collaboration across disciplines

However, from the interviews conducted with key players and outcomes of an EIP-SCC workshop with smart city project managers and stakeholders in November 2016, we concluded that this linear representation of the different stages of implementation is hardly realistic.

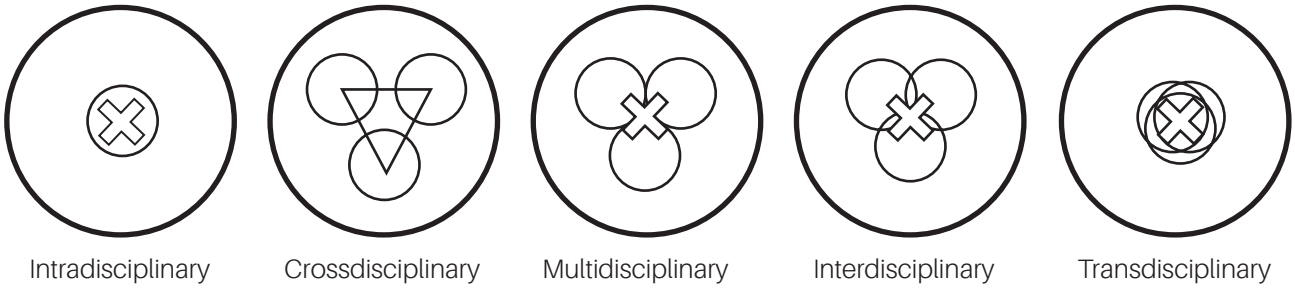

Figure 2.7 Depiction of different forms of collaboration across disciplines

The high level of collaboration that is required in integrated smart city projects between interdependent stakeholders and partners with different backgrounds and roles, and the complexity of the projects makes that the phases of implementation usually follow another path.

Figure 2.6 visualises the different levels of integration of disciplines when a problem has to be solved. The x represents the problem and the circle the different disciplines. Each circle corresponds to one of the following five levels of integration between disciplines:

- Intra-disciplinary: confined to a single discipline
- Cross-disciplinary: interpretation of one discipline from the paradigm of another
- Multidisciplinary: different disciplines cooperating, using knowledge from their own discipline
- Interdisciplinary: integrating the knowledge and approaches of different disciplines
- Transdisciplinary: unifying frameworks and synthesizing knowledge beyond disciplinary perspectives (Jenseni-us, 2012; Stember, 1991; Zeigler, 2006).

Smart city projects almost by definition involve multiple disciplines collaborating in a multi- inter- or trans-disciplinary fashion. Therefore truly integrated smart city projects need a variety of representatives from different disciplines, to implement a project that itself has a wide variety of problems as its scope. In addition, smart city projects are characterised by a high level of experimentation and some trial-and-error (Living Labs, testbeds, experimentation zones), what results in multiple iterations before satisfying outcomes are achieved.

2.4 Visualisation of implementation phases

During the November 2016 EIP-SCC workshop, the participants were encouraged to criticize the linear model, and to propose improvements for making it more realistic and more aligned with actual project and policy cycles. This resulted in a more realistic model describing how plans are implemented. Within the workshop, we introduced a cyclical model of project progress, where participants emphasized that many of the important project stages are not distinct stages at all, but continuous processes that are occurring simultaneously. Some processes are of course, clearly defined events, such as submitting a project proposal, but activities such as stakeholder engagement, as well as internal communication and evaluation, are ongoing activities occurring at different time scales. Working from these insights, the cyclical model transformed into a nested collection of project cycles, with both internal and external activities. Some discrete processes and milestones lie entirely within the realm of the project, while others straddle the line between the project and the higher level plans and strategies that helped to shape it.

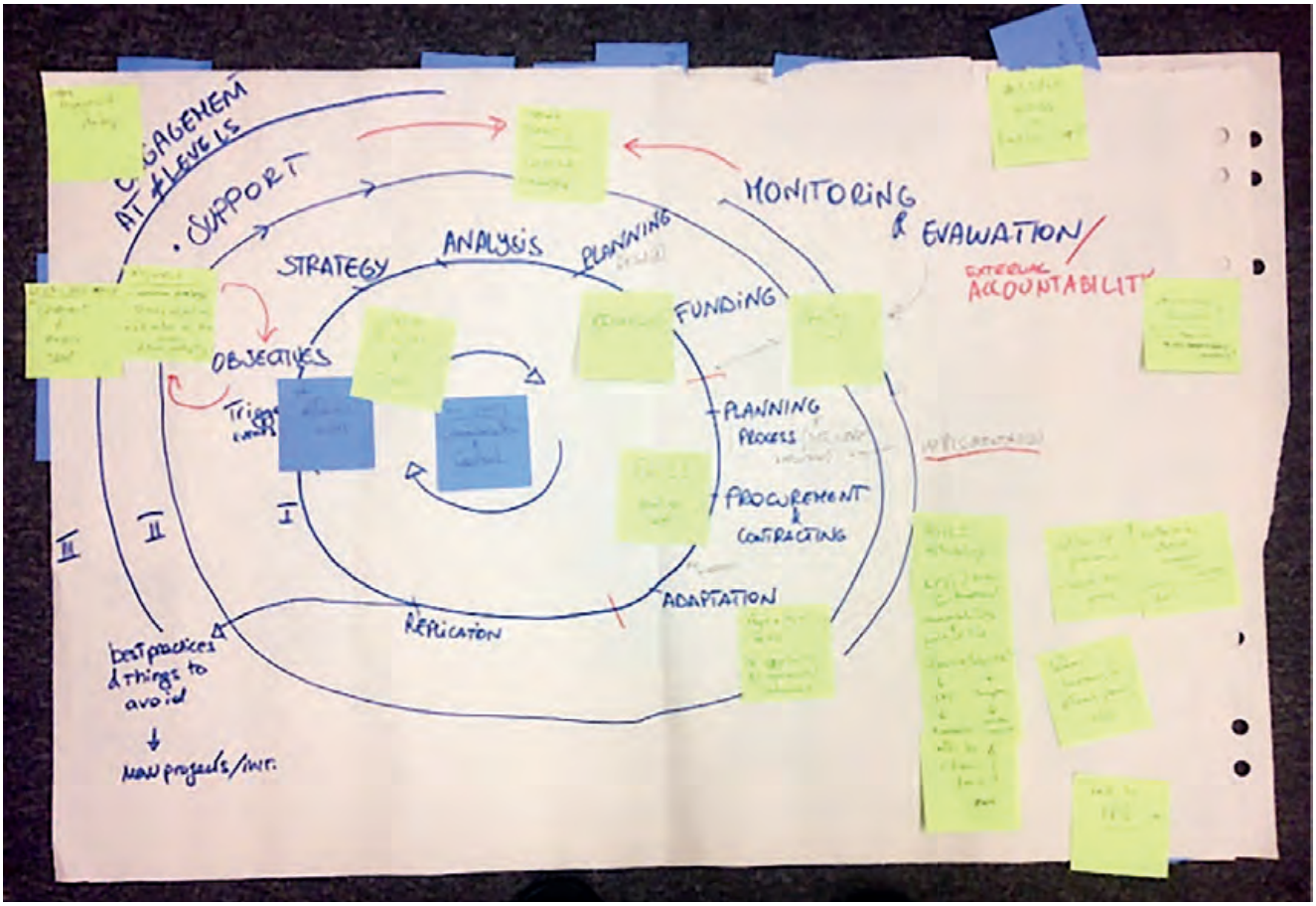

Figure 2.8 Workshop outcomes showing iterative, network character of implementation of smart city plans

Integrating the workshop outcomes with an analysis of EU smart city and energy efficiency projects, we developed a descriptive schematic of an idealized project cycle (Figure X). This provides a common framework for describing the phases of implementation of a smart city plan within the larger continuum of management and policy cycles.

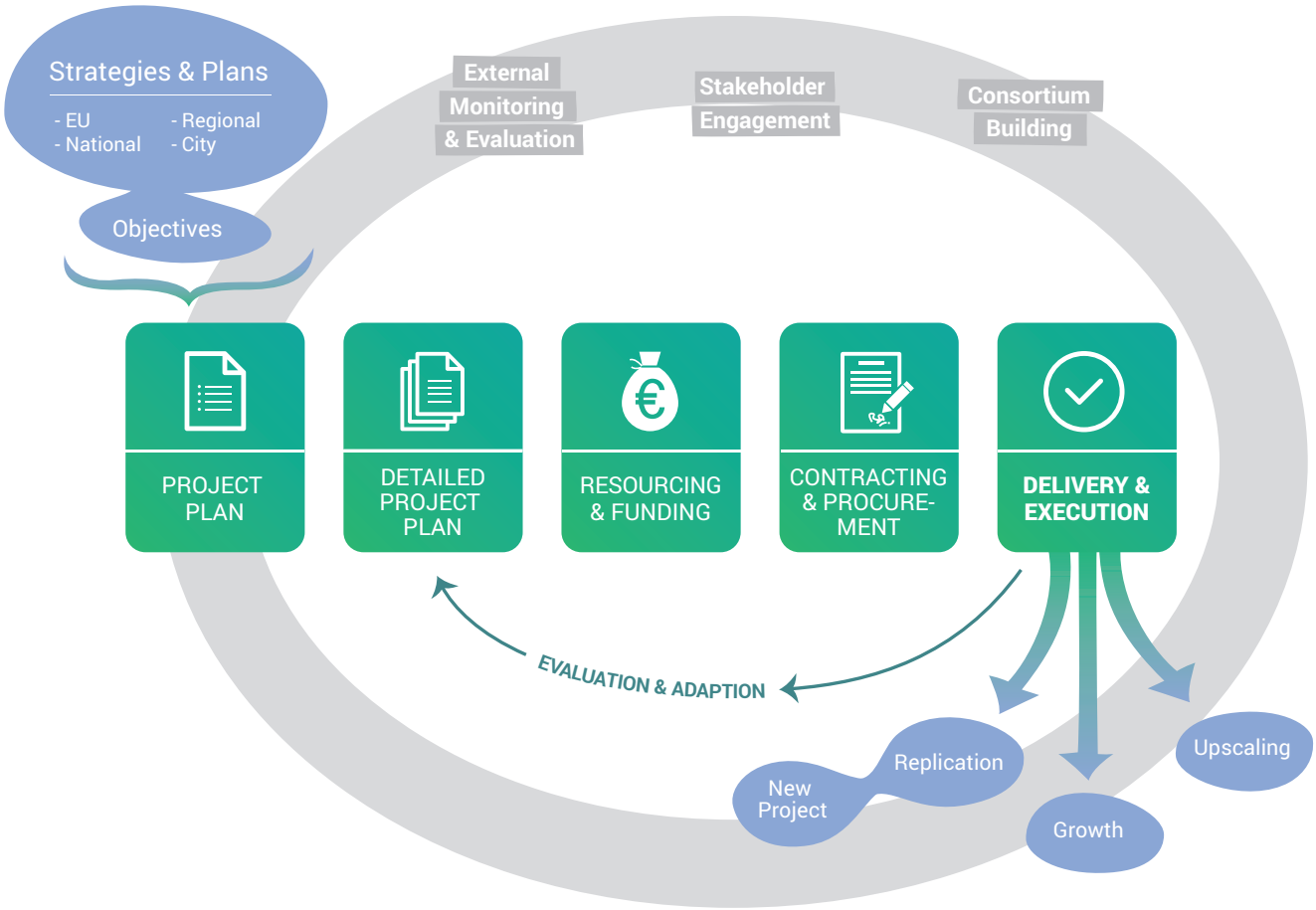

Figure 2.9: Draft version of integrated model involving iterative processes and overlapping tasks

3 STAKEHOLDERS, ROLES AND NETWORKS

3.1 Smart City stakeholders

Nearly all smart city projects are founded upon collaboration in the triple or quadruple helix of local administrations, knowledge institutes, industry and citizens. This means involvement of relevant stakeholders and governance play a dominant role in the successful implementation of any smart city project. The complexity of most smart city projects means that many stakeholders need to be involved, and the fact that many interdependencies exist between these stakeholders, means that a large variety of interests have to be aligned. The following list of possible stakeholders has been drafted:

- Municipality, local government, politicians
- Other local authorities
- Regional authorities
- National authorities
- Utilities
- Transport operators, owners of transport infrastructure
- Energy network operators and energy suppliers
- Owners of infrastructures, buildings and land
- (End)-users of buildings and services
- Real estate developers
- Investors, financial institutions, banks, private equity
- Citizens, tenants
- Bottom-up initiatives
- NGO's
- Local businesses
- Construction industry
- Architects, planners
- Advisors, consultants, engineering
- Knowledge institutes and universities
- Providers of technical solutions
- ICT consultants

3.2 Roles of actors

In the networks where these actors are related, the actors play specific roles. In smart city projects, Nijman (2014) observes that distinctions between design and use of smart solutions and the roles of government and citizen have become blurred. New roles emerge, such as citizens as data producer, tester and co-designer or co-creator of solutions, and of local governments as data interpreter and provider of knowledge on the local situation. Below an example is shown of her analysis of envisaged (configured) and observed (appropriated) roles of actors during the implementation of the Smart Citizen Kit project. This Kit enables citizens to measure local air quality, and has been used in Amsterdam.

	PROJECT TEAM	INSTITUTIONS	CITIZENS	FABLAB SMART CITIZEN TEAM
(Conceptually) Configured roles	- Initiator - Intermediator - Bridging - Open to learn/ learner	- Knowledge contributor - Monitoring air quality - Critic - Tester of kits - Data interpreter	- Active/smart citizen: • Engagement • Behavioral changes • Raising a political voice - Testers - Open for feedback/ learner - Tinkerer - Little knowledge on the topic	- Developer of the product - Technology driven - Learner (from the experiences in Amsterdam) - Learner (from institutions) - Support for current smart citizens
(Conceptually) Appropriated roles	- Initiator - Communicator (intermediator, open approach) - Facilitator - Smoothing technology appropriation - Tester - Re-developer SCK - Sharing findings - Learner	- Knowledge contributor - Monitoring air quality - Searching for possible roles - Tester - Data interpreter - Learner (from experiences with citizen science) - Critical reflection	- Data producer - Data interpreter - User - Knowledge contributor - Networker - Helper (helpdesk) - Tinkerer/ tester - Raising a Political Voice - Data comparer - Guiding the process	- Driver of the smart citizen moment - Open stance towards smart citizens - Curator - Learner

Table 3.1: Example of expected (configured) and actual (appropriated) roles. Source: Nijman 2014.

Figure 3.1: Preliminary visualisation of actor networks.

4 CHALLENGES, SOLUTIONS AND WORKAROUNDS

4.1 Methodology

Projects face many issues in different stages of their development. We refer to these issues as challenges, obstacles, and barriers, depending on the magnitude of their effect on the project. Here we consider a challenge to be an issue negatively affecting project success, but which is able to be overcome without deviation from the initial goals of the project. An obstacle is an issue that requires adjustment or some level of adaptation in order to be overcome. A barrier is an issue negatively affecting a project that results in the inability to complete or overcome the issue. We describe them collectively however, because the same issue can have different magnitudes of effect depending on the specific situation.

Specific challenges, obstacles, and barriers were excluded from the analysis if they were relevant only to a specific technology.

Projects were excluded from the research sources if they involved only:

- design, conceptualization, scenarios, methodologies, or other theoretical strategies;
- metrics, indicators, or standards design, development, or definition;
- cloud-based solutions;
- optimization, modelling, or management approaches;
- framework, platform, software, or app development;
- development, refinement, or marketing of private products.

Remaining projects that may have been relevant but that provided no website, deliverables, or project material access were also excluded.

4.2 Categories

Categories of obstacles have been initially adapted from content in scientific literature on transitions (Di Nucci et al., 2010) and (Wnuk et al., 2010). At a later stage the categories were refined with inputs from with workshop outcomes, project literature in SCIS and SCSP, and interviews (CoMO, 2016; SCSP, 2013a, 2013b). Can collective problems be addressed by shared solutions?

- Financial
  - High initial costs & questionable profitability
  - Perception of innovative solutions as too risky
  - Lack of incentives or the existence of disincentives
  - Split incentives

- Governance and Administration
  - Silos: Lack of inter-departmental coordination and communication
  - Incompatibility with public procurement policies
  - Regulations limiting implementation
  - Legislative or political instability
  - Insufficient political will or commitment
  - Administrative conflicts and cultural differences

- Technical
  - Lack of staff capacity
  - Data privacy
  - Data availability, sharing, and interoperability

- Social
  - High investment costs and payback times
  - Lack of awareness of financing opportunities
  - Organizing collective agreement and action
  - Lack of motivation – consumer priorities, attitude, and behaviour

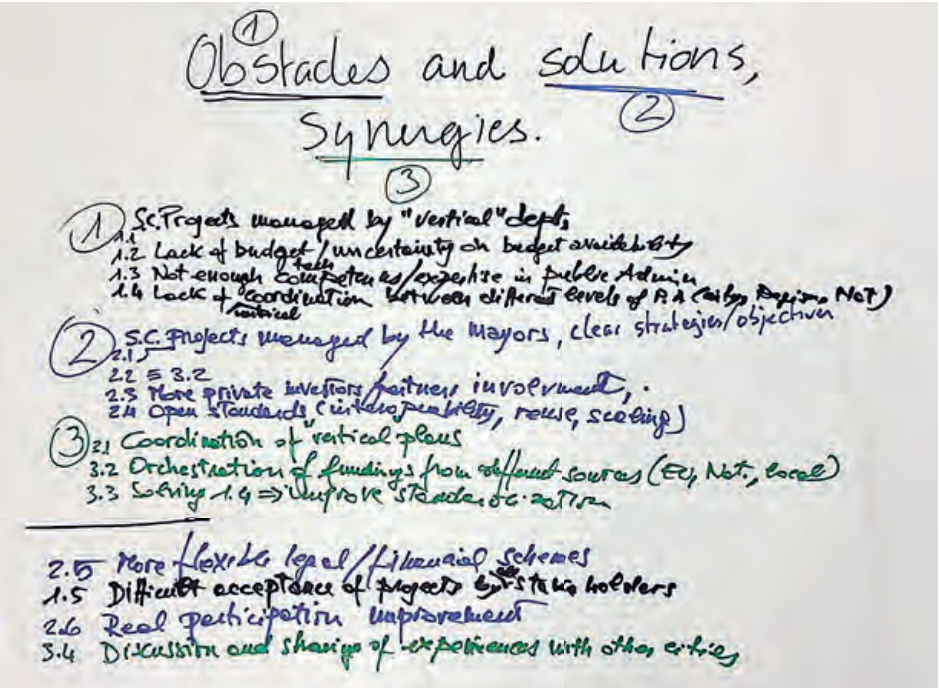

Figure 4.1: Outcomes of first exploration of obstacles, solutions, and synergies.

4.3 Financial

4.3.1 High initial costs & questionable profitability

SUMMARY

Cities' and companies' initial perception of prohibitively high costs, whether upfront costs, initial costs, or overall costs, are a common issue facing projects at different stages of development and implementation. Factors affecting this perception include the methodologies for determining return on investment (ROI), including internal and external rate of return, as well as assumptions about interest and discount rates.

Why a problem?

Many existing smart city projects tackle well-known and extremely pervasive issues, such as building renovations for energy efficiency. These issues have been well-known for decades, but remain so because they are often not economically attractive for outside actors to implement. There are many causes for this disparity between what the city values, and how this is represented monetarily. Often this is because of supply-price distortions – where the social and environmental costs of energy use are not included in the price, inhibiting the "evolution towards more responsible behaviour of the final customer" [1]. These distortions reduce the value of energy saved, while increasing the relative price of renewables compared to conventional sources [2], making it difficult to classify energy-saving measures within the standard financial models and valuation procedures used in finance [3]. Energy saving aspirations may provide net benefits to the city or the community, but will likely add costs that are difficult to finance through conventional mechanisms that do not value non-monetary benefits [4]. In short, "the payback period for companies is too long and the risk too high" [5].

Public-private partnerships (PPPs) can often help overcome other challenges facing smart city projects, including lack of initial funding, lack of staff capacity, lack of technical capacity to develop and manage innovative projects. The PPP may transfer to the private sector a large share of the responsibility for developing, managing, and completing the project. But the private sector may only be willing to engage in a PPP if the "partnership structure assures a competitive rate of return compared with the financial rate of return they could get on alternative projects of comparable risk" [6].

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[1] BEEM-UP, Final version of the exploitation and market deployment plan, 7th Framework Programme - BEEM-UP: Building Energy Efficiency for Massive market UPtake, 2014. **www.beem-up.eu/publications.html** (accessed February 7, 2017).

[2] R2CITIES, D2.1 Report on architectural barriers for green energy technologies, 7th Framework Programme - R2CITIES: Renovation of Residential urban spaces: Towards nearly zero energy CITIES, 2014. **smartcities-infosystem.eu/sites/default/files/r2cities_report_on_architectural_barriers_for_green_energy_technologies.pdf** (accessed February 7, 2017).

[3] City-zen, Business case models for retrofitting in Amsterdam, 7th Framework Programme - City-zen: City Zero (carbon) ENergy, 2016. https://eu-smartcities.eu/sites/all/files/City-zen_business%20model%20canvases_161216.pdf (accessed February 6, 2017).

[4] A. Stacey, E.H. Santamaria, M. Aksu, E. Demir, B. Kuban, P. Compere, Report and policy recommendations on the optimization of the regulatory framework, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Report-And-Policy-Recommendations-On-The-Optimization-Of-The-Regulatory-Framework.kl.**

[5] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[6] A. Stacey, J. Sawyer, M. Aksu, B. Yenilmez, E.H. Santamaria, E. Demir, B. Kuban, C. Degard, I. Nagy, Methodological guide on the development of urban integrated plans, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

High initial costs & questionable profitability

SOLUTION AND WORKAROUNDS

Bundling highly profitable project investments with less profitable or unprofitable elements can be a method for expanding the project while retaining profitability.

EXAMPLE

"...building pools - can provide a good solution for the management of property energy issues. The technique involves combining several buildings into a single joint project. This allows elements with lower energy saving potential to be included with others having higher energy saving potential. These pooled buildings have different levels of energy consumption, different construction materials, different fixtures and fittings etc., which leads to profitable cross calculations and also means that seemingly unprofitable buildings can be integrated into the project" [1].

[1] CITYnvest, A guide for the launch of a One Stop Shop on energy retrofitting, Horizon 2020 Framework Programme - CITYnvest: Increasing capacities in Cities for innovating financing in energy efficiency, 2017. **citynvest.eu/content/guide-launch-one-stop-shop-energy-retrofitting** (accessed November 8, 2016).

4.3.2 Perception of innovative solutions as too risky

SUMMARY

New or innovative solutions are unproven by definition. These potential solutions are therefore considered to carry with them a higher implicit risk, leading to apprehension from many stakeholders, including public entities, private enterprise, the public, and financial lenders.

Why a problem?

New or innovative solutions are generally unproven and unfamiliar, and often considered to incorporate more implicit risk. This risk can manifest itself in apprehension from public entities to support innovative projects, hesitation from private enterprise to get involved in projects where they lack experience, unwillingness for public consumers (end-users) to support unproven projects, and increased costs (or outright refusal) for funders to back innovative projects. Innovative processes are inherently unproven and generally do involve increased risk of failure; especially compared to the existing approach or business as usual.

Public entities have several concerns, including fear of making a bad decision with public money [1], lack of experience combined with risk-aversion [2], fears owing to lack of clear knowledge on costs and benefits [1], and the fear of unforeseen or long-term risks emerging after project conclusion, which may trigger a loss of confidence and backlash against innovative projects [2].

Private enterprise, including private partners in PPP, cite the public lack of demand and lack of internal awareness (esp. among architects and engineers) of innovative solutions [1,2.]

Public consumers: The public may be reluctant to adopt, convert to, or invest in more innovative solutions due to scepticism, unfamiliarity, expectations of unpredictability, and concern over the reliability of new technologies [2–6]. They may also lack willingness to try new things, or be comfortable in their routines and unwilling to behave differently or have to learn new skills.

Financial lenders: With increasing risks come increasing costs, and an increasing difficulty to secure funding. Much of this is due to the larger uncertainty inherent to the approach, leading to difficulty in properly characterizing the financial situation within an acceptable range of certainty. Banks may be unwilling to finance innovative projects due to lack of knowledge and lack of experience" [1,2,5].

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[1] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[2] EASEE, Identification of barriers and bottlenecks, 7th Framework Programme - EASEE: Envelope Approach to improve Sustainability and Energy efficiency in Existing multi-storey multi-owner residential buildings, 2012.

[3] HERON, Energy Efficiency Barriers in Buildings and Transport: 8 National Cases, Horizon 2020 Framework Programme - HERON: Forward-looking socio-economic research on Energy Efficiency in EU countries, 2016. **heron-project.eu/index.php/publications/deliverables-list** (accessed February 9, 2017).

[4] MEnS, Training Market Barriers Report, Horizon 2020 Framework Programme - MEnS - Meeting of Energy Professional Skills, 2015. **www.mens-nzeb.eu/en/information/expocenter/publications/635864688505150156/** (accessed November 8, 2016).

[5] BEEM-UP, Final version of the exploitation and market deployment plan, 7th Framework Programme - BEEM-UP: Building Energy Efficiency for Massive market UPtake, 2014. **www.beem-up.eu/publications.html** (accessed February 7, 2017).

[6] HERON, Synthesis Report on the Outcomes of the Questionnaire Survey, Horizon 2020 Framework Programme - HERON: Forward-looking socio-economic research on Energy Efficiency in EU countries, 2016. **heron-project.eu/index.php/publications/deliverables-list** (accessed February 9, 2017).

Perception of innovative solutions as too risky

SOLUTION AND WORKAROUNDS

Small-scale demonstration projects and living labs can help reduce some of the stakeholder issues regarding the implementation of innovative projects. Small-scale projects can provide a low-risk way for public entities to support test-beds for innovation; raise familiarity and skill levels by involving local partners in the project; reduce apprehension by verifying and validating the project claims; and alleviate unfamiliarity through public exposure and participation.

EXAMPLE

"The art of good innovation is spreading quickly with a growing number of 'Chief Innovation Officers' in cities throughout the county. This presents a strong opportunity to unite sustainability managers and innovation officers to advance the smart cities market. For example, the Environment Department in Boston works regularly with their new Office of Urban Mechanics – a joint venture in Boston and Philadelphia to create 'innovation incubators.' The offices focus on 'fail fast' innovation where new ideas are tested quickly to enable faster learning and therefore result in more robust solutions. The city has already made progress on using technology to increase citizen participation, building energy efficiency and boosting educational outcomes" [1.]

[1] E. Bent, M. Crowley, M. Nutter, C. Wheeler, Getting Smart About Smart Cities, Nutter Consulting and the Institute for Sustainable Communities (ISC) for the Urban Sustainability Directors Network (USDN), 2017. **us.iscvt.org/wp-content/uploads/2017/01/Smart-Cities-RG.pdf.**

4.3.3 Lack of incentives or the existence of disincentives

SUMMARY

In many cases a smart city project is attempting to tackle a problem which is in the public good, but goes against the self-interests or profitability of the existing service provider

Why a problem?

Some of the common goals among smart city projects involve reducing energy consumption, improving energy efficiency, and reducing the reliance on conventional fossil fuels. In most of these situations, there are already actors in play for whom the most advantageous scenario is continuation of the Business As Usual (BAU) scenario. This also includes the dilemma of service providers and increased efficiency – whereby for example a successful energy efficiency project results in a change in demand, and a resulting decrease in supply (and loss of profit) for the energy provider. "Most of the major energy companies are publicly owned, causing an unresolvable conflict of interest between profitability and pursuit of political benefits through popular, social pricing policy" [1]. Whether public or private, these energy retailers have a clear conflict of interest (and disincentive) to help their clients reduce their energy consumption [2].

In other cases the incentives may be less obviously problematic, but may still provide challenges to the implementation of smart city projects, such as the UK tax code, which prioritizes new construction over renovation of existing residential buildings [3].

[1] BEEM-UP, Final version of the exploitation and market deployment plan, 7th Framework Programme - BEEM-UP: Building Energy Efficiency for Massive market UPtake, 2014. **www.beem-up.eu/publications.html** (accessed February 7, 2017).

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[3] EFFESUS, Energy Efficiency in European historic urban districts a practical guidance, 7th Framework Programme - EFFESUS: Energy Efficiency for EU Historic Districts Sustainability, 2017.

Lack of incentives or the existence of disincentives

EXAMPLE

"...energy suppliers are adopting alternative business models that secure energy supply to a customer while implementing renewable generation technologies. Examples are utilities supporting homeowners with loans for small scale PV and wind instillations. Firms however must use alternate means to finance renewable energy projects without direct help of public energy utilities " [1].

[1] R2CITIES, D2.1 Report on architectural barriers for green energy technologies, 7th Framework Programme - R2CITIES: Renovation of Residential urban spaces: Towards nearly zero energy CITIES, 2014. **smartcities-infosystem.eu/sites/default/files/r2cities_report_on_architectural_barriers_for_green_energy_technologies.pdf** (accessed February 7, 2017).

4.3.4 Split incentives

SUMMARY

Split incentives are a commonly encountered issue, best exemplified by the tenant/landlord issue, whereby the one implementing the project (and bearing the costs), does not fully realize the financial benefits of the intervention. "Landlords, generally, have little incentive to invest in energy performance improvements of their properties, as this will not save them money; the energy savings will only benefit their tenants [1].

Why a problem?

Split incentives involve situations where "the flow of investments and benefits are not properly rationed among the parties to a transaction, impairing investment decisions" [2,3]. In practice, this challenge generally presents as an issue where the actors financing the project (the developer or building owner) and the actors benefiting from the project (the tenants) are different [4–6]. In this case there is little incentive for the developer to invest in a project which does not provide any financial benefits. The "developer is not interested in invest money in energy efficiency systems more expensive than minimum requirements because he will not pay the future energy bills" [7].
In some cases the building owner is not allowed to reflect the investment in the rental price, and thus has no way to recoup the investment. In other cases, bilateral contracts can "easily arrange the transfer of money, [but] they do not solve the transfer of risks" [5].

[1] EFFESUS, Energy Efficiency in European historic urban districts a practical guidance, 7th Framework Programme - EFFESUS: Energy Efficiency for EU Historic Districts Sustainability, 2017.

[2] S. Bird, D. Hernández, Policy options for the split incentive: Increasing energy efficiency for low-income renters, Energy Policy. 48 (2012) 506–514. doi:10.1016/j.enpol.2012.05.053.

[3] CSA, Green Leases: Glossary, (2011). **sustainca.org/green_leases_toolkit/glossary** (accessed March 30, 2017).

[4] HERON, Synthesis Report on the Outcomes of the Questionnaire Survey, Horizon 2020 Framework Programme - HERON: Forward-looking socio-economic research on Energy Efficiency in EU countries, 2016. **heron-project.eu/index.php/publications/deliverables-list** (accessed February 9, 2017).

[5] City-zen, Business case models for retrofitting in Amsterdam, 7th Framework Programme - City-zen: City Zero (carbon) ENergy, 2016. **eu-smartcities.eu/sites/all/files/City-zen_business%20model%20canvases_161216.pdf** (accessed February 6, 2017).

[6] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[7] R2CITIES, D2.1 Report on architectural barriers for green energy technologies, 7th Framework Programme - R2CITIES: Renovation of Residential urban spaces: Towards nearly zero energy CITIES, 2014. **smartcities-infosystem.eu/sites/default/files/r2cities_report_on_architectural_barriers_for_green_energy_technologies.pdf** (accessed February 7, 2017).

Split incentives

SOLUTION AND WORKAROUNDS

In order to "achieve a good energy strategy in real estate developments or retrofits, it is preferable that energy consumer should pay the bills in the case of renting; nevertheless, for home ownership it ´s very important that people should be conscious of the energy performance certificates to promote high performance new buildings and high performance retrofits" [1].

[1] R2CITIES, D2.1 Report on architectural barriers for green energy technologies, 7th Framework Programme - R2CITIES: Renovation of Residential urban spaces: Towards nearly zero energy CITIES, 2014. **smartcities-infosystem.eu/sites/default/files/r2cities_report_on_architectural_barriers_for_green_energy_technologies.pdf** (accessed February 7, 2017).

4.4 Governance and Administration

4.4.1 Silos: Lack of inter-departmental coordination and communication

SUMMARY

Smart city projects are often managed by vertically structured departments (silos) in the local government. Other project stakeholders, including local businesses, solution providers, and universities, are often siloed as well. Since no single department has the full mandate (or ability) to implement a holistically designed project, this can lead to long negotiations, and delays or postponement of implementation of the project.

Elaboration

This "policy gap occurs when ministries, public agencies, authorities, departments work in silos without co-ordination mechanisms, and roles and responsibilities are not clearly allocated across levels of government" [1].

The lack of horizontal coordination, cooperation, collaboration, or acceptance between vertical departments is a well-known issue in organizations and projects, and a common problem in the implementation of smart city projects [2–6]. During implementation of integrated strategies and plans in siloed organisations, no department generally has full mandate for achieving the targets. This can lead to long negotiations, delays or even postponement of the implementation of the project.

Siloed organizational structures can involve many issues that complicate the implementation process: information islands, the lack of an overall strategic vision, task fragmentation, and overlapping or blurred responsibilities. All of these can be a direct result of a lack of coordination and communication between departments.

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[1] OECD, Water Governance in Cities, Organisation for Economic Co-operation and Development (OECD), Paris, France, 2016. **www.oecd-ilibrary.org/governance/water-governance-in-cities_9789264251090-en** (accessed March 19, 2017).

[2] BEEM-UP, Final version of the exploitation and market deployment plan, 7th Framework Programme - BEEM-UP: Building Energy Efficiency for Massive market UPtake, 2014. **www.beem-up.eu/publications.html** (accessed February 7, 2017).

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[5] ECOSOC, Smart cities and infrastructure, Commission on Science and Technology for Development (CTSD), United Nations Economic and Social Council (ECOSOC), Geneva, CH, 2016. **unctad.org/en/Pages/MeetingDetails.aspx?meetingid=1048.**

[6] A. Stacey, J. Sawyer, M. Aksu, B. Yenilmez, E.H. Santamaria, E. Demir, B. Kuban, C. Degard, I. Nagy, Methodological guide on the development of urban integrated plans, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

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Silos: Lack of inter-departmental coordination and communication

SOLUTION AND WORKAROUNDS

Solution/Workaround

The issue of silos can be resolved by the clear definition of a person or entity (a system integrator) in charge of horizontal coordination with sufficient responsibilities and mandate. Successful coordination would require the establishment of truly multi- or inter-disciplinary teams. This approach will need to be adapted for each instance, as there is no standardized organizational structure for municipalities or their agencies.

Some approaches to overcoming siloes initiated by cities include:

- installing cross-sector departments (New York City)
- creating "special staff units" (Ludwigsburg)
- installing informal interdepartmental working groups (Freiburg)
- outsourcing the duty to quasi- independent project management companies (Vienna) [1]

Another approach is to collect and aggregate the different city infrastructure data streams and control operations in a single structure - an operations centre. Co-located services and employees from different departments, working together, may act as a "nerve centre" to facilitate coordination and communication, breaking down some of the walls of administrative silos [2].

EXAMPLE

"Bristol in the U.K." has "given senior executives a broad smart city mandate. Bristol is also breaking down silos between different departments in the municipality. To save money on real estate and improve coordination, the local authority is planning to co-locate nine teams in one space, which should help the city adopt new sensing technologies on a citywide scale. Bristol is also making sure it has high-level expertise in-house, primarily to ensure it doesn't become heavily reliant on a single vendor or systems integrator. 'The local authority has been astute enough to hire people with quite sophisticated technology and procurement backgrounds,' said Paul Wilson, managing director of Bristol Is Open, the smart city unit for Bristol. 'We know our strategy and we will go to vendors to fulfill aspects of our strategy. We have the intelligence to know what our plan is and we are in charge. That is very important for a city or it will be blown around in the wind of vendor games.'" [3].

"In March 2014, Amsterdam created the role of chief technology officer (CTO). The role is responsible for breaking down silos across the city government, setting overall strategic direction, providing a consistent face to external stakeholders and helping to navigate a complex political landscape" [4].

4.4.2 Incompatibility with public procurement policies

SUMMARY

Cities often have in place existing practices for procurement (the public purchase of work, goods or services from companies) that are incompatible with innovative solutions. They are based on an existing model of provision, and therefore support the business as usual scenario.

Elaboration

Public procurement processes are seen by many projects as being a cumbersome and complex procedure that involves too many stakeholders and intimidates project developers [1,2]. Existing procurement models discourage innovation in both products and services by having a rigid model of providing for the specifications required [3]. Municipalities have little experience with alternative approaches, such as Public Procurement of Innovation Solutions (PPI) and Pre-Commercial Procurement (PCP), and therefore are unaware of the potential benefits [2].

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[1] CITYnvest, A guide for the launch of a One Stop Shop on energy retrofitting, Horizon 2020 Framework Programme - CITYnvest: Increasing capacities in Cities for innovating financing in energy efficiency, 2017. **citynvest.eu/content/guide-launch-one-stop-shop-energy-retrofitting** (accessed November 8, 2016).

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[3] E. Bent, M. Crowley, M. Nutter, C. Wheeler, Getting Smart About Smart Cities, Nutter Consulting and the Institute for Sustainable Communities (ISC) for the Urban Sustainability Directors Network (USDN), 2017. **us.iscvt.org/wp-content/uploads/2017/01/Smart-Cities-RG.pdf.**

Incompatibility with public procurement policies

SOLUTION AND WORKAROUNDS

Solution/Workaround

One approach to promote innovative solutions is to tender calls for solutions instead of specific products or services – in this manner the solution provider is allowed a wide range of options to meet the guidelines of the tender, and may develop new solutions outside the expectations of the tender [1].

EXAMPLE

"A move from procuring goods and services to procuring solutions to a challenge. This is one new tender model that seeks to form a relationship and increase collaboration between the customer and suppliers and between suppliers. Using the responses to tenders to refine and add value to the proposed solutions from the private sector is an iterative process that builds capacity in both the customer and the market. It also uses the city as a testbed and demonstrator for new processes and technologies allowing and encouraging further replication and shared learnings across the public sector" [2].

EXAMPLE

"By taking on the role of an Intelligent Customer the public sector procurer can test the market for innovative solutions to Urban Challenges and can offer the city as a test bed for innovation. In times when public funding is a scarce resource, the use of the City's assets (such as District Heating systems and housing) as living test beds for innovative solutions provides SMEs, in particular, with the ideal arena to showcase their new products and processes, without the need for the provision of grants" [2.]

EXAMPLE

"[Washington] DC's complicated procurement process can take six to nine months. When funds must be spent within 12 months, sometimes there is not enough time to complete the actual work. Recognizing the delays in contract procurement, the District Department of the Environment created a Green Building Fund Grant Program for highly innovative projects. The grant allows the city to move more quickly than the traditional procurement process and fast-track highly strategic sustainability initiatives. The grant is currently funding projects to perform quality control for its energy benchmarking program, create a "smart buildings plan" for the city, drive innovation in the green appraisals market, green real estate listings for residential properties, and develop the DC Smarter Business Challenge – a green business competition platform" [3].

4.4.3 Regulations limiting implementation

SUMMARY

Project planning and implementation can be hindered by several challenges related to regulations and regulatory frameworks. The main issues are regulations that conflict with the project goals, and lock-in, subsidies, and regulations that favour specific technologies (including competing solutions) or business as usual (BAU). Another issue is the complexity and possible conflict of regulations at different governmental and regulatory levels (e.g. local, regional, state, country, E.U.).

Elaboration

Existing regulations may create an impediment to the introduction of innovative, novel, or simply different technologies. An example of this is with historic preservation rules and regulations that may impact the implementation (or cost-effectiveness of implementation) of energy technologies (e.g. rules requiring clay tile roofs where solar PV is not allowed, or exterior brick facades to remain and external insulation is not allowed). In some cases it is even unclear whether innovative approaches conform to the existing regulations, which may have been written in a different technological era [1]. A well-known issue in Spain is the Royal Decree 900/2015 on self-consumption of electricity [2], requiring special fees for PV-generated electricity, and thereby discouraging investment in PV installations [1,3]. Another issue is the refusal to allow "green" materials into the building code, so compliance with the law entails following the existing BAU approach [4].

Rules and regulations may be introduced (or already exist) which provide a preference or commitment to specific technologies or approaches. An example of this was a project in Denmark where the implementation of district heating was impeded by a regulated commitment (lock-in) to purchase a certain quantity of gas supply: "…natural gas companies were given the exclusive right to supply certain heating areas in order to ensure that they could finance the development of a national pipeline system around 30 years ago" [5].

The existing morphology of an area, including its associated infrastructures, may create an advantage for the BAU scenario. In can be difficult for a new or innovative approach to compete when the infrastructure for a specific approach is already in place. This is visible with, for example, existing electricity infrastructure vs. district heat, or private vehicle on public roadways vs. expanding public transit.

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[1] R2CITIES, D2.1 Report on architectural barriers for green energy technologies, 7th Framework Programme - R2CITIES: Renovation of Residential urban spaces: Towards nearly zero energy CITIES, 2014. **smartcities-infosystem.eu/sites/default/files/r2cities_report_on_architectural_barriers_for_green_energy_technologies.pdf** (accessed February 7, 2017).

[2] RD 900/2015, 10927 Real Decreto 900/2015, de 9 de octubre, por el que se regulan las condiciones administrativas, técnicas y económicas de las modalidades de suministro de energía eléctrica con autoconsumo y de producción con autoconsumo, Government of Spain. Ministry of Energy, Tourism and the Digital Agenda, Madrid, Spain, 2015. **www.boe.es/boe/dias/2015/10/10/pdfs/BOE-A-2015-10927.pdf** (accessed May 23, 2017).

[3] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[4] A. Stacey, E.H. Santamaria, M. Aksu, E. Demir, B. Kuban, P. Compere, Report and policy recommendations on the optimization of the regulatory framework, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Report-And-Policy-Recommendations-On-The-Optimization-Of-The-Regulatory-Framework.kl.**

[5] M.R. Di Nucci, U. Gigler, O. Pol, C. Spitzbart, Planning and Implementation Process Assessment Report, CONCERTO, a European Commission initiative within the European Research Framework Programme (FP6 and FP7), Vienna, Austria, 2010. **download.steinbeis-europa.de/concerto/website/CONCERTO_plus_plan-impl-assess_final_long.pdf** (accessed November 18, 2016).

Regulations limiting implementation

SOLUTION AND WORKAROUNDS

Cities managers need to direct the city policies and regulation to incorporate a more flexible approach - one that is more welcoming to innovation. This can start with allowing living labs and public procurement processes to permit temporary exceptions to regulations, to allow time for innovative, experimental, or disruptive approaches to test the market and see if there is a public demand for their services. By allowing these innovative approaches to test the field within a living-lab, the city is able to set the ground rules for the demonstration site, as well as the parameters required for future expansion or approval of the project approach.

EXAMPLE

"In 2014, Amsterdam created a new category of accommodation – 'Private Rental' – which clarified homeowners' rights and responsibilities for short-term letting. And from February 2015, Airbnb has been working with the city to collect tourist taxes from their hosts, which goes direct to the city. Amsterdam has worked closely with citizens and Airbnb to ensure it got this right" [1].

EXAMPLE

"In 2014, Seattle approved updated regulations to allow Uber, Lyft and other smartphone app-based transport services to operate legally. The result of more than a year's debate between the city, taxi companies and ride-share services, the regulation allows a new industry to thrive while maintaining high levels of public safety" [1].

EXAMPLE

"'Cities like Amsterdam have shown how productive it can be to engage in conversation with businesses and residents when thinking about how to update regulations in response to new business models' Patrick Robinson, Head of Public Policy, EMEA & Canada, Airbnb" [1].

[1] J. Gibson, M. Robinson, S. Cain, CITIE: A resource for city leadership, CITIE (City Initiatives for Technology, Innovation and Entrepreneurship): a joint project of Nesta, Accenture, Future Cities Catapult and CITIE.Index, 2015. **citie.org/reports/** (accessed May 14, 2017).

4.4.4 Legislative or political instability

SUMMARY

Projects are planned within a specific legislative and political context. Changes to this context can result in a multitude of new issues, including needs for new negotiations, reassessment of expectations, and project adaptation. Depending on the severity of the changes and their impact to the project, these can result in delays, postponement of implementation, or failure of the project.

Elaboration

The context within which the project is planned sets the stage for project implementation. Any relevant changes to the political or regulatory landscape can put the project at risk. Smart city projects with new or innovative solutions are generally considered more risky. Strong political support is often a requirement for a successful project [1]. The timelines of project planning and implementation may conflict, in duration, scale, or interval, with legislative cycles [2]. As many smart city projects may have elements that certain political factions may find controversial, the project may encounter an unexpected challenge, obstacle, or barrier due to changing laws or regulations, during one or more project phases.

Very similar to legislative changes, election cycles may run contrary to project cycles. This can result in, for example, a municipal champion of a project (the mayor) being replaced by a political rival with political goals that are inconsistent with the project [2], or the need to bring a new politician up to speed and gain their support for an ongoing project [3].

[1] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[2] M.R. Di Nucci, U. Gigler, O. Pol, C. Spitzbart, Planning and Implementation Process Assessment Report, CONCERTO, a European Commission initiative within the European Research Framework Programme (FP6 and FP7), Vienna, Austria, 2010. **download.steinbeis-europa.de/concerto/website/CONCERTO_plus_plan-impl-assess_final_long.pdf** (accessed November 18, 2016)

[3] CELSIUS, Genoa case study: the decision making process, 7th Framework Programme - CELSIUS - Combined Efficient Large Scale Integrated Urban Systems, 2014. **toolbox.celsiuscity.eu/index.php/Case_Studies_and_methodology_(social)** (accessed January 25, 2017).

Legislative or political instability

SOLUTION AND WORKAROUNDS

Project plans should involve the city government as a stakeholder and co-creator in the planning process. Both the process and the final project plan should be transparent and unambiguous about the scope and timeline, and any deviations from the original plan should be collaborative, approved by all stakeholders, and integrated into the project plan. Original and amended project plans should incorporate the political timeline into their possible risks, but these risks should be mitigated as much as possible by having a transparent, unambiguous, and consistent plan with approvals in place.

4.4.5 Insufficient political will or commitment

SUMMARY

Innovative smart city projects often need a committed partner (or partners) within the municipal political system to champion the cause and facilitate the process from planning to implementation. Commitment of municipal support is often needed in order to reduce the perception of risk, attract investors and partners, and engage the public.

Elaboration

Smart city projects with new or innovative solutions are generally considered more risky. Strong political support is often a requirement for a successful project [1]. Insufficient political will can provide another layer to the challenge, especially if the project requires municipal support in the form of staff capacity or policy changes [2].

Government support may also vary over the duration of the project. Many municipalities have a budget planning timeline that runs on a much different scale than the project itself, making long-term planning difficult or impossible. Funding mechanisms also may run on a different timeline scale than both the budgets or the project investment, "creating a quickly changing funding landscape" whereby funding schemes change often - even annually [3]. This scenario is often visible in, for example, the negotiation of an annual budget when trying to include long term investments in retrofit, renovation, or refurbishment [1,4].

[1] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[2] BEEM-UP, Final version of the exploitation and market deployment plan, 7th Framework Programme - BEEM-UP: Building Energy Efficiency for Massive market UPtake, 2014. **www.beem-up.eu/publications.html** (accessed February 7, 2017).

[3] EFFESUS, Energy Efficiency in European historic urban districts a practical guidance, 7th Framework Programme - EFFESUS: Energy Efficiency for EU Historic Districts Sustainability, 2017.

[4] M.R. Di Nucci, U. Gigler, O. Pol, C. Spitzbart, Planning and Implementation Process Assessment Report, CONCERTO, a European Commission initiative within the European Research Framework Programme (FP6 and FP7), Vienna, Austria, 2010. **download.steinbeis-europa.de/concerto/website/CONCERTO_plus_plan-impl-assess_final_long.pdf** (accessed November 18, 2016).

Insufficient political will or commitment

SOLUTION AND WORKAROUNDS

Smart city projects should fit within the overall city strategy or plan. If the smart city project is too ambitious, innovative, or demanding, for the current political landscape, then perhaps the context needs to change. Two approaches can be used here – one is to change the context by starting with smaller, less ambitious (or controversial) projects, and working up to the larger-scale, aspirational projects. Getting approval for a small living lab, for example, might garner enough support and attention that larger projects within the city become more viable. The other approach is to reimagine the narrative of the project. Much like working with homeowners who might be more willing to support an energy-efficiency project if better comfort and health are highlighted instead of efficiency – the project narrative can also be tuned to highlight positive effects that fit with the goals of the current political landscape (e.g. economics, jobs, tourism), without changing the project itself.

4.4.6 Administrative conflicts and cultural differences

SUMMARY

Incompatible administrative structures and styles, as well as differences in work-place culture may cause conflicts and challenges for a smart city project, especially the ad hoc sort of organization developed specifically to bring together a wide range of partners for a temporary project.

Elaboration

The administrative structure and working culture may provide a source of conflict and present issues for the progress of the project. Variations and incompatibilities between structures and administrative interaction (hierarchical structures vs. flat structures) as well as supervisory and management styles (e.g. democratic, autocratic, teamwork, micromanagement, etc.) are a common source of conflict in organizations, especially the ad-hoc sort of organization developed for a temporary project. The administrative structure may also have a higher authority (i.e. funding agency) with which they may have to report progress or provide deliverables – which can present issues depending on perceptions regarding management style, as well as the frequency, type, and magnitude of reporting. Differing work cultures can also create conflicts between project members and within project teams, causing issues for the advancement of the project. These may be related to differences between conflicting personalities, or progress from corporate culture clashes to the variability between regions and cultures.

Administrative conflicts and cultural differences

SOLUTION AND WORKAROUNDS

Administrative incompatibilities and workplace culture differences should be handled with strong project management before they become important issues that can compromise the project. Ground rules should be set regarding expectations and defining the project work culture.

EXAMPLE

"Administrative structure of the team is also an important success factor. A team leader with adequate empowerment and members with clear visions about their responsibilities will make it easier. The team members should also have links to relevant organizational structures (strategic planning, spatial planning, transportation, etc.)" [1].

[1] A. Stacey, J. Sawyer, M. Aksu, B. Yenilmez, E.H. Santamaria, E. Demir, B. Kuban, C. Degard, I. Nagy, Methodological guide on the development of urban integrated plans, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

4.5 Technical

4.5.1 Lack of staff capacity

SUMMARY

Lack of staff capacity can be broken into two subcategories, regarding both the technical competency of the existing staff, as well as the staff resources available, in both time and numbers.

Elaboration

Technical capacity refers to the competencies of staff and management involved in the project, which may require expertise in specific fields or areas not currently covered in the administration [1].

Staff capacity refers not to the competencies of the staff but to the quantity of available resources, in both available working hours as well as number of competent people.

Many smart city projects have found that a lack of available staff within city administration or relevant public institutions that have the experience, skills, or ability to deal with innovative smart city initiatives is often a limiting factor [2–4]. Innovative or integrated smart city projects may also be very time-consuming tasks, requiring the attention and commitment of dedicated staff [3].

[1] OECD, Water Governance in Cities, Organisation for Economic Co-operation and Development (OECD), Paris, France, 2016. **www.oecd-ilibrary.org/governance/water-governance-in-cities_9789264251090-en** (accessed March 19, 2017).

[2] BEEM-UP, Final version of the exploitation and market deployment plan, 7th Framework Programme - BEEM-UP: Building Energy Efficiency for Massive market UPtake, 2014. **www.beem-up.eu/publications.html** (accessed February 7, 2017).

[3] CITYnvest, A guide for the launch of a One Stop Shop on energy retrofitting, Horizon 2020 Framework Programme - CITYnvest: Increasing capacities in Cities for innovating financing in energy efficiency, 2017. **citynvest.eu/content/guide-launch-one-stop-shop-energy-retrofitting** (accessed November 8, 2016).

[4] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

Lack of staff capacity

SOLUTION AND WORKAROUNDS

Staff competency and capacity are tricky issues to deal with at the level of project implementation. The lack of capacity in either subcategory is difficult to remedy in the time span of project implementation. Public hiring practices may suffer from the same complexity or convoluted process as other administrative issues, resulting in a possible delay in project implementation if requirements are not caught early enough and remedied quickly.

While in theory, smart city projects should be rearranging the city workload and not adding to it, this may not be easily visible in the first stages of smart city project implementation.

The best advice for this challenge is to prepare accordingly. This includes checking to make sure that commitments from internal and external partners have a solid basis and that there is enough talented, flexible, staff to accommodate project needs.

Once the commitments are checked and the available staff is compared with the necessary staff, in both quantity and competency, the budget may need to be revised in order to accommodate training or hiring of staff.

EXAMPLE

When asked the question "If the project were to start now, knowing what you've learned so far, what would you have done differently?" one interviewee was very quick to reply: "Well I think I would have started with more staff. This sort of project should not be started with only one person. I also would have presented it to the city council with a budget. And of course if you want a budget you also have to define goals. So make it measurable from the beginning on" [1].

[1] Interviewee #5, Smart City Guidance Package Interview, (2017)

4.5.2 Data privacy

SUMMARY

Maintaining the privacy of data (including personal information) is a "constantly emerging issue in smart city projects [1]. Smart city projects often focus on data as a way to track activities, measure consumption, learn about usage patterns, and optimize solutions, but maintaining the trust of public and private entities with regards to privacy is of paramount importance in order to further these concepts.

Elaboration

Access to data is one of the core principles of many smart city projects. Collecting and processing data, promoting interoperability, and providing access to that data, while maintaining privacy, has become a common issue in smart city projects [1,2]. Some projects have found that not only are regulations concerning "data usage, protection, gathering and re-use of public sector information" inadequate, but existing regulations suffer from issues of noncompliance [3].

This page

[1] Interviewee #3, Smart City Guidance Package Interview, (2017).

[2] Interviewee #1, Smart City Guidance Package Interview, (2017).

[3] A. Stacey, E.H. Santamaria, M. Aksu, E. Demir, B. Kuban, P. Compere, Report and policy recommendations on the optimization of the regulatory framework, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Report-And-Policy-Recommendations-On-The-Optimization-Of-The-Regulatory-Framework.kl.**

Next page

[1] Interviewee #3, Smart City Guidance Package Interview, (2017).

[2] E. Bent, M. Crowley, M. Nutter, C. Wheeler, Getting Smart About Smart Cities, Nutter Consulting and the Institute for Sustainable Communities (ISC) for the Urban Sustainability Directors Network (USDN), 2017. **us.iscvt.org/wp-content/uploads/2017/01/Smart-Cities-RG.pdf.**

[3] OC, OpenColorado, OpenColorado (OC). (2017). **opencolorado.org/** (accessed June 8, 2017).

[4] FCG, Data Launchpad, Future City Glasgow (FCG) Initiative, Glasgow City Council (GCC). (2017). **data.glasgow.gov.uk/** (accessed June 8, 2017).

[5] FCG, OPEN Glasgow End Stage Report, Future City Glasgow (FCG) initiative, Glasgow City Council (GCC), Glasgow, Scotland, 2015.

[6] UT, Smart Cities Engagement, UrbanTide (UT). (2017). **urbantide.com/engage/** (accessed June 8, 2017).

Data privacy

SOLUTION AND WORKAROUNDS

Maintaining the trust of public and private entities with regards to privacy is of paramount importance in smart city projects. The project should be transparent about its data collection and use policy. Every dataset should include privacy considerations in its design and implementation [1]. Privacy needn't dominate the discussion or lead the conversation astray, but it should be treated with the respect and importance that it deserves [1].
A standardized approach to data privacy could help resolve some of the apprehension and resistance to sharing information, but this "would need to be quite complex, since privacy within a dataset can be compromised by comparing data from other datasets" [1].

EXAMPLE

Boulder, Colorado's IT department conducted a thorough "review of data schema and record refresh plans before publishing their open data website. This included developing licensing terms including terms of use, attribution and a disclaimer" [2]. The city is a founding member of OpenColorado [3] a collaborative project with other local governments sharing transparency strategies and providing open-source data and public information [2].

EXAMPLE

Glasgow, Scotland's Open Glasgow programme, embedded a "new culture of 'Open by Default' within Glasgow" where the City Data Hub [4] addresses "concerns about privacy and data quality and maintenance ... by providing a configurable workflow that includes validation checks, and automated publication from business systems" [5].

EXAMPLE

"Improved transparency, communication and collaboration by opening up data are significant factors in the smart city journey; one that Glasgow has undertaken and one that cities around the globe are pursuing' Pippa Gardner, Programme Manager, OPEN Glasgow" [6].

4.5.3 Data availability, sharing, and interoperability

SUMMARY

The limited interoperability of different data streams, platforms, and protocols, is a hindrance to fulfilling the full potential of many smart city projects. Maintaining data access, availability, and interoperability while working with different vendors has also emerged as a looming issue.

Elaboration

"Optimisation of ICT and integrated infrastructure will not be achieved if data is not shared and there is not commonality in platforms and protocols" [1].

Access to data is one of the core principles of many smart city projects. Collecting and processing data, promoting interoperability, and providing access to that data, while maintaining privacy, has become a common issue in smart city projects [2,3]. One of the major concerns with urban information systems is the lack of consistently updated real-time spatial and temporal information required to maintain the utility of the decision-support system [4].

Several projects noted problems with maintaining data availability and interoperability with private contractors – they fear being locked in to a proprietary platform or protocol provided by the outside vendor [5,6].

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[1] A. Stacey, E.H. Santamaria, M. Aksu, E. Demir, B. Kuban, P. Compere, Report and policy recommendations on the optimization of the regulatory framework, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Report-And-Policy-Recommendations-On-The-Optimization-Of-The-Regulatory-Framework.kl.**

[2] Interviewee #1, Smart City Guidance Package Interview, (2017).

[3] Interviewee #3, Smart City Guidance Package Interview, (2017).

[4] A. Stacey, J. Sawyer, M. Aksu, B. Yenilmez, E.H. Santamaria, E. Demir, B. Kuban, C. Degard, I. Nagy, Methodological guide on the development of urban integrated plans, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[5] E. Veronelli, Smart cities vs "locked-in" cities, REMOURBAN - REgeneration MOdel for Accelerating the Smart URBAN Transformation. (2016). **www.remourban.eu/News--Events/News/Smart-Cities-Vs-Locked-In-Cities.kl** (accessed November 11, 2016).

[6] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

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[1] A. Stacey, J. Sawyer, M. Aksu, B. Yenilmez, E.H. Santamaria, E. Demir, B. Kuban, C. Degard, I. Nagy, Methodological guide on the development of urban integrated plans, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[2] M.R. Di Nucci, U. Gigler, O. Pol, C. Spitzbart, Planning and Implementation Process Assessment Report, CONCERTO, a European Commission initiative within the European Research Framework Programme (FP6 and FP7), Vienna, Austria, 2010. **download.steinbeis-europa.de/concerto/website/CONCERTO_plus_plan-impl-assess_final_long.pdf** (accessed November 18, 2016).

[3] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[4] D. Pringle, Smartening up the city: New technologies promise a breakthrough for efforts to improve urban living, RCRWireless, 2016. **www.rcrwireless.com/20160617/internet-of-things/time-replace-silos-smart-city-strategists-tag28** (accessed May 24, 2017).

[5] E. Bent, M. Crowley, M. Nutter, C. Wheeler, Getting Smart About Smart Cities, Nutter Consulting and the Institute for Sustainable Communities (ISC) for the Urban Sustainability Directors Network (USDN), 2017. **us.iscvt.org/wp-content/uploads/2017/01/Smart-Cities-RG.pdf.**

Data availability, sharing, and interoperability

SOLUTION AND WORKAROUNDS

There are several ways municipalities can work to improve data availability and interoperability, and enable sharing of data to facilitate innovation. The development of a standardized protocol for data interoperability between localities could solve many of the issues of different cities and organizations adopting different protocols [1]. The statistical office of the country could be tasked with providing access to the data, maintaining its quality, structure, and interoperability [2].

Municipalities often lack the staff or technical capacity to create and maintain open data services in house [3], but the scale of these needs would be lessened with a standardized approach involving built-in interoperability.

EXAMPLE

"Bristol is alert to this issue. 'We are not going to rely on a vendor to sort this out for us,' says [Paul Wilson, managing director of Bristol Is Open, the smart city unit for Bristol, England]. 'If you outsource to a consultant, you can end up with lock-in. The local authority has been astute enough to hire people with quite sophisticated technology and procurement backgrounds to say: we are the city and we are the platform. We know our strategy and we will go to vendors to fulfill aspects of our strategy.'" [4].

EXAMPLE

"Many cities including San Francisco, Boston and Chicago have created policies or programs that encourage city agencies to track and release existing, non-sensitive data sets to the public. City agencies maintain a wealth of data sets that, when released to the public, can be used by citizens or entrepreneurs to create useful applications for the community. For example, 600 data sets have been released in San Francisco and dozens of apps have been created. Although the open data movement has helped make government more transparent and collaborative and has resulted in some useful applications, publishing a broad range of general open data sets takes a lot of time and resources, and can lead to new but hodgepodge innovations. Now, there is a concerted effort among cities to create and manage systems that are better at aggregating crowdsourced data, while being more targeted and strategic about the data sets they make available" [5].

4.6. Social

4.6.1 High investment costs and payback times

SUMMARY

Consumers' perception of prohibitively high investment costs and prohibitively long payback times are a common issue facing projects involving citizen stakeholders as investors.
Factors compounding this issue include other challenges addressed here: socioeconomic status and access to capital, lack of motivation, problems organizing collective agreement and action, and lack of awareness of financing opportunities.

Elaboration

Many existing smart city projects tackle well-known and extremely pervasive issues, such as the "energy efficiency gap" between optimal and actual energy efficiency investments (investments in energy efficient technologies are less than would be expected based on the expected cost savings from energy efficiency) [1,2]. Building renovations are a common showcase for these issues within smart city projects.

Payback time may not be an issue from a true economic rationale - if the net present value over the lifetime of the investment exceeds the investment cost – but the lifetime of the investment may exceed the expected occupancy time of the homeowner. In this case the homeowner may move before their investment is recovered, and the selling price may not be expected to properly reflect the investment: "this lack of influence of a property's energy performance on its price is a disincentive to making energy-related improvements" [3]. There may also be a perceived (or actual) negative effect on the value of a property due to project intervention [4]. This can include value or appraisal based on architectural features, such as the covering of external brick features due to the application of external insulation (and then stucco, paint, or another "lower value" covering).

[1] A.B. Jaffe, R.N. Stavins, The energy-efficiency gap: What does it mean?, Energy Policy. 22 (1994) 804–810.

[2] T.D. Gerarden, R.G. Newell, R.N. Stavins, R.C. Stowe, An Assessment of the Energy-Efficiency Gap and its Implications for Climate-Change Policy, National Bureau of Economic Research (NBER), Cambridge, MA, 2015. **www.nber.org/papers/w20905** (accessed November 9, 2015).

[3] EFFESUS, Energy Efficiency in European historic urban districts a practical guidance, 7th Framework Programme - EFFESUS: Energy Efficiency for EU Historic Districts Sustainability, 2017.

[4] M.R. Di Nucci, U. Gigler, O. Pol, C. Spitzbart, Planning and Implementation Process Assessment Report, CONCERTO, a European Commission initiative within the European Research Framework Programme (FP6 and FP7), Vienna, Austria, 2010. **download.steinbeis-europa.de/concerto/website/CONCERTO_plus_plan-impl-assess_final_long.pdf** (accessed November 18, 2016).

High investment costs and payback times

SOLUTION AND WORKAROUNDS

The narrative of the energy efficiency investment should be tailored in order to emphasize the direct co-benefits of the intervention – including increased comfort, improved aesthetics, enhanced lighting quality, healthier ventilation, and better acoustics, among others [1].

The timing of investments also provides opportunities for less costly investments with shorter payback times. Timing the integration of smarter technologies to replace an existing intervention (e.g. substituting PV roof tiles instead of normal during a planned roof replacement) instead of as an additional cost can help alleviate some of the burden [2].

EXAMPLE

"...it must be highlighted that this barrier can be an incentive for rehabilitation if it is showed that the energy rehabilitation may significantly reduce household spending, with the added benefits of having the property in better condition and improve the comfort inside" [2].

Properly executed smart city projects can also help change the negative perception of energy efficiency on architectural quality, "creating buildings that are "exemplary" both in terms of architectural and energy quality from the initial conception phase" [3].

[1] M. Ferreira, M. Almeida, Benefits from Energy Related Building Renovation Beyond Costs, Energy and Emissions, Energy Procedia. 78 (2015) 2397–2402. doi:10.1016/j.egypro.2015.11.199.

[2] R2CITIES, D2.1 Report on architectural barriers for green energy technologies, 7th Framework Programme - R2CITIES: Renovation of Residential urban spaces: Towards nearly zero energy CITIES, 2014. **smartcities-infosystem.eu/sites/default/files/r2cities_report_on_architectural_barriers_for_green_energy_technologies.pdf** (accessed February 7, 2017).

[3] M.R. Di Nucci, U. Gigler, O. Pol, C. Spitzbart, Planning and Implementation Process Assessment Report, CONCERTO, a European Commission initiative within the European Research Framework Programme (FP6 and FP7), Vienna, Austria, 2010. **download.steinbeis-europa.de/concerto/website/CONCERTO_plus_plan-impl-assess_final_long.pdf** (accessed November 18, 2016).

4.6.2 Lack of awareness of financing opportunities

SUMMARY

Many residents may be unaware of financing options or opportunities may exist to help them with the financial costs of project implementation.

Elaboration

Following the challenge of silos, the financial instruments available to consumers (in the form of rebates, subsidies, incentives, etc.) may also be obscured by their siloed nature. There may be many opportunities for both upfront and longer term financing help available, but consumers may be unaware of them, or confused by them, due to the fragmented, inconsistent, or unobvious nature of their source and marketing [1,2].

Although there may be "a large number of instruments to compensate the high initial investment costs, consumers are confused by the plethora of subsidies, premiums, tax rebates, etc.; or are simply not aware that they exist" [1].

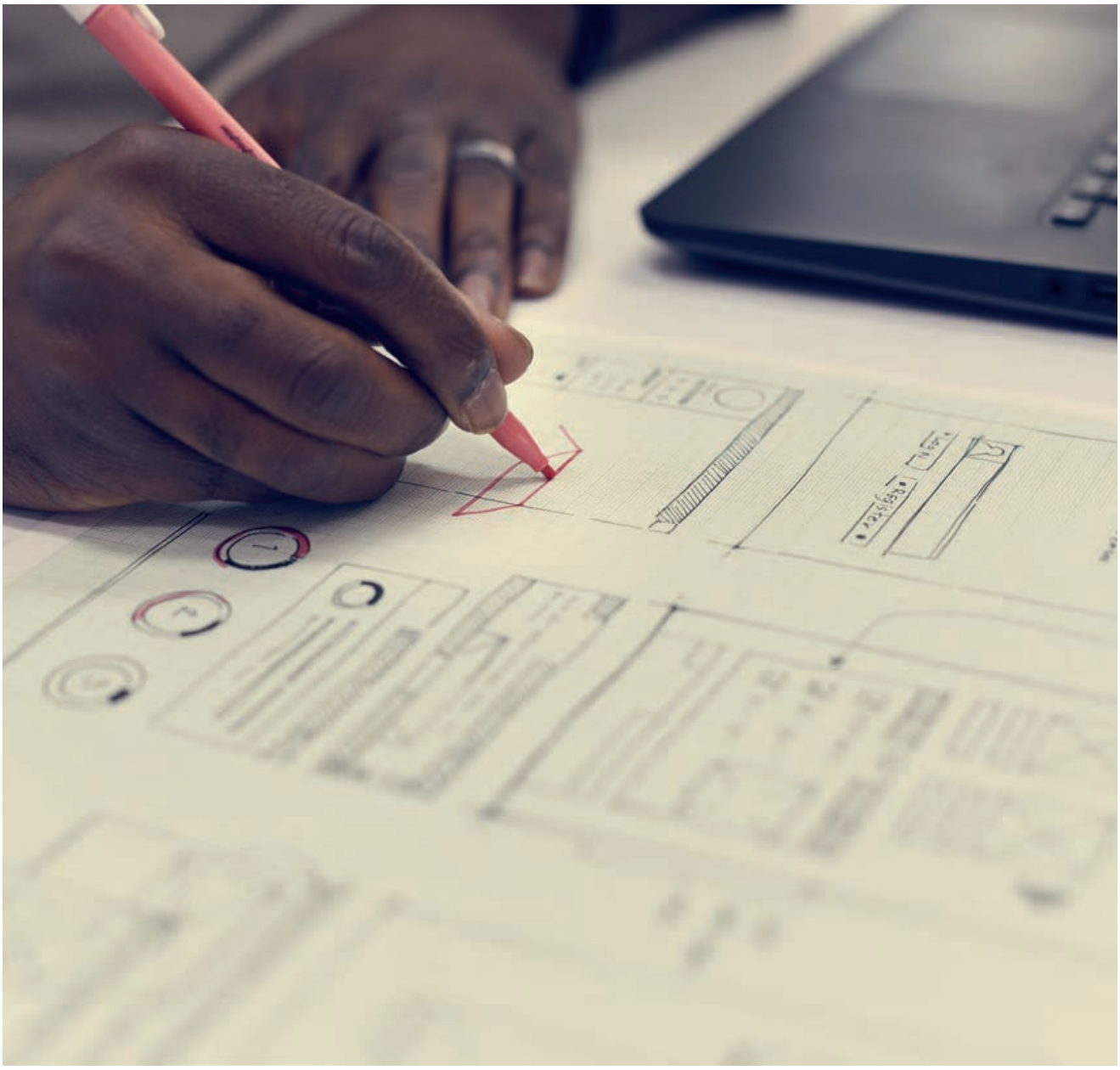
[1] HERON, Energy Efficiency Barriers in Buildings and Transport: 8 National Cases, Horizon 2020 Framework Programme - HERON: Forward-looking socio-economic research on Energy Efficiency in EU countries, 2016. **heron-project.eu/index.php/publications/deliverables-list** (accessed February 9, 2017).

[2] R2CITIES, D2.1 Report on architectural barriers for green energy technologies, 7th Framework Programme - R2CITIES: Renovation of Residential urban spaces: Towards nearly zero energy CITIES, 2014. **smartcities-infosystem.eu/sites/default/files/r2cities_report_on_architectural_barriers_for_green_energy_technologies.pdf** (accessed February 7, 2017).

Lack of awareness of financing opportunities

SOLUTION AND WORKAROUNDS

Promoting awareness of financial opportunities should be one of the first activities covered during project scoping, but this still emerges as a potential issue. Opportunities for external help with private financing should be one of the mandatory activities in project planning. The project team should collect and evaluate those specific opportunities that apply to the project and target market. The project group should bundle, simplify, streamline, and support the application process for the target market.



4.6.3 Organizing collective agreement and action

SUMMARY

Collective agreement is often a requirement for any smart city project to proceed. This challenge generally consists of trying to bring all of the different stakeholders in a project together toward a common goal, shared understanding and a collective agreement.

Elaboration

In its most general sense the challenge of collective agreement stems from fragmentation among a large number of different actors and a "lack of coordination/cooperation between multiple stakeholders and their interests" [1].

More specifically, the collective agreement challenge is most commonly encountered in smart city projects that involve renovation or retrofitting of multi-ownership buildings. Organizing collective agreements among the distributed owners and different actors in multi-owner buildings adds an additional layer of complexity to an already complicated process, owing to the diversity and divergent interests of the stakeholders [2,3].

This challenge is often intertwined with the split-incentives issue, as "…owners are rarely a homogeneous group, but a mix of owner-occupiers and short- and long-lease landlords, and of different age groups and household forms" with "often different and opposing interests on how to develop their properties" [3].

[1] A. Rivada, E. Hoyos, E. Demir, M. Aksu, A. Stacey, B. Yorston, J. Shawyer, C. Degard, P. Compere, I. Nagy, Report on non-technical barrier and legal and normative issues, Horizon 2020 Framework Programme - REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation, 2016. **www.remourban.eu/Technical-Insights/Deliverables/Reports/Downloadable-Deliverables.kl.**

[2] EASEE, Identification of barriers and bottlenecks, 7th Framework Programme - EASEE: Envelope Approach to improve Sustainability and Energy efficiency in Existing multi-storey multi-owner residential buildings, 2012.

[3] EFFESUS, Energy Efficiency in European historic urban districts a practical guidance, 7th Framework Programme - EFFESUS: Energy Efficiency for EU Historic Districts Sustainability, 2017.

Organizing collective agreement and action

SOLUTION AND WORKAROUNDS

In many countries, property owners within residential multiple ownership properties commonly (or are legally required to) establish an owners' association, condominium agreement, or housing cooperative to manage common building maintenance and utilities [1,2]. As part of these systems, owners generally make monthly or annual payments into a communal fund (and have a collective debt), to pay the costs of regular building maintenance, and cover unforeseen or future repairs.

Existing management and funding systems also provide a vehicle for the organization of collective action and for collective investments in smart city projects, such as energy efficiency and performance improvements [1]. In the absence of an existing collective agreement, professional property management companies can also fill the gap and "be used as an organisational and financial vehicle for energy-related retrofits in the absence of building owners' associations" [1].

[1] FFESUS, Energy Efficiency in European historic urban districts a practical guidance, 7th Framework Programme - EFFESUS: Energy Efficiency for EU Historic Districts Sustainability, 2017.

[2] LEAF, Improving the energy efficiency of apartment blocks, Intelligent Energy Europe (IEE) Programme - LEAF: Low Energy Apartment Futures, 2016. **www.lowenergyapartments.eu/project-findings/results-and-evaluation/** (accessed February 8, 2017).

4.6.4 Lack of motivation – consumer priorities, attitude, and behaviour

SUMMARY

Private investment in smarter solutions (e.g. energy efficiency) may be a low priority for households, resulting in a low private motivation to invest.

Factors compounding this issue include other challenges addressed here: socio-economic status and access to capital, high investment costs and payback time, problems organizing collective agreement and action, and lack of awareness of financing opportunities.

Elaboration

The decision of whether or not to invest in smarter solutions is driven by many factors besides the direct economic rationale. While cost reduction is the logical reasoning used to influence consumers, the primary behavioural drivers are much more complex, and vary greatly. Energy efficiency is a minor factor, with a "low priority, simply because households (even the environmentally aware ones) are much more attracted to other attributes of the products (be it dwellings or vehicles), such as thermal, visual and acoustic comfort, aesthetics, safety and health" [1,2]. In interviews of homebuyers, none of the owners had considered energy use in their purchasing decisions, while those customers that had installed efficiency measures stated that both thermal comfort and aesthetics were important drivers in addition to reduced costs [3,4]. "Energy is regarded more as a public service than a valuable good, which is difficult to change unless this implies a tangible improvement of the living standard" [5].
Another correlated social issue which feeds motivation is the source of information - and the trust involved: "Even the best advice of the most competent professional will not be accepted, if it is not corroborated by the opinions and experiences of relatives, friends, [or] colleagues" [2].

[1] City-zen, Social housing retrofitting in Grenoble : Mistral program, 7th Framework Programme - City-zen: City Zero (carbon) ENergy, 2016. **eu-smartcities.eu/sites/all/files/City-zen_business%20model%20canvases_161216.pdf (accessed February 6, 2017).**

[2] HERON, Energy Efficiency Barriers in Buildings and Transport: 8 National Cases, Horizon 2020 Framework Programme - HERON: Forward-looking socio-economic research on Energy Efficiency in EU countries, 2016.
heron-project.eu/index.php/publications/deliverables-list (accessed February 9, 2017).

[3] EASEE, Identification of barriers and bottlenecks, 7th Framework Programme - EASEE: Envelope Approach to improve Sustainability and Energy efficiency in Existing multi-storey multi-owner residential buildings, 2012.

[4] P. Tuominen, K. Klobut, A. Tolman, Energy efficiency improvement of building stock in the European Union, in: P. Huovila, V. Raasakka (Eds.), Proceedings SB11 Helsinki: World Sustainable Building Conference, CIB, Helsinki, Finland, 2011: pp. 195–200.

[5] BEEM-UP, Final version of the exploitation and market deployment plan, 7th Framework Programme - BEEM-UP: Building Energy Efficiency for Massive market UPtake, 2014. **www.beem-up.eu/publications.html** (accessed February 7, 2017).

Lack of motivation – consumer priorities, attitude, and behaviour

SOLUTION AND WORKAROUNDS

In order to meet the motivations of the consumer, the socially beneficial attributes should be bundled with, and emphasis given to, those characteristics or attributes that the homeowner is more likely to value. The narrative of the energy efficiency investment should be tailored in order to emphasize the direct co-benefits of the intervention – including a higher living standard, increased comfort, improved aesthetics, enhanced lighting quality, healthier ventilation, and better acoustics, among others [1–3].

EXAMPLE

People tend to trust the opinions of their social circle as well as their own direct experiences, and demonstration projects provide one way to influence these factors [4]. Demonstration projects and living labs can involve the public and allow them to develop their own awareness and motivations based on their own direct experiences, or those of their social circle, instead of words and papers.
"...it must be highlighted that this barrier can be an incentive for rehabilitation if it is showed that the energy rehabilitation may significantly reduce household spending, with the added benefits of having the property in better condition and improve the comfort inside" [5].

[1] City-zen, Business case models for retrofitting in Amsterdam, 7th Framework Programme - City-zen: City Zero (carbon) ENergy, 2016. **eu-smartcities.eu/sites/all/files/City-zen_business%20model%20canvases_161216.pdf** (accessed February 6, 2017).

[2] EASEE, Identification of barriers and bottlenecks, 7th Framework Programme - EASEE: Envelope Approach to improve Sustainability and Energy efficiency in Existing multi-storey multi-owner residential buildings, 2012.

[3] M. Ferreira, M. Almeida, Benefits from Energy Related Building Renovation Beyond Costs, Energy and Emissions, Energy Procedia. 78 (2015) 2397–2402. doi:10.1016/j.egypro.2015.11.199.

[4] HERON, Energy Efficiency Barriers in Buildings and Transport: 8 National Cases, Horizon 2020 Framework Programme - HERON: Forward-looking socio-economic research on Energy Efficiency in EU countries, 2016. **heron-project.eu/index.php/publications/deliverables-list** (accessed February 9, 2017).

[5] R2CITIES, D2.1 Report on architectural barriers for green energy technologies, 7th Framework Programme - R2CITIES: Renovation of Residential urban spaces: Towards nearly zero energy CITIES, 2014. **smartcities-infosystem.eu/sites/default/files/r2cities_report_on_architectural_barriers_for_green_energy_technologies.pdf** (accessed February 7, 2017).

5 MONITORING, KPIs, AND TOOLING

When running projects, programs and any action plan, regular systematic collection and analysis of information is essential to track their implementation progress against pre-set targets and objectives. It aims to answer the question "did we deliver?".

Monitoring is a necessary step for program management and permanent improvement:

- it clarifies program objectives,
- links activities and their resources to objectives,
- translates objectives into performance indicators and sets targets,
- routinely collects data on these indicators,
- compares actual results with targets
- reports progress to managers, authorities and citizen and
- alerts them to problems

Translating objectives into performance needs an appropriate set of indicators, key performance indicators, known as KPIs.

KPIs can either be quantitative or qualitative ones.

In addition, collecting set of KPIs values for a wide range of projects and programs is very useful for comparing the impacts of different options, as well as promoting success stories and best practices through benchmarking, a key element for replication and scaling-up.

Benchmarking helps in decision making and comforts in investment, thanks to reference to existing "similar cases" that contributes to de-risking the impact of the decision.

In this chapter, development of KPIs for evaluation and monitoring then benchmarking issues are presented. The results come from a wide collaboration between major initiatives, EU funded projects, evaluation schemes and standardization development.

The aim of this chapter is to propose a set of global categories of KPIs with a first level of subdivisions, to help cities and communities in following and evaluating the progress of their smart and sustainable projects and programs, both for management and reporting/communication purposes.

5.1 Monitoring

Monitoring gives information on where a policy, program or project is at any given time (or over time) relative to respective targets and outcomes. Monitoring focuses in particular on efficiency, and the use of resources.
While monitoring provides records of activities and results, and signals problems to be remedied along the way, it is descriptive and may not be able to explain why a particular problem has arisen, or why a particular outcome has occurred or failed to occur.
Evaluation deals with questions of cause and effect. It is assessing or estimating the value, worth or impact of an intervention and is typically done on a periodic basis.
Monitoring is an essential part of the management of complex projects/programs, and especially with permanent improvement strategies.
However, there is a critical need for defining what specific indexes best describe achievement, targets, impacts, etc…

5.2 KPIs

KPIs are these indexes relevant for evaluation and monitoring.
These indicators can be either quantitative or qualitative. Their value should be determined following standardized methods, in order to optimize comparison between projects/programs in a way to feed a benchmark of best practices, and thus help in defining targets based on existing success stories.

Several management systems and initiatives for a smart and sustainable development of cities and communities are implemented in Europe and even worldwide. Several major ones were considered in this work, as active partners within EIP SCC. Among them, the European energy award (eea) management system, EUROCITIES framework and its Citykeys H2020 project, the EU SCIS (Smart Cities Information System), inputs from several cities and communities, as well as standards and related documents and references.

Keeping in mind that there are many different types of cities and communities, in terms of size, domain of responsibilities, development, culture, historical context, local specificities, it was agreed to propose sets of KPIs consistent with the need for flexibility.

Thus, 4 different purposes with specific boundaries have been identified:

1. Program evaluation and management (holistic view)
2. Project evaluation and management (rather sectorial approaches)
3. Reporting and Communication (internal and external, including to citizen)
4. Benchmarking related issues (feeding a benchmark of best practices and success stories)

For each of these purposes, 5 major categories of KPIs were defined, common to all programs/projects:

These categories are related to:

- People
- Planet
- Prosperity
- Governance
- Replication/scaling-up

These categories can then be declined in subcategories as follows:

Category 1 – PEOPLE:
Health, Safety, Access to Services, Education, Social Cohesion, Mobility, Noise, Silver economy

Category 2 – PLANET:
Energy, Climate resilience, Water, Waste, Pollution, Ecosystem

Category 3 – PROSPERITY:
Employment, Equity, Green Economy, Economic Performance, Innovation, Attractiveness & Competitiveness

Category 4 – GOVERNANCE:
Organization, Community involvement, Training, Procurement, multi-level governance, development & Spatial Planning

Category 5 – REPLICATION/SCALING-UP:
Scalability, Replicability, local cooperation, cross-cities/communities cooperation

It is recommended to use KPIs relevant for each of these categories and subcategories in order to feed benchmarking database in a consistent manner and help in replication/scaling-up.

5.3 Benchmarking

One of the main barriers to engage in smart and sustainable strategy and programs for a city/community is related to the perception of risk when to decide to move from business as usual to innovative strategy. Thus, to help decision making, as well as help in motivation financial investment, a benchmark of best practices and reference cases with coherent values of KPIs is useful for projecting the city/community potential of improvement & benefits, and related investment.

The benchmark will contribute to defining the expected/planned targets and ways to reach them. The benchmark will thus report where parties choose to look at existing cases that they aspire to be like. By choosing success stories that are on the leading edge of the smart and sustainable development, they can identify best practices that help improve their own context.

Collecting KPIs from projects/programs implemented in each city/community in a systematic and consistent manner, will make it possible to feed progressively a common data base that will serve as benchmark, where any type of city/community should be “represented”. With such a major tool, decision making at city/community level to engage in a smart and sustainable development will be easier and support (financial and citizen engagement) to implementation more consistent and collective.

5.4 Standardization development

Standardization is an efficient way to harmonize methods and evaluation protocols, as well as to define **KPIs** and the way to calculate/evaluate their values. Implementing standards help in aligning initiatives and ambitions, as well as in considering a whole set of common issues and in using common methods for KPIs' calculation/definition and for monitoring, which is key for feeding a **benchmark** of best practices and success stories based on values.

Smart cities related standardization developments are conducted at global level (ISO, IEC, ITU) as well as at European Level (ETSI). S**ustainable development in cities and communities** related standardization developments are mainly conducted at global level by the ISO Technical Committee on sustainable development in communities, ISO TC 268, where management system standard has been published – ISO 37101 -, as well as KPIs related ones – ISO 3712x series – and infrastructures related ones – ISO 3715x series-.

At European level, it has been decided to harmonize the standardization developments between the three European Standardization Organizations (ESOs), CEN, CENELEC and ETSI, by creating a joint dedicated Sector Forum: CEN/CENELEC/ETSI Sector Forum Smart & Sustainable Cities and Communities – SF SSCC-. The aim is to harmonize the development in such a way that a set of consistent and complementary standards can be proposed to cities and communities, as a carrier to success stories' replication and scaling-up.

CEN/CENELEC/ETSI SF SSCC is working closely with EIP SCC, where the major expression of needs from cities and communities, including private sectors and citizens will be collected to feed EU standardization development as an answer to these needs.

6 REPLICATION AND UPSCALING

6.1 Introducion

Developments under the umbrella of Smart Cities aim to enhance the capacity of cities to become more sustainable, liveable and competitive. However, although a lot of resources are dedicated to the research, developing, building and maintaining Smart Cities the scaling up of success stories and the replication of cases is lagging behind and is in many cases an unsolvable challenge. A critical question in all the efforts is how results and experiences from living labs and case studies can be scaled up, replicated and transformed to other neighbourhoods, cities and urban areas while adapting to the local characteristics.

First exploration of upscaling and replication issues at EIP-SCC workshop 24 May 2016

As urban systems by definition are complex and highly depending on local characteristics, upscaling and replication of **Smart City and Communities demonstration projects** and living labs is a tricky issue. On the one hand, the settings and circumstances in piloting projects are specifically arranged for the course of demonstration which might not necessarily fully reflect the urban realities. On the other hand, plans and activities might be dedicated to the circumstances in one particular city, district or neighbourhood making the direct application in another setting difficult.
Two aspects that all such Smart City and Communities implementation efforts have in common is that they have to rely **on INTEGRATED and JOINT efforts**. Integrated, cross-sectoral efforts are needed to benefit from Smart City concepts. Various borders, originating from the so-called technical and administrative "silos", have to be overcome to create a common understanding and platform for Smart City implementation. In addition, JOINT efforts are required to tap upon the available local knowledge from all kind of different stakeholders affected by the projects and to co-create a common urban future. JOINT efforts also increase the democratic legitimacy of Smart City and Community endeavours. In this light – with a huge number of Smart City pilot projects ongoing across Europe – one of the most pressing questions is…

… how to come to larger scale implementation of Smart Cities and Communities strategies and exploitation of the pilot project results?

The chapter at hand aims at discussing measures and ways forward to fully exploit the potential of living labs and pilot projects of smart cities and communities projects, to identify the experienced bottlenecks at hand, underline determining elements, framework conditions to support concepts to move from testing, demonstration and pilots to larger scale implementation.

6.2 Upscaling? Sure… But upscaling WHAT?

The term '**upscaling**' of Smart City and Communities plans has been widely used in recent years which does not come as a surprise. Urban living labs, demonstration pilots and small scale implementations in most cases are to test and develop solutions in a changing real-world setting taking into account the local characteristics and circumstances. In all these examples the impact is very local around a specific area. The important question is how can the impact of these endeavours be increased and "scaled up" to a street, a district or a city.
The definition of what is meant by upscaling often remains very fuzzy and overlaps with the connotations of the terms of replication, acceleration and further diffusion. Therefore, it is essential to point out what is understood under the term 'upscaling' in this chapter. For the further discussion, the understanding of the JPI Urban Europe SmarterLabs[2] will be applied. SmarterLabs understand upscaling as the following:

- Upscaling ≠ growing Labs/ diffusion (i.e. the experiment continues with more actors /stuff)
- Upscaling ≠ replication of Labs (i.e. similar Labs on other location(s))
- Upscaling = the emergence of a set of novel practices (such as new governance practices or mobility practices), learned from practical experiments, with corresponding new structure and culture elements[3]

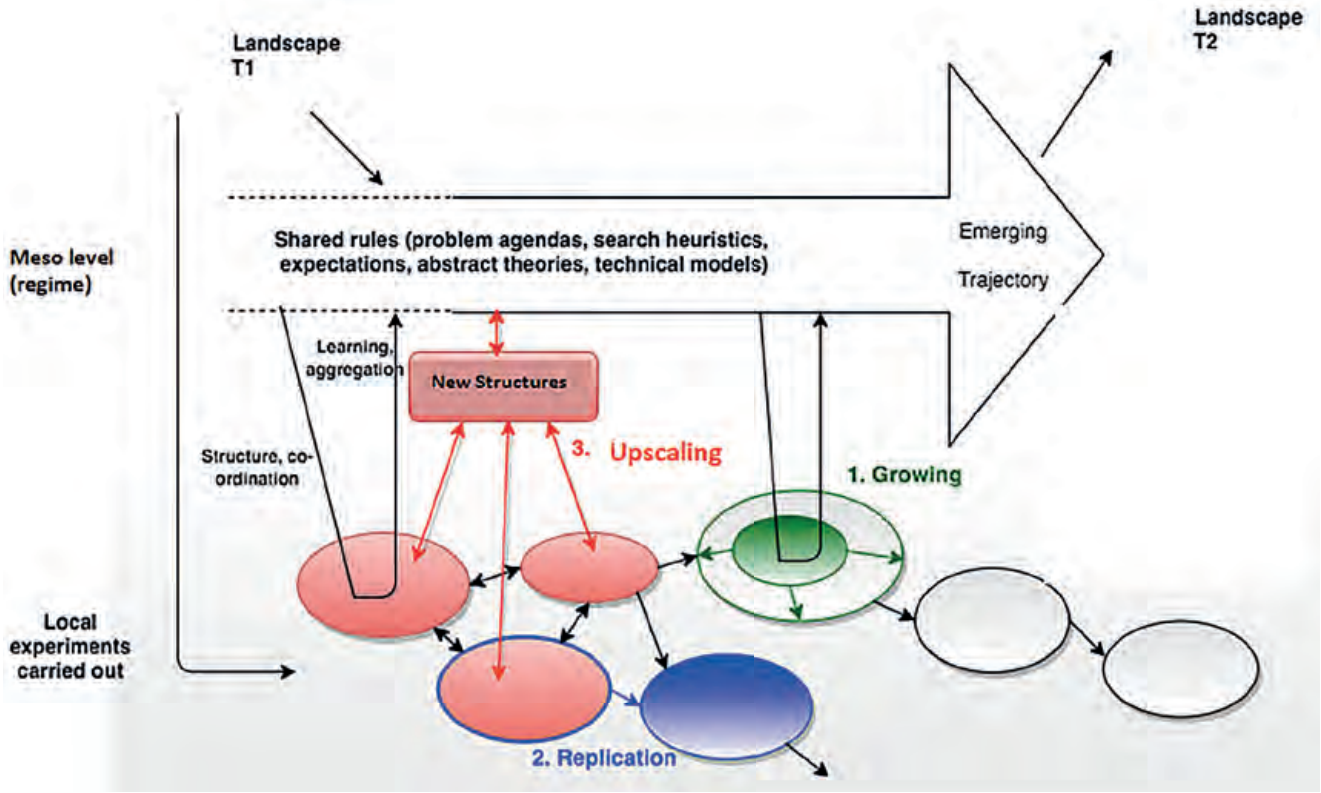


Figure 6.1 : The Figure is an adapted version by Marc Dijk (Maastrich University) of Naber (2016) and Geels and Raven (2006)

Therefore, the term upscaling describes the emergence of a new set of novel practices, learning from urban living labs, pilot and demonstration projects (practical experiments) with corresponding news structures and cultural elements. The graphic above aims at pointing out the connections between a given system (regime) consisting of shared rules, the local experiments and the new structures which result from these experiments and the influence on the shared rules and lead to a system change.

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[2] SmarterLabs: **www.smarterlabs.eu**

[3] Dijk, M (2016) Accellerating Impact Workshop, 16 Novermber 2016 Smart City Expo Barcelona: Kemp R. and Grin J. (2009) Opschaling van transitie-experimenten en verankering van systeem-innovatieve vernieuwing (Upscaling of Transition-Experiments and Anchoring of System Innovative Renewal). Unpublished report, TNO, Delft.

6.3 Framework conditions to accelerate impact, scaling up and across

Urban areas and cities are complex systems which reflect the interplay of political, geographical, demographic, social, cultural and economic characteristics. This complexity produces cities, and therewith cases, which are very different from each other, often unique. Due to these differences between cities, and even within cities, plug and play solutions and simple copy/pasting Smart Cities and Communities solutions do not contribute to the achievement of targets and goals. In this regard, the framework conditions reflecting the complexity of urban systems play the determining role for accelerating the impact of Smart Cities and Communities pilots, projects and living labs.

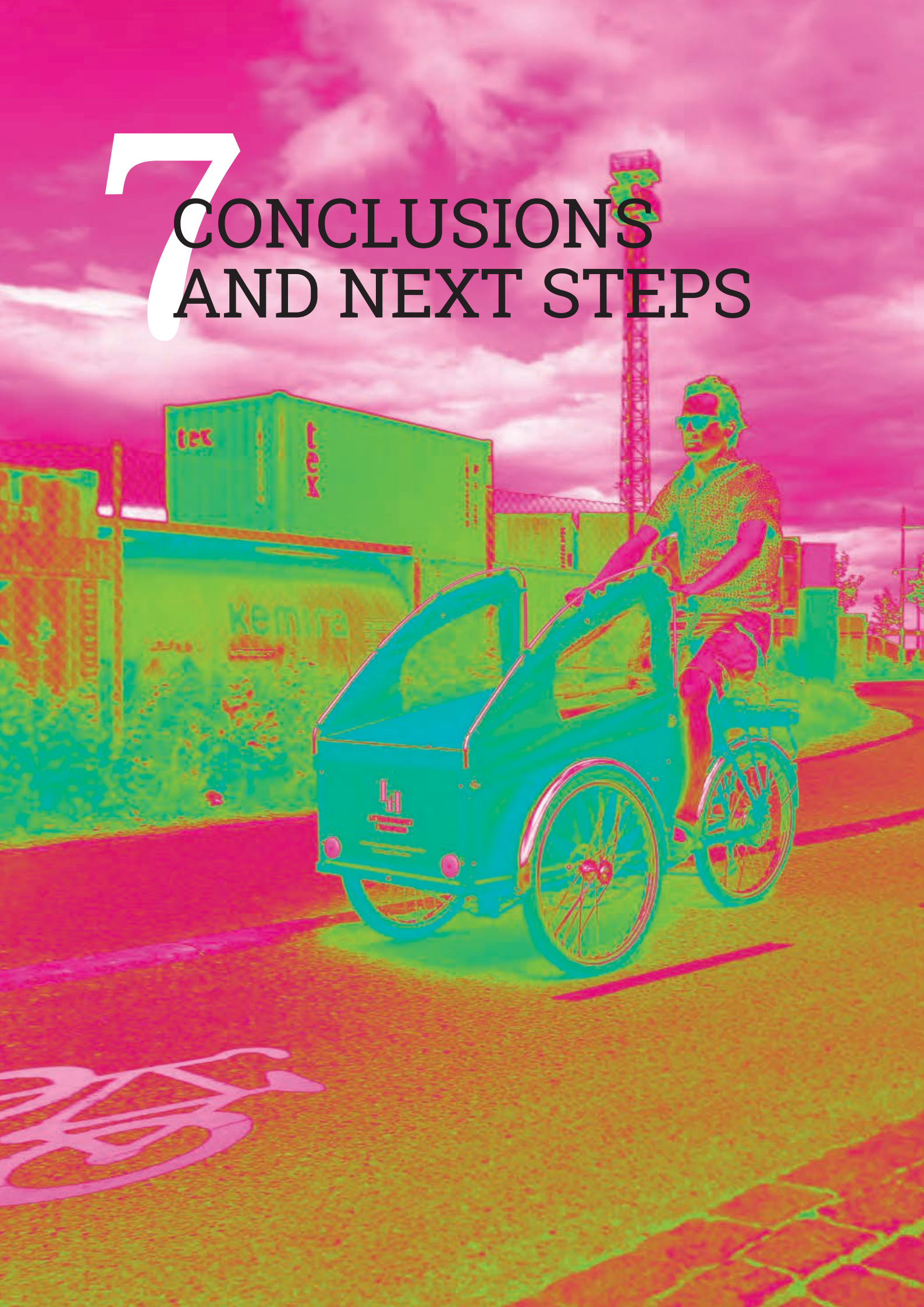
What all these frameworks have in common is the need for breaking out of silos, allowing the inter- and transdisciplinary of projects right from the beginning, and using projects as test beds for new organisational forms of processes. For identifying and providing a tailor-made solution to a characteristic urban challenge it is pertinent to overcome organisational barriers and allow new alliances and connections. Three determining areas of framework conditions have been identified impact of smart cities and communities projects, living labs and pilots:

1.) Participation
Participation of civil society and other relevant stakeholders is essential for larger scale implementation. The transparency, aims and kind of participatory processes should be clearly communicated. Furthermore, it is important that a well-planned process for the participation is in place at the beginning of the experimental project. Municipalities can be seen as enablers of "real" participatory approaches by providing the frameworks for experimentation, living labs and demonstration projects. Besides creating awareness and convincing a wider audience of the benefits of new developments, processes and solutions, real participation can activate the lean knowledge or civil society, businesses, NGOs, etc. and therewith establish an atmosphere of co-creation.

2.) Business Models
New business models for complex solutions, processes and smart technology are asked for in order to accelerate impact. The business models should go beyond the ones of "simple" ICT solution but should be related to the characteristics in a given city. The fact that citizens are more and more becoming prosumers is challenging traditional business models. Furthermore, new emerging business models in many cases are replacing old ones which causes tension and competitiveness between old, non-smart/sustainable processes, products, etc. and the new smart and sustainable ones.

3.) Governance:
Another integral element for scaling up and replication of smart and sustainable projects is governance. On the one hand, the established governance system of a given city provides the framework for experimentation. On the other hand, well-established routines in the governance system might limit the potential for scaling up of experimental projects. In order to enhance the impact of experimental projects, commitment on all governmental levels is required. Furthermore, in many cases living labs bring together people and stakeholders working in similar areas which would usually not work together. These new partnerships need to be maintained and the personal contacts deepened for enhanced impact of smart/sustainable projects.
These framework conditions will be further elaborated in the final document to be published in autumn 2017. As the activities on upscaling and replication of the EIP SCC initiative From Planning to Implementation and Upscaling of Smart City plans are still ongoing, a sophisticated conclusion will be provided in the final version of the Smart City Guidance Package in autumn 2017.

7 CONCLUSIONS AND NEXT STEPS



So far, creating the intermediate version of the SCGP has proven to be an exciting but arduous task. It appeared that the systematic scan of relevant CONCERTO, CIVITAS, FP7, H2020 and other projects, partly disclosed by the excellent SCIS, was more time-consuming than expected. Subsequently, a great deal of the project information needed more detailed investigation in order to become meaningful for the SCGP, for example by follow-up through additional desk research or interviews. The outcomes of interviews proved to be very useful in complementing the desk research of smart city projects, but it was not always easy to get appointments with busy professionals planning and realising great smart city projects. Further, we found many useful analyses of obstacles and barriers in projects, but often these were not yet sufficiently linked to solutions and workarounds. Finally, during writing it was not always easy to find the right balance between summarising information in the condensed format of two pages while doing justice to the wealth of information that had been collected.

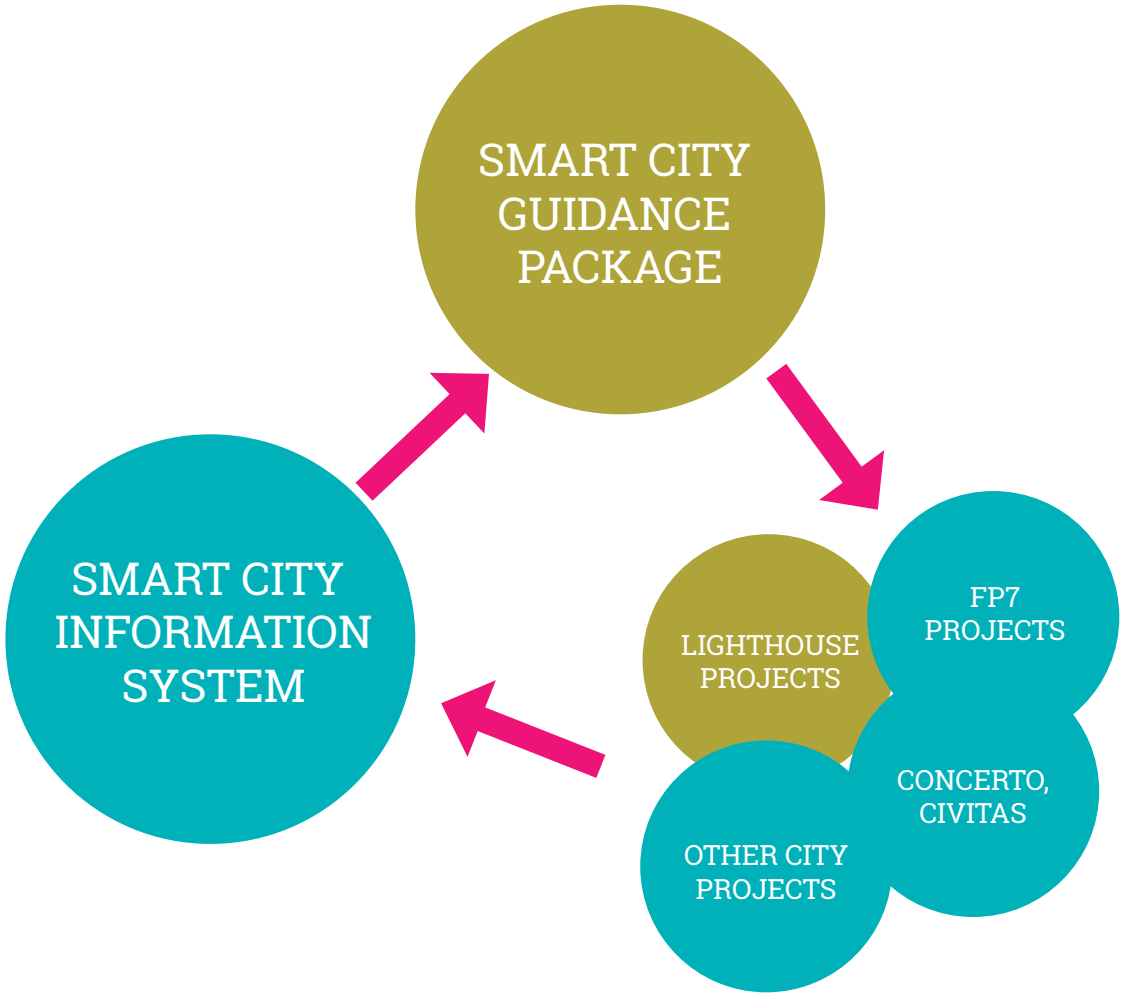


Figure 7.1 Links between SCGP, SCIS and sources of information as H2020 Lighthouse, FP7, CONCERTO, CIVITAS and other city-initiated projects

Nevertheless, interviews with follower cities and other cities planning smart city projects made clear that the SCGP can play an important role by making cities and urban stakeholders acquainted with the path ahead, mindful of the preconditions to be fulfilled for successful implementation and replication, and aware of where relevant information on experiences and best practices can be found.

We see this intermediate version as the point of departure for the next phase – expected in October 2017. During this phase, we will focus on:

- Completion, verification and elaboration of the collected material on types of smart city plans, phases from planning to implementation and replication, actors and roles, obstacles and solutions through extended desk research, 20 additional interviews, 2 webinars, and additional workshops planned at the Action Cluster meeting 20 June 2017, Nordic Edge event 28-29 September 2017, and Smart City Expo Barcelona ;

- Rethinking of the categorisation of the obstacles and barriers from the viewpoint of practitioners;

- Collection of more information on best practices, solutions and workarounds for each obstacle or barrier to better guide future smart city projects on overcoming these obstacles and barriers, preferably by collaborating with other Action Clusters and initiatives in the EIP-SCC such as Positive Energy Blocks;

- Additional analysis on the context and preconditions for planning and implementation of smart city projects, and their linkage to local specificities and other relevant in-situ factors as present energy system;

- Elaboration of the chapters on replication and replication and Monitoring, KPIs and tools;

- Identification of the needs of follower cities and other cities working on planning and implementation - and adjustment of the content of the SCGP to that, preferably by testing the SCGP in real-life situations;

- Refinement and integration of the information at internal Action Cluster meetings;

- Exploration of a better linkage to the information provided by SCIS;

- Organisation of reviews by 3-5 external experts.

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