Analysing the potential for wide scale roll out of integrated Smart Cities and Communities solutions

Final Report – Executive Summary

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Abstract

Cities worldwide are growing fast. Over half of the global population lives in urban areas, and this share increases every year. Urban population growth means that services need to reach more and more individuals. Technology is of great help in this race against urbanisation, providing innovative and more efficient ways to respond to the increasing demand for more sophisticated and complex services. To exploit technological opportunities, city planners, administrators, citizens, entrepreneurs and all other stakeholders must reconsider the way they have approached urban service provision up until now.

This report outlines the results of the analysis performed on evidence from smart cities and solutions cases, assessing the main features impacting the roll-out opportunities of integrated smart city solutions.

The assignment was commissioned by the European Commission Directorate-General for Energy (DG ENER) to contribute to the knowledge base of the European Innovation Partnership by analysing Smart Cities and Communities (SCC) solutions and initiatives that are linked to the Strategic Implementation Plan (SIP) of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC). It ultimately aims to use the analysis of SCC solutions to promote a better understanding of success factors for their deployment and roll-out.

Executive summary

This document is the Final Report of the study analysing the potential for wide scale roll-out of integrated SCC solutions, carried out by PwC, DTI, ISIS, SigmaOrionis, with the support of Sinergis and HIT.

The objective of this study is to support the European Commission in contributing to the knowledge base of the European Innovation Partnership by analysing Smart City solutions and initiatives that are linked to the Strategic Implementation Plan (SIP) of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC), thereby promoting a better understanding of success factors for their deployment and roll out.

To support the understanding and sharing of the best practices for the roll-out of integrated SCC solutions, the following activities were carried out:

- Screening and review of the most **relevant literature** on SCC solutions;

- Identification of **300 examples of SCC solutions,** of which approximately 200 are European, while the remaining examples come from the rest of the world;

- Analysis and description of **80 best practice examples of SCC solutions,** selected from a list of **300 examples of SCC solutions** (see second bullet point);

- In depth analysis of **10 case studies** (selected from the 80 examples of SCC solutions), putting particular emphasis on their **business models,** so as to make evidence available for other possible SCC solution initiators.

- Identification and analysis of **10 examples of "failure" of SCC integrated solutions,** to identify the most typical patterns of failure;

- Analysis of **synergies between the most relevant SCC groupings and organisations,** and insight into how to successfully use these synergies to further advance the concept and roll-out of Smart Cities;

- Investigation of the **commonalities between the SCC settings of the EU and China,** which could be leveraged to increase replication and market potential for European Smart Cities in China.

For the purpose of collecting the sample, multiple sources were used to identify leading examples of SCC solutions. The main data sources were the literature analysis carried out across all SCC key domains, relevant international Smart City benchmark studies and rankings to identify the most prominent cities implementing SCC solutions and, finally, the EU-funded initiatives supporting the development and implementation of Smart City solutions.

The context of the study

Technological development has led to a changing approach to business practices in urban infrastructure development, allowing for accurate and reliable measurement of socio-economic and environmental impacts. It is therefore possible to quantify – and, consequently, to price – the externalities generated by investments in urban infrastructure. This opens up new sources of revenue for projects, new business models for recovery and value capture, and new opportunities for investors.

Specifically, the cases analysed made it possible to identify commonalities in the value created to communities, depending on the sector they referred to (as reported in the table below).

	Type	Value proposition
Sustainable Urban Mobility	**Real-time road user information**	Enable people to take informed decisions about their mobility, saving time and energy.
	ITS-based enhancements of public transport	Reduce waiting time as well as emissions, and facilitate intermodal commuting.
	ITS for traffic monitoring, management and enforcement	Optimise fleet management and route scheduling.
Sustainable Districts & Built Environment	**Smart technologies for the built environment**	Pursue better living, resource efficiency and waste reduction.
	Sustainable districts	Reduce emissions and resource consumption by embedding integrated energy efficiency technologies.
	Place making	Create communities of interest that can be key to support integrated SCC solutions.
Integrated Infrastructure & Processes	**Smart City Platforms**	Allows real time monitoring and preventive steering of cities.
	Intelligent City Services	Co-ownership of local matters and outcomes. Efficiency savings for city administrations. Stimulate involvement at local level.
	Smart grids	Collected information and insights may serve planners and managers, but are often also shared with users, who can take more informed decisions and can also become *prosumers*, i.e. users that can switch from being energy consumers to becoming producers based on the circumstances.

Across the sample of analysed cases, city-wide integrated solutions were rare. Instead, solutions with higher levels of integration are emerging in smart districts, across some energy efficiency projects as well as in various mobility projects. These are generally encountered in urban development investments sustained by real-estate business cases, where the integrated SCC solutions are ancillary to more traditional business cases.

To ensure a comprehensive study, different aspects of SCC solutions' business models and deployment are assessed, namely:

- Ways and tools to govern SCC solutions, in particular for cities, which are faced with the challenge of exploring the economic return in SCC investments;

- How SCC solutions can be funded and which opportunities for financing arise from these new technological opportunities;

- Procurement process practices and tools are analysed in the context of SCC solutions.

- The importance of involving citizens and communities into SCC solutions.

- Features and conditions that favour and hinder the roll-out potential of SCC solutions;

- The opportunities for the EU to leverage the international dimension of SCC deployment by partnering with China.

Governance of integrated SCC solutions

City planning activities are changing due to technological development. The role of private companies shaping the development of cities has been increasing, whereby they act as investors, service or components providers, and users.

Budgetary constraints and the increasing complexity of urban investments for SCC solutions has lead city administrations to require the involvement of private players and, consequently, to adapt the governance of cities in order to attract them.

From a governance perspective, the following actions are suggested.

Manage the shift towards a collaborative operating model. Static and public administration-centred governance systems collide with the integrated SCC solutions approach. Collaboration must be favoured at different levels, specifically:

- **Integrating solutions enhancing coordination at city-governance level.** The analysis of SCC cases has shown that there still is a limited share of integrated solutions, as these tend to be developed at sectorial level. Although reasons are numerous, the separation at city government and planning level hinders coordination and collaboration among departments. This could be resolved by creating a centralized coordination office for integrated SCC solutions and by supporting city planning with appropriate tools/guidelines for SCC strategies and initiatives;

- **Strengthening multi-stakeholder partnerships at all levels.** SCC solutions are complex; they require the public sector to partner with private parties, which have the interest, capacity and skills to develop the projects. Thus, the governance of cities as well as that of specific SCC solutions should enhance the participation of the different parties, in partciular private companies and universities/research centres;

- **Enabling framework conditions for new business models**. Flexibility should be ensured in shaping roles and responsibilities related to SCC solutions. The public sector may consider taking charge of the management of project design and initial phases, but should ensure that this is done by maximising the involvement of the private sector and – potentially – users/universities, etc.

Establish a blueprint for an open, city-wide, service-oriented, interoperable IT platform, which would provide an agreed architecture on which city partners and suppliers can converge over time and establish a multi-level competitive landscape at the platform, services and application layers.

Manage data: data ownership and management is key in any digital process. As integrated SCCs make extensive use of data, which is collected, processed and shared in real-time, it would be advisable to **ensure that data is as free as possible.** Indeed, the more information is available, the higher the opportunities to use it for solutions. However, **data must be protected, controlled and assessed in terms of quality.**

Funding and financing opportunities

Current budget limits and constraints (e.g. stability pact rules) are forcing public authorities to look for alternative sources of capital to support the development of SCC solutions on a wide scale. At the same time, the possibility to create value through innovative technologies opens interesting business opportunities for private investors as well.

However, limited access to finance affects small innovative companies and start-ups, especially those engaging in innovative and risky projects. This limits both their capacity to develop innovative solutions and their ability to bring their products to the market.

The following recommendations arise from the analysis undertaken.

Rationalize the supporting role of the EC to SCC projects, depending on whether these can potentially generate revenues or not. In order to increase efficiency in the allocation of public resources, it is recommended that a clear distinction should be made between projects that are developed for RDI purposes and those that are not. RDI projects – including small-scale projects contributing to larger scale ones – should necessarily be supported via grants, as it is unlikely that they could pay back the investments made. Conversely, SCC projects that aim to be replicable – and hence commercially viable – entail neither the risk level of RDI projects, nor the purpose, but are business oriented. Therefore, it is recommended that an assessment and definition of the various SCC project types be carried out, in order to organize the support the EC can provide.

Centralize EU competences and roles both for the provision of grants and forms of financing and other support (e.g. technical assistance). There are a number of opportunities that support SCC initiatives. The number of different sources and opportunities may create complexity in achieving an efficient support to SCC projects. A single entity managing the different possible types of support would facilitate the allocation of resources, the access to them as well as the selection of the most appropriate support for each case. Considering that not all sources of support are directly managed by the EC (i.e. some funds are managed at local level) this recommendation may be complicated to realise. However, it could still be possible to envisage the involvement of a single, centralised intermediate entity managing or co-managing the support at least at national level.

Create forms of technical assistance for project design and implementation. SCC projects do not require the same type of support (e.g. commercial-oriented solutions should not be supported with grants, etc.). It is expected that a relevant number of projects would not necessarily require capital to be granted, but could rather benefit more from assistance in designing and implementing the project. Hence, the recommendation consists in considering the creation of a dedicated Technical Assistance Unit (similar to ELENA for energy projects) that could support stakeholders from SCC project origination to development. This is relevant in particular for those projects that can potentially be replicated, and therefore be of commercial value. Further, although the ELENA initiative is expected to soon embrace the mobility sector as well, there is no Technical Assistance model currently active, which goes beyond (or across) sectorial boundaries. Oppositely, it has been widely reported that SCC solutions tend to integrate energy, transport and ICT domains. Potentially, a coordinated and infra-sector Project Development Assistance (PDA)

could be effective filling the current gaps arising from the current silo approach to Technical Assistance.

Develop business accelerators in the field of SCC initiatives, bringing together private and public investors and entrepreneurs. A central role that the Commission might want to play supporting SCC projects and initiatives is to make easier and more efficient for all interested players to share their contribution, increasing SCC projects' odds of success. However, these parties are often limited in their potential involvement due to uncertainties and risks related to such innovative projects. Different activities could be envisaged:

- Creating a physical space for stakeholders to meet at specific dates, but also through on-line platforms that facilitate cooperation and co-development;

- Sharing practices and recommendations on the basis of experiences, to target future efforts on the success stories;

- Using the European Innovation Partnership on Smart Cities and Communities (EIP-SCC) as an effective tool convening: cities – large and small; with industry – large and small; with investors of all types; and trusted associations, academics and intermediaries.

- Organising dedicated sessions within SCC-related events for project promoters to open discussions on their projects with potentially interested private and public investors.

Support solutions to enable smaller companies and small-scale projects to receive appropriate finance. Further opportunities are yet to be consolidated in the new investment environment. Among the most promising opportunities, **investment platforms ensure access to finance to small-size promoters involved in SCC solutions.** These are co-investment arrangements – which can be supported by EFSI – that aim to reduce transaction costs and provide for more efficient risk allocation through the aggregation of thematic-focus (or geographic-focus) investments.

Procurement models

Cities strongly rely on external suppliers, as local authorities increasingly define themselves as commissioners and not deliverers of services. The creation and development of a SSC solution requires a continuous innovation process involving high numbers and different categories of stakeholders. In this context, public procurement becomes an opportunity for the public administration to foster the innovation process, stimulating innovation from the demand side, thereby supporting state-of-the-art SC projects and solutions.

The following recommendations arise from the analysis undertaken.

Foster the exchange of best practices also creating synergies between platforms. As Public Procurement of Innovation (PPI) models have recently been introduced, the EC should map each SCC solution that adopted a PPI model and spread the information; this would foster the exchange of best practices (including templates adopted for bids) among MS and city authorities and ensure that the procurement models and practices that proved to work best are shared and known among practitioners. A specific focus should also be placed on how to make better use of standards in public procurement in order to resolve ICT lock-in (i.e. the public authority is unduly dependent on a single supplier, vendor or developer beyond the

timeframe of the initial procurement contract, damaging competition for future procurement).

Support the development of user-friendly guidelines, templates and standard text to facilitate procurement. Also in terms of fostering the exchange of best practices and supporting the dissemination of knowledge, the EC should keep investing in developing guidelines for the effective take-up of SCC solutions. Guidelines should be practical, including examples showing how suggestions could be translated into reality.

Assess standards and specifications. The European Commission should assess standards and specifications in order to make sure that selected standards and specifications foster interoperability and reduce lock-in. This is currently organised on a national basis (e.g. within the context of MSs' National Interoperability Frameworks); however, there has been an effort at a European level to adopt a common framework that fosters collaboration between MS. It would be useful not only to map all standards available in the field of SC, and develop new ones when necessary, but to promote an awareness campaign towards the procurers to inform them on the use of platforms based on open standards and full interoperability.

Review procurement policies to ensure they are aligned with SC contracting principles. As anticipated in the governance section, the approach of public authorities towards urban development solutions requires a change. Data should be owned by the city and not by the supplier, or clear requirements on data availability via open standards should be included in the procurement; contracts should ensure that contractual arrangements encourage collaboration with other players to create new value, and the sharing of common city assets.

Put in place practices and agreements to avoid supplier lock-in. Potentially by integrating interoperability requirements into all ICT procurement, using commercial off-the-shelf products and open standards wherever possible, and factoring in the costs of exit from the outset.

Involving citizens and communities

There is a rich literature on the benefits of participatory approaches to city design, yet there is little consensus on what exactly these benefits are. Integrated solutions must acknowledge the different views and harmonize approaches effectively to maximize the impact for Smart City solutions.

Different possibilities are possible to ensure SCC solutions' success involving citizens and communities; the main ones are suggested below.

Enable community empowerment for the development of sustainable business models. Communities have a particular role to play in the development and success of smart solutions, yet, evidence shows that in most cases there is only a traditional citizen involvement strategy in place, involving promotion, recruitment of participants and community participation to a limited extent, and that little systematic data is available to assess these efforts. Successful solutions tend to be embedded in a comprehensive smart city vision. Collaboration, co-creation and co-development are key conditions for success. Possibly, it would also be positive to insist on a consistent citizen engagement strategy and on making citizens, businesses and communities co-owners of integrated solutions in procurement processes.

Integrate citizens, businesses and communities into the entire project cycle, from development to implementation of integrated SCC solutions. The evidence of the best practise case studies shows that the multiple roles residents could play in regional and urban living labs are not utilized. In fact, emphasis is often placed on the innovative technological aspects but not on innovating the engagement process. Conversely, ensuring inclusive innovation in integrated SCC solutions, and working with stakeholders to ensure a shared understanding of citizen engagement in the process of designing, testing and implementing integrated SCC solutions would facilitate the match between the demand for solutions and their provision.

Create an open innovation ecosystem between different experimentation set-ups. The investigation of best practices has shown that there are bottom-up as well as outside-in solutions that are community-driven or driven by ICT-enabled business innovation. Furthermore, sharing economy solutions are emerging and innovating business models in integrated SCCs. The sharing economy is a topic of much discussion amongst city leaders as cities weigh the pros and cons of the disruption of traditional services with the benefits of potentially improved and expanded shared services.

The roll out of SCC solutions

Applying smart solutions to limited-scale contexts would certainly enable the testing of SCC technologies, governance approaches, etc. However, it would not serve the purpose of responding to the global needs arising from urbanisation. What is thus needed is to ensure that solutions can be scaled (increase in size) and replicated (rolled-out in an environment other than the one they have been applied to in the first place).

The analysis performed shows that there is no single element that represents more than others an obstacle or an enabler to the roll-out of SCC solutions. Instead, it is the joint action of different elements that would limit or facilitate the possibility for a project to be successfully implemented at a higher scale or in other contexts. These refer to the i) technological context (the presence of a technological support network for the SCC solution to function); ii) the socio-cultural context (the ability to respond to citizens' needs and make them a part of developing the solution); iii) the political-institutional context (level of required support from the public administration); and the iv) economic-business context (which refers to the business models and relative environment). The presence of an ecosystem, which is able to converge political institutions, investors, industry players and – to the extent required – citizens, facilitates the implementation of projects that have been successful elsewhere.

An effective way for a solution to succeed has proven to be testing it on small groups of citizens and stakeholders, adapting it and then scaling it to the whole city.

While demonstration projects seem to be a good tool to cope with the risk of project failure, which would otherwise be an obstacle for a public administration to endorse innovative Smart City solutions, they also represent the risk of being endless tests, which never reach an operational status. The safe area represented by research projects does not have to lead to endless demonstrators, which may represent a form of failure in themselves if the specific solution does not become economically viable or if it keeps being based on different small projects without scaling up to the operational

phase. On the other end, demonstration projects may serve the need of showing quick gains and encouraging stakeholders in taking actions.

Partnering with China

SCC solutions are not limited to the European context. It is widely acknowledged that the Asia-Pacific area – in particular China – will experience a significant increase in the number of SCC solutions being developed, becoming the leading region in this sector. For this reason, particular attention has been devoted to exploring the Chinese Smart City context and market – a growing potential source of opportunities for EU businesses – focusing specifically on three different levels of EU-China collaboration: industrial, research and policy-dialogues.

Partnering with Chinese companies – as well as with the Chinese institutions – would give European companies and research centres the opportunity to expand their business and cooperate towards innovative solutions. However, there are still questions on how to achieve the benefits offered by the Chinese market without running the risk of compromising competition.

The recommendation here is to **support the introduction of EU companies into the Chinese Smart City market by also providing the necessary protection frameworks.** The global race towards efficient solutions for urbanisation-related service demand will strongly benefit from international partnerships. Specifically, China seems to represent one of the key players for Europe to establish valuable cooperation and sharing of best practices. The Chinese side expressed a strong interest in having a platform to collaborate with the EU in the energy field at policy, technology and business levels. Such a platform may also be used for "matchmaking," which would provide insights into business options for both Chinese and European partners. What is important is to first define and agree on the necessary frameworks to ensure that competition stays fair both in China and in Europe.

Specifically, the main concern seems to be that foreign companies may replicate solutions developed by EU R&D centres and firms. To avoid this, **a supportive legal framework should be established for IP protection.** A good smart city regulatory environment will provide the protection that EU companies (especially SMEs and start-ups) need while being adaptable enough to allow for the risk-taking and trial-and-error that innovation requires. This means EU public entities may step in and agree with their Chinese counterparts on creating the right Intellectual Property (IP) protection laws and a supportive legal framework for companies wishing to provide their solutions on the Chinese market.